WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR AERONAUTICAL METEOROLOGY

TWELFTH SESSION

MONTREAL, 16–20 SEPTEMBER 2002

ABRIDGED FINAL REPORT WITH RESOLUTIONS AND RECOMMENDATIONS

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Secretariat of the World Meteorological Organization – Geneva – Switzerland

REPORTS OF RECENT WMO SESSIONS

Congress and Executive Council

902 — **Thirteenth World Meteorological Congress**. Geneva, 4–26 May 1999.
903 — **Executive Council**. Fifty-first session, Geneva, 27–29 May 1999.
915 — **Executive Council.** Fifty-second session, Geneva, 16–26 May 2000.
929 — **Executive Council**. Fifty-third session, Geneva, 5–15 June 2001.
932 — **Thirteenth World Meteorological Congress**. Proceedings, Geneva, 4–26 May 1999.
945 — **Executive Council**. Fifty-fourth session, Geneva, 11–21 June 2002.

Regional associations

891 — **Regional Association I** (Africa). Twelfth session, Arusha, 14–23 October 1998.
924 — **Regional Association II** (Asia). Twelfth session, Seoul, 19–27 September 2000.
927 — **Regional Association IV** (North and Central America). Thirteenth session, Maracay, 28 March–6 April 2001.
934 — **Regional Association III** (South America). Thirteenth session, Quito, 19–26 September 2001.
942 — **Regional Association VI** (Europe). Thirteenth session, Geneva, 2–10 May 2002.
944 — **Regional Association V** (South–West Pacific). Thirteenth session, Manila, 21–28 May 2002.

Technical commissions

893 — **Commission for Basic Systems**. Extraordinary session, Karlsruhe, 30 September–9 October 1998.
899 — **Commission for Aeronautical Meteorology**. Eleventh session, Geneva, 2–11 March 1999.
921 — **Commission for Hydrology**. Eleventh session, Abuja, 6–16 November 2000.
923 — **Commission for Basic Systems**. Twelfth session, Geneva, 29 November–8 December 2000.
931 — **Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology**. First session, Akureyri, 19–29 June 2001.
938 — **Commission for Climatology**. Thirteenth session, Geneva, 21–30 November 2001.
941 — **Commission for Atmospheric Sciences**. Thirteenth session, Oslo, 12–20 February 2002.
947 — **Commission for Instruments and Methods of Observation**. Thirteenth session, Bratislava, 25 September–3 October 2002.
951 — **Commission for Agricultural Meteorology**. Thirteenth session, Ljubljana, 10–18 October 2002.

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NOTE

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CONTENTS

PART I

SEPARATE MEETINGS OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. **OPENING OF THE SESSION** (agenda item 1)

1.1 The twelfth session of CAeM was held at the ICAO Headquarters Building in Montreal, Canada from 16 to 20 September 2002. It was opened at 2.00 p.m. on 9 September by Mr N.D. Gordon (New Zealand), president of the Commission. It was then suspended following the opening ceremony to enable participants to attend the conjoint CAeM session/ICAO Meteorology Divisional Meeting. The CAeM session resumed its work on 16 September 2002.

1.2 Mr Gordon welcomed the Secretary-General of WMO, Professor G.O.P Obasi, and the Secretary-General of ICAO, Mr R.C. Pereira. Mr Gordon thanked Professor Obasi for taking time from his busy schedule to address the Commission session, and Mr Pereira for kindly hosting the session at the ICAO headquarters building. He welcomed all CAeM members and aviation user representatives and thanked members of the Commission for their work during the intersessional period as well as staff members of both the ICAO and WMO Secretariats for the preparations for the session.

1.3 Professor Obasi welcomed Mr Pereira and expressed his appreciation to ICAO for hosting the CAeM session and for the excellent services and facilities provided for the event. Professor Obasi welcomed all delegates and aviation user representatives and thanked Mr Gordon and the vice-president, Mr J. Goas (France), for their able leadership in guiding the work of the Commission. He also thanked the members of CAeM working groups for their effective contributions to the work of the Commission.

1.4 Professor Obasi noted with satisfaction that since the early days of aviation, the main objective of the AeMP – providing weather information to aviation – had been achieved through close cooperation with ICAO, the airline industry, civil aviation authorities and the NMSs.

1.5 The WMO Secretary-General highlighted major developments with important implications for the Commission, namely the tragic events of 11 September 2001, the adoption of the 5LTP and Commission involvement in the implementation of Agenda 21. He pointed out that the events of 11 September 2001 had adverse meteorological impacts in terms of the immediate reduction of the availability of aircraft reports that affected forecast accuracy, and financial difficulties that affected the recovery of aeronautical meteorological service costs from some airlines. With regard to Agenda 21, the Secretary-General expressed pleasure that the Commission had responded to environmental concerns through its active collaboration with all stakeholders in investigating the possible contribution of aircraft engine emissions to environmental problems. In this regard, Professor Obasi congratulated the Commission for the preparation of the booklet *Aviation and the Global Atmospheric Environment*. He urged the Commission to pursue its involvement in aviation-related environmental issues in the light of the outcome of the WSSD, held in Johannesburg, South Africa in September 2002.

1.6 Professor Obasi indicated that the full transfer of responsibilities from all RAFCs to the two WAFCs, the establishment of back-up procedures between the two WAFCs, closer contacts with the user community, and the introduction of Quality Management would have significant impacts on the AeMP and the Commission's activities. As the WAFS was fully dependent on the proper functioning of the WWW, Professor Obasi called upon all WMO Members to continue to ensure that the required basic data be made available in a timely fashion to forecasting centres, in particular to the WAFCs. In this regard, he pointed out the vital importance of giving due recognition to the WWW contributions to the provision of meteorological service for international air navigation so that decision-makers would give higher priority to strengthening the infrastructure and human resources of the NMSs. He thanked WMO Members, in particular France, Finland, the United Kingdom and the United States, for having made available to other Members WAFS satellite terminals and workstations, mostly through the WMO VCP.

1.7 The Secretary-General pointed out that closer interaction between ICAO, WMO and the aviation industry had contributed significantly to fostering closer contacts, better understanding of users' needs and enhanced meteorological service to meet those needs. He highlighted joint efforts by ICAO, WMO and IATA to enhance cooperation among all stakeholders at the national level to address issues of common interest. In this regard, he said that enhanced cooperation would be of paramount importance to WMO and the NMSs, in view of the increasing trend towards cost recovery from aviation and increased reliance on alternative service delivery. Professor Obasi urged the Commission to give due consideration to these issues, which were expected to have long-term implications for the NMSs.

1.8 Professor Obasi indicated that a number of AeMP high priorities, including NMSs' capacity building and advances in science and technology, would increase demands for higher training standards. In this regard, he expressed pleasure that, since the previous CAeM session, there had been a large number of training events conducted on various topical issues, attended by participants from all WMO Regions. He expressed his appreciation to the United Kingdom for the continued convening of the United Kingdom/WMO aviation seminars, to the Untied States for its continued financial support to WMO training activities, to various other countries for hosting these events, and to ASECNA and ICAO for co-sponsoring training activities with WMO. The Commission strategic plan for training, as well as the training concepts that included low-cost training solutions, were noted with great interest.

1.9 Professor Obasi highlighted new advances in science and technology that would make the provision of aeronautical meteorological services more effective in terms of enhanced aviation safety and reduced costs to users, and urged the Commission to provide guidance and advice for implementing these advances. He expressed satisfaction at the fairly wide representation of Members at the session, which reflected the increasing need for enhanced involvement in WMO's work by developing countries and countries with economies in transition. In this regard, he urged the Commission to give particular attention to the balance among the officers and experts who would undertake the Commission's work.

1.10 Professor Obasi assured the Commission of his continued commitment to the promotion of the application of meteorology to aviation, and to ensuring that WMO continued to assume a leadership role in all relevant global initiatives and activities aimed at addressing the concerns of humanity, as a prestigious, respected and exemplary organization. He said that he was looking forward to the recommendations of the Commission, and expressed his confidence that the session would be conducted in the traditional spirit of cooperation and mutual understanding which had been the hallmark of WMO meetings. He concluded his address by wishing all delegates an enjoyable stay in Montreal and a most successful and productive session.

1.11 The ICAO Secretary-General welcomed all delegates and thanked Professor Obasi for his kind invitation to address the session. Mr Costa Pereira reminded the session that the working arrangements between ICAO and WMO implemented from 1 January 1954 had provided for ICAO to define the requirements for meteorological information for international air navigation and for WMO to specify the technical methods and practices to be used to meet the stated requirements. This clear definition of responsibilities had become the cornerstone of the two organizations' enduring relationship based on cooperation, mutual trust and dedication to the provision of meteorological information for aviation.

1.12 Mr Costa Pereira highlighted technological developments that had taken place since 1990 that had led to the implementation of a policy of integrating information technology into all of ICAO management functions and progressively to a culture based on greater interaction within ICAO and with the outside world. This technological revolution was reported to have enabled ICAO to be more effective and more responsive to ICAO member states, and to improve day-to-day contacts with ICAO partners such as WMO. Furthermore, information technology had significantly increased the capacity of ICAO and WMO to meet the pressing needs of the global air transport industry. Mr Costa Pereira said that during the 20th century, a long way had been covered in mastering the technological part of the aviation equation and that focus must now be on more attention and energy on the human aspects of the aviation equation. This would be achieved through specialized training to keep skills and knowledge up to date. Mr Costa Pereira indicated that this task would remain one of his top priorities. He indicated that WMO had been progressive in meeting its responsibilities in this area by supporting training initiatives aimed at maintaining the high standard of meteorologists and that ICAO recognized and appreciated the dedication of WMO to the development of human resources. Mr Costa Pereira expressed the hope that these efforts would continue.

1.13 Mr Costa Pereira said that the conjoint CAeM session/ICAO Meteorology Divisional Meeting would define a roadmap for meteorological information for the next decade or so and that WMO would establish the best practices to implement this policy in the traditional spirit of collaboration between the two organizations. Mr Costa Pereira concluded his address to the session by wishing all a most productive and enjoyable meeting.

1.14 Mr Gordon again thanked Professor Obasi and Mr Costa Pereira, and assured them that their advice and guidance would be fully taken into account during the deliberations of the Commission session. He highlighted a number of topical issues relevant to the session. With regard to the significance of the aviation sector to many NMSs, Mr Gordon pointed out that the results of a WMO survey carried out in December 2000 had indicated that aviation was the most important national economic application sector served by NMSs. The survey also indicated that the main issues currently facing NMSs were the overall level of government funding, modernization, provision of aeronautical meteorological services, capacity building and the role of the NMS at the national level. Other results of the survey indicated that while in most cases, such as in aviation, the costs for the provision of public meteorological services were being met by governments, a significant number of NMSs recovered the costs for the provision of specialized services through cost recovery arrangements. Mr Gordon pointed out that, with meteorological services to aviation playing such a vital role in the activities of NMSs, the responsibility of the Commission had been to help plan, organize and improve these services. As the work of the Commission would be greatly facilitated by resources provided by WMO and Members, Mr Gordon urged that sufficient attention be paid to the needs of aviation and the AeMP.

1.15 Mr Gordon singled out training as one key issue on which the Commission would concentrate to meet the expressed needs of aviation in line with reiterated relevant appeals from previous Commission, Executive Council and Congress sessions. He indicated that the level of training provided since the previous session had been possible mostly because of the generous support by WMO Members and cooperation with ASECNA and ICAO. He said that the session would have to decide not only what training would be needed over the next four years, but also how this could best be achieved and how to ensure that adequate resources be made available.

1.16 The second key issue highlighted by Mr Gordon was Quality Management, addressed earlier by Professor Obasi during the opening of the conjoint CAeM session/ICAO Meteorology Divisional Meeting, held in the morning. At this session, the Secretary-General had conveyed the concerns of the WMO Executive Council about the implications of possible mandatory quality standards that could lead to widening the gap between developed and developing countries. Mr Gordon expressed his satisfaction with the way the draft 6LTP intended to address Quality Management. In this regard, he said that he was looking forward to the conclusions of the session on the issue.

1.17 Mr Gordon noted that many other important matters to be discussed by this session included, among others, cost recovery, the use of WAFS data, improvement of warnings and the provision of more useful products to assist in aerodrome terminal areas. He strongly recommended that the Commission review and comment on the 6LTP, which provided a blueprint for what would be expected to be achieved over the next few years. Mr Gordon expressed the view that the next most important decision for the session would be the resulting structure and working arrangements for the Commission to achieve the results in the Plan.

1.18 In concluding remarks, Mr Gordon pointed out that, in these challenging times for both the aviation industry and NMSs, the Commission should keep firmly in mind that their goal in making decisions and recommendations should be to cost-effectively and sustainably improve service to aviation as all entered the 21st century.

1.19 There were 165 participants at the session. These included delegates from 70 WMO Members and observers from five international organizations. A complete list of participants is given in Appendix A to this report.

2. ORGANIZATION OF THE SESSION (agenda item 2)

2.1 CONSIDERATION OF THE REPORT ON CREDENTIALS (agenda item 2.1)

The Commission decided that, in accordance with WMO General Regulation 22, it was not necessary to establish a Credentials Committee. The Commission approved the report of the representative of the Secretary-General.

2.2 ADOPTION OF THE AGENDA (agenda item 2.2)

The provisional agenda was adopted by the session. The final agenda is given in Appendix B to this report.

2.3 ESTABLISHMENT OF COMMITTEES (agenda item 2.3)

2.3.1 Two working committees were set up to examine in detail the various agenda items:

(*a*) Committee A to consider agenda items 6 and 7. Mr D. Murphy (Ireland) was elected chairperson of the committee;

(*b*) Committee B to consider agenda items 5, 8, 9, 10, 11 and 12. Mr C. McLeod (Canada) was elected chairperson of the committee.

2.3.2 In accordance with WMO General Regulation 24, the Commission established a Nomination Committee and a Coordination Committee. The Nomination Committee was composed of the principal delegates of Chile, France, Ghana, Japan, Malaysia and the United States. The Coordination Committee was composed of the president of CAeM, the representative of the Secretary-General and the chairpersons of Committees A and B.

2.3.3 The Commission also established an Ad Hoc Group on Composition and Structure to review the proposed new structure of the Commission. This Group was composed of Mr R.P. Canterford (Australia), Mr H. Pümpel (Austria), Mr C. McLeod (Canada), Mr Lee Boon-ying (Hong Kong, China), Ms M. Petrova (Russian Federation), Mr M. Edwards (South Africa) and Mr C.R. Flood (United Kingdom). Mr Flood was nominated as the chairperson. Mr K.G. Carlson (Sweden) was appointed Rapporteur on the Previous Resolutions and Recommendations of the Commission and Relevant Resolutions of the Executive Council.

2.4 WORKING ARRANGEMENTS AND OTHER ORGANIZATIONAL MATTERS (agenda item 2.4)

The Commission approved various organizational aspects for the conduct of the session at its first plenary meeting. It agreed that, in accordance with WMO General Regulation 111, no minutes of the session would be prepared, but that statements by delegations would be reproduced and distributed as and when requested, in accordance with WMO General Regulation 112. A full list of documents presented at the session is contained in Appendix B to this report.

3. REPORT BY THE PRESIDENT OF THE COMMISSION (agenda item 3)

3.1 REPORT OF THE PRESIDENT (agenda item 3.1)

3.1.1 The Commission noted with appreciation the report of the president of CAeM, Mr N. Gordon, highlighting progress made to meet the goals and objectives of the AeMP since the eleventh session of CAeM in March 1999. The Commission thanked the president for his effective leadership and the achievements of the Commission during this intersessional period. The Commission was pleased to learn that CAeM was composed of 290 experts from 138 WMO Members. It expressed its appreciation to all CAeM members for the achievements of the Programme, as well as for the invaluable support of the WMO Secretariat. These achievements related to, among others, training, progressive implementation of the WAFS, fostering contacts with users, the update of relevant regulatory and guidance material, and the increased availability of global high-quality and high-resolution automated aircraft reports with significant benefits for NWP model forecast accuracy.

3.1.2 The need for paying greater attention to the issue of cost recovery of meteorological services provided to users was highlighted and the very important role of the Secretariat as a voice for all the meteorological community in addressing relevant topical issues was stressed. In this regard, the Commission felt that continued cooperation between WMO and ICAO would be a cornerstone for ensuring that the voice of the meteorological community would be heard and taken into account. Some delegates expressed their appreciation regarding the increased attention that the Commission had given to topical issues such as the recovery of meteorological costs, training and Quality Management, as well as the recognition of the importance of enhancing the accuracy and usefulness of aviation weather forecasts and warnings.

3.1.3 Various achievements of the Commission were found under the following main areas of the 5LTP, with additional information provided in the report of the session under separate agenda items.

TRAINING IN AERONAUTICAL METEOROLOGY

3.1.4 The Commission recalled that, while training under the AeMP 5LTP had been given the highest priority, there was a disparity between earmarked training resources under the regular budget and the growing training needs of Members. Nevertheless, it noted with satisfaction that, as a result of cooperation with Members and parent organizations, 13 training events had been conducted since March 1999, attended by a total of 430 participants from all Regions. The Commission expressed its appreciation to the United Kingdom for continuing to convene, jointly with WMO, the annual aviation seminar, and to the United States for providing significant financial resources to fund various seminars. It also thanked other Members for their valuable support in hosting these training events.

3.1.5 The Commission agreed that, since ongoing training activities would continue to be vital to ensuring the sustainability of aeronautical meteorological services, the support of Members for future activities was essential, as was the introduction of innovative means of delivering training, and providing additional WMO funding in addition to the AeMP regular budget, in particular for a proposed technical conference in association with the next session of the Commission.

3.1.6 The Commission commended the contribution of the CAeM Working Group on TREND for a number of important initiatives it had taken to enhance training in aeronautical meteorology as mentioned under agenda item 5, Training in the Field of Aeronautical Meteorology. It welcomed the ongoing series of TREND Newsletters that provided relevant useful technical and scientific information on aeronautical meteorology to CAeM Members, and noted with satisfaction that the preliminary issue of the *Compendium on Tropical Meteorology for Aviation Purposes* had been published by the Secretariat in May 2002.

FOSTERING CLOSER CONTACTS WITH THE AVIATION COMMUNITY

3.1.7 The Commission recognized that fostering closer contacts among aeronautical meteorology service providers and users was particularly important given the serious situation facing many airlines as a result of the tragic events of 11 September 2001, and the increasing global trend toward the recovery of aeronautical meteorological costs from the aviation industry. In this regard, the Commission was pleased to note that mutual participation of ICAO and WMO at meetings convened by the two organizations and attended by other aviation stakeholders such as IATA and ASECNA had contributed to fostering closer contacts between meteorological service providers and users, and to enhancing aeronautical meteorological services to meet users' needs.

3.1.8 The Commission noted with satisfaction the first-ever joint ICAO/WMO letter sent in September 2000 to ICAO contracting states and WMO Members, in which the two organizations asked for enhanced cooperation at the national level to ensure that the provision of aeronautical meteorological service continued to contribute effectively towards the safety, regularity and efficiency of international air navigation. Furthermore, the Commission was pleased to note that an exchange of letters between IATA and WMO in 2000 had resulted in the establishment of focal points by the two organizations tasked with addressing relevant issues of concern to either party.

3.1.9 The Commission was pleased to learn that the updated WMO *Guide to Practices for Meteorological Offices Serving Aviation* (WMO-No. 732) would include guidance material on closer contacts at the national level between service providers and users. Furthermore, it noted with satisfaction the proposed emphasis placed on enhancing the provider/user interface as a component of the AeMP 6LTP.

COST RECOVERY

3.1.10 The Commission expressed satisfaction that, following strong representations by Members and the WMO Secretariat, the ICAO Global Conference on the Economics of Airports and Air Navigation Services held in Montreal, Canada (June 2000), had agreed not to modify the current policies and guidance material on cost recovery from aviation. It stressed in particular the positive role played by the Secretariat in ensuring that the interests of the meteorological community were preserved regarding the continued inclusion of core services as part of the cost to be recovered from aviation on a fair and equitable manner by meteorological service providers. The French delegation raised two important aspects related to cost recovery and relations between ICAO and WMO:

(*a*) France welcomed the very positive role played by WMO during the ICAO Conference on the Economics of Airports and Air Navigation Services (ANSConf 2000), as the spokesperson for NMSs. France stressed that WMO should be the spokesperson for all the Members of the Organization, and in particular, those NMSs that had chosen to recover the basic costs related to aeronautical meteorological services;

(*b*) The delegation noted the good relations that existed between WMO and ICAO and expressed the view that these relations should be pursued to address topical subjects such as the introduction of the quality approach in the aeronautical meteorological services, based on guidance from WMO bodies, i.e. the Executive Council and Congress.

The Commission noted with interest that ICAO had reactivated the ANSEP, tasked with reviewing the current guidance on cost recovery for services provided for international air navigation. The Commission urged experts from Member countries and the representative of the WMO Secretariat on the Panel to collaborate in addressing future amendment proposals to the current ICAO guidance material.

3.1.11 The Commission welcomed the fact that, on request, joint ICAO/WMO missions had been successfully conducted to assist in finding appropriate ways to resolve differences related to the recovery of costs for meteorological service provided to the aviation industry in a number of Member countries. The Commission urged the two organizations to continue to provide similar assistance to States/Members when requested in the future.

3.1.12 The Commission was informed that there were some indications that the issue of the provision of air navigation services, including aeronautical meteorological services and rules related to the manner in which these services would be delivered within the European Economic Area, could be re-examined. It was pointed out that this would have an impact not only on cost recovery but also on the role and responsibility of the Meteorological Authority as currently defined by ICAO. The Commission agreed that this situation warranted close monitoring because it could have impacts beyond the European Economic Area. The Commission noted that additional information on this issue was found in this report under agenda item 8, User/Provider Relationships.

QUALITY MANAGEMENT SYSTEMS

3.1.13 The Commission recalled the inclusion of recommended practices on quality systems in Amendment 72 to ICAO Annex 3/WMO Technical Regulation [C.3.1], which had come into force in November 2001. The Commission welcomed the decision of the CAeM PROMET Working Group meeting in October 2001 to establish a TTQ, which had subsequently prepared a document highlighting the objectives, expected results, milestones and means of implementing ISO 9000 quality systems, discussed under agenda item 7, Quality Management.

3.1.14 The Commission agreed with the president that there would be a need for ongoing close coordination of activities related to Quality Management being carried out within CAeM and CBS, and welcomed the AeMP 6LTP proposed emphasis to assist Members in working towards the implementation of Quality Management. In this regard, the Commission welcomed the establishment of an Inter-commission Task Group on Quality initially proposed by the presidents of technical commissions that had been endorsed by the fifty-fourth session of the Executive Council in June 2002.

IMPLEMENTATION OF THE WAFS

3.1.15 The Commission was pleased with the recent significant progress in the implementation of the WAFS that included the transfer of full responsibilities from all remaining RAFCs to the London and Washington WAFCs, and the continued harmonization of their activities, including improved back-up procedures between the two WAFCs. Furthermore, it noted with satisfaction that progress was being made to ensure that aeronautical meteorological service providers were able to prepare all WAFS charts locally. In this regard, the Commission noted with appreciation that both the United Kingdom and the United States, in collaboration with ICAO and WMO, had offered to assist in providing training to aeronautical meteorology service providers to enable them to access and use the GRIB- and BUFR-coded WAFS products for the preparation of these WAFS charts locally.

OBSERVATIONS IN THE TERMINAL AREA

3.1.16 The Commission welcomed the active participation of WMO at the three meetings of the ICAO AMOSSG held between 2000 and 2002. The Commission noted with interest that these AMOSSG meetings had addressed, among other issues, the requirements for meteorological observations and reports at aerodromes, the assessment of the capabilities of automated weather observing stations, and the development of relevant guidance material. The results of the AMOSSG work that included relevant amendment proposals to current ICAO/WMO regulatory and guidance material had been submitted for consideration by the conjoint CAeM session/ICAO Meteorology Divisional Meeting.

FORECASTS AND WARNINGS IN THE TERMINAL AREA

3.1.17 The Commission recognized the importance of ensuring and enhancing the accuracy and usefulness of forecasts and warnings for the terminal area, and agreed with the president's view that aeronautical meteorology could be entering a new era, given rapid advances in techniques and technologies including nowcasting and fine-scale models. The Commission further agreed that there could be significant new benefits to be provided to aviation from improved forecasting and new products. The Commission was pleased that progress was being made in the development of methods for globally consistent and user-oriented verification of TAFs.

AUTOMATED AIRCRAFT OBSERVATIONS

3.1.18 The Commission expressed its appreciation to AMDAR Panel members for their dedicated efforts in carrying out AMDAR activities, and to WMO Members for providing the financial resources to support these activities. The Commission was pleased that the number of AMDAR observations exchanged on the GTS was about 130 000 per day, representing more than a 2.5-fold increase compared with 1998, when the AMDAR Panel was established. The Commission endorsed the view of the fifty-third session of the Executive Council in 2001 '…that AMDAR had proved to be a very cost-effective data source that responded to the needs of WMO Programmes and brought benefits to end-users'.

3.1.19 One of the most outstanding achievements of the Panel had been the development and publication of an AMDAR Reference Manual that comprised a comprehensive technical description of AMDAR, ranging from sensor systems to final output data. The Commission was aware that all these achievements of the Panel were due to the financial contributions kindly provided by Members to pay for, in particular, the very valuable services of the AMDAR Technical Coordinator. In view of this, the Commission agreed with the president that it was vital that Members continued to provide financial support for carrying out AMDAR activities.

UPDATING REGULATORY AND GUIDANCE MATERIAL

3.1.20 The Commission recognized that since its previous session, WMO Technical Regulation [C.3.1] had been updated as a result of the implementation of Amendment 72 to ICAO Annex 3 in November 2001. As a result of this, consequential changes had been introduced in Appendix I of WMO Technical Regulation [C.3.3], Flight Documentation — Model Charts and Forms, and reflected accordingly in the aeronautical meteorological codes contained in the *Manual on Codes* (WMO-No. 306), Volume I.1, Part A.

AVIATION AND THE ENVIRONMENT

3.1.21 The Commission expressed its appreciation to all those who had been involved in the preparation of the booklet *Aviation and the Global Atmospheric Environment*. It noted that the booklet had been based on the *Special Report on Aviation and the Global Atmosphere* published in 1999 by the IPCC, and that it would be published in the near future. It welcomed the ongoing cooperation of the TREND Working Group with ICAO's CAEP, particularly on climate change-related issues.

FUTURE STRUCTURE AND PLANS OF THE COMMISSION

3.1.22 With regard to the structure of the subsidiary bodies of CAeM, the Commission noted that the AWG meeting held in February 2002 had proposed the adoption of some of the more relevant new CBS working practices but not a full move to a structure based on OPAGs. In particular, a proposal was endorsed by the CAeM/AWG for its replacement by a CAeM Management Group, under which each Group member would have specific responsibilities for taking action and reporting on subjects contained in the AeMP 6LTP and for supporting the overall work of the Commission. Furthermore, the AWG had endorsed the re-establishment of the PROMET and TREND Working Groups with amended terms of reference. The results of discussions on these proposals are found under agenda item 14, Establishment of Working Groups.

3.1.23 The Commission noted that the president had highlighted what he believed to be the major issues facing aeronautical meteorological services. These included the trend towards privatization and alternative service delivery for aeronautical meteorological services, which would require guidance and assistance for Members facing such changes, as well as further seminars on the implementation of cost recovery. The Commission noted with satisfaction the imminent advent of the final phase of the WAFS, which had come about through the visionary work that had begun more than 20 years before. The Commission agreed with the president's assessment that aeronautical meteorological services were at the threshold of major breakthroughs in providing benefit to aviation in the terminal area, in particular through innovative services based on a combination of new observing systems and the application of nowcasting techniques, including frequently run, very high-resolution models. The Commission recognized that while the worldwide implementation of such innovative services would take many years, the time was right to take the first steps towards making it happen. The Commission endorsed the president's view that this would need substantial planning and development with trial implementation at a number of airports, together with the necessary training and technology transfer. This would require adequate support from the WMO regular budget and extrabudgetary sources of funds, as well as continued dedicated efforts from all CAeM members.

3.2 GUIDANCE ON ALTERNATIVE SERVICE DELIVERY (agenda item 3.2)

The Commission noted with satisfaction that the guidance on alternative service delivery had been prepared with valuable contributions from the Executive Council Advisory Group on the Role and Operation of NMHSs. The Commission made comments and suggestions to improve the document and suggested in particular that quality systems and the issue of having several providers of meteorological services in a given country, which would have serious implications for aviation safety, should be addressed. The Secretariat informed the Commission that this important guidance material would be made available to Members in all WMO languages.

4. REPORT BY CHAIRPERSONS OF WORKING GROUPS (agenda item 4)

REPORT OF THE CHAIRPERSON OF TREND

4.1 The Commission considered the report of the chairperson of TREND, Mr H. Pümpel (Austria), and noted with satisfaction the activities carried out by TREND during the intersessional period. The Commission also noted with satisfaction the achievements related to training activities, environmental issues, TAF verification and cooperation between TREND and WMO bodies, ICAO and scientific and technical institutions. The Commission noted that the one fully funded meeting of TREND during the intersessional period was held in Hong Kong, China in October 2000, at the kind invitation of Hong Kong, China.

4.2 The Commission expressed satisfaction that TREND had developed a strategic plan for training approved by the PROMET session in October 2001 and that training initiatives proposed by the chairperson of TREND had been endorsed by the CAeM AWG session held in February 2002. Detailed information on these innovative training initiatives is found in agenda item 5, Training in the Field of Aeronautical Meteorology.

4.3 The Commission noted with satisfaction that, in order to back up the training process, TREND had been actively involved in the review and update of a number of guidance materials listed under agenda item 10, Publications and Guidance Material. The Commission commended TREND for the publication of four issues of the highly appreciated TREND Newsletters. These issues were based on the proceedings of American Meteorological Society (AMS) Conferences on Aviation, Range and organized Aerospace Meteorology, the Workshop on Aeronautical Meteorology held within the Meeting of the European Geophysical Society held in 2000, the results of a survey on cost recovery and selected scientific articles as well as information related to Aeronautical Meteorology presented by the president of CAeM at the Executive Council in 2001.

4.4 The Commission noted with satisfaction that, in line with its terms of reference, TREND had been involved in a number of aviation-related environmental activities in close cooperation with ICAO. In this regard, the Commission was pleased that the chairperson of TREND had attended the meeting convened in 1999 for the presentation of the *IPCC Special Report on Aviation and the Global Atmosphere*, as well as the meeting of ICAO's CAEP in 2001. The Commission thanked TREND for having taken the lead in the development of the booklet *Aviation and the Global Atmospheric Environment*, with the assistance of Mr N. Gordon, Mr N. Sabogal (UNEP Nairobi) and the WMO Secretariat. This booklet was expected to be published soon.

4.5 The Commission was aware that it had entrusted TREND in 1999 to establish and supervise a dedicated Task Force on TAF Verification. The Commission was pleased that the Task Force led by Mr E.G. Williams (Australia) had prepared a draft that had been further discussed and refined by the TREND meeting held in Hong Kong, China, in 2000 and endorsed by the PROMET Working Group in 2001. In this regard, the Commission noted with satisfaction that PROMET had established two pilot projects, with Australia and France taking the lead in implementing them in their respective regions. The report on the preliminary results of these pilot projects is found in paragraphs 6.20 and 6.21 of this report.

4.6 The Commission noted with satisfaction the continued fruitful cooperation of TREND with PROMET and other technical commission subsidiary bodies, the AMDAR Panel, ICAO and scientific organizations such as the AMS and the European Geophysical Society. The Commission commended TREND for its active involvement in field research projects (e.g. MAP). Additional information on cooperation issues is found in agenda item 11, Cooperation with Other WMO Bodies and International Organizations.

REPORT OF THE CHAIRPERSON OF THE WORKING GROUP ON PROMET

4.7 The Commission considered the report of Mr M. Edwards (South Africa), chairperson of the Working Group on PROMET, on activities carried out by the Working Group since CAeM-XI. The Commission noted with satisfaction PROMET's achievements, in particular its contribution to the development and implementation of Amendment 72 to WMO Technical Regulation [C.3.1], the development of TAF verification and the update of WMO guidance material.

4.8 The Commission noted with interest that, in order to make its work more efficient and more equally divided among all PROMET members, 10 PROMET subgroups had been established to deal with each of the terms of reference identified in Resolution 5 (CAeM-XI). It also noted the significant progress made in implementing the WAFS, and the need for both ICAO and WMO to address the remaining meteorological requirements prior to the final phase of the WAFS. Examples of such requirements included the training of service providers to access and use the BUFR-coded SIGWX forecasts, and the need for WAFS forecasts to meet the operationally-desirable accuracy of forecasts indicated in Attachment E of WMO Technical Regulation C.3.1, as set forth in Volume II of *Technical Regulations* (WMO-No. 49). Mr Edwards pointed out that WAFS products should be refined and updated continuously, even after the final phase of the WAFS.

4.9 The Commission noted the concern expressed by PROMET regarding the limitations of prevailing visibility in the case of large aerodromes, and the opposition of IATA to the introduction of more than one concept of prevailing visibility. The Commission noted the desire, expressed by some experts who had attended the previous METG meeting of the EANPG, to continue to keep the current provision for reporting visibility.

4.10 The Commission was informed about Members' activities in using radar reflectivity to support flight operations in convective weather conditions, and on the decision of PROMET to keep this subject under review. The Commission was also informed about Members' experiences with automated METAR and automated observing stations. It highlighted the undeniable advantages of the latter in terms of performance, uniformity and continuity of measurements, despite the fact that they were not fully compliant with WMO Technical Regulation [C.3.1]. It was noted that these systems were particularly useful when continuous human presence was not possible.

4.11 The Commission noted with satisfaction the involvement of PROMET in TAF verification, and expressed its strong support for the suggestion made by TREND that there should be one internationally standardized and tested TAF verification programme. The Commission was pleased that, in order to speed up the implementation of such a programme, two pilot projects had been implemented — the first by European countries and ASECNA, with France taking the lead; the second by Australia, New Zealand and South Africa, with Australia taking the lead. The Commission recognized that these pilot projects had achieved important results in addressing TAF verification. This would facilitate the assessment of meteorological forecasts that would be very useful in reassuring users about the quality of the meteorological service provided. The results of these pilot projects are found under agenda item 6, Aeronautical Meteorological Codes. The Commission was pleased to note that a small study group had also been set up to study and report on a number of aspects related to quality assurance. A report on the work of this group is found under agenda item 7, Quality Management.

4.12 With regard to aeronautical meteorological codes, the Commission noted that the use of the BUFR code to transmit WAFS SIGWX forecast products would require adequate communication links capable of supporting binary data and training to enable service providers and users to access, decode and use BUFR-coded products. As a result, some providers of aeronautical meteorological services would need more time before being able to receive such BUFR-coded WAFS products, and a longer period to be able to encode observations and forecasts in BUFR format. In this regard, it was pointed out that WAFS charts would continue to be transmitted by the satellite broadcast systems until July 2005.

4.13 In line with the directives of the two previous CAeM sessions, the Commission was informed that steps had been initiated by the Secretariat to update the publication *Guide to Practices for Meteorological Offices Serving Aviation* (WMO-No. 732), with the president of the Commission taking the key role in carrying out this task. The Commission commended those PROMET members who had volunteered to prepare a preliminary draft of the *Guide*. It urged PROMET to finalize the remaining work and the Secretariat to find the necessary resources to publish the *Guide* as soon as this work was completed.

5. TRAINING IN THE FIELD OF AERONAUTICAL METEOROLOGY (agenda item 5)

5.1 The Commission reiterated its satisfaction that since its previous session in 1999, a large number of training events attended by participants from all WMO Regions had been conducted in aeronautical meteorology or with aeronautical meteorology components. It noted, however, that only four of these events were fully funded from the regular budget, with the remaining events organized by Members and sponsored by WMO or with WMO providing major support at other organizations' training events. The Commission noted with appreciation the major contributions of Members in aeronautical meteorology training, in particular Botswana, Cameroon, Colombia, Indonesia, Malaysia, Mexico, Niger, Senegal, the United Kingdom and the United States; and other organizations, namely ASECNA and ICAO.

5.2 The Commission noted with appreciation that, since March 1999, the United Kingdom, in cooperation with WMO, had carried out four aviation training seminars attended by participants from Regions I, II and VI. In parallel, the United States took the lead in a cooperative effort with WMO in holding two seminars on WAFS data and products applications in Kuala Lumpur, Malaysia, and in Mexico City, Mexico, in 1999 and 2000, respectively, for participants from Regions II, III, IV and V. The United States also cooperated with WMO in coordination with ICAO, in convening the ATS/MET/Pilots Coordination and Volcanic Ash training seminar in Bogotá, kindly hosted by Colombia in November 2001 and attended by participants from Regions III and IV.

5.3 The Commission noted with satisfaction the excellent working relations WMO enjoyed with its sister organization that led to ICAO actively participating at four WMO Regional Training Seminars on Cost Recovery between 1999 and 2000, and expressed its gratitude to Botswana, Indonesia, Mexico and Senegal for hosting these training events attended by participants from Regions I, II, III, IV and V. In this context, the Commission was pleased to note that the president and vice-president of CAeM were among the lecturers at some of these seminars, and thanked France, the United Kingdom and the United States for having kindly provided lecturers for the seminars. The Commission was grateful to the United States for the financial assistance provided to participants who attended both the WAFS and cost recovery seminars held in Mexico City and the ATS/MET/Pilots Coordination Seminar held in Bogotá.

5.4 The Commission also noted with appreciation that ASECNA had organized, in cooperation with WMO and ICAO, a seminar on WWW data management and WAFS products applications, and a seminar on ATS/MET/Pilots Coordination and Amendment 72 to Annex 3/Technical Regulation [C.3.1], held respectively in Niamey, Niger in 2000 and in Douala, Cameroon in 2001 for participants from French-speaking African countries.

5.5 The Commission, aware that the demand and need for training in aeronautical meteorology by far exceeded the very limited financial resources allocated for aeronautical meteorological training activities in the regular budget of WMO, urged Members to improve this situation through their generous financial assistance to the WMO Secretariat to organize training events or to conduct, in close collaboration with the WMO Secretariat, such events with participants from other countries. However, the Commission also noted with concern that in order to meet the growing training needs of Members, the appropriate funding should be provided through the regular WMO budget. Therefore, the Commission adopted Recommendation 1 (CAeM-XII).

5.6 The Commission requested the president to seek guidance from Fourteenth Congress on the prioritization of training activities funded through the regular WMO budget with particular attention to the needs of the AeMP.

5.7 The Commission expressed its appreciation for the development or update of much guidance material to help the training process, as listed under agenda item 10, Publications and Guidance Material.

5.8 Mutual training of aeronautical users and providers of meteorological information was viewed as a prerequisite for sustainable development of the industry. The Commission agreed that special emphasis should be made on training the customer, i.e. CNS/ATM on the aeronautical meteorological products and methods, and aeronautical meteorological personnel should also be prepared to learn from the customer and take into account their current and future needs. In this regard, the Commission welcomed the strategic plan for training developed by the TREND Working Group that highlighted among others the need to make training material available in electronic form, support for regional and specialized training including on-the-job training, enhancement of user training and Web-based methods of information delivery. Moreover, the Commission endorsed the PROMET and the AWG view that training would be particularly needed in two topical areas, namely, nowcasting and Quality Management systems. The Commission welcomed the training initiatives that included innovative low-cost solutions proposed by the chairperson of TREND, Mr Pümpel, and endorsed by the CAeM AWG during its meeting in February 2002. The Commission was pleased to note the detailed information on the training concepts developed by Mr Pümpel and endorsed these concepts as providing an excellent foundation for the future strategies that should be employed in training. Detailed information on these concepts is found in Annex I to this report.

5.9 The Commission noted with satisfaction that, as a result of the redesign of the AeMP Web page, a large volume of training material was available through the Internet. Posted material included converted PowerPoint slides of PCGRIDDS training lectures, lectures presented at the Cost Recovery Seminars in November 1999, and lectures presented at the annual United Kingdom/WMO seminars. Other posted material included presentations from the president of CAeM to the Executive Council and issues of the TREND Newsletter. Some Members requested assistance in using the Web-based material.

5.10 The Commission was grateful for the offer made by Hong Kong, China to play host to an appropriate training event that would be convened by the Commission, and for its offer to provide lecturers on topics in aeronautical meteorology.

5.11 The Commission noted with interest the results of a survey conducted by the Secretariat in February 1999 on the availability of aeronautical meteorology information on Members' Web sites listed on the WMO home page. This survey showed that 68 Members representing nearly 37 per cent of total WMO membership had Web sites. Nine of these 68 Members (13 per cent) provided free access to some of their aeronautical meteorology information on their Web sites. Three Members – Australia, Canada and the United States – provided full access to aviation information on their Web sites. The Commission felt that such Web-based methods of information delivery could be used for training purposes. In this regard, it requested the Secretariat to set up a directory on its Web site with links to training, including Web-based training, hosted at national centres. The Commission requested TREND to investigate further the use of Members' Web sites for training purposes.

5.12 The Commission also noted with interest the results of the global survey conducted by the Secretariat in July 2000 on how costs for aeronautical meteorological services were recovered from the aviation industry. Of 103 replies, 45 countries indicated that they had attended one of the WMO cost recovery seminars and nine of these reported to have implemented cost recovery as a result of their participation.

5.13 The Commission was requested to provide information on the retention of aviation meteorologists after they had received advanced aeronautical meteorology training.

GRIB/BUFR TRAINING FOR MEMBER STATES WITHIN THE SADIS FOOTPRINT

5.14 The Commission was aware that in the final phase of WAFS the broadcast of all T4 charts would be replaced by WAFS products encoded in GRIB and BUFR code format. The Commission noted with interest that small teams had been established in all of the ICAO regions fully or partly within the SADIS footprint to ensure that Member States received the required assistance and training in the use of GRIB- and BUFR-coded products. The Commission was informed that over the previous two years, Member States within the SADIS footprint had been consulted to ascertain the need for any training requirements in the use of GRIB- and BUFR-coded products. The Commission noted, however, that most workstation manufacturers were still finalizing their BUFR visualization software, and that none of the currently fielded software fully met the required standard. As a result of this, all Member States that had been using proprietary software with their SADIS systems would have to purchase new BUFR decoding software as well as to have some degree of training in the use of that software. It was noted that systems produced by some manufacturers were no longer supporting SADIS. Therefore, SADIS users were requested to approach one of the companies indicated by the WAFS provider state in order to obtain appropriate software. The Commission noted with interest that the SADISOPSG requested that the SADIS provider state publish information on the SADIS Web site at http://www.metoffice.com/SADIS by the end of the summer 2002 that would indicate the status of the software of each of the various workstation manufacturers that continued to offer services to SADIS customers.

5.15 The Commission noted with satisfaction that the training programme aimed at ensuring that all Member States using SADIS had the capability to make full and proper use of GRIB- and BUFR-coded products had already begun. The first workshop was conducted in

March 2002 in Niamey, Niger, attended by participants from 14 French-speaking African countries. The Commission was pleased that this workshop was such a tremendous success, with all 14 countries considered to have been fully trained in the use of the BUFR code. The Commission noted with pleasure that similar workshops were being organized in Bangkok, Thailand for the Asia/Pacific countries, and Pretoria, South Africa for English-speaking countries, and that similar workshops would take place for SADIS users across regions under the SADIS footprint. Although it would not be possible to provide training for more than one individual per country, it was considered vital that the necessary arrangements be made to enable countries to send to one of these workshops operational users of SADIS who had the capability of passing on any training received to the remaining operational staffs within their own countries. To ensure that all Members had the necessary capability, a regional training officer was strongly recommended to back up the training seminars where necessary. The Commission was informed that both ICAO and WMO had been involved in this process from the start, and that the forthcoming workshops would be advertized in due time through both the ICAO and WMO regions.

5.16 The Commission was informed that a task force established by the Asia/Pacific Region would soon conduct a survey on how user states were preparing for the transition from the use of T4 charts to GRIB and BUFR codes. The Commission was asked to consider the results of such surveys as well as the results of surveys likely to be conducted in other regions, so as to ensure that the necessary assistance would be provided to those Members in need.

5.17 The Commission was requested to include basic training on computer software and hardware installation and maintenance as part of training in this area. Due to the very high cost of workstations, the Commission was encouraged to look into the possibility of providing a guarantee that software suppliers would support their products for a number of years.

CANADIAN INITIATIVES INVOLVING THE AVIATION COMMUNITY IN TRAINING

5.18 The Delegate from Canada informed the Commission that since the privatization of the ANS, a renewed emphasis had been placed on client contact and user education. The ANS operator, NAV CANADA, was the provider of many of those services through an agreement with the Meteorological Service of Canada (MSC). Clients initially expressed dissatisfaction with some services, as well as unease about the transition of the provision of ANS services to the private sector. In response to this concern, Canada developed a series of six local area knowledge manuals, which were to become available in 2003 on NAV CANADA's Web site at http://www.navcanada.ca. The methodology used by the MSC to develop these manuals entailed MSC meteorologists conducting extensive interviews with local pilots, dispatchers, flight service specialists and others to gather information on the specific weather effects and patterns in each area.

5.19 A second initiative was a series of TAF writing workshops. These hands-on workshops brought together operational forecasters with a number of different client groups. In addition to TAF writing exercises, where users were invited to prepare TAFs based on real and simulated weather situations, discussion ensued on how TAF could be made more useful to the end-user and on TAF performance measures and their meanings. The Commission was informed that the increased contacts of personnel involved with the provision of aviation weather services with the end-users of those services was having a positive effect on client satisfaction in Canada. It was also noted that a benefit of these increased contacts was improved training programmes for operational meteorologists and flight service specialists.

INITIATIVE IN AVIATION TRAINING IN THE RUSSIAN FEDERATION

5.20 The Delegate from the Russian Federation presented to the Commission an example of the programme of a training course for meteorologists working in aviation weather forecasting departments used in that country. This programme, intended for developing refresher training, included the purpose of the courses, the qualifications required, and the scale and content of the courses. The programme was considered by the ICAO EANPG METG PT/EAST in 2002 for future implementation by the Member States of the group. The Commission noted with interest that the material proposed was designed to improve skill level and quality of knowledge of meteorologists in aviation forecasting. The Commission was informed about the activities of the WMO Regional Meteorological Educational Centre in Moscow tasked with upgrading the qualification of aeronautical meteorologists of the CIS and Mongolia. It was also informed about joint activities of Roshydromet and the State Civil Aviation Authority of the Ministry of Transport of the Russian Federation in training specialists in the field of aeronautical meteorology at the St. Petersburg Civil Aviation Academy.

6. AERONAUTICAL METEOROLOGICAL CODES (agenda item 6)

IMPLEMENTATION OF AMENDED AERONAUTICAL METEOROLOGICAL CODES

6.1 The Commission was aware that the implementation of changes to paragraphs 15.1.1 and 51.1 of the *Manual on Codes* (WMO-No. 306) on 1 November 2001 proposed by ICAO and approved by the fifty-third session of the Executive Council in June 2001 had been postponed at the request of ICAO. The postponement of the implementation date was due to serious operational difficulties anticipated by the ICAO MET Group of the EANPG meeting in September 2001. This Group felt that compliance with the proposed mandatory inclusion of an additional line following the WMO abbreviated bulletin header containing the code names METAR, SPECI and TAF and the time group would lead to serious operational problems for systems such as

VOLMET, satellite broadcast systems (SADIS and ISCS) as well as airline planning and briefing systems.

6.2 The issue had since been considered by the EANPG, which called for 'ICAO to bring to the attention of WMO the need for amendment of the bulletin code format for METAR, SPECI and TAF in order to delete redundant information and to make the bulletin formats for METAR, SPECI and TAF codes consistent'. The Commission was informed that the meeting of the CBS ET on Data Representation and Codes held in Prague, Czech Republic in April 2002 had proposed not to include the additional line following the WMO abbreviated header in any bulletin. The group confirmed, however, the mandatory inclusion of the code names METAR and SPECI at the beginning of each individual report and TAF at the beginning of each individual forecast. The Commission was informed that this proposal would be part of an overall aeronautical meteorological code amendment proposal stemming from new and amended aeronautical requirements submitted for consideration and approval by CBS-Ext. (2002) in December 2002 with an implementation date of November 2004.

CONSIDERATION OF CODE ISSUES DISCUSSED BY THE PROMET SESSION IN 2001

6.3 The Commission was informed about the results of discussions on code issues by the previous PROMET session in October 2001 that included the definition of precipitation intensity criteria to be addressed in cooperation with CIMO, AUTO METAR and the definition of objective criteria for convective clouds. With regard to precipitation intensity, the Commission noted that the CIMO Expert Meeting on the Requirements and Representation of Data from Automatic Weather Stations in April 1999 concluded that subjective terms such as light, moderate and heavy were typical for human observations, but not for automatic or instrument measurements. CIMO's view was that the definitions of subjective precipitation intensity and weather phenomena suitable for aeronautical meteorological use should be regarded as user-specific requirements and that CIMO could not be responsible for such definitions, although it could provide assistance on this matter. Furthermore, CIMO expressed the view that any modification to the alphanumerical codes such as SYNOP and METAR should not be pursued because of the planned migration to the binary BUFR code.

6.4 The need for quantitative definitions of precipitation intensities to meet ICAO CNS/ATM requirements was highlighted by some Members of the Commission, who also indicated that these intensities were not sufficient and that more research and development were needed to build confidence in this information. However, it was indicated that no aeronautical requirements existed for these quantitative intensities, and user representatives reiterated their position to stick to the three descriptive categories of intensity – light, moderate and heavy – that they considered satisfactory.

6.5 The Commission noted with interest the summary of the results of discussions during the PROMET session regarding a proposal for the objective definition criteria for cumulonimbus (Cb) and towering cumulus (TCU) developed by Météo France to assist air traffic controllers in anticipating aircraft deviations. The Commission endorsed the PROMET proposal that CIMO should take an in-depth look at radar reflectivity thresholds for convective clouds and consider the following objective criteria based on radar data for the definition of Cb. CIMO was requested in particular to consider the objective criteria for convective activity of TCU, level 1 (above 30 dBZ), and Cb, level 2 (above 41 dBZ), based on radar data and reported to aeronautical users to indicate the presence of Cb and TCU in the vicinity or at an aerodrome when no human meteorological observer was on duty but weather radar information was available. The Commission requested PROMET to conduct a comparison between human reports of observed TCU/Cb and radar reflectivities in Member countries through a survey to back up the work to be carried out by CIMO. In the event where the above proposal met aeronautical requirements, the Commission further requested that steps be taken to improve the definition of the current concept of 'vicinity of aerodrome' to ensure that meteorologists took into account these criteria to report convective activities accordingly. In this regard, the ICAO definition of vicinity would apply.

6.6 The Commission noted with interest that the PROMET Working Group had also discussed automated aeronautical meteorological reports such as AUTO METAR. The Commission concurred with the PROMET view that current AUTO METAR did not fulfil all the requirements of a comprehensive METAR as stated in current standard and recommendation practices of WMO Technical Regulation [C.3.1]. However, the Commission endorsed the PROMET view that current AUTO METAR had undeniable advantages in terms of performance, continuity and uniformity of measurements, which made them very useful when continuous human presence was not possible.

MIGRATION FROM ALPHANUMERIC CODES TO THE DIGITAL CODE BUFR AND TO CREX

6.7 The Commission was aware that an enabling provision was introduced in Amendment 72 to Technical Regulation [C.3.1] that provided for WAFS SIGWX forecasts dissemination in BUFR that would ultimately replace the current T4 SIGWX charts during the WAFS final phase. Furthermore, enabling provisions were introduced as part of Amendment 72 for the use of the BUFR code for graphical SIGMETs for tropical cyclones and volcanic ash. In this regard, it was indicated that the United Kingdom Met Office had been broadcasting BUFR coded SIGWX forecasts that could be accessed and used, including for training purposes.

6.8 The Commission noted with interest that CBS-XII in 2000 had recognized that BUFR and CREX offered greater advantages compared to the traditional alphanumeric codes such as the current aeronautical meteorological codes METAR, SPECI and TAF. In this regard, it was pointed out that already several new requirements for AWSs and high-resolution models that required higher-resolution data in time and space were not being met by the traditional alphanumeric codes. It was noted that the BUFR and CREX codes were universal and flexible, and could be easily expanded to satisfy all observational requirements including national needs. CREX offered direct human readability and BUFR provided for condensation (packing) of the data and allowed coding of quality flags and associated values. It was further noted that the self-description, flexibility and expandability of these two codes were fundamental in light of the fast evolution of science and technology, which needed representation forms for new data types.

6.9 As pointed out at CBS-XII, the use of the BUFR code required adequate communication links to support binary data, which were not yet available in a number of countries. The Commission recognized that these countries would need more time before being able to receive binary observations and perhaps a far longer period to be able to encode observations in BUFR. As a result, the Commission was pleased to note that CBS had considered the following phased approach for the migration from the current traditional alphanumeric codes to the BUFR and CREX codes:

(*a*) As from November 2002, in a voluntary and experimental manner, some data producers could transmit in real-time observations in BUFR or CREX (and also in traditional alphanumerical codes, if requested by voluntary experimental users);

(*b*) CBS-Ext. (2002), held in December 2002, was to review the migration process and consider a detailed plan for phasing out all traditional WMO code forms and retaining only the so-called Table Driven Codes: FM 94 BUFR and FM 95 CREX.

6.10 The Commission was informed that the simultaneous transmissions of real-time observations in BUFR and CREX and in the traditional alphanumeric codes would not be possible on the existing AFTN links, communication systems and end systems. Furthermore, the OPMET databases would not be able to accommodate both types of observations with identical date/time groups in the message.

6.11 The Secretariat provided information to the Commission about some of the results of the meeting of the CBS ET on the Migration to the Table Driven Code Forms held in Washington, D.C., United States in May 2002. The Team comprised experts from France, Germany, Japan, the Netherlands and the Russian Federation, as well as from ECMWF, EUMETSAT, ICAO and JCOMMOPS. The ET developed a detailed plan for the migration from the alphanumeric codes to the Table Driven Code Forms for consideration by CBS-Ext. (2002). One result of particular interest to the Commission included a proposal contained in the migration plan to organize at least seven major training events on all aspects of the migration process for all WMO Regions. Another was the representation on the ET of large countries that could have already consulted their civil aviation administrations regarding possible difficulties that could be experienced by the AFTN as a result of this migration. In reply to a query about how the migration plan and the dissemination of test messages would be organized, the Commission was informed that the migration plan should also consider the required changes in AFTN message switches, end systems and OPMET databanks. The Secretariat indicated that CBS-Ext. (2002) would be expected to address all these issues.

PROPOSAL FOR REVIEWING THE WIND SHEAR CODE AND DESCRIPTORS FOR DUST AND SAND

6.12 The Commission noted with interest the proposal submitted by the Delegate from the Republic of Korea for reviewing the code form FM 15/16 METAR/SPECI in order to provide information on the time of wind shear occurrence to flight crew and aviation users, as well as a proposal for a descriptor in Code Table 4678 qualifying the dust or sand raised at very high levels and travelling long distances. Furthermore, the Commission noted that there could be some difficulty for the dissemination of this report because of the character limit of the AFTN.

6.13 As a first step, the Commission decided to ask ICAO to submit this matter for consideration by its relevant study group to find out whether such an aeronautical requirement existed. The Commission thanked Hong Kong, China for having made available to Delegates copies of its publication *Windshear and Turbulence – Information for Pilots*, which had been prepared in collaboration with IFALPA, and noted that electronic copies of this publication were accessible via the AeMP Web site.

THE AUTOMATION OF AVIATION FORECASTS AND OBSERVATIONS – THE CURRENT UNITED KINGDOM POSITION

6.14 The Commission noted with interest the information provided by the United Kingdom regarding the Met Office's current position with regard to the automation of aviation forecasts and observations and the potential changes to the TAF and METAR codes that would be required to notify the aviation community of the production methods used. The United Kingdom highlighted the efforts put on the automation of synoptic observations and forecast production that resulted in significant efficiencies being made over a large number of meteorological services provided by the Met Office. As one example, it was indicated that the automatic display of global observations and NWP model output in front of the forecaster had enabled the production of all the WAFC SIGWX charts above FL 240 by only two forecasters. However, the Commission was informed that there were still areas of forecast production and weather observation, namely METARs, TAFs, TREND forecasts, and low-level SIGWX and aerodrome warnings, that were relatively labour intensive.

6.15 The Commission noted with interest that, in the United Kingdom, automatic TAFs were regularly produced as the first computer-derived estimates of the forecast and that this resulted in some significant efficiency in TAF production. In this regard, the United Kingdom recommended that if in the future automatic TAFs and TRENDs were to be generated and disseminated without any human intervention, changes to the TAF and TREND codes would be necessary to allow for identification of such automatic TAFs. With regard to automatic TRENDs production, the United Kingdom also recommended that there should be a change to the METAR code to allow for identification of such automatic TRENDs.

6.16 It was suggested that it should also be indicated when a TAF was produced for aerodromes for which only automatic observations were available. Although the latter was backed by a few Delegates, several others expressed concerns that this could indicate a poorer quality TAF. It was decided that this subject should be referred back to PROMET as the appropriate body for such consideration. ICAO would be kept informed of developments in this area through the usual arrangements.

THE USE OF AUTOMATED OBSERVATIONS IN SUPPORT OF AERODROME OPERATIONS – THE CURRENT UNITED STATES POSITION

6.17 The Commission noted with interest the information provided by the United States on the use of AOSs to provide service to aviation. The information indicated that the use of AOSs enabled the United States to provide meteorological observations at airports that had never had any observations. This capability had increased the level of safety at these airports. Further, the United States had augmented observations at airports that required a METAR in accordance with ICAO Annex 3/WMO Technical Regulation [C.3.1] provisions. The United States indicated that other countries were recognizing the advantages of automation and were implementing their own programmes. France confirmed that it had adopted this position.

6.18 The United States pointed out that the ICAO AMOSSG had reviewed the state of the art of automation and how automated observations could support aerodrome operations, and had submitted amendment proposals for ICAO Annex 3/WMO Technical Regulation [C.3.1]. The United States indicated that further work was envisioned to allow the full use of automated observations to support operations at international aerodromes, and that it supported the evaluation of such work with the understanding that automated observations could meet the meteorological service needs of international carriers. Other countries supported this position.

VERIFICATION OF AERODROME FORECASTS

6.19 The Commission noted with interest the progress made by Hong Kong, China in the verification of TAF, the practical considerations made in its implementation, as well as plans for extending the TAF verification scheme to TREND-type landing and take-off forecasts.

RESULTS OF THE PROMET PILOT PROJECTS ON TAF VERIFICATION

6.20 The Commission noted with interest the reports on the results of the PROMET pilot projects on TAF verification submitted by Australia and France. The reports highlighted the results of TAF verification for airports in Australia and New Zealand, with Australia taking the lead; and for airports in some European and African countries, with France taking the lead. Australia generated TAF verification statistics using the principles described by the CAeM ET on TAF verification, and France applied its own TAF verification algorithm.

6.21 The principles for verification, controlled parameters for selected airports and the indicators performed were described in both pilot projects. The Commission appreciated the work carried out by PROMET's two pilot projects on TAF verification and thanked the participating countries, Australia and France, as well as those that contributed their data for this project. The Commission felt that, in view of the importance and the highly sensitive nature of TAF verification, the final step preparing for implementation of a unified, user-oriented method with flexible parameter thresholds should be carried out by a small ET for completion within one year based on the principles and methods agreed by PROMET in its October 2001 meeting. For the purpose of identifying weaknesses in the production of TAFs, Members were encouraged to continue to develop and run specific verification programmes for their own benefit. The Commission agreed that the implementation and operation of TAF verification should be left to individual Members or by regional agreements to specialized regional centres. It was felt that, while comparability of results was paramount to the success of the scheme, special emphasis should also be placed on marginal weather conditions as defined by the user community and due recognition be made of the local knowledge and skill in aviation weather forecasting. The Commission appreciated that, for special climatological and topographic situations as well as rare events, individual studies might be needed in addition to the generally applicable standard methods of verification. Additional information regarding TAF verification is found under agenda item 4, Reports by Chairpersons of Working Groups.

VOLCANIC ASH ADVISORIES

6.22 The Commission noted with interest the information provided by the United States Delegates on the implementation of the standards and recommended practices contained in ICAO Annex 3/WMO Technical Regulation [C.3.1] with regard to the issuance of volcanic ash advisories by VAACs and the issuance of volcanic ash SIGMETs by MWOs. While great strides had been made over the past decade in providing information on volcanic ash to en-route aircraft, there was still a need to improve the accuracy and timeliness of these messages. Further, as noted by the United States, there was a need to ensure that these products were consistent not only in format but, of greater importance, in content of information provided to the end-user, namely air traffic service and airline operation centres. It was deemed essential that there be no misinterpretation resulting from lack of information. The United States encouraged WMO to review existing practices and procedures to determine what additional guidance or guidelines would be required at VAACs and MWOs.

7. QUALITY MANAGEMENT (agenda item 7)

7.1 The Commission welcomed the incorporation of a specific item related to Quality Management in the draft 6LTP for aeronautical meteorology, namely the proposal to develop relevant guidance to assist all Members in working towards implementation of Quality Management systems to enhance the quality of their service to aviation users, and to improve efficiency. An important aspect of quality systems to be implemented would be a globally consistent, user-oriented verification of key products such as TAFs.

7.2 The Commission was aware that Quality Management provisions based on ISO 9000 were included as recommended practices in Amendment 72 to Technical Regulation [C.3.1] implemented in November 2001. The Commission was informed that the fifty-third session of the Executive Council, held in June 2001, had pointed out that any mandatory implementation of ISO 9000 quality assurance would lead to significant costs to NMSs and could increase the gap between developed and developing countries.

7.3 In line with the wishes of the Council that a study be conducted on the introduction of ISO 9000 in WMO Technical Regulation [C.3.1], the Commission noted with satisfaction that PROMET had set up a small group of experts called the Task Team on Quality (TTQ). The report of PROMET's TTQ is covered under this agenda item, in paragraph 7.8 to paragraph 7.12.

7.4 The Commission noted with interest that two independent reports of CBS studies on Quality Management had provided estimates of the costs that were considered by the CBS-MG as prohibitive for many NMHSs to achieve ISO 9000 certification. It was pointed out that with respect to ISO certification, the ISO 9000 Quality Management standard should not be taken as product guarantee, and meant only that the processes influencing quality conformed with the relevant standard's requirements. Furthermore, the Commission also noted with interest that the CBS-MG was of the view that the development of Quality Management processes within the existing framework of WMO's Technical Regulations, in particular the WWW procedures and practices, would be the best way forward. The fifty-fourth session of the Executive Council in June 2002 agreed that WMO should work towards its Quality Management framework. The Council pointed out that the integration of Quality Management procedures and processes within the WWW manuals and guides would also benefit those Members that had chosen to implement ISO 9000 by possibly serving as a component of the latter. The Council emphasized the importance of an independent auditing component and endorsed the proposal to establish an inter-Commission task group to develop an overall approach for the WMO Quality Management Framework. The Commission requested that the work of this task group be completed in the near future.

7.5 It was pointed out that when Quality Management performance indicators were linked to the performance of staff and therefore to staff salary, the application of this Quality Management could become more difficult and contentious. It was also pointed out that ISO 9000 should not be seen as a panacea. It was stressed, in particular, that it was possible to provide a minimum quality service which was certified, but that it was also possible to provide an excellent service without being certified. However, the Commission felt that Quality Management was an excellent tool that should be supported. Furthermore, Malaysia, on behalf of the 10 Members of ASEAN, felt that Member countries should implement quality assurance systems in their own way at their own pace. A similar view was expressed by other Delegates, including from the Russian Federation. Other Delegates supported the introduction of Quality Management and indicated that this would contribute to the quality and efficiency of aeronautical meteorological services.

7.6 It was suggested that within the WMO framework the development of Quality Management should include formalization of the planning and preparation of Quality Management components such as customer consultation and surveys, establishment of process improvement groups, and documentation of procedures, as appropriate to individual Members.

7.7 The Commission noted the Russian Federation's information that the WMC in Moscow provided meteorological information to aviation in accordance with Annex 3/Technical Regulation [C.3.1], and that the service provided by this Centre was therefore legitimate.

REPORT OF THE PROMET TTQ

7.8 The Commission noted that France had indicated that WMO and ICAO documents should have initially been written in a standard form in accordance with principles of the ISO 9000 standard, but that this was not currently the case. The Delegate from France requested that measures be taken to this end as soon as possible, especially by WMO and ICAO. These measures should include the introduction in WMO and ICAO documents of information such as desirable operational accuracy of forecasts, the maximum acceptable duration of the breakdown of instruments, the desirable accuracy of aeronautical meteorological measurements and the order of priority for operational tasks in crisis situations.

7.9 The Commission noted with interest information from France on costs related to the implementation of a quality system, including particularly consultancy fees and audit costs. In this context, the Delegate from France indicated that WMO and ICAO could consider methods of limiting these costs to reasonable levels, particularly those related to the audit certification, and drew the Commission's attention to the following issues: the resources needed for the implementation of quality systems, given that meteorological authorities were increasingly subjected to cost-related pressures; the tendency towards a 'two-tier' system (those who would be certified and those who would not); and the results that this would have on competitiveness and therefore on access to resources. Finally, it was felt that the approach envisioned by WMO and ICAO to solve this problem through cooperation in the field of meteorology among Members would be more vital than ever before.

7.10 The fifty-third session of the Executive Council in 2001 suggested that a study highlighting both the positive and negative aspects of quality assurance be conducted in Member countries already using ISO 9000 series of quality assurance, with a view to sharing experience with other Members on this matter. In line with the wishes of the Council, the PROMET WG established a TTQ in October 2001. The mandate given to the TTQ was to develop objectives, expected results, milestones and means; highlight the advantages, potential difficulties and costs for implementing such a system; and prepare a report on the subject.

7.11 The Commission noted with appreciation that the TTQ report addressed all the issues for which it had been established. The Commission was pleased to note that the report highlighted among other things the principles governing the ISO 9000 series. These included customer focus, leadership, involvement of people approach and system approach to management, continual improvement, factual approach to decision-making and mutually beneficial supplier relationships. The report provided 12 milestones as significant steps to be followed when implementing a quality system, and interesting information on the main components of the costs involved in implementing the ISO 9000 series. These included the cost of consultants, training of auditors and annual auditing costs from accredited organizations. In this regard, the Commission recalled that any costs associated with the implementation of quality systems for aeronautical meteorological services could be recovered through existing cost recovery mechanisms. The Commission noted the comments of some Members that cost recovery might be difficult to implement in some countries.

7.12 The Commission thanked all the experts who contributed to this excellent report, as well as Members and organizations that supported the implementation of these pilot projects.

OVERALL VIEWS

7.13 The Commission discussed at length the issue of the implementation of Quality Management in the provision of aeronautical meteorological service in various countries, including the information attached in Annex II to this report. Views expressed varied from recommending continued implementation of ISO 9000 to the use of a Quality Management system based on WMO procedures and practices. The Commission generally did not agree with upgrading to the standard of the current ISO 9000 recommended practice that came into force in November 2001, and highlighted the costs that would result from its mandatory implementation, which not all countries would be in a position to recover. However, some Delegates considered that ISO 9000 provided real benefits, although this did not mean that it was suitable for all. With regard to future work in this area, the Commission looked forward to the results of the inter-commission task group, and the Commission's future directions were embodied as one component of the 6LTP, as contained under agenda item 9, Long-term Planning.

8. USER/PROVIDER RELATIONSHIPS (agenda item 8)

AVIATION METEOROLOGY SERVICES IN NEW ZEALAND

8.1 The Commission noted the information provided by the Delegate from New Zealand on the provision of aeronautical meteorological services in that country. With regard to user/provider relationships, the Commission noted in particular that the Meteorological Service of New Zealand (MetService) had strong one-to-one relationships with individual airline customers, and found these to be of more benefit than wider consultation meetings. Experience in New Zealand had shown that the one-to-one relationships could greatly assist providers in their ability to respond rapidly to changes in the meteorological requirements of users.

ASECNA's experience

8.2 The Commission was informed about ASECNA's strategy to improve and strengthen its relationship with users, which was focused on developing and strengthening service capacities, a judicious and concerted effort towards cost recovery and compatibility between the Services' capacities and the costs of services rendered.

8.3 The Commission noted with interest the two main activities on which the development and strengthening of ASECNA's meteorological centres were based, namely continuous staff training and consolidation of the Agency's equipment plan. It noted with satisfaction that two training courses had been organized in 2002, one on satellite meteorology and the other on GRIB, BUFR and other aeronautical meteorological codes.

8.4 The Commission noted with interest that the equipment plan for the period 2000-06 integrated the needs expressed by the airlines that entailed the strengthening of the capacities of meteorological centres.

8.5 The Commission congratulated ASECNA for its active participation in assistance and cooperation programmes in Africa through its commitment, among others, to install and maintain MSG receiving stations, as well as the virtual training laboratory at the African School for Meteorology and Civil Aviation in Niamey, Niger; and to reinforce weather watch systems and create a main maintenance/training centre at EAMAC, Niamey. ASECNA was also to make one of its staff members available to WMO as a telecommunications consultant for the WWW Strategic Plan for Africa.

8.6 The Commission noted with satisfaction that, with regards to the recovery of aeronautical meteorological costs, ASECNA was prepared to establish a dialogue with the airlines. In this regard, a technical panel of experts from ASECNA and IATA was to meet yearly to review all the engagements made by ASECNA to meet user requirements, and an IATA/ASECNA financial panel was to meet yearly to set aeronautical licence fees for the purpose of providing aeronautical meteorological and other services.

8.7 The Commission encouraged ASECNA to continue to establish and implement its equipment plan in consultation with IATA and to continue to improve its meteorological services for international air navigation.

Customer consultation process in the United Kingdom

8.8 The Commission was informed about a number of steps that the United Kingdom had taken to enhance the level of consultation between aeronautical meteorological service providers and the user community. The Commission was further informed that, in the United Kingdom, the meteorological authority was the CAA, and the provider of meteorological service to aviation was the Met Office. This ensured the separation of the responsibility of the regulator from that of the service provider. The CAA negotiated on an annual basis with the Met Office the full range of national service requirements and their related costs. The Commission noted with interest that most consultations between providers and users were carried out on a multilateral basis, although individual air traffic service providers were able to make direct unilateral requests to the meteorological authority based on evolving operational requirements.

8.9 The Commission was informed about the core facilities and services that provided the underpinning infrastructure used to deliver all of the Met Office direct services. In the United Kingdom, it was reported that such core service requirements and relevant costs were agreed to annually within the Core Customer Group (CCG) that represented all main stakeholders including the CAA. The CCG also had responsibility for agreeing to the relative 'fair' shares of the core costs that should be borne by each of the CCG members. The Commission noted with interest that reviews of the performance of the core services as delivered by the Met Office were performed quarterly by the CCG and that a subgroup of the CCG would meet on an ad hoc basis to address specific issues of requirement and costs that could arise from time to time.

8.10 At the suggestion of the United Kingdom, the Commission recommended that with regard to consultation between aeronautical meteorological service providers and users, stakeholders should be encouraged to ensure that consultations included the requirements and costs of facilities and services needed to serve exclusively aeronautical requirements, and the fair share of the facilities and services required to serve both aeronautical and non-aeronautical requirements. In this regard, the IATA Representative indicated that customer consultation was a good idea and that a more coordinated effort in this area was desirable, but financial constraint was a limiting factor for IATA to participate in consultation processes in all countries where different cost recovery schemes were being applied.

SOUTH AFRICAN EXPERIENCE

8.11 The Commission noted with interest the information provided by the Delegate from South Africa on the introduction of cost recovery for aeronautical meteorological services in the South African Weather Bureau (SAWB). Information related to the steps followed for the introduction of national regulations for the recovery of costs of aeronautical meteorological services based on the relevant ICAO and WMO guidance material, and the transformation of an NMS from a government department into an agency applying business principles. The transformation phase of the meteorological service comprised the restructuring programme of the SAWB, consultation with users and administration processes that resulted in reaching an agreement with a national entity to issue invoices on behalf of the SAWB to apply a nominal charge for the meteorological services provided to users.

8.12 The Commission noted with interest that the experience in South Africa had provided a good example on how to deal with the transformation of a government department providing services free to users into an organization with some level of commercialization. It was pointed out that the better the planning was, the smoother the transformation process would be.

'SINGLE EUROPEAN SKY' – IMPACTS ON AERONAUTICAL METEOROLOGICAL SERVICES PROVISION

8.13 The Commission was informed that the European Commission had published legislative proposals in December 2001 to support the EU initiative for the creation of a 'Single European Sky' that included specific arrangements for the provision of ANS that could significantly impact the organization of aeronautical meteorological service provision within Europe. These arrangements related to the separation of the responsibility of service provider from that of the service regulator, and the creation of a harmonized system of authorization for service provision which would enable an authorized service provider in one EU member state to operate in another member state. The Commission noted the concern of some Members about the possible negative consequences resulting from such a decision, primarily in the area of air transport safety.

8.14 The Commission stressed the importance of the issue of separation of responsibility of the provider from the regulator. It recalled that the fifty-fourth session of the Executive Council in June 2002, while recognizing that alternative arrangements existed in light of varying situations among countries, had reaffirmed its earlier views on the advantages of NMSs being designated the meteorological authority for ICAO purposes. The Commission noted that the designation of NMSs as meteorological authorities would give them more visibility that would facilitate contact with national decision makers and help secure needed resources to support the overall operations of their services.

8.15 The Commission was informed, however, that IATA preferred the separation of the regulator functions from those of the service provider, and that EUROCONTROL had indicated that regulation and service provision should be separated. Several Members supported that view while others did not. The Commission noted, however, that the trend toward a separation between regulator and provider was established and would possibly continue. In light of this, the Commission requested the president to draw this to the attention of the Executive Council and Congress for their consideration. Some Members felt there was a need to ensure the clarification of the roles of the meteorological authority, and for clear criteria defining the required competencies of the meteorological authority to be developed by ICAO and WMO. Some Members felt that there were in fact three roles in this area: regulator; service provider; and service facilitator, the agency responsible for arranging for meteorological services to aviation.

8.16 With respect to the commercialization of the provision of meteorological services to aviation in Europe, it was indicated that this decision had to be addressed at the national level in Europe before its full implementation in 2005. In this context, the Commission expected to take great interest in this development in Europe that could have worldwide implications for NMSs, including regions such as Africa, where the arrangements were completely different.

8.17 The Commission felt that, for safety reasons, there should be only one service provider active in a given airspace or specific aerodrome site at any given time.

COST RECOVERY FOR AERONAUTICAL METEOROLOGICAL SERVICES – EXPERIENCE GAINED WITH AN ISLAND STATE

8.18 The Commission noted with interest that the United Kingdom's Met Office had been invited to give assistance to a small island state to investigate the introduction of a cost recovery system for its meteorological services. It was indicated that the main focus of the Met Office involvement was to prepare a report for the establishment of a fair level of costs that the island state could legitimately recover from aviation charges.

8.19 The Commission noted that the various principles and methodologies described in the ICAO and WMO guidance material on cost recovery had been followed, namely ICAO's *Manual of Air Navigation Service Economics* (ICAO DOC. 9161) and WMO's *Guide on Aeronautical Meteorological Services Cost Recovery – Principles and Guidance* (WMO-No. 904). The consultation process with providers and customers and governments had been proposed to ensure that from an early stage the customer community had the opportunity to influence the work undertaken. The inventory of each category of facilities and services provided to meet exclusively aeronautical and non-aeronautical requirements or to meet both requirements had been established. At all stages in the process, the figures used together with any assumptions made had been recorded and documented so that customers could clearly understand the basis for the calculations.

8.20 The Commission was informed that following estimates of the fair level of aeronautical meteorological costs to be recovered, a series of recommendations was set out to indicate how the implementation of the proposed cost recovery scheme should proceed. These recommendations related to consultations with the government, the civil aviation authorities, users and customers. Following the establishment of the cost recovery scheme, the Commission highlighted the need for continuing regular consultations with all stakeholders regarding in particular service requirements, quality and costs.

8.21 The Commission noted the IATA view that there was an inconsistency that costs for AIREPS/ACARS which were of benefit for the WWW were not offset against charges for core meteorological services that were frequently cost recovered from aviation.

9. LONG-TERM PLANNING (agenda item 9)

9.1 The Commission examined the draft 6LTP relating to Programme 4.3, which provided the scientific and technical details of the AeMP for the period 2004-07. The Commission was pleased that the aeronautical meteorology component of the 6LTP had been prepared to be consistent with and to support the overall framework of the WMO 6LTP developed by the fifty-second and fifty-third sessions of the Executive Council held in 2000 and 2001. The Commission expressed its gratitude to all those who had contributed to the development of the draft AeMP 6LTP, in particular the president of the Commission, members of the CAeM AWG and the Secretariat. The Commission was pleased to note that the draft AeMP 6LTP had been reviewed by PROMET in October 2001, and refined and endorsed by the AWG in February 2002. The Commission noted with interest that the refined AeMP 6LTP had been examined and endorsed by the fifty-fourth session of the Executive Council in June 2002.

9.2 During discussions on the 6LTP, the importance of having appropriate performance indicators was highlighted, both for the elements of the 6LTP and for aviation weather services.

9.3 The Commission reviewed and subsequently endorsed the AeMP 6LTP for the period 2004-07 found in Annex III to this report.

9.4 The Commission requested its president to submit the AeMP 6LTP to Fourteenth Congress in 2003.

10. PUBLICATIONS AND GUIDANCE MATERIAL (agenda item 10)

10.1 The Commission expressed its appreciation for the effort undertaken by CAeM experts during the intersessional period for the development and update of numerous regulatory and guidance material in the field of aeronautical meteorology. The Commission noted with satisfaction that this material included, in addition to the four issues of the TREND Newsletter published between 2000 and 2002, the following:

(*a*) *Guide on Aeronautical Meteorological Services Cost Recovery – Principles and Guidance* (WMO-No. 904), published and distributed to Members in 1999;

(*b*) Copies of the booklet *The Application of Numerical Weather Prediction Products in Aviation*, developed by the United Kingdom Met Office from the proceedings of the United Kingdom/WMO annual seminars held from 1999 to 2002, distributed to all participants at the seminars, and also made available to all WMO RMTCs;

(*c*) WMO Technical Note No. 195 - *Methods of Interpreting Numerical Weather Prediction Output for Aeronautical Meteorology* (WMO-No. 770), updated in 1999, and translated into French and Spanish;

(*d*) Supplements to the *Technical Regulations* (WMO-No. 49), including Technical Regulation [C.3.1], Volume II, published in 1998 and 2001 as a result of the implementation of Amendments 71 and 72;

(*e*) *Aerodrome Reports and Forecasts: A User's Handbook to the Codes* (WMO-No. 782), updated to take into account consequential changes to the codes stemming from the introduction of Amendment 72 to Technical Regulation [C.3.1] and distributed in 2001;

(*f*) Preliminary issue of the *Compendium on Tropical Meteorology for Aviation Purposes* (WMO-No. 930) in May 2002;

(*g*) A major review undertaken in 2001 of the *Guide to Practices for Meteorological Offices Serving Aviation* (WMO-No. 732), which was expected to be finalized in 2002 and published during 2003.

10.2 The Commission noted with appreciation that the draft booklet *Aviation and the Global Atmospheric Environment* had been prepared by the chairperson of TREND in collaboration with the Secretariat with the active involvement of Mr N. Sabogal (UNEP Nairobi). The draft booklet summarized relevant findings contained in the *IPCC Special Report on Aviation and the Global Atmosphere* and included additional scientific findings that had emerged since the publication of the IPCC report in 1999. The draft booklet had been circulated amongst experts in the field and many useful comments had already been incorporated into the draft. It had been reviewed and was expected to be jointly published by WMO and UNEP. Furthermore, the Commission noted with appreciation that the president of CAeM and the chairperson of TREND, in collaboration with the Secretariat, had actively contributed to the update of the publication *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258), Volume I, published in 2002. The Commission was pleased to note that the draft guidance material initiated by the Secretariat entitled *Aeronautical Meteorological Cost Recovery* and *Alternative Service Delivery for Aviation* had been redrafted to reflect comments and suggestions made by the Advisory Group on the Role and Operations of NMHSs. The results of discussions on this guidance material by the Commission are found under agenda item 3, Report by the President of the Commission.

10.3 The Commission concurred with the view expressed by the CAeM AWG session in February 2002 that publications and technical documents should be updated in a timely manner, in order to include the latest data and modern scientific and technological developments. In this context, the Commission requested that the publications *Meteorology in the Service of Aviation* (WMO-No. 706) and the *Guide on Meteorological Observation and Information Distribution Systems at Aerodromes* (WMO-No. 731), published in 1988 and 1990 respectively, be updated and published as soon as possible.

11. COOPERATION WITH OTHER WMO BODIES AND INTERNATIONAL ORGANIZATIONS (agenda item 11)

11.1 The Commission recalled that Congress had requested the presidents of technical commissions and regional associations to play major roles in the continuing assessment of WMO Programmes, especially through the identification of areas of common activity and overlapping interests, and to develop cooperation arrangements at the working level.

11.2 The Commission noted with pleasure that, since CAeM-XI in 1999, fruitful cooperation with WMO technical commissions included the continued support to CAeM activities provided by CBS, CIMO and their respective ETs. The Commission noted with satisfaction that CAeM members and the AMDAR Technical Coordinator (TC) had been actively involved in the work of CBS and CIMO through their various subsidiary bodies.

11.3 The Commission noted with interest that the president of CAeM had asked for further assistance from relevant CBS bodies to better define precipitation intensity and weather phenomena suitable for aeronautical meteorological use as requested by XII-RA II (September 2000). The Commission noted with satisfaction that aeronautical meteorological code issues had been addressed by the relevant CIMO/CBS ET meetings.

11.4 The Commission noted with interest that the president of CBS had attended AMDAR Panel meetings. Furthermore, the development and implementation of the project on aircraft in-flight icing by the CAS WWRP was expected to lead to closer cooperation between CAS and CAeM. The Commission concurred with the CAeM AWG statement that the new potential for routine humidity measurements from aircraft should be part of the crosscutting issues that would need to be addressed by CAeM, CBS, CIMO and the AMDAR Panel.

11.5 The Commission agreed that the effective and active participation of ASECNA, IAOPA, IATA and IFALPA in the work of CAeM and its working groups during their intersessional period, and the close and cordial relations that had existed throughout, had contributed to the positive results of its work.

11.6 The Commission was pleased to note that in line with the working arrangements concluded between ICAO and WMO in Basic Document No. 3, *Agreements and Working Arrangements with Other International Organizations* (WMO-No. 60), cooperation between WMO and ICAO was being pursued in developing guidance and regulatory material in aeronautical meteorology and through their mutual participation in ICAO study groups and relevant WMO working groups.

11.7 The Commission recognized the full support provided by EUROCONTROL to the European

Commission regarding the development of requirements for the future CNS/ATM system.

INTERNATIONAL GLOBAL AMDAR ACTIVITIES – NEW NATIONAL AND REGIONAL INITIATIVES

11.8 The Commission expressed its appreciation to AMDAR Panel members for their dedicated efforts in carrying out AMDAR activities and to WMO Members for providing the financial resources to support these activities since the establishment of the AMDAR Panel in 1998. The Commission noted the view of the fifty-third session of the Executive Council in 2001 that AMDAR had proved to be a very cost-effective data source that responded to the needs of WMO Programmes and brought benefits to end-users. The Commission was pleased to learn that established regional AMDAR programmes that involved 10 countries and 15 airlines, as well as the very effective E-AMDAR Programme involving 18 European countries, continued to expand and become more cost-effective with increased observations and improved data quality. It noted with satisfaction that, through remote targeted observations, these programmes were also producing much-needed data over data-scarce or data-void areas of the world. The Commission also noted with interest that new developing AMDAR Programmes were being implemented in Canada; Japan; South Africa; Saudi Arabia; and Hong Kong, China, and that potential AMDAR Programmes were being considered by a growing number of countries in Africa, Asia, the Middle East and South America. In this regard, the Commission was aware that all the achievements of the Panel were due to the kind financial contributions provided by Members to pay in particular for the very valuable services of the AMDAR Technical Coordinator. In view of this, the Commission reiterated its appeal to Members to continue to provide, on a voluntary basis, financial support for the implementation of the AMDAR Programme. The Commission considered strongly that, given that automated aircraft reports were an increasingly vital component of the WWW GOS, the activities of the AMDAR Panel in developing and coordinating AMDAR Programmes should receive funding from the regular budget, in line with the high priority given to other aspects of the WWW Programme.

11.9 The Commission was informed about the progress made by Hong Kong, China in the implementation of an AMDAR Programme aimed at increasing the number of upper-air observations in the vicinity of Hong Kong International Airport (HKIA). The Commission noted with interest the encouraging results of studies carried out to evaluate AMDAR data quality and their potential for detecting low-level wind shear and turbulence in the vicinity of HKIA. Regarding the suggestion made by Hong Kong, China that collected AMDAR observations should have higher temporal resolution to suit the temporal scale of wind shear, the Commission was requested to approach the AMDAR Panel with a view to studying the feasibility of observations with higher resolution, and considering a pilot project if found feasible.

11.10 The Commission noted the information provided by the Russian Federation on activities carried out to establish an ASDAR/AMDAR system in the country. The Commission noted with interest that a monitoring exercise was being conducted on the reception of automated data from aircraft via the GTS. It noted that statistics on data collection over the European part of Russia represented only 3 per cent of the total AMDAR data collected. Furthermore, of the data collected over the European part of Russia, only 23 per cent was ascent/descent data. In that regard, it was indicated that the Trans-Siberian and Cross-Polar Corridors that passed over sparsely populated regions of Siberia and the Far East were those which were most poorly covered by AMDAR data. It was further indicated that airlines with routes passing over the North Pole, over-flying Russia and serving the countries of South-east Asia had interest in obtaining additional meteorological information. In that regard, it was pointed out that AMDAR information covering the Russian Federation would help in obtaining more accurate temperature and winds data at flight levels used for flights in the Trans-Siberian and Cross-Polar corridors that would contribute to flight safety and efficiency.

11.11 The Commission was pleased to note that the Russian Civil Aviation Administration and Roshydromet would continue to develop the technical and structural elements of a nationwide system for the collection and use of AMDAR/ASDAR data. Future activities would include a comprehensive analysis of AMDAR/ASDAR data that would lead to the development of a long-term plan for the establishment of a network of AMDAR reception and transmission systems over the European part of Russia and subsequently the transmission of such data through the GTS.

11.12 The Commission welcomed the interest of the Russian Federation in collaborating with the AMDAR Panel to develop the Russian AMDAR Programme expected to contribute to improved quality of aeronautical meteorological forecasts for international air navigation.

11.13 The Commission was informed that several potentially very useful projects were being implemented by Members and the aviation industry that would make a substantial contribution toward the extension of and improvement to meteorological observations from aircraft. These included the upgrade of the specification for onboard aircraft software that would become the new industry-wide standard, the development of new observations and sensing systems, e.g. the measurement and reporting of turbulence, humidity and icing, and the development of different types of AMDAR systems in the United States, Canada and Australia.

11.14 The Commission noted, however, that there were operational constraints to be addressed by the AMDAR Panel, including, among others, the reliance on the cooperation with the airline industry, the lack of humidity data and the need for higher data sampling rates to pick up smaller sounding structures. It requested the Panel to continue to take appropriate action to address these constraints.

12. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT EXECUTIVE COUNCIL RESOLUTIONS (agenda item 12)

In accordance with established practice, the Commission reviewed those resolutions and recommendations adopted prior to its twelfth session which were still in force and adopted Resolution 1 (CAeM-XII). The Commission also examined the resolutions of the Executive Council related to aeronautical meteorology and adopted Recommendation 1 (CAeM-XII).

13. SCIENTIFIC LECTURES (agenda item 13)

13.1 The president introduced the lecturers, Mr K. Reid from EUROCONTROL (Belgium), who had been invited to deliver the lecture 'A Fresh Approach to the Provision and Management of Aeronautical Information in the Twenty-First Century – The Meteorological Perspective'; and Mr T. Hauf from the University of Hannover (Germany), who had been invited to deliver the lecture 'Perspectives in Nowcasting and Aviation Weather':

13.2 The Commission thanked Mr Reid and Mr Hauf for their excellent lectures, which were followed by stimulating discussions. The Commission felt that, similar to previous occasions, and because of their importance to aeronautical meteorology, the lectures should be translated and published if funds permitted.

14. ESTABLISHMENT OF WORKING GROUPS (agenda item 14)

14.1 The Commission was informed that its AWG session held in Geneva in February 2002 had agreed that, overall, the current structure of the Commission had served the Programme well and that there was only a need to expand and share responsibilities among AWG members so that each had a role to play in effectively implementing the Programme. In this regard, the Group further agreed on a proposal to rename the current AWG as the 'CAeM Management Group' with revised terms of reference. The Commission reviewed the suggestion of the AWG, and decided to establish a CAeM Management Group and two OPAGs considered necessary for the work of the Commission between its twelfth and thirteenth sessions. The Commission gave its commitment to the main long-term objective of the AeMP to ensure the worldwide, reliable provision of quality, timely, cost-effective, sustainable and responsive meteorological services to users throughout the world in support of safe, regular and efficient aviation operations. It agreed that to meet this objective and achieve the goals of the AeMP 6LTP, the intersessional work of the Commission could best be accomplished through the following three groups:

(*a*) The Management Group, which would operate in an empowered fashion with the ability to take decisions on behalf of the Commission in the intersessional period in matters of urgency. The group would consist of:
   - (i) The president and vice-president of the Commission;
   - (ii) The two co-chairpersons of PROMET and of TREND;
   - (iii) Two additional Members to achieve regional balance;
   - (iv) Such other additional experts as the president felt necessary to accomplish the tasks of the CAeM Management Group;

(*b*) TREND would be an OPAG to accomplish specific tasks in the following areas in order to achieve the goals of the LTP:
   - (i) Training;
   - (ii) Impact of aviation on the environment;
   - (iii) Very-short-range terminal forecasts;
   - (iv) Forecasting and warning of en-route meteorological hazards;
   - (v) Forecast verification;
   - (vi) CNS/ATM system developments;
   - (vii) Quality Management;
   - (viii) Technology transfer;
   - (ix) Liaison with CAS;

(*c*) PROMET would be an OPAG. The tasks to be undertaken to achieve the goals of the LTP would fall into the following areas:
   - (i) WAFS;
   - (ii) Aeronautical meteorological codes;
   - (iii) Aeronautical meteorological observations;
   - (iv) Cost recovery of meteorological services for aviation;
   - (v) Regulatory and guidance material;
   - (vi) Liaison with CBS and CIMO;
   - (vii) Liaison with ICAO and aviation user organizations.

14.2 With regard to the CAeM Management Group and the two OPAGs, Resolutions 2 (CAeM-XII), 3 (CAeM-XII) and 4 (CAeM-XII) were adopted.

14.3 Recognizing the need to enhance collaboration with ICAO and user organizations, one of the highest priorities of the AeMP, the Commission agreed that ICAO, IAOPA, IATA, IFALPA, IFATCA, ASECNA and EUROCONTROL should be invited to participate in the work of PROMET and TREND.

14.4 The Commission, noting the increased importance of the activities of CAeM, encouraged its president and the WMO Secretariat to keep Members of the Commission informed by all appropriate means of progress in its work by distributing through the AeMP Web site and as appropriate circular letters from the president of CAeM, reports of sessions, newsletters, etc.

15. ELECTION OF OFFICERS (agenda item 15)

Mr N.D. Gordon (New Zealand) was unanimously elected president of the Commission. Mr C. McLeod (Canada) was elected vice-president of the Commission.

16. ANY OTHER BUSINESS (agenda item 16)

There were no issues raised by Members of the Commission under this agenda item.

17. DATE AND PLACE OF THE THIRTEENTH SESSION (agenda item 17)

The Commission noted with appreciation the offer by Germany to host the thirteenth session of the Commission in 2006, subject to confirmation. It further noted that in accordance with the WMO Convention and General Regulation 187, the date and place of the next session would be finalized by the president of the Commission after consultation with the Secretary-General.

18. CLOSURE OF THE SESSION (agenda item 18)

18.1 In closing the session, the president of the Commission, Mr N.D. Gordon (New Zealand), thanked all those who had facilitated the work of the Commission during the previous four years. He thanked in particular Mr J. Goas (France), the vice-president, and Mr C. Flood (United Kingdom) for their many years of service to the Commission, and wished them all the best as they were leaving the Commission. He thanked the ICAO Secretariat for hosting the session and providing excellent facilities and services for the event. He thanked the WMO Secretariat for the valuable support given to the implementation of the AeMP and in particular for its efforts that contributed to the smooth conduct of this Commission session.

18.2 Mr E. Sarukhanian, representative of the Secretary-General, expressed his sincere appreciation to the president, vice-president and all the participants for the fruitful work done during the session. He then offered sincere thanks to the ICAO Secretariat for the excellent facilities provided and close collaboration shown during the session and the conjoint meeting. Mr Sarukhanian also expressed his gratitude to the Canadian Meteorological Service for its excellent support given to the WMO Secretariat in organizing and conducting the session.

18.3 Following the customary exchange of courtesies, the twelfth session of the Commission for Aeronautical Meteorology was closed at 12.30 p.m. on Friday, 20 September 2002.

RESOLUTIONS ADOPTED BY THE SESSION

RESOLUTION 1 (CAeM-XII)

REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

CONSIDERING:

(1) That all resolutions other than Resolution 1 (CAeM-XI) adopted prior to its twelfth session are now obsolete,

(2) That all recommendations adopted prior to its twelfth session have been reconsidered by the Executive Council,

NOTING the action taken on the recommendations adopted prior to its twelfth session,

DECIDES:

(1) To keep in force Resolution 1 (CAeM-XI);

(2) Not to keep in force Resolutions 2, 3, 4 and 5 (CAeM-XI);

(3) Not to keep in force Recommendations 1 and 2 (CAeM-XI).

RESOLUTION 2 (CAeM-XII)

THE MANAGEMENT GROUP OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY (‘CAeM MANAGEMENT GROUP’)

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

NOTING:

(1) The very effective experience of other WMO Technical Commissions in establishing Management Groups,

(2) The report of the president of the Commission to CAeM-XII,

RECOGNIZING THAT:

(1) The effectiveness of the Commission depends to a large extent on the effective management of its activities during its intersessional periods,

(2) A Management Group should be required to ensure the integration of activities of the Commission, evaluate the progress achieved, coordinate strategic planning and in matters of urgency take decisions on behalf of the Commission, as well as decide on necessary adjustments to achieve the objectives of the Programme,

DECIDES:

(1) To establish the CAeM Management Group (CAeM-MG) with the following terms of reference to replace the current CAeM Advisory Working Group:

- (*a*) To assist the president in guiding, coordinating and monitoring the activities of the Commission and its Open Programme Area Groups, including the establishment of Expert Teams and appointment of Rapporteurs as required;
- (*b*) To keep under review the terms of reference and working methods of PROMET and TREND, and to make adjustments as necessary;
- (*c*) To take responsibility for achieving results under WMO Long-term Plans through PROMET and TREND;
- (*d*) To ensure that the activities of the Commission meet the needs of developing countries;
- (*e*) To ensure that Members are informed of the activities of the Commission, through the AeMP Web site and other means;
- (*f*) To ensure cooperation with other WMO bodies in pursuit of WMO Long-term Plan strategic goals;
- (*g*) To assist the president, as required, to take decisions on behalf of the Commission during the intersessional period on matters of urgency;

(2) That the composition of the CAeM Management Group shall be as follows:

- (*a*) The president of CAeM (chairperson);
- (*b*) The vice-president of CAeM;
- (*c*) The co-chairpersons of PROMET;
- (*d*) The co-chairpersons of TREND;
- (*e*) Two members as necessary to provide regional balance:

  Mr F. Hidalgo (Colombia) – (the focal point on Regional Aspects of the Aeronautical Meteorology Programme (AeMP) in Region III designated by XIII-RA III);

A Rapporteur on Regional Aspects of the AeMP in Region I to be designated by XIII-RA-I;

(*f*) Additional experts as the president considers necessary to accomplish the tasks of the Management Group:

Mr D. Lambergeon (France);
Mr D. Underwood (United Kingdom);
Mr M. Andrews (United States).

RESOLUTION 3 (CAeM-XII)

OPEN PROGRAMME AREA GROUP ON TRAINING, THE ENVIRONMENT AND NEW DEVELOPMENTS IN AERONAUTICAL METEOROLOGY (TREND)

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

NOTING:

(1) The continuing rapid developments in the application of modern forecast techniques and methodologies,

(2) The results of the United Nations Conference on Environment and Development (UNCED), including the Rio Declaration and Agenda 21,

(3) Resolutions 14 and 15 (EC-XLIV),

CONSIDERING:

(1) The potential benefit of the application of advanced techniques and methodologies to aeronautical meteorological services,

(2) The development of advanced techniques for the quality control of meteorological data and forecasts,

(3) The need for CAeM to take a lead role in considering the implications of Agenda 21 in the field of aeronautical meteorology,

(4) The unique opportunity that aviation reports provide to enhance the global monitoring of the atmospheric environment,

(5) The tasks to be accomplished under the Sixth Long-term Plan,

DECIDES:

(1) To establish an Open Programme Area Group (OPAG) on Training, the Environment and New Developments (TREND), working as appropriate through small task-oriented and time-limited Expert Teams to tackle specific issues, with the following terms of reference:

(*a*) To support Members in their drive to improve the qualifications of meteorological personnel. This is to be achieved by helping to organize training events, collecting, reviewing and producing training material to be made available in electronic form on the AeMP Web site and as appropriate in printed copies, and facilitating access to training material and methods designed by specialized institutions;

(*b*) To review, in close cooperation with the International Civil Aviation Organization (ICAO) and aeronautical user organizations, scientific evidence of the impact of aviation on the environment, and publish relevant information for the benefit of the aeronautical meteorological community;

(*c*) To review and report on technical, operational and administrative measures aimed at mitigating aviation impact on the environment, taking into account similar work by the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Environment Programme (UNEP), and encourage cooperation with airlines in the gathering of relevant data;

(*d*) To encourage, in liaison with the Commission for Atmospheric Sciences (CAS) and relevant institutions, research and development of forecasting methods of hazardous weather affecting aviation en route such as turbulence, icing, tropical cyclones and volcanic ash, and to raise awareness of such methods that have proved successful with a view to promoting their application on a wider scale;

(*e*) To advise and assist Members in the application of objective methods and techniques aimed at improving the timeliness, accuracy and reliability of warnings and forecasts for the terminal area. Phenomena to be addressed include strong winds, low visibility/ceiling conditions, and runway state. In close cooperation with the OPAG on the Provision of Meteorological Information Required by Civil Aviation (PROMET), the transfer and application of affordable technology, considering feasibility and cost-effectiveness, will be encouraged with the support of Members and relevant research institutions;

(*f*) To advise on the use of appropriate verification methods for forecasts and warnings, including World Area Forecast System (WAFS) products, in the framework of a Quality Management system, with the aim of identifying areas for improvement through training and/or technology upgrades;

(*g*) To identify new or enhanced data sources with a potential to improve forecasts and warnings, and publicize examples of their application;

(*h*) To demonstrate, in close cooperation with forecasting centres and research institutions, the impact of new observing systems and forecasting techniques with a view to encouraging their introduction;

(*i*) To assist in training activities aimed at improving the flow and utilization of information between users and providers of aeronautical meteorological services in close cooperation with PROMET. This will be achieved by identifying, reviewing and, where necessary, producing relevant guidance material;

(*j*) To assist Members in the planning, development and implementation of meteorological systems to support the Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) systems of ICAO;

(*k*) To advise on issues regarding Quality Management;

(2) That TREND will carry out its tasks through a number of Expert Teams as established by the Management Group;

(3) To designate, in accordance with General Regulation 32 of the WMO General Regulations, Mr H. Pümpel (Austria) and Ms S. Lau (Hong Kong, China) as co-chairpersons of TREND;

REQUESTS the Secretary-General to invite ICAO, the International Air Transport Association (IATA), the International Council of Aircraft Owner and Pilot Associations (IAOPA), the International Federation of Airline Pilots' Associations (IFALPA), the International Federation of Air Traffic Controllers' Associations (IFATCA), the Agency for Air Navigation Safety in Africa and Madagascar (ASECNA) and the European Organization for the Safety of Air Navigation (EUROCONTROL) to participate in the work of TREND.

RESOLUTION 4 (CAeM-XII)

OPEN PROGRAMME AREA GROUP ON THE PROVISION OF METEOROLOGICAL INFORMATION REQUIRED BY CIVIL AVIATION (PROMET)

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

CONSIDERING:

(1) The continuing need to improve the quality of meteorological information required for aviation,

(2) The operational and technological advances in the field of meteorology and data processing,

(3) The continuing need for advice on meteorological observing arrangements at aeronautical meteorological stations, adequate to meet stated aeronautical requirements, and which conform to WMO standard observing practices and instrument specifications,

(4) The tasks to be accomplished under the Sixth Long-term Plan,

DECIDES:

(1) To establish an Open Programme Area Group (OPAG) on the Provision of Meteorological Information Required by Civil Aviation (PROMET) with the following terms of reference:

(*a*) To advise on the implementation and operation of the World Area Forecast System (WAFS). This is to be achieved by:

(i) Coordinating as appropriate with the World Weather Watch (WWW);

(ii) Ensuring that all Members have full access to WAFS products and are able to prepare flight documentation based on WAFS products;

(*b*) To formulate proposals for amending aeronautical codes, coding instructions and meteorological message formats to meet operational requirements;

(*c*) To provide advice on observing arrangements at aerodromes to meet stated requirements. This is to be achieved by:

(i) Monitoring developments in observing techniques including the automation of observations;

(ii) Investigating better availability and utilization of the information;

(*d*) To liaise with the Aircraft Meteorological Data Relay (AMDAR) Panel to ensure that the requirements for automated meteorological reports from aircraft are met;

(*e*) To advise on and promote improved service delivery to users. This is to be achieved by:

(i) Encouraging Members to establish regular consultations with major airlines, aviation representative bodies and aviation service providers;

(ii) Encouraging users and aviation representatives to avail themselves of the AeMP Web site;

(*f*) To keep under continuous review the regulatory and guidance material related to the provision of services to aviation;

(*g*) To keep under review relevant aeronautical meteorological guidance material, including the existing guidance material on aeronautical meteorological practices and observing arrangements at aerodromes;

(*h*) To keep under continuous review the mechanism of cost-recovery of aeronautical meteorological service and provide advice and guidance to Members as requested;

(*i*) To liaise with the Commission for Basic Systems (CBS) on matters relating to support provided by WWW for aeronautical meteorology and the development and implementation of Quality Management systems, and to liaise with the Commission for Instruments and Methods of Observation (CIMO) with regard to aerodrome meteorological measurements;

(*j*) To act as the Commission's focal point for the International Civil Aviation Organization

(ICAO) and aeronautical user organizations on all aspects relating to the provision and distribution of meteorological information to meet stated requirements;

(2) That PROMET will carry out its tasks through a number of Expert Teams as established by the Management Group;

(3) To designate, in accordance with General Regulation 32 of the WMO General Regulations, Mr M. Edwards (South Africa) and Ms M. Petrova (Russian Federation), as co-chairpersons of PROMET;

REQUESTS THE SECRETARY-GENERAL to invite ICAO, the International Air Transport Association (IATA), the International Council of Aircraft Owner and Pilot Associations (IAOPA), the International Federation of Airline Pilots' Associations (IFALPA), the International Federation of Air Traffic Controllers' Associations (IFATCA), the Agency for Air Navigation Safety in Africa and Madagascar (ASECNA) and the European Organization for the Safety of Air Navigation (EUROCONTROL) to participate in the work of PROMET.

RECOMMENDATIONS ADOPTED BY THE SESSION

RECOMMENDATION 1 (CAeM-XII)

TRAINING ACTIVITIES OF THE AERONAUTICAL METEOROLOGY PROGRAMME

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

NOTING:

(1) That Thirteenth Congress gave the highest priority to training requirements in aeronautical meteorology,

(2) That the fifty-third session of the Executive Council stressed that, while training in aeronautical meteorology was given the highest priority, there was a disparity between earmarked resources and the growing needs of Members,

FURTHER NOTING Regulation 181 of the WMO General Regulations,

RECALLING that the survey conducted among WMO Members in 2001 indicated that aviation was the most important economic sector serviced by National Meteorological Services (NMSs),

CONSIDERING the continuing need for various training activities in aeronautical meteorology, cost recovery, Quality Management and other important matters aimed at improving the safety and efficiency of aviation,

FURTHER CONSIDERING the limited financial resources currently available to conduct relevant training events,

RECOGNIZING the role of the Education and Training Programme in supporting all WMO training activities,

FURTHER RECOGNIZING the generous contributions provided by Members and sister organizations,

ENCOURAGES Members to continue to contribute towards training activities in aeronautical meteorology;

REQUESTS Fourteenth Congress to ensure additional funding for:

(1) Training activities under the Aeronautical Meteorology Programme;

(2) Convening of a Technical Conference with emphasis on improvement to services in the terminal area focusing on low-cost methods which can be applied by all Members.

RECOMMENDATION 2 (CAeM-XII)

REVIEW OF THE RESOLUTIONS OF THE EXECUTIVE COUNCIL BASED ON PREVIOUS RECOMMENDATIONS OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY

THE COMMISSION FOR AERONAUTICAL METEOROLOGY,

NOTING with satisfaction the action taken by the Executive Council on previous recommendations of the Commission for Aeronautical Meteorology,

CONSIDERING that many of these recommendations have become redundant in the meantime,

RECOMMENDS that Resolutions 9 (EC-LI) and 8 (EC-LIII) no longer be considered necessary.

ANNEXES

ANNEX I

Annex to paragraph 5.8 of the general summary

TRAINING CONCEPTS FOR AERONAUTICAL METEOROLOGY

1) Continued training in the use and application of WAFS products

- The two WAFCs will continue to remain the main pillars of support for such training while WMO's role will be mainly in supporting participants with their travel expenses and helping to organize the venues and select lecturers.
- Subjects to be covered include the operational conversion of BUFR-coded SIGWX forecasts and GRIB-coded wind/temperature forecasts to T4 charts by local service providers, which will need the highest priority to achieve a smooth transition to the final phase of WAFS.
- Training for the development of tailored products suitable for specific aviation users will be one of the activities that could help generate extra resources in addition to those recovered under the current ICAO/WMO guidance on aeronautical meteorological cost recovery.

2) Training in the use of new data types and regional/local model output

- Training will focus on the use of new or enhanced data from satellites (including derived products from scatterometers, etc.), Doppler radar and wind profiler installations and networks, and the use of AMDAR profiles in lieu of or in addition to available radiosonde ascents that will require active support from instrument designers and data providers or advanced users (e.g. NOAA FSL for AMDAR data).
- Training will also focus on the use of limited area models adapted from widely available modelling systems (e.g. MM5, ETA-family).
- Both classroom training and computer-based remote learning would be useful concepts for these training needs.
- The role of WMO would concentrate on facilitating access to such events, distributing training material and fostering conjoint seminars with data providers and users.

3) Training in nowcasting of phenomena that are relevant for the safe, efficient and reliable conduct of air transport

Such phenomena include:

- Convective events;
- Low visibility /ceiling;
- Low-level wind shear and turbulence;
- Strong precipitation;
- Winter storms affecting both air and ground operations;
- Duststorms and sandstorms;
- Strong winds affecting terminal acceptance capacity of airports;
- In-flight and ground icing; and
- High-level turbulence, also associated with breaking mountain waves and turbulence near thunderstorm tops.

4) Training required for change management

The rapid changes in working environments for aeronautical meteorologists require active change management. New functions need to be fulfilled; others are becoming obsolete. To manage such dramatic changes, specialized training for managerial, technical and meteorological staff is urgently required. Areas to be covered could include the following:

- Computer literacy training and upgrades to new systems;
- Use of new technology in observing, forecasting and warnings;
- Accounting and staff management procedures;
- Quality assurance procedures;
- Customer relations;
- Marketing;
- User training;
- Generation of user-specific products; and
- Verification.

5) Training the trainers

In this case the role of WMO will be highly important and crucial. As travel and subsistence costs are limiting the number of large seminars, the most cost-effective approach should be to support local and regional training staff by providing refresher courses, training materials and new methods of teaching.

6) Training the users

The diminishing face-to-face briefings for air crews and the lack of direct contact with dispatchers, route planners and other key airline staff have dramatically increased the need to re-establish a common knowledge base for all aviation stakeholders. In this regard:

- Training requirements will need to be assessed individually for each organizational unit (NMSs, branches and regional offices), and will therefore not lend themselves easily to off-the-shelf training programmes.
- The type of training needs will be worked out in cooperation with training specialists, business experts, technology leaders and financial experts.

The role of WMO will be crucial in addressing the training needs of Members, determining the most cost-effective ways of achieving goals and in playing the role of a 'clearing house' by facilitating contacts and cooperation between experts and organizations in need of training. Classroom training may not be the main thrust, but extended stays of experts in the units referred to above may be a promising approach.

ANNEX II

Annex to paragraph 7.13 of the general summary

EXPERIENCES WITH QUALITY MANAGEMENT

Implementation of a Quality Management system at ASECNA and its application to aeronautical meteorology

1. The Commission noted with interest that ASECNA had introduced Quality Management in response to requests made by users. The Agency introduced Quality Management essentially by establishing a Task Team on Quality Approaches, raising awareness of these approaches, providing training, developing and implementing quality processes and taking steps for certification.

2. The Commission also noted with interest that the quality approaches awareness-raising programme, aimed at managers and staff in all ASECNA member states, included seminars covering business culture, listening to clients, non-quality costs, assessments and corrective action, and the distribution of quality information bulletins to complement the awareness-raising sessions. The Commission was informed that the training provided by external specialized companies focused on those responsible for the processes that had the mission of drawing up quality processes, and on qualified auditors responsible for verifying the application of processes.

3. Whilst recalling that Amendment 72 to Annex 3/Technical Regulation [C.3.1] came into force in November 2001 and recommended that meteorological service for international air navigation should comply with ISO 9000 series quality assurance standards and be certified by an approved organization, the Commission noted that ASECNA was aware that implementation of ISO 9000 would involve preparatory action such as calibrating instruments, making transmission systems reliable, maintaining installations and providing staff training. The Commission was informed that ASECNA had opted for a sector-based approach to certification and that within this framework 'in-flight control' had just been certified for the 2000 version of ISO 9000. It was noted that other sectors, such as engineering, equipment maintenance, purchase and supply, were actively being prepared for certification and that the experience gained would be useful for the certification of operational activities.

4. ASECNA reported that difficulties in implementing a Quality Management system essentially related to staff and equipment, e.g. the lack of quality specialists, the often-observed slowness of the Agency's staff to adhere to quality processes and the relatively high costs for services. The Agency considered that such a system should be implemented progressively, particularly in regions where the capacities of Meteorological Services were still insufficient. The ASECNA Delegate proposed that the Commission should help assess any shortcomings in order to define and plan the changes required to bring aeronautical meteorological services up to Quality Management standards.

The implementation of the Quality Management system by the United Kingdom Met Office

5. The United Kingdom Delegate informed the Commission about work undertaken by the Met Office for achieving ISO 9000 Quality Management system accreditation, and in doing so meeting the recommended practices introduced by Amendment 72 to Annex 3/Technical Regulation [C.3.1]. The main incentives for seeking this accreditation included the improvement of Met Office processes across the whole of its business, the need to measure its improvements, and the expectation from Met Office major customers that their service providers should be ISO 9000 certified.

6. The Commission noted with interest that 23 key business processes had been identified and reviewed, and that a programme of process improvement had been completed in April 2001. As a result of the success of this programme, the Met Office decided to completely change its structure to be organized along the lines of processes rather than divisions. The implementation of this organizational change was completed in April 2002, and an ISO 9000 team was set up. In collaboration with consultants, this team established and implemented the Quality Management system and in particular supervised the preparation of all Quality Management-related documentation, as well as the organization of the internal auditing of all processes. It was indicated that key performance indicators (KPIs) had been developed to quantitatively

measure process and product performance, and that these KPIs would be used to give incentives to Met Office employees through annual staff bonuses.

7. The Commission noted with interest that the ISO 9000 accreditation organization had successfully carried out a pre-assessment audit of the Met Office, and that full ISO 9000 certification of the Met Office had been achieved in August 2002. It was noted that the main benefits the Met Office had gained from seeking ISO 9000 accreditation included a clearer understanding of the end-to-end processes within the organization, a more clearly defined manner for obtaining customer requirements, and better means by which process outputs could be measured so that continuing improvement could be achieved.

Implementation of the quality assurance system at Météo France

8. The Commission noted with interest that in 1996 Météo France had started to implement a quality system based on the ISO 9000 standard with the aim of obtaining certification by 2005. The Commission was informed that two of its divisions had obtained certification to date.

9. The Commission also noted with interest the example of process analysis of quality procedures applied to the provision of meteorological service for international civil aviation, together with relevant detailed documentation of procedures. In this regard, it was recalled that the introduction through Amendment 72 to Annex 3 Technical Regulation [C.3.1] of quality systems, including certification, meant for the meteorological authority the assurance that services and products supplied to aeronautical users met their needs and requirements, as well as the specifications indicated by the responsible regulator organization(s).

10. It was indicated that the process analysis required for monitoring user satisfaction consisted in describing each individual process up to the identification of basic procedures. This information was submitted together with the reference quality documentation. It was pointed out that the collection of complete documentation was necessary and should take into consideration relevant official ICAO and WMO documents which provided most of the fundamental information.

ANNEX III

Annex to paragraph 9.3 of the general summary

WMO SIXTH LONG-TERM PLAN (6LTP) FOR AERONAUTICAL METEOROLOGY

DRAFT AERONAUTICAL METEOROLOGY COMPONENT OF THE 6LTP FOR 2004-2007

Programme 4.3 - Aeronautical Meteorology Programme (AeMP)

4.3.1 Purpose and scope

The purpose of the Aeronautical Meteorology Programme (AeMP) is to assist Members, through an internationally coordinated Programme, in their efforts to further the application of meteorology to aviation. The scope of the Programme, in the framework of WMO's role of facilitating international coordination and cooperation, covers improvements to the provision of operational meteorological information required by the aviation industry (including the requirements specified by Technical Regulation [C.3.1]) to ensure the safety, regularity and efficiency of air navigation, and to the provision of meteorological assistance and expertise to non-real time aviation activities This Programme will directly contribute to WMO Strategy 1 through enhancing aviation safety, to Strategy 2 through enhancing benefits to the aviation sector, and to Strategy 4 through ensuring the sustainability of the worldwide provision of services.

4.3.2 Main long-term objective

The main long-term objective of the AeMP is to ensure the worldwide, reliable provision of good quality, timely, cost-effective, sustainable and responsive meteorological service to users throughout the world in support of safe, regular and efficient aviation operations.

4.3.3 Implementation activities for the period 2004-07

The implementation of the Programme includes the following activities and appropriate performance indicators, with the highest priority on training, focus on aviation users, and improved terminal forecasting:

(a) Organize specialized training activities

Within an overwhelming need for training, emphasis will be placed on nowcasting and very short-range forecasting techniques, and on ensuring that WAFS products are used to best advantage. Innovative approaches to training will be used, including the establishment of CAeM as a clearing house for available materials and expertise.

Performance indicators:

- Number of Members who have had staff participate in CAeM training activities; and
- Measure of satisfaction with the benefits their services have received through taking advantage of CAeM training activities.

(b) Improve mutual understanding of needs and capabilities between service providers and users

This activity will aim to better understand the users' needs and promote provision of meteorological services that respond to these needs. Publicity material (including quantified benefits of aviation meteorological services) will be developed and promoted, directly and via the CAeM Web site.

Performance indicators:

- Number of Members that have established regular consultation meetings with major aviation users or their representative bodies; and
- Number of hits on the AeMP Web site.

(c) Assist Members in the planning, development and implementation of meteorological systems to support the CNS/ATM systems of ICAO

Guidance and assistance will be provided to Members on the planning, development and implementation of meteorological systems to support the new CNS/ATM systems, in coordination with ICAO.

Performance indicators:

- Availability of guidance for Members; and
- Number of Members with an implementation plan for meteorological systems to support the new CNS/ATM systems.

(d) Improve and tailor forecasts of terminal weather to benefit the safety and efficiency of aviation operations

In addition to traditional activities of improving TAFs, there will need to be a new focus on novel products and techniques which can assist in improving airport capacity, including forecasting of conditions conducive to wake vortex formation, and disruptive phenomena such as fog and dust. Progress will be made in the development, application and technology transfer of nowcasting techniques and local, high resolution, frequently updated numerical models. In addition, economic benefits will come through new products providing longer lead-time forecasts of disruptive weather conditions.

Performance indicators:

- Overall global performance measures for TAFs;
- Number of Members with access to products from high resolution models in support of terminal forecasting;
- Number of Members assisted through AeMP technology transfer activities; and
- Number of Members providing forecasts more than 24 hours in advance of disruptive weather conditions for the aviation industry.

(e) Assist Members in the implementation of cost recovery and other changes to national service arrangements

Guidance and assistance will be provided to Members undergoing review of their national arrangements for aeronautical meteorological service delivery, including the implementation of cost recovery, and the role of the designated meteorological authority. WMO will participate in the reactivated ICAO Panel (ANSEP) dealing with cost recovery matters.

Performance indicators:

- Number of Members assisted; and
- Measure of satisfaction with assistance provided.

(f) Strive towards a Quality Management system with an approved standard for aviation meteorological services

Guidance will be developed to assist all Members in working towards implementation of Quality Management systems, with the key benefits of helping aviation meteorological service providers and their staffs to raise the quality of their service to aviation users, and to improve efficiency.

Performance indicators:

- Availability of guidance for Members; and
- Number of Members operating a Quality Management system with an approved standard.

(g) Develop and implement a WMO-approved set of methods for performance measurement of aviation forecasts and warnings

The initial focus will be on finalizing and implementing the work done on a user-oriented TAF verification system with flexible threshholds.

Performance indicators:

- Number of Members utilizing TAF verification information; and
- Number of Members formally assessing quality of aviation forecasts and warnings.

(h) Ensure beneficial utilization of the products of the WAFS

The plan foresees that all Members will have full access to WAFS BUFR and GRIB products, and the ability to produce locally all necessary flight documentation based on WAFS and to support the production of local and regional aviation forecasts.

Performance indicators:

- Number of Members with full access to WAFS products; and
- Number of Members producing locally all necessary flight documentation.

(i) Improve warnings for en-route weather hazards, including icing, turbulence, tropical cyclones and volcanic ash

Performance will be assessed and improved through better exploitation of global and regional NWP model information, remote sensing information (particularly novel satellite products), and contributing together with the WMO TCP to the completion of the implementation of the ICAO TCACs.

Performance indicators:

- Measures of performance for en-route weather hazards; and
- Level of implementation of ICAO TCACs.

(j) Improve the usefulness and cost-effectiveness of meteorological observations in the terminal area

Improved benefits will be obtained through better utilization of the capabilities of available automated systems, both in direct support of aviation in the terminal area, and as a data source in support of nowcasting and very short-range forecasting.

Performance indicator:

- Number of aerodromes enhancing their observing programmes through the use of automated systems.

(k) Further develop cost-effective global collection and dissemination of automated meteorological reports from aircraft to enhance the GOS and improve forecasting of aviation weather hazards

Through coordination of Members' activities by the AMDAR Panel, with assistance by the WMO Secretariat, the availability of good quality global upper-air data (including humidity) will be enhanced, in particular from data-sparse areas of the world, and progress will be made on resolving data ownership issues.

Performance indicators:

- Number of Members operating AMDAR programmes;
- Number of AMDAR observations reporting turbulence, humidity and icing;
- Number of AMDAR observations available for global data assimilation systems; and
- Impact of AMDAR reports on NWP models.

(l) Assist ICAO in updating SARPs, and prepare guidance material on their correct application

Updates to Technical Regulation [C.3.1] in response to evolving requirements will be carried out in coordination with ICAO, and guidance material will be prepared on the correct application of these international SARPs.

Performance indicators:

- Updated SARPs; and
- Guidance material issued.

(m) Promote enhanced understanding and awareness of the impact of aviation on the environment

This component will be implemented through publication of information material, CAeM participation in the work of the ICAO CAEP and the development of new products which could facilitate mitigation of environmental impacts.

Performance indicators:

- Publications issued or updated; and
- New products developed.

Results

It is expected that the implementation of the Programme will lead to better provision of services to aviation worldwide, and a significant contribution to the GOS, as indicated by the measures in (a) through (m).

APPENDIX A

LIST OF PERSONS ATTENDING THE SESSION

A. OFFICERS OF THE SESSION

N.D. Gordon	President
J. Goas	Vice-president

B. REPRESENTATIVES OF WMO MEMBERS

Member	*Name*	*Capacity*
Algeria	F. Salah	Delegate
Argentina	J.M. Afonso	Principal delegate
Armenia	N. Alaverdian (Ms)	Principal delegate
Australia	R.P. Canterford	Principal delegate
	E.G. Williams	Delegate
Austria	H. Pümpel	Principal Delegate
Azerbaijan	C. Aliyev	Principal Delegate
	N.S. Kuseynov	Alternate
Bahrain	A. Daham	Principal Delegate
Belgium	C. De Swert (Ms)	Principal Delegate
	J. Leten	Delegate
	N. De Keyser (Ms)	Delegate
	E. Herssens	Delegate
Botswana	M. Matlhaga (Ms)	Principal Delegate
Brazil	A.F. Gusmao	Principal Delegate
	C.R. Henriques	Delegate
Bulgaria	G. Mednikarov	Principal Delegate
Canada	C. McLeod	Principal Delegate
	K. Macdonald	Alternate
	J.A. Naismith	Alternate
	M.D. Everell	Delegate
	P. Chen	Delegate
	D. Lynch	Delegate
	J. Lancaster (Ms)	Delegate
	D. Mein	Delegate
	B. Angle	Adviser
	M. Anderson (Ms)	Observer
	G. Fournier	Observer
	B.A. Kirby	Observer
Cape Verde	J. Baptista Silva	Principal Delegate
Chile	L. Villaroel R.	Principal Delegate
China	Liu Yingjin	Principal Delegate
	Liu Guoping	Delegate
	Zhou Heng	Delegate
	Zhou Jianhua	Delegate
	Ma Qingyun	Adviser
	Xu Jianliang	Adviser
	Zhang Xiao Bing	Adviser
Croatia	B. Gelo (Ms)	Principal Delegate
Cuba	J. Ayon-Alfonso	Principal Delegate
	G. Armengol-Matas	Alternate
Czech Republic	I. Obrusník	Principal Delegate
	M. Wolek	Delegate
	B. Techlovsk	Delegate
	M Trefny	Delegate
	E. Schoberova (Ms)	Delegate
Denmark	B. Dybdahl	Principal Delegate
Egypt	M.Z. Mohamed Ghaly	Principal Delegate
Estonia	J. Saar	Principal Delegate
Finland	M. Mäkelä	Principal Delegate
	K. Österberg	Alternate
	O. Korhonen	Delegate
France	J. Goas	Principal Delegate
	D. Lambergeon	Alternate
	F. Martini (Ms)	Delegate
	J. Tirot	Delegate
Gambia	L.M. Touray	Principal Delegate
	S. Jobe	Alternate
Germany	E. Lorenzen	Principal Delegate
	K. Sturm	Alternate
	T. Hauf	Delegate
Ghana	A.A. Juati	Principal Delegate
Hong Kong, China	Lee Boon-ying	Principal Delegate
	Shun Chi-ming	Alternate
Hungary	I. Mersich	Principal Delegate
	V. Fejes-Sándor (Ms)	Alternate
Iceland	U. Ólafsdóttir (Ms)	Principal Delegate
Iran, Islamic Republic of	A. Shaneh	Principal Delegate
Ireland	D. Murphy	Principal Delegate
Italy	R. Sorani	Principal Delegate
	C. De Simone	Alternate
	D. Scordato	Delegate
Japan	Y. Momoi	Principal Delegate
	K. Sasaki	Alternate
Kazakhstan	K. Kamaletdinov	Principal Delegate
Kuwait	Y. Al-Jenaee	Principal Delegate
	K. Shuaibi	Delegate
Lebanon	A. Bejani	Principal Delegate
Libyan Arab Jamahiriya	A.R. El Haj	Principal Delegate
	A.E. Ben Ali	Delegate
	M.K. Ghargab	Delegate
	M.T. El Alem	Adviser
Malaysia	Ooi See Hai	Principal Delegate
	M. Appadurai	Observer
Morocco	A. Abidi	Principal Delegate
Netherlands	W. Van Dijk	Principal Delegate
	L. Hart	Delegate
	A.C.A.P. van Lammeren	Delegate
New Zealand	N. Gordon	Principal Delegate
	K. Mackersy	Delegate
	P. Lechner	Delegate

Member	Name	Capacity
Norway	A. Heidegård	Principal Delegate
Oman	Y. Majed Al-Saifi K. Al-Najar	Principal Delegate Delegate
Peru	P.C. Romo Lazo C.B. Medina Zea	Principal Delegate Delegate
Poland	R. Klejnowski P. Gozdzik T.P. Kodziolka	Principal Delegate Alternate Delegate
Portugal	A. Monteiro J.J. Ferreira	Principal Delegate Alternate
Qatar	A.H. Al-Mulla	Principal Delegate
Republic of Korea	Kim Sang-Jo Park Jin Seok	Principal Delegate Alternate
Republic of Yemen	A.M. Al-Hada'a N.A. Breeh	Principal Delegate Alternate
Romania	D. Visoiv	Principal Delegate
Russian Federation	V.A. Trenin M. Petrova (Ms) B.K. Kiselev V. Khrolenko A. Rasputikov	Principal Delegate Alternate Delegate Adviser Adviser
Rwanda	A.N. Twagirumukiza	Principal Delegate
Saudi Arabia	A. K. Mudarris I. Al-Jizani	Alternate Observer
Senegal	O. Sall M.A. Watt B. Gueye	Principal Delegate Delegate Adviser
Seychelles	W. Agricole	Principal Delegate
South Africa	M. Edwards M. Horak	Alternate Delegate
Spain	J. Herrero	Delegate
Sudan	S.D. Kafi	Principal Delegate
Sweden	K.G. Carlson E. Noréus (Ms)	Principal Delegate Observer
Switzerland	D. Ulrich U. Sutter	Principal Delegate Alternate
Syrian Arab Republic	I.E. Al-Beik K. Arshid N. Nezar	Principal Delegate Delegate Delegate
Trinidad and Tobago	G. De Souza	Principal Delegate
Tunisia	J. Bouraoui	Delegate
Ukraine	N.M. Nefedyeva (Ms)	Principal Delegate
United Arab Emirates	H.S.S. Al-Amri A. Al-Ali H.R.S. Ahmad	Principal Delegate Alternate Delegate
United Kingdom of Great Britain and Northern Ireland	D. Underwood D. Johnson C. Flood N. Gait B. Perry	Principal Delegate Delegate Delegate Adviser Observer
United Republic of Tanzania	S.M. Sillayo	Principal Delegate
United States of America	M. Andrews J. May R. Heuwinkel R. Stone R. Olson G. Swanson (Ms) S. Albersheim	Principal Delegate Alternate Alternate Delegate Delegate Delegate Delegate
Yugoslavia	D. Radovanović	Principal Delegate

C. Invited expert

Z. Gat (Ms) Israel

D. Representatives of international organizations

Organization	Name
Agency for Air Safety in Africa and Madagascar (ASECNA)	A. Miampika L. Finke Fictime
European Organization for the Safety of Air Navigation (EUROCONTROL)	K. Reid
International Air Transport Association (IATA)	A. Laaksonnen (Ms) W. Qualley M. Comber H. Defalque
International Civil Aviation Organization (ICAO)	O.M. Turpeinen R. Romero D. Ivanov H. Cissé N. Arias (Ms) B. Hellroth
International Federation of Air Line Pilots' Associations (IFALPA)	K. Paradis (Ms)

E. Lecturers

J. Guddal	University of Hannover
K. Reid	EUROCONTROL

F. WMO Secretariat

G. O. P. Obasi	Secretary-General
E.I. Sarukhanian	Secretary General's Representative; Acting Director, World Weather Watch – Applications
N.T Diallo	Chief, Aeronautical Meteorology Division (AEM)
S. Benarafa	Scientific Officer, AEM
F. Hayes	Conference Officer; Director, Conference, Printing and Distribution Department
C. Qarbal (Ms)	Senior Administrative Assistant, World Weather Watch – Applications
B. Vuitteney-Gelman (Ms)	Senior Secretary, AEM

APPENDIX B

AGENDA

	Agenda item	Document Nos.	PINK Nos. and person submitting	Resolutions and recommendations adopted
1.	OPENING OF THE SESSION		1(1), president of CAeM	
2.	ORGANIZATION OF THE SESSION		2(1) REV. 1, president of CAeM	
2.1	Consideration of the report on credentials			
2.2	Adoption of the agenda	2.2(1); 2.2(2),		
2.3	Establishment of committees			
2.4	Working arrangements and other organizational matters			
3.	REPORT BY THE PRESIDENT OF THE COMMISSION		3(1), president of CAeM	
3.1	Report of the president	3.1(1)		
3.2	Guidance on alternative service delivery	inf. 6		
4.	REPORTS BY CHAIRPERSONS OF WORKING GROUPS	4(1); 4(2)	4(1), president of CAeM	
5.	TRAINING IN THE FIELD OF AERONAUTICAL METEOROLOGY	5(1); 5(2); 5(3); 5(4)	5(1), chairperson, Committee B	Rec. 1
6.	AERONAUTICAL METEOROLOGICAL CODES	6(1); 6(2); 6(3); 6(4); 6(5); 6(6); 6(7); 6(8); 6(9); 6(10); inf. 5; inf. 7; inf. 10	6(1), chairperson, Committee A 6(2), Chairperson, Committee A	
7.	QUALITY MANAGEMENT	7(1); 7(2); 7(3); 7(4); 7(5); inf. 8; inf. 9	7(1), chairperson, Committee A	
8.	USER/PROVIDER RELATIONSHIPS	8(1); 8(2); 8(3); 8(4); 8(5); 8(6)	8(1), chairperson, 8(1), chairperson,	
9.	LONG-TERM PLANNING	9(1)	9(1), chairperson, Committee B	
10.	PUBLICATIONS AND GUIDANCE MATERIAL	10(1)	10(1), chairperson, Committee B	
11.	COOPERATION WITH OTHER WMO BODIES AND INTERNATIONAL ORGANIZATIONS	11(1)	11(1), chairperson, Committee B	
12.	REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT EXECUTIVE COUNCIL RESOLUTIONS	12(1)	12(1), chairperson, Committee B	Res. 1 Rec. 2
13.	SCIENTIFIC LECTURES	13(1); 13(2)	13(1), president of CAeM	

	Agenda item	Document Nos.	PINK No. and person submitting	Resolutions and recommendations adopted
14.	Establishment of Working Groups	14(1)	14(1), president of CAeM	Res. 2; 3; 4
15.	Election of officers		15(1) rev. 1, chairperson, Nomination Committee 15(2), president of CAeM	
16.	Any other business		16(1), president of CAeM	
17.	Date and place of the thirteenth session		17(1), president of CAeM	
18.	Closure of the session		18(1), president of CAeM	

APPENDIX C

LIST OF ABBREVIATIONS

5LTP	Fifth WMO Long-term Plan
6LTP	Sixth WMO Long-term Plan
ACARS	Aircraft Communications Addressing and Reporting System
AeMP	Aeronautical Meteorological Programme
AFTN	aeronautical fixed telecommunications network
AIREPS	Aircraft Reports
AMDAR	Aircraft Meteorological Data Relay
AMOS	Aerodrome Meteorological Observing System (ICAO)
AMOSSG	Aerodrome Meteorological Observing Systems Study Group (ICAO)
AMS	American Meteorological Society (United States)
ANS	Air Navigation Services
ANSEP	Air Navigation Services Economics Panel
AOS	Automated Observing System
ASDAR	Aircraft to Satellite Data Acquisition and Relay
ASECNA	Agency for Air Navigation Safety in Africa and Madagascar (Dakar, Senegal)
ASEAN	Association of South-East Asian Nations
ATS	air traffic services
AWG	Advisory Working Group
AWS	Automatic Weather Station
CAA	Civil Aviation Authority (United Kingdom)
CAeM	Commission for Aeronautical Meteorology
CAEP	Committee on Aviation Environmental Protection (ICAO)
CAS	Commission for Atmospheric Sciences
Cb	Cumulonimbus
CBS	Commission for Basic Systems
CBS-MG	CBS Management Group
CIMO	Commission for Instruments and Methods of Observation
CIS	Commonwealth of Independent States
CNS/ATM	Communications, Navigation and Surveillance/Air Traffic Management (ICAO)
E-AMDAR	EUMETNET AMDAR
EANPG	European Air Navigation Planning Group (ICAO)
EC	Executive Council
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
ET	Expert Team
EU	European Union
EUMETNET	European Meteorological Services Network
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EUROCONTROL	European Organization for the Safety of Air Navigation
FAA	Federal Aviation Administration (United States)
FSL	Forecast Systems Laboratory (NOAA)
GOS	Global Observing System
GTS	Global Telecommunication System
IAOPA	International Council of Aircraft Owner and Pilot Associations
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFALPA	International Federation of Airline Pilots' Associations
IFATCA	International Federation of Air Traffic Controllers' Associations
IPCC	Intergovernmental Panel on Climate Change
ISCS	International Satellite Communication System
ISO	International Organization for Standardization

JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM In Situ Observing Platform Support Centre
LTP	Long-term Plan
METEOSAT	EUMETSAT series of meteorological geostationary satellites
METG	European Meteorological Group (ICAO)
MSC	Meteorological Service of Canada
MSG	METEOSAT second generation
MWO	Meteorological Watch Office
NMHS	National Meteorological and Hydrological Service
NMS	National Meteorological or Hydrometeorological Service
NOAA	National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
OPAG	Open Programme Area Group
PCGRIDDS	Personal Computer based GRidded Interactive Display and Diagnostic System
PROMET	Provision of Meteorological Information Required by Civil Aviation
PT	Project Team
RA	Regional Association
RAFC	Regional Area Forecast Centre
RMTC	Regional Meteorological Training Centre
SADIS	(WAFS) Satellite Distribution System (ICAO)
SADISOPSG	SADIS Operations Group
SARP	Standard and Recommended Practice
SIGMET	Significant Meteorological information
SIGWX	Significant Weather
TAF	Terminal Aerodrome Forecast
TCAC	Tropical Cyclone Advisory Centre
TCP	Tropical Cyclone Programme
TCU	Towering Cumulus
TREND	Training, the Environment and New Developments
TTQ	Task Team on Quality
UNEP	United Nations Environment Programme
VAAC	Volcanic Ash Advisory Centre
VCP	Voluntary Cooperation Programme
WAFC	World Area Forecast Centre
WAFS	World Area Forecast System
WG	Working Group
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development
WWRP	World Weather Research Programme
WWW	World Weather Watch

PART II

MEETINGS HELD CONJOINTLY WITH THE METEOROLOGICAL (MET) DIVISIONAL MEETING (2002) OF ICAO

TABLE OF CONTENTS

Page

LIST OF RECOMMENDATIONS*

* Recommendations annotated “RSPP” relate to proposals for amendment of Standards, Recommended Practices, Procedures for Air Navigation Services or guidance material in an Annex.

HISTORY OF THE MEETING

1. DURATION

1.1 The Meteorology Divisional Meeting (2002) (MET/02) was opened by the President of the Council, Dr. A. Kotaite, at 1100 hours on 9 September 2002 in the Assembly Hall of the Headquarters of the Organization in Montreal. At the first Plenary, the meeting was also addressed by the Secretary General of ICAO, Mr. R.C. Costa Pereira, the Secretary-General of WMO, Professor G.O.P. Obasi, the President of the Air Navigation Commission, Mr. D. Galibert, and Dr. N. Gordon, President of the Commission for Aeronautical Meteorology. The meeting was held in part conjointly with the Twelfth Session of the Commission for Aeronautical Meteorology (CAeM-XII) of the World Meteorological Organization (WMO). The closing Plenary was held on 26 September 2002.

2. REPRESENTATION

2.1 The MET/02 Divisional Meeting was attended by 188 participants from 70 Contracting States and four international organization. A list of participants is found on pages iv-1 to iv-7.

3. OFFICERS

3.1 The following officers were elected at the first Plenary meeting:

Chairman:	Ms. N. De Keyser
First Vice-Chairman:	Mr. T. Williams
Second Vice-Chairman:	Mr. A. Gusmão.

4. SECRETARIAT

4.1 The Secretary of the meeting was Dr. O.M. Turpeinen, Chief, Meteorology Section, ICAO assisted by Mr. N.T. Diallo, Chief, Aeronautical Meteorology Unit, WMO. They were assisted for:

Agenda Item	Item Secretary	Assisted by
1	Mr. R. Romero	Mr. T. Fox and Mrs. N. Arias
2	Mr. R. Romero	Mr. N. Halsey and B. Hellroth
3	Mr. B. Barrefors	Mr. N. Halsey and Mr. H. Cisse
4	Mr. T. Fox	Mr. B. Barrefors and Mr. D. Ivanov

Messieurs J-C. Bugnet; C. Dalton; C. Gauthier; R. Lambo; D. Monaco; A. Pavlovi*ƒ*; M. Paydar; B. Peguillan; and B. Sekwati of the ICAO Secretariat provided advice to the meeting, as required.

4.2 General administrative arrangements for the meeting were made under the direction of Mr. A.P. Singh, Director, Bureau of Administration and Services. Language services were provided under the direction of Mr. Y.N. Beliaev, Chief, Language and Publications Branch, assisted by Mrs. R.J. Ezrati, Chief, Interpretation Section, Mr. S.M. Mostafa (Arabic Section), Mr. D. Wilson (English and Publications Section), Mr. P. Butler (French Section), Mr. V. Gapakov (Russian Section) and Mr. H. Scarone (Spanish Section).

4.3 The physical arrangements for the meeting were made by Mr. M. Blanch, Chief, Conference and Office Services Section, Ms. A. Craig, Document Control Officer and Mr. J.D. Daoust, Chief, Printing Section. Other specialist officers of the ICAO Secretariat provided advice to the meeting as required.

5. ADOPTION OF THE AGENDA

5.1 The agenda transmitted to the meeting by the Air Navigation Commission was adopted at the first Plenary meeting.

6. WORKING ARRANGEMENTS

6.1 The organization plan submitted to States in advance of the meeting was approved without change at the opening Plenary.

6.2 A coordinating group was established in accordance with the *Directives to Divisional-type Air Navigation Meetings and Rules of Procedure for their Conduct* (Doc 8143), and met throughout the meeting. The members were the Chairman of the meeting, the Secretary of the meeting and representatives of the various Secretariat services catering to the meeting. The group was able to coordinate the activities of the meeting using the services and accommodations available.

7. OPENING REMARKS

7.1 President of the Council, Dr. Assad Kotaite

I have the great pleasure and honour to declare the Meteorology Divisional Meeting open which is taking place two days prior to the first anniversary of the tragic events of 11 September in the United States. ICAO is determined to restore the full confidence of the public in the global air transport system and to ensure that such a heinous act is never again perpetrated anywhere in the world. This meeting is held conjointly with the twelfth Session of the World Meteorological Organization Commission for Aeronautical Meteorology. You will recall that the ninth Session was also held in Montreal in 1990 conjointly with the COM/MET/OPS Divisional Meeting. On behalf of the Council and the Secretary General, Mr. Renato Cláudio Costa Pereira, I wish to extend a warm welcome to all of you. I hope that you will have a pleasant and productive stay in Montreal during the coming weeks.

I would like to extend a special greeting to Professor Godwin Obasi, Secretary-General of our sister organization, the World Meteorological Organization with which we have working arrangements. The work to be done at this divisional meeting has implications for both of our organizations and, with the customary assistance and cooperation of WMO, we believe that the output of the meeting will be truly responsive to the meteorological requirements of our Member States.

Professor Obasi has just returned from the World Summit on Sustainable Development held in Johannesburg, South Africa from 26 August to 4 September. Both organizations, ICAO and WMO, are committed to sustainable development. Each organization has in its own field an environmental programme. The statement by ICAO to the World Summit on Sustainable Development underlined its responsibility and that of its 188 Contracting States "to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment".

This particular Meteorology Divisional Meeting comes at an important time when ICAO is implementing the communications, navigation, and surveillance/air traffic management (CNS/ATM) systems which will have a profound impact on all international air navigation systems. One of the major tasks of this meeting is to develop the meteorological support to the CNS/ATM systems. The world area forecast system (WAFS), the international airways volcano watch (IAVW) and the use of the air-ground data link for transmitting meteorological information are important components of the meteorological support to the CNS/ATM systems to be addressed by this meeting.

With regard to the WAFS, the time has now come for the provisions to be completed for the so-called final phase of WAFS in which the two world area forecast centres in London and Washington will produce global upper wind/temperature forecasts and significant weather forecasts in digital format for direct transmission to States through the three ICAO satellite broadcasts. Concerning the term "final phase", it is, however, very important to realize that achieving the final phase of the WAFS does not mean that the system would be "finalized" and that there would be no need for further development; on the contrary, the WAFS has to be responsive to the rapid future changes in aviation and meteorology and, in fact, the meeting is invited to consider the future development of WAFS. In this context, you are, inter alia, expected to address the need for improved forecasts for clear air turbulence and icing.

Concerning the IAVW, you may be aware that, as a result of serious incidents, the necessary regulatory provisions have been developed. The remaining issue to be resolved is the effective implementation of the IAVW which still leaves something to be desired in some parts of the world. You are therefore invited to address matters related to the implementation of IAVW. In this context, a proposal will be made to consider formalizing the role of volcano observatories in selected States which hitherto have provided services on a voluntary basis.

As far as the use of data link for transmitting meteorological information is concerned, the meeting is expected to consider aspects related to both the downlink and uplink of information. One of the challenges for the future is to organize the quality control of meteorological information included in the automatic dependent surveillance (ADS) messages, which constitutes a vital input to the forecast models run by the world area forecast centres.

Another important topic to be discussed by the meeting is related to the meteorological support for operations at aerodromes and in the terminal area which is intended to contribute towards improvements in airport capacity. This involves a proposal to take account of the availability of automated meteorological observing systems at aerodromes.

The restructuring of Annex 3 is also to be addressed by the meeting. The Seventh Africa-Indian Ocean Regional Air Navigation Meeting called for such a restructuring in view of the difficulties encountered by States attributed to the increasing complexity of some of the Annex 3 provisions. Subsequently, a conjoint proposal by the ICAO and WMO Secretariats was presented to the Council which agreed that Annex 3 should be restructured into core Standards and Recommended Practices and detailed technical specifications and requirements. It was further agreed that the restructured Annex 3 material should be tabled for consideration by this meeting.

The final item to be discussed at this meeting reflects the institutional changes and trends in the provision of meteorological service to international air navigation which are taking place in States. In common with most of the other fields involved in civil aviation, the Meteorological Services in many States have had to respond to the global pressures to change the way in which services are provided to users, for example, by becoming self-financing or financially autonomous bodies in their own right. These changes have prompted frequent requests from States for advice regarding the interpretation of relevant SARPs in Annex 3 concerning the designated meteorological authority for the provision of, and access to, OPMET information required to service international air navigation, and the recovery of the costs associated with providing these services. You are invited to take advantage of this worldwide meeting to propose the development of more up-to-date guidance material to assist States in this regard.

It is also expected that, following the introduction into Annex 3 of SARPs relating to quality assurance in Amendment 72, you will wish to discuss the implementation of the new SARPs. You may wish to provide advice to ICAO and WMO on the continuous improvement in guidance material and the provision of training in order to facilitate global implementation.

Finally, the meeting is expected to address the use of the Internet as an alternative means of collecting and disseminating aeronautical meteorological information. In this respect, it is proposed for you, as the first step, to consider the use of the Internet as a back-up to the traditional aeronautical telecommunications.

The President of the Air Navigation Commission, Mr. Daniel Galibert, will provide more detailed explanations regarding your agenda.

Your programme is extensive with more than 50 working papers, and it is of great importance to the safety and efficiency of international civil aviation. The Council considers that the issues, that you are addressing, are essential and therefore, your final report will be reviewed by the Air Navigation Commission and the Council shortly after the completion of this meeting. It only remains for me to extend to you my best wishes for a successful meeting.

7.2 **WMO Secretary-General,**
Professor G.O.P. Obasi

It is indeed an honour and a pleasure for me to be with you today at the opening of this important conjoint session of the Commission for Aeronautical Meteorology (CAeM) and Meteorology Divisional Meeting. I should like, first of all, to express my sincere appreciation to Mr. Assad Kotaite, President of the Council of the International Civil Aviation Organization (ICAO) and to Mr R. C. Costa Pereira, Secretary-General of ICAO, for the kind offer extended to WMO to hold this important event in the ICAO Headquarters building and for the excellent support services and facilities provided for the event. I should like to welcome all delegates from WMO Members and ICAO Contracting States as well as representatives from other international organizations and the aviation industry.

This conjoint session, which is the seventh since the first one in 1954, is further testimony to the excellent relationship that existed between WMO and ICAO. The cooperation between ICAO and WMO is embodied in the formal Working Arrangements which came into effect in 1954. In essence, the Arrangements provide for ICAO to take the lead in setting the requirements for meteorological service for international air navigation and for WMO to take the lead for specifying the methods and practices to be used to meet these requirements. In this respect, it is to be recalled that the International Meteorological Organization (IMO), the predecessor of WMO, had established as far back as 1919, the Commission for the Application of Meteorology to Aerial Navigation, which later became the International Commission for Aeronautical Meteorology, to provide guidance and necessary coordination with regard to international aeronautical meteorology. This was soon after the first commercial air transportation became operational. Over the years, fruitful collaboration has developed between the International Meteorological Organization and its successor WMO and the International Commission for Aeronautical Navigation (ICAN) and its successor ICAO.

The origin of such cooperation can be seen in the effects of weather on aviation that gained wide coverage from that day in 17 December 1903 when the first successful flights of an engine-powered aircraft were terminated because a gust of wind overturned and damaged the aircraft. Just a week before these events, an editorial page of a very influential New York newspaper, dated 10 December 1903, carried the following remark:

> "...We hope that Professor Langley will not put his substantial greatness as a scientist in further peril by continuing to waste his time and money involved in further airship experiments. Life is short, and he is capable of services to humanity incomparably greater than can be expected to result from trying to fly. ... For students and investigators of the Langley type, there are more useful employments".

Today, no one can dispute the place of the aviation industry in the economies of nations and its contribution to the well-being of society. The tremendous growth in civil aviation activities is highlighted in the annual Review of Civil Aviation for 2000, published in the ICAO Journal of July/August 2001 that indicates that over 1.6 billion passengers have been transported in 2000, and that over 400 billion tonne-kilometres have been flown. This growth is in no small measure due to the safety and efficiency of aviation operations. In this regard, weather remains an important parameter in the aviation equation and indeed many National Meteorological Services (NMSs) were initially established to provide primarily weather information to aviation. Today, the Services, under the aegis of WMO's Aeronautical Meteorology Programme and with up-to-date scientific and technical advice from the Commission for Aeronautical Meteorology, provide cost-effective meteorological services in support of safe, regular and efficient aviation operations worldwide.

One of the most prominent outcomes of international cooperation in serving the aviation industry has been the development and implementation of the World Area Forecast System (WAFS) which started over 20 years ago. The system is primarily dependent on the provision of basic meteorological data to run numerical weather prediction models that generate aviation information. At the outset, it was obvious to both the aviation and the meteorological communities that without the timely availability of basic meteorological data there would be no aviation meteorological information. This was indeed well recognized in Recommendation 3.2/1, of the conjoint session of CAeM and the ICAO Communication/Meteorology Divisional Meeting held here in Montreal, in 1982. By this Recommendation, the conjoint session invited WMO to, "arrange for the necessary World Weather Watch support to the world area forecast centres and regional area forecast centres and, in particular, for the availability of the required basic data on a global scale in the case of world area forecast centres and, for the areas of responsibility, in the case of the regional area forecast centres".

As you are aware, WMO's World Weather Watch (WWW) Programme, comprising an integrated system composed of National Services and facilities owned and, operated by WMO Members, has responded effectively to this request, enabling the WAFS to achieve its ambitious goals. Over the past two decades, the unflinching commitment of WMO Members and advances in science and technology have resulted in considerable development in the three components of the WWW. The Global Observing System (GOS) component comprises surface-based and space-based observing subsystems, the Global Data-processing System (GDPS) is composed of an integrated network of data processing centres equipped with modern facilities, including powerful computers, and the Global Telecommunication System (GTS) is a worldwide system for the rapid exchange of data and information.

In order to enhance the GOS, the WMO Aircraft Meteorological Data Relay (AMDAR) Programme was established in 1998, in close cooperation with various airlines and National Meteorological Services. Currently, over 130 000 AMDAR observations per day are being exchanged through the GTS. In addition, six operational near-polar orbiting meteorological satellites and eight operational geostationary environmental observation satellites complete the global data coverage. Such data have resulted in a remarkable improvement in the quality of weather forecasts in support of aviation operations. This ensemble of data provided to various weather forecasting centres including the World Area Forecast Centres (WAFCs), constitute the basic ingredient for the generation of meteorological information. The uniqueness of the overall WMO system is that the data and the products are provided in a free and unrestricted manner to all National Meteorological Services and to WAFS Centres.

Among the broad range of external and internal factors that have implications for the NMSs is the increasing tendency toward the commercialization or privatization of the Services. This tendency may adversely affect the current funding level of NMSs despite users' increasing demand for improved services and new delivery systems. In view of all these new elements, I should call upon this conjoint session to give due recognition to the important contribution of NMSs and the WWW in the provision of meteorological service for international air navigation, so that national authorities and the international community give higher priority to the strengthening of the infrastructure and human resources of the NMSs.

Today, the advent of the final phase of WAFS as envisaged in 1982 is imminent, with the full transfer this year of all Regional Area Forecast Centres' responsibilities to the London and Washington WAFCs. The ability of the two WAFCs to produce semi-automated significant weather forecasts and to transmit these by satellite broadcasts in digital codes, to be received by over 200 satellite terminal equipment in more than 150 countries, have come about through the visionary work that commenced more than 20 years ago. In this regard, I would like to thank all WMO Members for their commitment to WAFS, and in particular, to the Finland, France, United Kingdom, the United States and others for providing a number of WAFS satellite terminal equipment and workstations, mostly within the framework of WMO Voluntary Cooperation Programme.

I would like to mention a few other issues that the conjoint session could consider:

First, we should take cognizance that the advent of more advanced commercial aircraft, the advances in telecommunications and computers and the improvement ;in weather observing system and numerical weather prediction for more accurate and longer range forecasts, would no doubt result in changes in the requirements and the provision of aeronautical services. Efforts should therefore concentrate on effective planning to ensure that WAFS continues to meet fully the evolving aeronautical requirements.

Secondly, as you are aware, quality management based on ISO 9000 that has been introduced in ICAO Annex 3 and WMO Technical Regulation [C.3.1) became applicable on 1 November 2001. However, WMO is currently reviewing the implementation of quality management based on ISO 9000. The WMO Executive Council felt that any mandatory implementation of ISO 9000 would lead to considerable expenses to NMSs and to widening the gap between developed and developing countries. I would therefore urge this conjoint session to take into account the views expressed by the Executive Council by maintaining the optional nature of the implementation of ISO 9000.

Thirdly, in order to support and facilitate the transition from the current conventional provision of international air navigation to the ICAO Communication Navigation Surveillance/Air Traffic Management (CNS/ATM) system, aeronautical meteorological services must meet global as well as regional and national requirements and contribute to improving aviation safety and to providing an identifiable cost-benefit to the aviation industry. In this regard, consideration should be given to support the aeronautical meteorological services of developing countries.

Finally, I have also noted that this conjoint session, under the item dealing with "Institutional changes and trends in the provision of meteorological service to international air navigation" will consider two other issues of major importance to WMO, namely the use of the Internet to access aeronautical meteorological information and the commercialization arid privatization of aeronautical meteorological services.

As regards the use of the Internet, the WMO Executive Council requested that due consideration should be given to adequate security measures to ensure the efficient and safe operations of WWW centres and the Global Telecommunication Systems and to the implications related to data exchange policy. As regards the access to aeronautical meteorological information, it is to be recalled that in accordance with Annex 4 to Resolution 40 of the WMO Twelfth World Meteorological Congress adopted in 1995, "Aeronautical information generated specifically to serve the needs of aviation and controlled under the Convention of International Civil Aviation (Chicago, 1944) is not included in the application of the practice". This practice relates to specifications for the classification and conditions attached to the use of data and products exchanged among WMO Members.

The issue of recovery of meteorological costs for aeronautical services and the growing trend towards alternative service delivery including the commercialization and privatization of these services are of concern to WMO and NMSs. I will urge the conjoint session to give due consideration to these issues which have long-term implications for the NMSs.

In view of these considerations, WMO is particularly looking forward to the results of your discussions on these issues, which will form the basis for further consultations between our two Organizations.

As in the past, I wish to assure you that WMO will spare no efforts in reaching the goals that ICAO and W/P have set for the provision of meteorological service for international air navigation for the present and the future. I therefore look forward to your recommendations on many of the important issues to be discussed under the various agenda items of this conjoint session. I am confident that your deliberations will be conducted in the traditional spirit of cooperation and mutual understanding, which has been the hallmark of ICAO and WMO meetings.

I wish you all an enjoyable stay in Montreal and a most successful and productive conjoint session.

7.3 **President of the Air Navigation Commission,**
Mr. G. Galibert

Good morning ladies and gentlemen. It is my great pleasure, on behalf of the Air Navigation Commission, to welcome you to Montreal and to ICAO Headquarters. Before addressing your agenda in detail, I should inform you that the Air Navigation Commission has followed closely the development of the proposals to amend Annex 3 that you will be discussing at this meeting. As the President of the Council has already stated, the implementation of CNS/ATM systems and the challenge of improving airport/airspace capacity are issues of much importance to the international aviation community and ICAO. The Commission has noted that two of the agenda items specifically address the meteorological aspects of these two issues, and we are looking forward with interest to reviewing your proposals in this regard. I should also like to remind the meeting that in your discussions the Air Navigation Commission expects that due consideration will always be given to the operational aspects of any particular issue. This means that the operational impact of every proposed measure must be carefully assessed. Moreover, it will be expected that the cost-effectiveness of your proposals will have received due consideration.

Turning to the rather extensive agenda that you have before you, the Commission is pleased to see under Agenda Item 1 that, following agreement by the meeting on relevant proposals to amend Annex 3,and their adoption by the ICAO Council and WMO Executive Council, the World Area Forecast System will have achieved the "final phase" originally envisaged by the 1982 COM/MET Divisional Meeting. However, it is also noted that the meeting intends to take due account of the inexorable future technical advances to propose means to ensure that the WAFS continues to develop to meet evolving operational requirements, as it has done in the past. Your discussions on improving the quality and delivery of WAFS icing and turbulence forecasts will be very important for flight safety , and will be strongly supported throughout the international aviation community. Another item on your agenda that concerns flight safety is the International Airways Volcano Watch(IAVW). It is noted that the meeting will be concentrating on the full implementation of the IAVW, including introducing requirements for selected volcano observatories to be listed in the FASID Parts of the relevant regional air navigation plans. Agenda Item 1 also deals with the uplink and downlink of meteorological information. In this regard, the Air Navigation Commission has noted the excellent coordination between the ICAO OPLINK Panel and the METLINK Study Group in developing operational requirements for the downlink and uplink of MET information, the results of which form appropriate proposals for the amendment of Annex 3 for your consideration.

In Agenda Item 2, you will be asked too discuss various proposals concerning the contribution which MET can make to improving airport/airspace capacity. In the eyes of the Commission, all positive and cost-effective contributions to this cause, however small, will be most appreciated by the international aviation community.

The Air Navigation Commission was interested to follow the development of the proposal under Agenda Item 3 to re-structure Annex 3 into core SARPs and technical requirements and specifications, in line with Appendix A of Assembly Resolution A33-14. Although this exercise might be considered mainly editorial, it is by no means a trivial task. The re-structured Annex 3 is expected to assist States in implementing Annex 3 provisions that, due to their complexity, may otherwise have been considered rather difficult to translate into easily understood local staff instructions. I would like to take this opportunity on behalf of the Commission to thank WMO for its excellent cooperation in this complex task.

Finally, in Agenda Item 4, the meeting has to address a number of difficult institutional issues, including global pressures for changes in the way in which MET services are provided to users, the designation of the meteorological authority in this new environment and the recovery of costs for meteorological services for international air navigation, the implementation of quality assurance for meteorological services, and the operational use of the internet for the collection and dissemination of OPMET information. These are all important issues that will figure in the work of ICAO and WMO during the next decade, and clear guidance from this meeting will be essential to ensure that the ICAO and WMO secretariats understand what the aviation community expects of them in this regard. I should also like to draw your attention to the question of quality assurance and to remind you that quality assurance is of critical importance for all disciplines in the aviation industry. The seamless provision of aeronautical information to pilots, dictates that all providers of such information, as far as possible, move in step. In this regard, it is noted that, although both MET and AIS information are subject to similar requirements, the status of the core AIS requirements in Annex 15 on quality assurance are Standards, while those of Annex 3 are Recommended Practices. It will be of considerable benefit to the international aviation community if the meeting could advise the Commission the date by which it will be expected that the core requirements in Annex 3 concerning quality assurance may be proposed for upgrade to Standards.

I must say that the Commission which is highly interested in the outcome of your debate, will be very privileged in receiving and advanced report of your deliberations. I have scheduled an informal meeting of the ANC for the afternoon of the last day of the meeting on the of 27 September in order for the Commission to benefit from an early, albeit informal, presentation of your conclusions by your chairman or vice-chairman depending on their availability and by the secretary of the meeting. We, Commissioners, look forward to this presentation and, in the mean time, to meeting most of you in the course of your stay in Montreal.

I will conclude in wishing you a very pleasant and productive meeting and a happy stay in Montreal with the nicest weather a MET specialist can forecast.

7.4 President of the Commission for Aeronautical Meteorology, Mr. N. Gordon

It is a great honour to address you now as we commence our work together over the next three weeks, at the most important international aviation meteorology meeting for 12 years.

It is a great pleasure to address you in the lovely city of Montreal and only a meeting of meteorologists could have arranged such beautiful weather — at least for now.

It was of course in Montreal some 23 years ago that a group of very clever people — the Area Forecast Panel — met to design the blueprint for the World Area Forecast System (WAFS). I would like at this point to pay tribute to their vision and foresight, and note that at least one of them, Charlie Sprinkle is here with us today. The focus of the conjoint Communications/Meteorology/Commission for Aeronautical Meteorology (CAeM), Seventh Session in Montreal 20 years ago, in 1982, was very much WAFS.

We met again conjointly in Montreal in 1990 to progress the WAFS implementation, and also amongst the important items to take a key step forward in the worldwide harmonization of METAR and TAF coding.

And now, after a further 12 years, we meet again to essentially finalize the important work on WAFS as our very first agenda item., and to sow the seeds for further development to meet evolving needs.

There are other very significant technical items on our conjoint agenda — taking advantage of meteorological and technical progress in forecasting, modelling, communications and automated observing systems. We will consider a major restructuring of Annex 3, as well as many amendments to take into account the progress in our abilities.

Perhaps the most important item on the conjoint agenda is more policy than technical — *Item 4: Institutional changes and trends in the provision of meteorological services to international air navigation*. Here we will discuss matters such as cost recovery, commercialization, quality management and use of the Internet.

Colleagues, these are challenging times for the aviation industry — not least because of the terrible events of last year, which are very much on everyone's mind this week.

The aviation industry will survive, it will recover, it will move on — albeit perhaps in a changed form. Aviation is just too fundamental to the world.

We can help. One thing I would ask you to remember as we debate and cogitate and make important decisions over the next three weeks — that is the important part as meteorologists that we can play in adding value to the aviation industry. In keeping people and planes safe, in helping airlines and air traffic control and management to be as efficient and effective as possible and we can only do that ourselves through building on the infrastructure of the WMO World Weather Watch, operated by NMSs worldwide.

So this should be the goal of our deliberations — to make decisions that will result in a better service to aviation as we embark on this 21st century.

LIST OF REPRESENTATIVES

CD	—	Chief Delegate
ACD	—	Alternate Chief Delegate
D	—	Delegate
ALT	—	Alternate
ADV	—	Adviser
COBS	—	Chief Observer
OBS	—	Observer

State/Territory	Name	Designation
Afghanistan	Mir, Y.	OBS
Algeria	Cherif, T.	OBS
Angola	Kasu, M.	D
Argentina	Afonso, J.	CD
	Sanchez Ara, E.A.	OBS
Armenia	Alaverdian, N.A.	CD
Australia	Canterford, R.	CD
	Sabin, G.	ACD
	Williams, E.G.	D
	Aleck, J.	OBS
Austria	Pumpel, H.	CD
	Ableidinger, M.	D
Azerbaijan	Aliyev, C.V.	CD
	Huseynov, N.S.	ACD
Bahrain	Daham, A.	CD
Belgium	De Keyser, N.	CD
Botswana	Matlhaga, M.	CD
Brazil	Gusmao, A.	CD
	Henriques, C.R.	D
	Basilio Dias, J.A.	ADV
	Ribeiro, L.	OBS
Bulgaria	Mednikarov, G.	CD
Cameroon	Mendouga, P.A.	D
	Tekou, T.	OBS
Canada	Mein, D.T.E.	CD

State/Territory	Name	Designation
	Naismith, J.A.	ACD
	Chen, P.	D
	Everell, M.D.	D
	Fournier, G.	D
	Lancaster, J.	D
	Macdonald, K.	D
	Mcleod, C.	D
	Angle, B.	ADV
	Kirby, B.A.	ADV
	Lynch, D.	ADV
	Servranckx, R.	OBS
Cape Verde	Silva, J.B.	CD
Chile	Villarroel Rocco, L.	CD
China	Zhou, H.	CD
	Xu, L.	D
	Lee, B.Y.	ADV
	Ma, Q.Y.	ADV
	Shun, C.M.	ADV
	Zhang, X.	ADV
Colombia	Gonzalez, M.	OBS
	Pulido, J.M.	OBS
Croatia	Gelo, B.	CD
Cuba	Ayon Alfonso, J.	CD
	Armengol Matos, G.	ACD
Czech Republic	Gorgol, O.	CD
	Obrusnik, I.	D
	Schoberova, E.	D
	Techlovsky, B.	D
	Trefny, M.	D
	Wolek, M.	D
Denmark	Dybdahl, B.	CD
	Andresen, S.E.	ACD
Egypt	Mohamed, M.Z.	CD
	Al Bagoury, M.	OBS
Estonia	Saar, J.	CD
Ethiopia	Belayneh, M.	OBS
Finland	Korhonen, O.	CD

State/Territory	Name	Designation
	Tupamaki, M.	ACD
	Polvinen, J.	ADV
	Makela, M.	OBS
	Osterberg, K.K.	OBS
France	Soucheleau, A.	CD
	Goas, J.	ACD
	Lambergeon, D.	ACD
	Tirot, J.	D
	Andriamonje, M-J.	ADV
	Martini, F.	ADV
Gambia	Touray, L.M.	CD
	Jobe, S.	D
Germany	Kloppel, M.	CD
	Sturm, K.	CD
	Lorenzen, E.	D
	Mickler, T.	OBS
	Schmincke, M.	OBS
Ghana	Juati, A.	CD
Hungary	Mersich, L.	CD
	Fejes-Sandor, V.	ACD
Iran, Islamic Republic of	Mahdavi, G.	CD
	Shaneh, A.	D
Ireland	Murphy, D.	CD
	McGinley, A.	OBS
Italy	Sorani, R.	CD
	de Simone, C.	ACD
	Scordato, D.	D
Japan	Momoi, Y.	CD
	Mahara, T.	D
	Sasaki, K.	D
Kazakhstan	Kamaletdinov, K.	ADV
Kuwait	Shuaibi, K.M.	ACD
	Al Jenaee, Y.	D
Lebanon	Bejjani, A.	CD
Malaysia	Appadurai, M.	D
	Ooi, S.H.	D

State/Territory	Name	Designation
Mauritius	Gungah, A.	OBS
Netherlands	Van Dijk, W.	CD
	Hart, L.	D
New Zealand	Lechner, P.D.	CD
	Gordon, N.D.	ACD
	MacKersy, K.W.	D
Nigeria	Eniojukan, D.O.	OBS
Norway	Heidegard, A.	D
Oman	Al Saifi, S.	CD
	Al Najar, K.	D
Peru	Nicholson, G.	CD
	Pedro, A.	D
Poland	Kadziolka, T.	CD
	Klejnowski, R.	D
	Gozdzik, P.	ALT
Portugal	Monteiro, A.	CD
	Ferreira, J.	ACD
Republic of Korea	Kim, S.J.	CD
	Park, J.S.	ACD
Romania	Visoiu, D.	CD

State/Territory	Name	Designation
Russian Federation	Rudakov, V.A.	CD
	Romanenko, Y.	ACD
	Dudochkina, E.P.	D
	Khrolenko, V.M.	D
	Kiselev, B.A.	D
	Lysenko, I.	D
	Pavlova, A.V.	D
	Petrova, M.V.	D
	Rasputikov, A.S.	D
Saudi Arabia	Al Ghamdi, S.	CD
	Al Mudarris, A.	D
	Al Jezani, I.	ADV
	Gari, F.	OBS
Senegal	Sall, O.	CD
	Watt, M.A.	D
	Gueye, B.	OBS
Seychelles	Agricole, W.	CD
South Africa	Nadison, D.	CD
	Edwards, M	ACD
	Horak, M.	D
	Narsing Parbhio, Y.	ADV
Spain	Adrover, L.	CD
	Herrero, J.	D
Sudan	Kafi, E.D.	CD
Sweden	Noreus, E.	CD
	Carlson, K.	ADV
Switzerland	Sutter, U.	CD
	Ulrich, D.	ACD
Syrian Arab Republic	Al Beik, I.E.	CD
	Al Khatib, N.	ACD
	Arshed, K.	ALT
Tunisia	Bouraoui, J.	D
Ukraine	Natasiyenko, V.	CD
	Nefedyeva, N.	D
	Sitak, V.	D
	Sydorenko, Y.	D
United Arab Emirates	Al Ali, A.A.	ACD

State/Territory	Name	Designation
	Ahmad, H.R. Al Amri, H.	D D
United Kingdom	Perry, B. Underwood, D. Gait, N.J. Johnson, D.	CD ACD ADV ADV
United Republic of Tanzania	Sillayo, S.	CD
United States	Whatley, D. Heuwinkel, R. Albersheim, S. Andrews, M.J. Schmidt, S. Swanson, G. Olson, R. Stone, R.	CD ACD D D D D ADV ADV
Yemen	Al Hada'a, A. Breeh, N.	CD ALT
Yugoslavia	Radovanovic, D.	D
Zimbabwe	Mazambara, E.C.	CD

International Organization	Name	Designation
Agency for Air Navigation Safety in Africa and Madagascar (ASECNA)	Miampika, A. Finke Fictime, L	COBS OBS
EUROCONTROL	Reid, K.	OBS

International Organization	Name	Designation
International Air Transport Association (IATA)	Defalque, H. Comber, M. Fronzak, M.J. Hoeven, E. Laaksonen, A. Qualley, W. Sonnabend, H.R. Todo, N. Woveris, W.P.	COBS OBS OBS OBS OBS OBS OBS OBS OBS
International Federation of Air Line Pilots Associations (IFALPA)	Paradis, K. Vinson, S.	COBS OBS

AGENDA OF THE MEETING

Agenda Item 1: Meteorological component of CNS/ATM systems
- 1.1: Final phase of the WAFS
- 1.2: Uplink/downlink of OPMET information
- 1.3: Development of specialized WAFS products for turbulence and icing forecasts
- 1.4: International airways volcano watch (IAVW)

Agenda Item 2: Meteorological support for operations at aerodromes and in the terminal area
- 2.1: Meteorological observing systems at aerodromes
- 2.2: Tailoring meteorological information format, content and timeliness to support improvements in airport capacity

Agenda Item 3: Restructuring of Annex 3

Agenda Item 4: Institutional changes and trends in the provision of meteorological services to international air navigation

Agenda Item 5: Statement by delegations

GLOSSARY OF TERMS

ACC	area control centre
ACMET	aerodrome capacity MET forecast
ADS	automatic dependent surveillance
AFI	Africa-Indian Ocean Region
AFS	aeronautical fixed service
AIS	aeronautical information service
AMDAR	aircraft meteorological data relay
AMOSSG	Aerodrome Meteorological Observing Systems Study Group
ANC	Air Navigation Commission
AOP	aerodrome operational planning
APIRG	AFI Planning and Implementation Regional Group
ASECNA	Agency for Air Navigation Safety in Africa and Madagascar (The)
ATC	air traffic control
ATIS	automatic terminal information service
ATM	air traffic management
ATNP	Aeronautical Telecommunication Network Panel
ATS	air traffic services
BUFR	Binary universal form for the representation of meteorological data
CAeM	Commission for Aeronautical Meteorology
CAVOK	cloud and present weather better than prescribed values or conditions
CIS	Commonwealth of Independent States
COM/MET	Communications/Meteorology
COM/MET/OPS	Communications/Meteorology/Operations
CTBTO	comprehensive nuclear-test-ban treaty organization
D-ATIS	data link — automatic terminal information service
D-VOLMET	data link — VOLMET
EANPG	European Air Navigation Planning Group
EDR	eddy dissipation rate
EUR	European Region
FANS	future air navigation systems
FASID	facilities and services implementation document
GOES M	geostationary satellites
GTS	global telecommunication system
IAOPA	International Council of Aircraft Owner and Pilot Associations
IATA	International Air Transport Association
IAVW	international airways volcano watch

IAVWOPSG	International Airways Volcano Watch Operations Group
IFALPA	International Federation of Air Line Pilots' Associations
INTELSAT	International Telecommunications Satellite Organization
ISCS	international satellite communications system
IUGG	International Union of Geodesy and Geophysics
LVP	low visibility procedures
MET	meteorological
METAR	aviation routine weather report
METG	Meteorology Group
MWO	meteorological watch office
NMS	national meteorological serivce
OPLINKP	Operational Data Link Panel
OPMET	operational meteorological
PANS	Procedures for Air Navigation Services
PANS-ABC	*Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (Doc 8400)
PANS-ATM	*Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444)
PIRG	planning and implementation regional group
PT/MET/ATM	Project Team on MET in the CNS/ATM concept for EUR Region
RAFC	regional area forecast centre
RAN	regional air navigation
RSMC	regional specialized meteorological centres
SADISOPSG	Satellite Distribution System Operations Group
SARPs	Standards and Recommended Practices
SIGWX	significant weather
SIP	special implementation project
SPECI	aviation selected special weather report
SWH	high level SIGWX
SWM	medium level SIGWX
TC	tropical cyclone
TCAC	tropical cyclone advisory centre
TCP	tropical cyclone programme
UN	United Nations
VAFTAD	volcanic ash forecast transport and dispersion
VAG	graphical volcanic ash advisory
VAWSG	Volcanic Ash Warnings Study Group
VSAT	very small aperture terminal
WAFC	world area forecast centre

WAFS	world area forecast system
WAFSOPSG	World Area Forecast System Operations Group
WAFSSG	World Area Forecast System Study Group
WISTSG	Low Level Wind Shear and Turbulence Study Group
WMO	World Meteorological Organization
WWW	World Weather Watch

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Agenda Item 1: Meteorological component of CNS/ATM systems

1.1:1 FINAL PHASE OF THE WAFS

1.1:1.1 Introduction

1.1:1.1.1 The meeting recalled that the world area forecast system (WAFS) had been created in response to fundamental changes in the operational requirements that arose in the mid to late 1970s due to the rapid increase in air transport all over the world and the introduction of much longer-range flights. These trends had dictated that operators increasingly required global meteorological route forecast information and, moreover, guaranteed standardized quality and format for these forecasts wherever they operated. The parallel technical developments in communications and computers enabled the centralization of operational control by the major airlines at their home bases. This meant that flight planning for the larger airlines became predominantly computerized, which in turn required that the forecast upper winds and temperatures used as input for computer flight planning also had to be in numerical form. At the same time, flight planning for some airlines, and in any case, for international general aviation continued to be largely manual-based. It was noted that the operational requirements that emerged in the late 1970s were for standardized, high quality, global forecasts in both numerical and graphical formats to be available in all Contracting States/Member States for flight documentation and flight planning for practically any prospective route.

1.1:1.1.2 In order to properly assess these emerging requirements, the ICAO Air Navigation Commission (ANC), in 1978, agreed that the Area Forecast Panel should be established to develop proposals for a new area forecast system. The proposals developed by the Area Forecast Panel were considered by the conjoint ICAO COM/MET Divisional Meeting/Seventh Session of the WMO Commission for Aeronautical Meteorology in 1982. The conjoint meeting had recommended that a new global area forecast system should be established in line with the proposals of the Area Forecast Panel and formalized in an appropriate amendment to ICAO Annex 3 — *Meteorological Service for International Air Navigation*/WMO Technical Regulations [C.3.1]. This amendment proposal was subsequently adopted/approved by the ICAO Council/WMO Executive Council and became applicable in 1984. In 1983, the ANC had agreed to the dissolution of the Area Forecast Panel and the creation of the World Area Forecast System Study Group (WAFSSG) to present amendment proposals, as necessary, to regulatory documents to ensure progress to the final phase of the WAFS, in step with the pre-requisite technological developments.

1.1:1.1.3 The meeting noted that the WAFS had been established in two phases (initial and final) taking due account of the expected developments in telecommunications technology and global numerical weather prediction. The initial phase comprised two World Area Forecast Centres (WAFC) in London and Washington producing standardized, high-quality global forecasts of upper winds and temperatures in numerical format. These numerical forecasts were transmitted to fifteen Regional Area Forecast Centres (RAFC) in Brasilia, Buenos Aires, Cairo, Dakar, Frankfurt, Las Palmas, London, Melbourne, Moscow, Nairobi, New Delhi, Tokyo, Toulouse, Washington and Wellington. These RAFCs produced graphical upper wind/temperature charts based on the numerical output, and significant weather (SIGWX) forecasts for selected areas of coverage for all the major international air routes. The RAFCs then transmitted the graphical upper wind/temperature and SIGWX forecasts to Contracting States/Member States and users, mostly by HF facsimile broadcast. The final phase of the WAFS required the two WAFCs to produce global SIGWX forecasts in addition to the global upper wind/temperature forecasts and transmit these direct to Contracting States/Member States by satellite broadcast, at which time there would no longer be a requirement for RAFCs. The planning for the final phase of the WAFS was updated by the conjoint ICAO COM/MET/OPS Divisional Meeting/Ninth Session of the WMO Commission for Aeronautical Meteorology in 1990. The resulting amendment, inter alia, introduced enabling provisions for the transfer of responsibilities from the RAFCs to the two WAFCs to ensure a smooth transition to the final phase.

1.1:1.2 **Status of the WAFS**

Transfer of responsibilities from RAFCs to WAFCs

1.1:1.2.1 The meeting was aware that the planning for the transfer of responsibilities from RAFCs to the WAFCs had been conducted by the ICAO planning and implementation regional groups (PIRGs), in accordance with Council action on relevant recommendations of the ICAO COM/MET/82 Divisional Meeting/Seventh Session of the WMO Commission for Aeronautical Meteorology. The meeting recalled, that the main functions of the RAFCs had been the production of SIGWX forecasts for selected areas and the transmission of WAFS output in graphical form to user States. It was noted that the transmission function of the RAFCs had been undertaken by the WAFCs since the implementation of the three satellite broadcasts in the mid 1990s. In regard to the production of SIGWX forecasts, the PIRGs had begun developing appropriate transition plans in the mid 1990s and, as each PIRG was satisfied that the relevant WAFC could produce the SIGWX forecasts required for the region(s) concerned, a conclusion had been reached on the date of closure of the RAFC(s) serving that region. The transition plans, and the intent and date for closure of RAFCs had been duly noted by the ICAO Council. The meeting was pleased to see one example of a thorough evaluation of WAFC products done by RAFC Dakar, as part of the transfer of the RAFC responsibilities. The meeting noted with satisfaction that the responsibilities of all RAFCs had been transferred to the WAFCs, in accordance with the transition plans of the PIRGs concerned. The meeting expressed its appreciation to all of the RAFC Provider States for the RAFCs listed in paragraph 1:1.1.1.3 above, in recognition of the excellent manner in which they had discharged their responsibilities under the WAFS. The meeting also expressed appreciation to the PIRGs for the efficient planning of the transfer of responsibilities from the RAFCs to the WAFCs.

WAFS output products

1.1:1.2.2 The meeting noted that the two WAFCs were currently producing four times daily global coverage of upper wind/temperature, tropopause, maximum wind and humidity forecasts in the GRIB code form for all the levels required in Annex 3/Technical Regulations [C.3.1], and upper wind/temperature forecasts in T4 facsimile format for all the areas of coverage and levels required in the regional air navigation (RAN) plans. The production of SIGWX forecasts was divided approximately equally between the two WAFCs. This involved the production of high-level SIGWX (SWH) forecasts four times daily in T4 facsimile format for all areas of coverage required in the RAN plans, and medium level SIGWX (SWM) forecasts for limited geographical areas, in accordance with Annex 3/Technical Regulations [C.3.1]. In this respect, due inter alia to the additional costs involved, it was emphasized that requirements for WAFS SWM forecasts must be processed through the relevant PIRGs and, must be restricted to "limited geographical areas", in accordance with Annex 3/Technical Regulations [C.3.1]. According to Annex 3/Technical Regulations [C.3.1], SIGWX forecasts issued in binary form should be in the BUFR code form. WAFC London had been transmitting BUFR-coded WAFS products on the satellite broadcast for some time to enable States/Members to test their BUFR decoding/processing software and the BUFR coded WAFS products would become operational during November 2002. WAFC Washington would begin similar transmissions towards the end of September 2002 (test files available from the following FTP site: ftp.ncep.noaa.gov/pub/awc/bufr) and become operational by the end of May 2003.

Transmission of WAFS output products by satellite broadcast

1.1:1.2.3 The meeting recalled that there were three satellite broadcasts providing global coverage and transmitting WAFS products as part of the ICAO aeronautical fixed service (AFS) in accordance with Annex 10 — *Aeronautical Telecommunications*. These comprised the International Satellite Communication System (ISCS) provided by the United States, which operated two of the uplinks: ISCS(1) serving the North and South American Regions, the North Atlantic Region, and the Central America and Caribbean Region, through an INTELSAT Atlantic Ocean satellite, and ISCS(2) which served the Pacific Region and the eastern part of the

Asia Region through an INTELSAT Pacific Ocean satellite. The third uplink, which was provided by the United Kingdom, comprised the Satellite Distribution System for Aeronautical Information Relating to Air Navigation (SADIS), serving the European, Middle East and African-Indian Ocean Regions, and the western part of the Asia Region, through an INTELSAT Indian Ocean satellite. The operation and development of the SADIS was managed by the SADIS Operations Group (SADISOPSG). The total number of States/Members receiving the satellite broadcasts was now over 160, comprising around 200 very small aperture terminals (VSAT).

1.1:1.2.4 The meeting noted that thirteen of the fifteen Agency for Air Navigation Safety in Africa and Madagascar (ASECNA) meteorological centres were operating one-way VSAT SADIS systems. Before the end of the year 2003 all fifteen centres would be equipped to receive SADIS data. The meeting was pleased to note that the 2-way VSAT SADIS recommended by the AFI Planning and Implementation Regional Group (APIRG) had been installed in April 2002 and was now operational.

1.1:1.2.5 The meeting noted that products from WAFCs were not regularly received by the Russian Federation and some States from the Commonwealth of Independent States (CIS) because of the unreliable operations of the Astrium receivers and that therefore, the aeronautical meteorological centre in Moscow was issuing the corresponding forecasts. In this context, the meeting recalled that the extent to which WAFS products were used was up to the State concerned. However, it was pointed out that such national non-WAFS products were provided under a joint agreement between the States/Members concerned and as such did not come under Annex 3/Technical Regulations [C.3.1] nor regional air navigation plans.

1.1:1.3 **Support of WWW to the operations of WAFS**

1.1:1.3.1 The meeting noted with satisfaction the continued WMO World Weather Watch (WWW) programme support to the operation of the ICAO WAFS and noted the future developments of the WWW programme. In order to ensure that policy-makers, relevant organizations and national meteorological services gave high priority to the strengthening of the WWW Programme as a whole to meet current and future aviation requirements, the meeting emphasized the continuing need for the WWW programme support for the availability of the required basic data on a global scale to support the operation of the WAFS. In this regard, the meeting formulated the following recommendation:

Recommendation 1/1 — Support of WWW to the operation of WAFS

That WMO arrange for the continued support of the World Weather Watch Programme to the operations of the World Area Forecast System through the availability of the required basic data on the global scale.

1.1:1.4 **Ongoing issues for resolution**

Transmission and decoding of WAFS GRIB/BUFR output

1.1:1.4.1 The meeting recalled that the current transmission on the three satellite broadcasts in T4 digital facsimile format, of global SWH forecasts, and SWM forecasts for limited geographical areas, produced objectively by the WAFCs; and the capability of States/Members to receive such forecasts, if they so desire, effectively satisfied the SIGWX requirements for the final phase of the WAFS. The meeting noted that the WAFSSG and the SADISOPSG nevertheless had proposed that it would be advantageous for the WAFS SIGWX forecasts to be transmitted in the BUFR code form, in order to benefit from the substantially reduced bandwidth requirements and provide better scope for user States to process the forecasts by computer. This proposal had been included as an enabling provision in Amendment 72 to Annex 3/Technical Regulations

[C.3.1], which became applicable in 2001. It was also noted that the modification of software to decode and display WAFS SIGWX products in the BUFR code form by the workstation manufacturers was well in hand.

1.1:1.4.2 The meeting understood that, in order to decode and display WAFS SIGWX products in BUFR code form, it would be necessary for States/Members to obtain the appropriate software and for their staff to be trained in its use. In this regard, the meeting was informed that those States/Members that receive the ISCS broadcast would have to replace their STAR IV workstations due to the fact that the workstation manufacturer had gone out of business. In the case of those States/Members receiving the SADIS broadcast, they would have to obtain software from their workstation manufacturer. Exceptions to this would be those States/Members using workstations provided by WSI, Alden and RSL, because these manufacturers would not provide software to decode/display BUFR-coded products. It was confirmed that WAFC London would provide BUFR technical specifications for those States/Members intending to develop their own software.

1.1:1.4.3 The meeting noted that the current planning time scale envisaged that all States/Members that wished to receive such assistance would have had sufficient time to be in a position to work satisfactorily with WAFS output in the GRIB and BUFR code forms before the applicability date for Amendment 73 to Annex 3/Technical Regulations [C.3.1] in November 2004. The meeting felt that, in light of the latest information provided to the meeting by the WAFC Provider States, user States, and the Secretariat, additional time would be required to give assurance that all user States have had adequate opportunity to avail themselves of the offered assistance, and thereby become capable of using WAFS output in the GRIB and BUFR code forms. The meeting, therefore, agreed that a note for inclusion in Annex 3/Technical Regulations [C.3.1] should be formulated indicating that the production/transmission of WAFS graphical output i.e. T4 facsimile charts, by the WAFCs would continue until 1 July 2005 (Recommendation 1/5 refers). However, the meeting wished to reinforce the continuing need for workshops/seminars to assist interested States/Members in working with WAFS products in the GRIB and BUFR code forms. Moreover, it was felt that those attending should be operational users of the system with the capability of passing on any training received to the remaining operational staff within their State. In this regard, the meeting formulated the following recommendation:

Recommendation 1/2 — Training assistance to States/Members on workstation operation and display of WAFS products using GRIB and BUFR code forms

That,

a) WMO organize, in coordination with ICAO and the WAFC Provider States, workshops/seminars including roving workshops on the use of WAFS products in the GRIB and BUFR code forms in order to ensure that interested States/Members have access to this assistance before the applicability date of the relevant WAFS provisions in Amendment 73 to Annex 3/Technical Regulations [C.3.1];

b) ICAO and WMO bring to the attention of States/Members the need to provide assistance, as necessary, to WMO in conducting the GRIB/BUFR seminars/workshops, if States/Members are in a position to do so;

c) States/Members obtain or develop software in order to decode and display WAFS products in the GRIB and BUFR code forms in time for the applicability date of Amendment 73 to Annex 3/Technical Regulations [C.3.1]; and

d) States/Members ensure that the appropriate personnel attend the GRIB/BUFR training events.

WAFC back-up facilities

1.1:1.4.4 The meeting noted that the WAFSSG, at its eighth meeting in 2001, had drawn particular attention to the need, with the advent of the "final" phase of the WAFS, to formalize the WAFC back-up procedures and include these in Annex 3/Technical Regulations [C.3.1]. An initial draft of these procedures had been developed by the WAFSSG, and the WAFC Provider States had agreed to test, and refine as necessary, the procedures given in this initial draft in time for presentation of the proposed technical requirements/specifications for consideration by the meeting. The meeting reviewed the WAFC back-up procedures and agreed that they should be updated to remove detail that would require frequent amendment such as communications headers. Following this updating and necessary editorial adjustments, the backup procedures should be included as an attachment to Annex 3/Technical Regulations [C.3.1] (Recommendation 1/5 refers). The meeting was pleased to note that the two WAFCs had made great efforts to harmonize their respective WAFS output products. This had involved aligning both the "look" of the output, such as depiction of information, and the forecast positions of fronts/jetstreams etc. at points of output product overlap. The meeting agreed that such harmonization was of critical importance, not least for effective WAFC back-up procedures, and that this matter must receive continuous attention by the WAFC Provider States and the WAFSSG (or its successor group).

Depiction of multiple or "stacked" jetstreams and crossing jetstreams

1.1:1.4.5 The meeting was informed that the steadily increasing sophistication of the numerical weather prediction models had rendered it necessary for the WAFCs to devise a method of depiction in 2-dimensions for multiple jetstreams that were, in effect, stacked vertically above each other. It had been agreed at the eighth meeting of the WAFSSG in 2001 that for all jetstreams there should be an indication of the vertical extent of the 80 kt isotach in the form of, for example, a two-figure number written underneath the jet core, where the two-figure values referred to the height of the 80 kt isotach in hundreds of feet above and below the jet, respectively. Based on this proposal, in the case of so-called "stacked jets", only one jet would be shown on the SWH forecast and the other jet core(s) would be indicated using the foregoing 80 kt isotach system. The meeting was aware that this problem was mainly of concern only to the operators and, therefore, the method had subsequently been tested with the International Air Transport Association (IATA), which agreed that it was satisfactory. The meeting also considered that the BUFR code tables should be modified to accommodate these new features and that workstation manufactures need also be advised by WAFC Provider States. The meeting reviewed draft examples of "stacked jets" and "crossing jets" on the WAFS SWH chart presented by the WAFC Provider States and agreed that these updated examples should be included in Appendix 1 to Annex 3/Technical Regulations [C.3.1] — Model charts and forms, as part of Amendment 73. In this regard, the meeting formulated the following recommendation:

RSPP **Recommendation 1/3 — Amendment 73 to Appendix 1 to Annex 3/Technical Regulations [C.3.1] — Depiction of multiple jetstreams and crossing jetstreams**

That, WMO:

a) include the WAFS SWH charts depicting multiple jetstreams and crossing jetstreams given in Appendix A to this report as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1].

b) modify the BUFR code tables accordingly to accommodate these new features.

Issuance of SIGWX forecasts

1.1:1.4.6 The meeting next discussed the lead time for the issuance of SIGWX forecasts by WAFCs. It was suggested that it should be extended from the current 12 hours to 16 hours to meet the needs for a growing number of non-stop operations of 15 hours or longer. In this regard, however, it was pointed out that issuing the SIGWX forecasts 16 hours before the validity time would have an impact on the accuracy of the forecast since it would be based on earlier data. Under these circumstances, the meeting agreed that the time of issuance should be reviewed by the WAFSSG or its proposed successor group for a future amendment to Annex 3/Technical Regulations [C.3.1]. In this regard the meeting formulated the following recommendation:

Recommendation 1/4 — Lead time for issuance of WAFS SIGWX forecasts

That ICAO arrange for a suitable body to consider the feasibility and advisability of amending the lead time for issuance of SIGWX forecasts to 16 hours.

1.1:1.5 **Amendment 73 to Annex 3/Technical Regulations [C.3.1] concerning the "final" phase of the WAFS**

1.1:1.5.1 The meeting noted that the proposal to amend Annex 3/Technical Regulations [C.3.1] to take account of the "final" phase of the WAFS had been developed with the assistance of the WAFSSG. It had been found necessary to propose amendments to Chapters 1, 3, 5, 7, 9, and 11, Appendix 1 and Attachment A. The main thrust of the proposal concerned the transfer of RAFC responsibilities to the WAFCs, the elimination of the requirement to produce and transmit WAFS products in T4 facsimile format due to their replacement by GRIB and BUFR files , and the need to maintain the integrity of WAFS data for issuance to operators, as required by Annex 3/Technical Regulations [C.3.1], once all the WAFS data is transmitted to Contracting States/Member States in the binary form.

1.1:1.5.2 In regard to the "objectives" of the WAFS in Annex 3/Technical Regulations [C.3.1], it was proposed that these should be amended to introduce the notion that "full advantage should be taken of evolving technologies", to ensure that the WAFS maintained its currency and cost effectiveness as relevant technologies advance in the future. In view of the fact that, following Amendment 72, the frequency of issuance of GRIB data was now four times daily, it was agreed that plain language amendments to upper winds and temperatures and jetstream forecasts were no longer required. At the same time, the need for the WAFCs to acknowledge receipt of any messages from meteorological offices advising of a significant discrepancy in the WAFS data was introduced.

1.1:1.5.3 In respect of maintaining the integrity of the WAFS data, the meeting appreciated that providing the data in a form that was easily processed into a variety of products, raised the concern that operators could be provided and charged for so-called "value-added" or "augmented" products as flight documentation when, in fact, they had not requested such products and simply required the WAFS products as per Annex 3/Technical Regulations [C.3.1]. While there was no reason such value-added products should not be supplied to any airline(s) requesting them, the meeting recognized that the charges for the additional service should not form part of cost recovery under the air navigation charges, but should be the subject of separate charges negotiated between the airline(s) concerned and the meteorological authority. IATA expressed a strong requirement that any airline should be able to expect to receive flight documentation strictly in accordance with the provisions of Annex 3/Technical Regulations [C.3.1], from any meteorological office designated by a State to serve international air navigation, as listed in the relevant regional air navigation plans. In their view, the flight documentation issued should be WAFS products in line with the provisions in Annex 3/Technical Regulations [C.3.1]. Following its review of the amendment proposal, the meeting formulated the following recommendation:

RSPP **Recommendation 1/5 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — World area forecast system**

That, the proposal to amend Annex 3/Technical Regulations [C.3.1] given in Appendix B to this report be included as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1].

1.1:1.6 **Development of the WAFS beyond Amendment 73**

1.1:1.6.1 The meeting discussed the development of the WAFS beyond Amendment 73 noting the inexorable advances in technology and computers relevant to the WAFS which, if there was no means of advantage being taken of such developments to improve the WAFS, would render the WAFS "frozen in time", to the clear detriment of future quality and cost effectiveness. In view of this, the meeting agreed that, with the implementation of Amendment 73, all reference to the so-called "final" phase of the WAFS was redundant and counter-productive and should be eliminated, and the development of the WAFS should continue in the future to meet evolving operational requirements as it had done in the past. The meeting also agreed that, in order to ensure the WAFS is capable of meeting the evolving operational requirements, which could vary from one region to another, it was essential that an ICAO group continued to be in existence that could coordinate the development of the WAFS through appropriate proposals to amend Annex 3/Technical Regulations [C.3.1]. Moreover, following Amendment 73, all WAFS output would be provided by the two WAFC Provider States and the meeting considered that technical advice and feedback should continue to be available to the WAFCs from a group, inter alia, comprising user States and users.

1.1:1.6.2 The meeting was aware that it was not the policy of the Air Navigation Commission to maintain study groups in existence indefinitely; it was strongly recommended, therefore, that ICAO should consider replacing the WAFSSG. In this regard, the meeting recalled that a similar problem had applied to the operation and development of the SADIS which, at the request of the PIRGs concerned, had been solved by the establishment of an operations group, SADISOPSG. The meeting agreed that this group had proved to be very effective in guiding the operation and development of the SADIS, and had provided a vital forum for operator input. In light of the foregoing considerations, the meeting recommended that ICAO should consider replacing the WAFSSG with a WAFS Operations Group (WAFSOPSG) which could provide the necessary guidance for the operation and development of the WAFS to ensure that it would continue to meet evolving operational requirements, and also provide a forum for operator advice and feedback concerning these requirements. The meeting also agreed that the most effective way to facilitate the availability of technical expertise to the WAFCs in such a group would be to invite representation on the group from one of the ex-RAFC Provider States in each region, user States that had provided members to the WAFSSG, a user State from each region, IATA, the International Council of Aircraft Owner and Pilot Associations (IAOPA), the International Federation of Air Line Pilots' Associations (IFALPA) and WMO. After reviewing the draft terms of reference for, and composition of the proposed WAFSOPSG, the meeting formulated the following recommendation:

Recommendation 1/6 — Establishment of a WAFS Operations Group (WAFSOPSG)

That, in order to ensure that the operation and development of the WAFS continued to meet current and evolving operational requirements in a cost effective manner, ICAO consider the establishment of a WAFS Operations Group (WAFSOPSG) to replace and take over any outstanding tasks of the WAFSSG, with terms of reference and composition as given in Appendix C to this report.

1.2:1 UPLINK/DOWNLINK OF OPMET INFORMATION

1.2:1.1 Introduction

1.2:1.1.1 The meeting recalled that the COM/MET/OPS Divisional Meeting (1990) had formulated a recommendation calling for ICAO, in consultation with WMO, to arrange for a suitable body to develop a proposal to amend Annex 3 — *Meteorological Service for International Air Navigation*/Technical Regulations [C.3.1] to:

a) update the provisions for manually-produced air-reports;

b) develop Standards and Recommended Practices (SARPs) related to automated air reporting for meteorological information; and

c) develop consequential amendments to other relevant ICAO documents.

1.2:1.1.2 It was noted that the Air Navigation Commission had authorized the formation of the Meteorological Information Data Link Study Group (METLINKSG)[1] to address these issues. It was noted that initially, the issues addressed by the Secretariat, with the assistance of the METLINKSG, were related to the downlink of meteorological information. However, a few years later these issues were expanded to cover the uplink of meteorological information to aircraft.

1 Initially called Automatic Air-reporting Study Group (ATARSG).

1.2:1.2 **Automated air-reporting**

1.2:1.2.1 The meeting was aware that in order to address these issues, Chapter 5 of Annex 3/Technical Regulations [C.3.1] had been thoroughly revised with the assistance of the METLINKSG. In addition to updating the SARPs related to manual reports (i.e. air-reports through voice communications), new provisions related to automated air-reporting had been developed. The reasoning behind the new provisions had been to associate automated routine air-reporting for meteorological information to the automatic dependent surveillance (ADS) reports required for air traffic control (ATC) purposes. The link was considered appropriate since these reports already included the meteorological information required (i.e. wind and temperature as mandatory parameters, and turbulence and humidity as optional elements) and that the only outstanding issue was how to route this information to the meteorological centres concerned. The group had considered that, in view of the very large number of ADS reports that were expected to become available in the future, these reports should be addressed from the ATS units to the world area forecast centres (WAFCs) which would then disseminate the information to meteorological centres as basic MET data using the WMO global telecommunication system (GTS).

1.2:1.2.2 The meeting understood that the aeronautical requirement for automated air-reports was to be met by the meteorological information data block of the ADS message; all other types of aircraft reports (e.g. aircraft meteorological data relay (AMDAR) reports) were considered basic meteorological data and thus, were being addressed within the relevant WMO Programmes. The meeting recognized, nevertheless, the importance of the AMDAR Programme in its invaluable support to the World Weather Watch (WWW) Programme of WMO.

1.2:1.2.3 The meeting was aware that the detailed specifications for meteorological parameters to be included in the meteorological information data block of ADS reports had been incorporated in Appendix 3 to Annex 3/Technical Regulations [C.3.1] since Amendment 72. These included detailed instructions related to turbulence reporting which was expected to be provided as an index. This index was a function of the mean and peak eddy dissipation rate (EDR) encountered during the 15-minute period immediately preceding the observation. The meeting noted that the EDR index had been selected based on tests undertaken in Australia and the United States and that the choice had largely been based on the fact that the EDR index could potentially be used in the future as an input variable in the numerical weather prediction (NWP) models run by the WAFCs. It was recognized that such a use could have a positive impact on the quality of turbulence forecasts.

1.2:1.2.4 With regard to the reporting frequency stipulated by Annex 3/Technical Regulations [C.3.1], Chapter 5, 5.3.1, it was suggested that the frequency should perhaps be amended in view of the fact that the FANS-1 equipped aircraft could not meet the stated requirement to report every 30 seconds during the climb-out phase of the flight. In this regard, it was, however, pointed out that MET reporting would only be undertaken when ADS was being applied and that the use of ADS in the terminal area would be impossible for FANS-1 equipped aircraft, since the reporting frequency for ATC purposes would have to be very high, i.e. a message every six to twelve seconds. Under these circumstances, the meeting agreed that there was no need to amend the requirements related to the reporting frequency.

1.2:1.2.5 In the case of automated special air-reports, it was noted that these would not be associated with ADS reports; rather, they would be downlinked as a separate data-link service. The basic requirements for automated special air-reports were stated in Annex 3/Technical Regulations [C.3.1] and the service itself was being developed by the Operational Data Link Panel (OPLINKP).

1.2:1.2.6 In light of the foregoing discussions and clarifications provided, the meeting concluded that the necessary provisions for automated air-reports were in place and that no major changes thereto were currently required.

1.2:1.2.7 The meeting considered, however, that the implementation of MET reporting using ADS had been slower than expected. The only regions where ADS reports (including the meteorological information data block) were made available on a large-scale operational basis were the North Atlantic and Pacific Regions. The operational trials had demonstrated the importance of close coordination between the ATS and MET authorities when implementing the automatic air-reporting procedures. The meeting was pleased to note that the implementation of automatic air-reporting procedures was being addressed regularly at the regional ICAO ATS/MET/Pilot coordination seminars and that such seminars continued to be organized by ICAO, in coordination with WMO.

1.2:1.2.8 Of various items that were observed during the operational trials in the North Atlantic Region, one issue in particular was brought to the attention of the meeting. This related to a certain aircraft type that had software onboard which had produced "rogue" winds with wind directions systematically in error. To avoid a negative impact on the NWP models run by the WAFCs, the transmission of MET data from these aircraft had to be discontinued. This issue had showed clearly that MET data from aircraft, while generally of an excellent quality, should be subject to a systematic quality control. The meeting recalled that the ADS MET data first reached the ATS unit before it was disseminated to the WAFCs. The meeting agreed that it would be rather difficult for the ATS units receiving the ADS MET data to carry out a systematic quality control of MET data and that the centres best suited to undertake this task would be the WAFCs, where all incoming MET data was already subject to quality control procedures. An additional issue that would also need to be considered related to the necessary feed-back to be provided to the operators of aircraft so that corrective action could be taken by them, as necessary. The meeting agreed that this issue was rather complex and needed to be further addressed by ICAO, in coordination with WMO and the WAFCs. In this regard, the meeting formulated the following recommendation:

Recommendation 1/7 — Quality control of the meteorological information included in ADS reports

That ICAO, in coordination with WMO and the WAFC Provider States:

a) develop procedures for the quality control of meteorological information included in ADS messages; and

b) consider the ways and means of providing the necessary feed-back to the operators concerned.

1.2:1.3 **Uplink of OPMET information to aircraft**

1.2:1.3.1 The meeting noted that the increased use of data link in the communications, navigation, and surveillance/air traffic management (CNS/ATM) environment was envisaged and that data-link services were being developed by various ICAO bodies. With regard to those data-link services that included MET data, the METLINKSG had been responsible for the development of the meteorological specifications for these services. Subsequently these specifications had been referred to the OPLINKP and Aeronautical Telecommunication Network Panel (ATNP) to finalize the operational and telecommunications aspects. In order to provide the meteorological specifications in a form customarily used by telecommunication software engineers, these were presented in terms of templates together with the corresponding tables displaying the ranges and resolutions of parameters required for these services.

1.2:1.3.2 The meeting noted with satisfaction that this work had been completed for the local routine and special report (to be included in the data link — automatic terminal information service (D-ATIS)) and the aerodrome routine meteorological report (METAR) and aerodrome special meteorological report (SPECI) (to be included in the data link — VOLMET (D-VOLMET)). Moreover, it was noted that the meteorological specifications for uplinking aerodrome forecasts (TAF) and SIGMET messages had been included in Annex 3/Technical Regulations [C.3.1] as part of Amendment 72; however, the subsequent work by the OPLINKP and ATNP had not yet been completed.

1.2:1.3.3 The meeting proceeded to review the templates for the following remaining meteorological messages:

a) special air-report (downlink);

b) volcanic ash advisory message;

c) tropical cyclone advisory message;

d) aerodrome warning; and

e) wind shear warning.

1.2:1.3.4 The meeting noted that the development of templates for volcanic ash advisory messages and wind shear warnings had been coordinated with the Volcanic Ash Warnings Study Group (VAWSG) and the Low Level Wind Shear and Turbulence Study Group (WISTSG), respectively. In this context, the meeting also reviewed the draft definition of VOLMET which had been aligned with the terminology used for ATIS. The necessary consequential amendments to the *Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444) and to the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (Doc 8400) were also reviewed.

1.2:1.3.5 Having reviewed and agreed to the foregoing proposal, the meeting formulated the following recommendation:

RSPP **Recommendation 1/8 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Templates for messages to be uplinked to, or downlinked from, aircraft in flight**

That,

a) the proposal given in Appendix B to this report be included as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1]; and

b) the consequential draft amendments to PANS–ATM (Doc 4444) and to PANS–ABC (Doc 8400) given in Appendices D and E to this report be included in Amendment 3 to PANS–ATM (Doc 4444) and Amendment 26 to PANS–ABC (Doc 8400), respectively.

1.2:1.3.6 The meeting was aware that, as a part of Amendment 72 to Annex 3/Technical Regulations [C.3.1], enabling provisions had been introduced allowing the issuance of SIGMET messages for volcanic ash and tropical cyclones in graphical format using the WMO BUFR code form. Similar proposals were being made for volcanic ash and tropical cyclone advisories under Agenda Item 1.4. Other graphical products were expected to be uplinked to the cockpit in the future. The choice of the BUFR code form was considered the most appropriate since this code would be widely used in the future by the MET community, inter alia, for coding significant weather (SIGWX) by the WAFCs. However, the METLINKSG had been advised that the BUFR code form might not be the best format for transmitting graphical information to aircraft due to the large bandwidth required and that other numerical code formats could be available that would require only a small fraction of the bandwidth needed for transmitting information using the BUFR code form. The meeting concurred with the view that using the BUFR code form for ground-to-ground exchanges while using another numerical code for the air-to-ground exchanges would be an additional complication and therefore, it was agreed that the matter should be very carefully assessed before recommending codes other than the BUFR code form for the air-ground data-link of meteorological information. In this way a balance could be struck between the maximum standardization of the code forms used and the minimum use of the bandwidth for transmission of data. In this context, the meeting formulated the following recommendation:

Recommendation 1/9 — Consideration of the code to be used for uplinking meteorological information to aircraft in flight

That ICAO arrange for a suitable body to consider, in coordination with WMO, the code that would be the most appropriate for use for the uplink of meteorological information to aircraft, taking due account of the need for overall standardization and the requirements for minimizing the bandwidth.

1.2:1.4 **Implementation of data-link applications**

1.2:1.4.1 The meeting noted that the implementation of D-ATIS and D-VOLMET data-link applications in the ASECNA area would prepare ASECNA member States and airlines in the region, for a gradual introduction of new CNS/ATM systems in the AFI Region especially in the area of D-VOLMET and D-ATIS ground/air data-link applications as part of the future air traffic management tools.

1.2:1.5 **MET support to ATM**

1.2:1.5.1 The meeting was informed of the progress of the work performed by the Project Team on MET in the CNS/ATM concept for the EUR Region (PT/METATM) established in response to a decision by the EANPG in 1999. The main task had been to draft a strategy to develop the means to meet the requirements over the next fifteen years for meteorological information in the EUR CNS/ATM concept.

1.2:1.5.2 A number of generic requirements for meteorological information had been consolidated. An inventory of current and foreseen capabilities in the meteorological field had been established. It was the opinion of the PT/METATM that, given the role that aeronautical meteorology could play in the new ATM environment, new worldwide developments could be expected during the period foreseen by this strategy, i.e. by the summer of 2003.

1.2:1.5.3 The project team had concluded that the meteorological systems should be progressively enhanced and integrated to ensure that the service evolved in a well-managed and economical way. This would provide the expert services and products necessary to support collaborative decision making, an essential component of the future ATM system.

1.2:1.5.4 The meeting was informed that to date there had been no formal validation of the user requirements on behalf of ATM and airline users. This was planned to be undertaken through the ICAO EUR/NAT Regional Office and Eurocontrol.

1.2:1.5.5 The team had expressed serious concern that, in spite of the improved capabilities enabled by recent technical developments to observe, analyse, forecast and disseminate meteorological information, the air transport industry was lacking a consistent understanding of how to exploit these capabilities in the most beneficial way. It had also been considered that a good economic data analysis of the costs of the weather impact on ATM was of great importance and could be based on the work of the Eurocontrol Performance Review Commission.

1.2:1.5.6 These developments were noted with great interest by the meeting. In this context, it was indicated that similar task forces had been established in other ICAO Regions. In particular, the meeting was informed of the developments in the AFI Region where the experience gained in the EUR Region were considered to be highly useful to assist the work of the task force.

1.3:1 DEVELOPMENT OF SPECIALIZED WAFS PRODUCTS FOR TURBULENCE AND ICING FORECASTS

1.3:1.1 WAFS turbulence forecasts and associated output products

1.3:1.1.1 The meeting recognized that the WAFS currently provided substantial meteorological support to the ICAO communications, navigation, and surveillance/air traffic management (CNS/ATM) systems, primarily in respect of ATM by virtue of the WAFS global GRIB data. This support would be enhanced by the introduction of global SIGWX forecasts in the BUFR code form which could be utilized directly by airline and ATM computers. The meeting noted the increasing concern in the aviation community with en-route clear air turbulence, and that the requirement for automated air-reports contained in the ADS messages to be routed to the two WAFCs by ATC computers, would provide a unique data set at the WAFCs that should be used, inter alia, to provide improved and/or additional WAFS turbulence forecasts and associated output products. However, it was recognized that improving WAFS turbulence forecasts (including mountain waves and mountain induced turbulence) would depend on the development of improved algorithms and increased model resolution as much as on the availability of an improved global turbulence data set from automated air-reports, although the latter would clearly assist in the validation of improved algorithms. The meeting considered that turbulence output products in grid point format would be the most useful for direct assimilation into airline and ATM computers. It was recalled that the automated turbulence reports from aircraft were to be made in terms of eddy dissipation rate (EDR). The WAFC Provider States had indicated that some of the operational WAFC models would be able to assimilate EDR data through a 3-dimensional variational analysis system. Eventually, increases in the resolution of operational models would allow EDR to be used as a fundamental observation unit.

1.3:1.1.2 The meeting agreed that all efforts should be made to take maximum advantage of the availability of global EDR data at the WAFCs to improve turbulence forecasts. In view of the impact of clear air turbulence on the safe and efficient routing of aircraft, especially for future “free-flight” or “dynamic” routing, the meeting agreed that the WAFC Provider States and other States/Members in a position to do so, and the WAFSSG (or its successor group), should endeavour to make maximum use of the increased availability of global turbulence reports in terms of EDR and in step with improved model resolution, to improve the algorithms for turbulence forecasts and the associated WAFS output products.

1.3:1.2 WAFS icing forecasts and associated output products

1.3:1.2.1 Although severe icing, as indeed severe turbulence, had always been considered a serious hazard for aircraft operations, the meeting was aware that a series of fatal aircraft accidents during the past decade, in which icing had been cited as a contributory factor, had focused increased attention on this phenomenon. The meeting noted that in respect of icing, the operators had a number of special requirements, such as the use of icing forecasts tailored for specific routes, in order to secure relief from the need for additional fuel uplift on routes for which forecasts of icing had been issued over wide areas. As in the case of turbulence, in order to improve the WAFS icing forecasts, and possibly provide these forecasts in grid point format, the icing forecast algorithms would also have to be improved. The meeting, therefore, encouraged further research by the WAFC Provider States, and other States/Members in a position to do so, and the WAFSSG (or its successor group) to improve the icing forecast algorithms, with a view to introducing improved and/or additional WAFS icing output products that better meet the operational requirements for the CNS/ATM systems.

1.3:1.2.2 In this regard, the meeting formulated the following recommendation:

Recommendation 1/10 — Improvement in detection, forecast algorithms and WAFS output products for turbulence and icing

That, the WAFC Provider States, other States/Members in a position to do so, and the WAFSSG (or its successor group), continue and, if possible, intensify the development of improved detection, and forecast algorithms for:

a) turbulence (including mountain waves and mountain-induced turbulence) making maximum use of global EDR data and improved model resolution; and

b) icing,

in order that the WAFCs may improve existing WAFS SIGWX output products and/or propose the introduction of new WAFS turbulence and/or icing output products that would better satisfy the operational requirements, particularly of the CNS/ATM systems.

Note.— Any proposals that may emerge for the introduction of new WAFS output products for turbulence and/or icing should be processed through the WAFSSG (or its successor group) and, if accepted, be further processed as a proposal to amend Annex 3/Technical Regulations [C.3.1] in the usual manner.

1.4:1 INTERNATIONAL AIRWAYS VOLCANO WATCH (IAVW)

1.4:1.1 Introduction

1.4:1.1.1 The meeting recalled that the IAVW had been developed in the early 1980s, in response to a number of serious incidents in which jet transport aircraft had encountered volcanic ash in flight and lost power on one or more engines. Due to the fact that volcanic ash in the atmosphere was of little direct safety interest to anyone except aviation, the international aviation community had to take the lead and seek the cooperation of States/Members, and other international organizations to organize a global volcanic ash monitoring and warning system based, as far as practicable, on existing observing networks.

1.4:1.1.2 The meeting noted that the IAVW comprised two parts: an "observing (detection, monitoring, reporting)" part; and a "warning" part. The observing part included:

a) ground-based observations of volcanic eruptions/ash cloud from various existing organized networks such as volcano observatories, meteorological observatories, disaster relief teams, and any national disciplined units such as border police/immigration etc, stationed in mountainous and volcanically active areas;

b) satellite detection/monitoring of volcanic ash, and;

c) observations of volcanic eruptions/ash cloud from aircraft-in-flight.

1.4:1.1.3 The warning part, initially, comprised:

a) the issuance of NOTAMs by aeronautical information services (AIS) units for both significant pre-eruption volcanic activity and eruptions/ash cloud, and including any associated closure of air routes; and

b) the issuance of SIGMETs by meteorological watch offices (MWO) for volcanic ash in the atmosphere.

Later, in addition to NOTAMs and SIGMETs, volcanic ash advisories had been introduced. These advisories were issued by nine designated volcanic ash advisory centres(VAAC) in Anchorage, Buenos Aires, Darwin, London, Montreal, Tokyo, Toulouse, Washington and Wellington. The planning and development of the IAVW had been coordinated through the Volcanic Ash Warnings Study Group (VAWSG) which had been created by the Air Navigation Commission in 1982 to assist the Secretariat in this respect.

1.4:1.2 **Status of the IAVW**

1.4:1.2.1 The meeting noted that over the two decades since June 1982, when a British Airways B 747 had lost power temporarily on all four engines due to the ingestion of volcanic ash, explosive volcanic eruptions had continued to affect aviation. Fortunately, no aircraft had been lost due to volcanic ash, but the danger was ever-present and the cost in aircraft diversions/delays and the refurbishing of damaged airframes, equipment and engines of those aircraft that had inadvertently flown through volcanic ash was estimated to be well over $ 300M, and mounting. Since 1982, the relevant regulatory documents (those of ICAO and other interested organizations) had been amended to introduce provisions for the IAVW. However, whilst ensuring the currency of the regulatory documents in this respect was necessary, it was not sufficient. In this regard, the meeting recognized that certain parts of the IAVW were still not implemented satisfactorily in some regions. The meeting appreciated that the development of the IAVW had not been an easy, nor a straightforward, task. The IAVW, unavoidably, was a complex system involving the coordination of services from agencies that had no previous experience of working with civil aviation, such as the vulcanological agencies. Moreover, the subject itself rendered the task even more difficult because it involved dealing with active volcanoes — one of the most unpredictable powers of nature.

1.4:1.2.2 The meeting noted with satisfaction that in spite of the foregoing caveats, the IAVW had been successfully established. The meeting was aware that, on average there were fifty to sixty volcanic eruptions per year globally, of which ten or more were expected to be sufficiently explosive to eject an ash column that reached jet aircraft cruising levels. It was noted that the chief support of the IAVW were the nine VAACs, each covering its agreed area of responsibility. These areas were gradually being extended to cover additional air routes, as necessary. Although the VAACs relied heavily on satellite imagery and volcanic ash detection techniques, in most cases they still needed to be notified that a volcano had erupted to enable them to focus on the area concerned. This meant that fast and reliable notification of an eruption to the VAACs from any of the observing sources was absolutely critical.

1.4:1.2.3 It was noted that the planning and development of the IAVW had been based on advice from the VAWSG which worked mainly through correspondence, but held meetings to develop the substantive amendments to Annex 3 — *Meteorological Service for International Air Navigation*/Technical Regulations [C.3.1] concerning the IAVW. The World Meteorological Organization (WMO) also arranged meetings of the VAACs, primarily to foster discussions/proposals on the more scientific aspects of the IAVW, such as the detection of volcanic ash from satellite data and the models used to forecast volcanic ash movement etc. The VAAC meetings were also attended by experts from air traffic control (ATC), International Air Transport Association (IATA), International Federation of Air Line Pilots' Associations (IFALPA) and vulcanological agencies, to ensure that their advice was readily available to the scientists from the VAACs. The VAWSG meetings and the VAAC meetings so far had been held alternately, as many of the participants had attended both meetings.

1.4:1.2.4 The meeting noted with satisfaction that an ICAO *Handbook on the International Airways Volcano Watch (IAVW) — Operational Procedures and Contact List* (Doc 9766) had been published in 2000 containing, inter alia, the IAVW operational procedures and contact list, and the ICAO *Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds* (Doc 9691) had been published in 2001. It was noted that the ICAO IAVW Handbook could be accessed through the ICAO Web site at www.icao.int. Furthermore, the meeting noted that all of the VAACs operated Web sites.

1.4:1.3 **Ongoing issues for resolution**

Issuance of SIGMETs for volcanic ash by MWOs

1.4:1.3.1 The meeting noted that some of the ICAO planning and implementation regional groups (PIRGs) had identified a serious problem that had arisen due to the lack of issuance of SIGMETs by MWOs in certain Contracting States/Member States. Although this was a general problem, not due to the IAVW itself, it had become most noticeable for SIGMETs for volcanic ash, because in this case the VAAC associated with the MWO concerned was normally aware that an eruption/volcanic ash had been reported in the FIR for which the MWO was responsible and had issued a volcanic ash advisory. The VAAC and the operators were then primed to watch for the issuance of the required SIGMET by the MWO, and immediately noticed when it was not issued. The meeting emphasized that this problem was a serious safety issue, and noted that the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG) and CAR/SAM Regional Planning and Implementation Group (GREPECAS) had recommended the need for ICAO special implementation projects (SIP) in their regions to assist States/Members requiring it to fully implement the SIGMET procedures in the MWOs that they had designated in the regional air navigation plans. The Council had since approved the SIP for the CAR/SAM Regions. The meeting wished to reinforce these recommendations, in order to lend support to the urgent approval by ICAO of SIPs concerning SIGMET procedures and the review of associated guidance material. A related issue was emphasized by the users who pointed out that States/Members should adhere to all the technical specifications and format for VA SIGMETs as prescribed in Annex 3/Technical Regulations [C.3.1], Appendix 5. In this regard, the meeting formulated the following recommendations:

Recommendation 1/11 — Special implementation projects on the issuance of SIGMET messages by meteorological watch offices

That, ICAO give urgent consideration to the organization of special implementation projects recommended by the PIRGs to assist States/Members in fully implementing the SIGMET provisions in Annex 3/Technical Regulations [C.3.1] by the meteorological watch offices designated in the regional air navigation plans .

Note.— In organizing such special implementation projects:

a) coordination with WMO will facilitate implementation; and

b) particular attention should be paid to the issuance of SIGMETs for volcanic ash in Contracting States/Member States in volcanically active areas.

Recommendation 1/12 — Implementation of SIGMET requirements

That ICAO,

a) conduct regional surveys of the issuance of SIGMET messages and particularly those for volcanic ash, in coordination with WMO, and list any shortcomings and deficiencies in accordance with regional procedures for the requisite follow-up measures;

b) review the regional SIGMET guides to ensure that all are up to date, and draw States/Members' attention to these guides, together with a request that States/Members review the operations of the MWOs they have designated for inclusion in the regional air navigation plans to ensure that SIGMET messages are being issued as required; and

c) arrange for the relevant planning and implementation regional groups to conduct periodic tests of the issuance and reception of SIGMET messages for volcanic ash.

1.4:1.3.2 A concern was expressed that there was a possibility that the foregoing efforts would not completely solve the problem of non-issuance of SIGMETs for volcanic ash. It was proposed, therefore, that the volcanic ash advisory message be upgraded to be the primary hazard warning message for volcanic ash. The meeting considered that such a fundamental change would have very far-reaching implications for OPMET data banks, flight planning, communication routing and priorities and that it should first be considered by an ICAO group such as the VAWSG (or its successor group). In order to achieve this, the meeting formulated the following recommendation:

Recommendation 1/13 — Upgrade of the volcanic ash advisory message to a "warning"

That, ICAO seek the views of an appropriate group on the proposal to upgrade the status of the volcanic ash advisory to a "warning".

Notification of volcanic eruptions to VAACs by volcano observatories

1.4:1.3.3 The meeting recognized that the front line of defence for the IAVW were the networks of volcano observatories established by States/Members to monitor selected active volcanoes. The meeting was informed that difficulties were being experienced by some vulcanological agencies in obtaining the necessary funding to extend their work programme to include sending messages on volcanic activity to ACC, MWO and the VAAC in their region. These additional funds most often involved staffing and communications costs. The users cautioned the meeting that the additional requirements should only include those listed in Annex 3/Technical Regulations [C.3.1], Appendix 5, paragraph 5.1, and that aviation should only be charged for the marginal cost of providing this information. The meeting agreed that, in view of flight safety considerations, it was essential that notification of impending or occurring volcanic eruptions were sent immediately by the volcano observatories directly, or through their respective agencies, as decided by States/Members concerned. The meeting considered that this requirement was no different from the aviation requirements for meteorological information, which were long standing. In this way, the vulcanological agencies, whose information was required by international civil aviation should be able to recover the agreed additional costs for providing this service to aviation. While the meeting understood the reasons for including the requirements for information from vulcanological agencies in Annex 3/Technical Regulations [C.3.1], some concerns were raised that this might imply that the meteorological authority would be responsible for arranging cost recovery through the civil aviation authority. In this regard, the meeting was advised that ICAO Annexes, and indeed this particular provision, were addressed to Contracting States/Member States. It would be the responsibility of the Contracting State concerned to arrange for any cost recovery through the civil aviation authority in consultation with the vulcanological agency, meteorological authority and users in the customary manner.

1.4:1.3.4 Following this discussion, the meeting agreed that the requirement for the notification to ACCs, MWOs and VAACs of impending or occurring volcanic eruptions by volcano observatories should be included in Annex 3/Technical Regulations [C.3.1], and the specific volcano observatories from which this service was required should be listed in the relevant regional air navigation plans in the form of an appropriate table in the facilities and services implementation document (FASID). Following its review of the amendment proposal as given in Appendix B to the report, the meeting formulated the following recommendation:

RSPP **Recommendation 1/14 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Inclusion of a requirement for information from selected State volcano observatories in Annex 3/Technical Regulations [C.3.1] and the meteorology part of the regional air navigation plans**

That,

a) requirements for volcanic activity information to be sent by selected States/Members' volcano observatories to their "associated " area control centres (ACC), meteorological watch offices (MWO), and volcanic ash advisory centres (VAACs) as determined by regional air navigation agreement and given in Appendix B to this report, be included as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1]; and

b) the meteorology parts of the relevant regional air navigation plans be amended to introduce a new table in the ANP/FASIDs listing the State volcano observatories from which this information is required, the ACC, MWO and VAAC to which each volcano observatory should send its information, and the communications means to be used for this purpose by the States/Members concerned.

Requirement for maintenance of a 24-hour watch by VAACs

1.4:1.3.5 The meeting noted that most of the VAACs already operated a 24-hour watch but, in order that all the VAAC Provider States establish a 24-hour watch for the VAACs they provide and to recover the costs of maintaining such a watch, the meeting agreed that this should be stated as a requirement in Annex 3/Technical Regulations [C.3.1]. Following its review of the amendment proposal as referenced in Appendix B to this report, the meeting formulated the following recommendation:

RSPP **Recommendation 1/15 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Maintenance of a 24-hour watch by VAACs**

That, the requirement for VAACs to maintain a 24-hour watch provided in Appendix B to this report be included as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1].

Graphical volcanic ash and tropical cyclone advisories and graphical SIGMETs

1.4:1.3.6 The meeting was aware that enabling provisions for the issuance of volcanic ash advisories by VAACs and SIGMETs for volcanic ash and tropical cyclones by MWOs, in graphical form, were given in Annex 3/Technical Regulations [C.3.1]. Up to the time of the meeting , volcanic ash advisories and SIGMETs had not been issued in graphical format. It was noted, however, that volcanic ash forecast transport and dispersion (VAFTAD) graphics were issued by VAAC Washington, but these were unmodified computer output from the VAFTAD model and did not include all available information, such as satellite data. The meeting agreed that graphical volcanic ash and tropical cyclone advisories and SIGMETs would be the most useful format for flight dispatchers and pilots, particularly in view of the complex positional and flight levels information that are contained in these messages in alphanumerical format. The meeting recalled that States/Members were expected to be in a position to receive, decode and process WAFS meteorological information in the WMO BUFR code by mid 2005, when the transmission of WAFS products in T4 facsimile format were expected to cease. The meeting considered that it would, therefore, be appropriate for the VAACs and tropical cyclone advisory centres (TCAC) to issue graphical advisories in the BUFR code form while ensuring that these output products would comply with the formats given in Appendix 1 to Annex 3/Technical Regulations [C.3.1] — Model charts and forms. The availability of volcanic ash and tropical cyclone advisories in the BUFR code form at the MWOs concerned would, in turn, render it easier for the MWOs to issue the associated SIGMETs in the BUFR code form, as well as in alphanumeric form. Following its review of the amendment proposal as referenced in Appendix B to this report, the meeting formulated the following recommendation:

RSPP **Recommendation 1/16 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Volcanic ash and tropical cyclone advisories in the BUFR code form**

That,

a) WMO develop appropriate specifications and tables to enable volcanic ash advisory centres and tropical cyclone advisory centres to issue their respective advisories in binary form in the BUFR code form to meet the output product requirements in Appendix 1 to Annex 3/Technical Regulations [C.3.1], and develop a model graphical advisory for tropical cyclones for inclusion in Appendix 1; and

b) the enabling provision given in Appendix B to this report be included in Annex 3/Technical Regulations [C.3.1] as part of Amendment 73.

Proposal of introduction of a new specification and format of a graphical volcanic ash advisory

1.4:1.3.7 One VAAC Provider State proposed the introduction of a new specification and format for the graphical volcanic ash advisory (VAG). The meeting considered that while the proposal had considerable merit, it should be examined by the VAWSG (or its successor group), and if endorsed, then sent by ICAO to WMO for further consideration and processing as part of a future amendment to Annex 3/Technical Regulations [C.3.1]. Following its review of the proposal the meeting formulated the following recommendation:

Recommendation 1/17 — Proposed volcanic ash advisory in graphical format

That ICAO forward the proposed format for the volcanic ash advisory given in Appendix H of this report to an appropriate body for consideration.

Note.— If the proposed format is endorsed by the appropriate body, the proposal should be forwarded to WMO for consideration and processing for the next amendment to Annex 3/Technical Regulations [C.3.1].

Information from the United Nations (UN) Comprehensive Test Ban Treaty Organization (CTBTO)

1.4:1.3.8 The meeting noted that two of the five observing networks supporting treaty verification organized by the recently established UN CTBTO provided global seismic and infrasonic data, respectively that could be of considerable assistance to the IAVW in detecting and/or confirming explosive volcanic eruptions. The meeting was interested to learn that ICAO, with the assistance of WMO, had been in contact with the CTBTO which was undertaking assessments of the usefulness of such data to the IAVW. It was expected that these networks could provide a valuable independent source for the detection of explosive volcanic eruptions that could add considerable support to the available satellite data. The meeting was aware that this could be especially important in the near future because the next series of United States geostationary satellites (GOES M) would not provide infrared data in one of the specific bands (12µm) used in one of the volcanic ash detection techniques. These negotiations were progressing well and the meeting was informed that some initial results were expected by the end of 2002. The meeting expressed support for this endeavour and wished to encourage the negotiations between ICAO, WMO and the CTBTO in order to complete the assessment of the usefulness of these additional data sets as soon as possible. In this regard, the meeting formulated the following recommendation:

Recommendation 1/18 — Completion of the assessment of the usefulness of seismic and infrasonic data from the CTBTO observing networks to IAVW

That, in view of the safety implications, ICAO, with the assistance of WMO, invite the United Nations CTBTO to complete its assessment of the usefulness of global seismic and infrasonic data from CTBTO treaty verification networks to the detection of volcanic eruptions under the IAVW, as soon as practicable.

1.4:1.4 **Investigation of new and improved uses of the satellite data for the purpose of enhancing the detection of volcanic ash by VAACs**

1.4:1.4.1 The meeting noted with satisfaction the work being undertaken by Australia to improve satellite-based techniques for the detection of volcanic ash clouds and their discrimination from water/ice cloud and encouraged States/Members that operate VAACs to undertake similar research under the guidance of WMO.

1.4:1.4.2 In this regard, the meeting was reminded that EUMETSAT had recently launched the second generation METEOSAT. This series of satellites had a number of additional capabilities that would assist such future research. In this regard the meeting formulated the following recommendation:

Recommendation 1/19 — Research in the detection of volcanic ash from satellite data

That, WMO encourage Provider States of the VAACs to continue, and if possible accelerate, research into the detection of volcanic ash from satellite data.

1.4:1.5 **Provision of information for international air navigation on solar radiation storms and other bio-hazards**

1.4:1.5.1 The meeting next discussed a proposal that information should be provided to aircraft on solar radiation storms and other bio-hazards, in addition to the existing arrangements to provide information on radioactive materials released into the atmosphere from nuclear accidents. It was pointed out that with the opening of the new polar routes, aircraft operating in these high latitudes could be exposed to hazardous levels of solar radiation that could affect health, communications and the global positioning system. The meeting considered that this proposal merited examination by an appropriate ICAO body, such as VAWSG (or its successor group) suitably strengthened by the addition of experts in these fields. In this regard, the meeting formulated the following recommendation:

Recommendation 1/20 — Evaluation of developing SARPs for radiation and other hazardous materials released into the atmosphere

That, ICAO arrange for a suitable body to assess, in consultation with WMO:

a) existing operational procedures and notification practices on the accidental release of radioactive material from nuclear facilities and the need to enhance existing SARPs;

b) the need to develop an international format for advisories for all radioactive and hazardous materials released into the atmosphere; and

Note.— Coordination among ATS providers and airlines should be undertaken to ensure that any product can be easily interpreted by the operational units concerned for tactical and strategic planning.

c) the need for providing information for international air navigation on solar radiation storms and other bio-hazards.

1.4:1.6 **Tropical cyclone advisory system**

1.4:1.6.1 The meeting noted that, working in parallel with the IAVW was the system under which tropical cyclone advisory centres (TCAC) provided advice to aviation on the development and movement of tropical cyclones. In this case, it had not been necessary for ICAO to organize a system from scratch, as had been done for the IAVW, because WMO already had an established tropical cyclone programme (TCP). ICAO, therefore, had designated seven WMO TCP Regional Specialized Meteorological Centres (RSMCs) as tropical cyclone advisory centres to issue tropical cyclone advisories in a format specifically designed for the needs of aviation. The various WMO regional TC plans had all been amended to include this requirement for international civil aviation. The meeting noted, however, that some of the designated TCACs did not yet issue their TC advisories in the format required by ICAO. It also noted that the format rendered it possible for tropical cyclone positions to be indicated to a resolution of one minute of latitude and longitude, which did not imply that this level of accuracy was achievable. The meeting invited all TCAC Provider States to implement the issuance of advisories for aviation in the format required by ICAO. In this regard, the meeting formulated the following draft recommendation:

Recommendation 1/21 — Issuance of tropical cyclone advisories for international civil aviation

That tropical cyclone advisory centres Provider States be invited, as a matter of urgency, to implement the issuance of tropical cyclone advisories for aviation in the format specified by ICAO.

1.4:1.7 **International Airways Volcano Watch Operations Group (IAVWOPSG)**

1.4:1.7.1 Following the inclusion of Amendment 73 into Annex 3/Technical Regulations [C.3.1] the meeting agreed that sufficient provisions would be in the regulatory documents to enable the IAVW to operate effectively once all provisions were implemented. This meant that the main task of the VAWSG to propose appropriate amendments to Annex 3/Technical Regulations [C.3.1] would be completed, although many non-regulatory tasks remained incomplete. However, since the IAVW had become fully operational, in large measure due to the work of Provider States and the VAWSG, and rather active due to the frequency of volcanic eruptions, the VAWSG had spent an increasing amount of its time assisting the Secretariat in coordinating and developing the system. Moreover, as had been mentioned in connection with the World Area Forecast System Study Group (WAFSSG) under Agenda Item 1.1, the meeting was aware that it was not the policy of the Air

Navigation Commission to maintain study groups in existence indefinitely. In view of this, the meeting agreed that there was a critical need to have an ICAO group to assist the Secretariat in coordinating and developing the IAVW, but in the future such a group should be broader-based than a typical ICAO study group, and with a global perspective.

1.4:1.7.2 The meeting had already noted the success of the SADIS Operations Group, and agreed that a similar type of group would be appropriate to coordinate and guide the development of the IAVW. In an operations group, representation could be invited from the Provider States for VAACs and user States, in addition to representation from International Atomic Energy Agency (IAEA), International Air Transport Association (IATA), International Federation of Air Line Pilots' Associations (IFALPA), International Union of Geodesy and Geophysics (IUGG) and WMO, who were already represented on the existing VAWSG. It was noted that the VAWSG at its latest meeting in 2000, had felt it necessary to invite participation from all the VAACs in order to ensure that there was full agreement on how to proceed in the future. In the event, this had proved to be very beneficial and numerous outstanding problems had been solved at the meeting. It was agreed that continued effective coordination of such a complex global system as the IAVW was critical to its reliable operation and flight safety. The meeting developed draft terms of reference for, and composition of, the proposed IAVWOPSG. In this regard, the meeting formulated the following recommendation:

Recommendation 1/22 — Establishment of an IAVW Operations Group (IAVWOPSG)

That, ICAO consider the establishment of an IAVW Operations Group (IAVWOPSG) to replace, and take over any outstanding tasks of the VAWSG, with the terms of reference and composition as given in Appendix I to this report.

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Agenda Item 2: Meteorological support for operations at aerodromes and in the terminal area

2.1:1 METEOROLOGICAL OBSERVING SYSTEMS AT AERODROMES

2.1:1.1 Introduction

2.1:1.1.1 The meeting noted that the issue of automatic meteorological observing systems had been addressed by the COM/MET/OPS/90 Divisional Meeting which had concluded that at that time, surface wind, runway visual range (RVR), air and dew-point temperatures and atmospheric pressure could have been satisfactorily automated while visibility, present weather, cloud amount, cloud type and recent weather needed to be inserted in the reports by a human observer. This assessment of the situation was reflected in the current edition of Annex 3 — *Meteorological Service for International Air Navigation*/Technical Regulations [C.3.1] which required the use of human observers for these parameters.

2.1:1.1.2 In view of the rapidly changing technology and the operating environment, the European Air Navigation Planning Group (EANPG) in 1999 had called for the review of Annex 3/Technical Regulations [C.3.1] provisions governing the requirements for meteorological observations at aerodromes. As a follow-up to this conclusion the Air Navigation Commission had agreed to the establishment of Aerodrome Meteorological Observing Systems Study Group (AMOSSG) to assist the Secretariat in its review of the operational requirements for the provision of meteorological observations at aerodromes and to assess the capability of automatic observing systems to meet those requirements. The group had also been expected to prepare a proposal to amend Annex 3/Technical Regulations [C.3.1] to introduce a requirement for reporting "prevailing visibility" instead of "minimum visibility".

2.1:1.2 Proposed amendment to Annex 3/Technical Regulations [C.3.1]

2.1:1.2.1 The meeting noted that the AMOSSG had held three meetings where thorough reviews of Chapter 4 of Annex 3/Technical Regulations [C.3.1] had been undertaken. The provisions had been reviewed in two stages: first, the underlying operational requirements had been reconsidered largely based on the views expressed by the users; and second, an assessment of the current capabilities of automatic observing systems to meet the expected requirements, at the present time and in the near future, had been undertaken.

2.1:1.2.2 With regard to the user requirements, the AMOSSG had concluded that the existing provisions of Annex 3/Technical Regulations [C.3.1] corresponded to user requirements and that no substantial changes needed to be introduced in the current Annex 3/Technical Regulations [C.3.1] provisions at that stage.

2.1:1.2.3 Concerning the present capability of automatic observing systems, the AMOSSG had recognized that substantial progress had been made in their development over the previous few years. In this respect, the group had concluded that, out of the five parameters where human intervention was required in accordance with Annex 3/Technical Regulations [C.3.1], visibility was the only one that could now be observed with fully automatic systems. It was considered that the remaining four parameters (i.e. present weather, cloud amount, cloud type and recent weather) still required more work before automatic observing systems could be used in *lieu* of human observers. However, the meeting noted that the AMOSSG had been of the view that, with respect to the cloud amount, automatic systems were close to meeting the stated requirements. The meeting agreed that the observation of present weather, cloud amount, cloud type and recent weather could not yet be fully observed by automatic observing systems without human intervention. It was agreed that this situation should be included in Amendment 73 to Annex 3/Technical Regulations [C.3.1] by introducing enabling provisions related to observing and reporting visibility with automatic systems, together with other amendments that had been agreed by the meeting. Furthermore, the possible use of automatic systems, in parallel with human observers, for observing and reporting present weather and cloud amount should be taken into account in the amendments.

2.1:1.2.4 The meeting noted that, based on the foregoing assessment of the operational requirements and the capability of automatic observing systems to meet those requirements, a thorough revision of the whole Chapter 4 had been carried out with the assistance of the AMOSSG. In addition to editorial improvements, the revision included the following proposals:

a) proposals to upgrade nineteen Recommended Practices to Standards, in view of their maturity and importance to the safety of international air navigation;

b) proposals in response to conclusions formulated by the EANPG:

— obligation to issue aerodrome routine meteorological reports (METAR) for at least two consecutive observations immediately prior to the aerodrome resuming operations at aerodromes that are not operational throughout 24 hours;

— enabling provisions to use fully automated systems during non-operational hours; and

— obligation to cancel aerodrome forecasts (TAF) that cannot be kept under continuous review;

c) proposal to enable the use of either the traditional alphanumeric codes (METAR/SPECI or TAF) or the BUFR code form to disseminate reports and forecasts;

d) proposal to introduce an averaging period for measuring variations in the mean wind speed (gusts);

e) proposal to limit reporting winds as "variable" for mean wind direction for wind speeds less than 6 km/h (3 kt);

f) proposal to use the maximum runway light intensity for assessment of RVR for METAR and aerodrome special meteorological report (SPECI); and

g) proposal to redefine "vicinity" in relation to the aerodrome reference point rather than the aerodrome perimeter.

2.1:1.2.5 The meeting considered the amendments listed under a) to g) above and agreed that they should be included in Amendment 73 to Annex 3/Technical Regulations [C.3.1] with three modifications.

2.1:1.2.6 Firstly, with regard to the proposed obligation to issue METAR for at least two consecutive observations prior to the aerodrome resuming operations (2.1:2.4 b) above refers), the meeting considered that for operational reasons the proposal formulated by the EANPG would not necessarily be applicable for all other ICAO Regions and that the number of METAR required before the resumption of aerodrome operations in each region should be left up to the RAN agreement. It was also noted that these METAR were issued during non-operational hours and could be, according to the draft provisions to be included in Amendment 73 to Annex 3/Technical Regulations [C.3.1], based on automatic observing systems. Concerning the corresponding draft provision related to SPECI (Annex 3/Technical Regulations [C.3.1], Chapter 4, 4.4.3 refers), it was understood that its introduction would not change the long-standing practice of the EUR Region where SPECI were not issued.

2.1:1.2.7 Secondly, regarding the enabling clause to issue METAR/SPECI and TAF in the BUFR code form (2.1:2.4 c) above refers), it was suggested that the provision would be premature for inclusion in Amendment 73 to Annex 3/Technical Regulations [C.3.1]. This was due to concerns about the ability of the AFTN message switching centres to cope with METAR, SPECI and TAF in the BUFR code form particularly if dual dissemination combining METAR/SPECI and TAF in the alphanumeric and BUFR code forms would take place. The meeting agreed therefore that enabling clauses should not be included at this stage in Annex 3/Technical Regulations [C.3.1].

2.1:1.2.8 Thirdly, regarding the definition of "vicinity", the meeting agreed that the issue needed further consideration and should be referred to the AMOSSG.

Prevailing visibility

2.1:1.2.9 The meeting recalled that at the COM/MET/OPS Divisional Meeting (1990) some States/Members had indicated that they used "prevailing visibility" instead of "minimum visibility", as the former provided better representative values of visibility for aircraft operations and the latter was unduly conservative and tended to restrict operations unnecessarily when the lowest visibility was not affecting the runways and approaches. The COM/MET/OPS Divisional Meeting (1990) had felt nevertheless that the practice of reporting "minimum visibility" should be continued at that stage.

2.1:1.2.10 The issue had been raised again by user organizations a few years later and the Secretariat had been tasked with studying the proposal to introduce the concept of prevailing visibility as used in North America. As a part of this study, States/Members and international organizations had been consulted on whether, based on operational considerations, they would support, in principle, the development of a proposal to amend Annex 3/Technical Regulations [C.3.1] to introduce the reporting of prevailing visibility. The replies had indicated broad support for the development of such a proposal. However, a number of fundamental issues had been raised by States/Members and international organizations, in particular, related to the reporting of directional variations in cases of non-uniform visibility. Subsequently, the Air Navigation Commission had agreed that a proposal incorporating the reporting of prevailing visibility in METAR and SPECI, together with criteria related to the inclusion of directional variations in visibility in these reports, should be developed.

2.1:1.2.11 A draft amendment to Annex 3/Technical Regulations [C.3.1] had been developed with the assistance of the AMOSSG. It was noted that the proposal was based on the concept used in North America, in accordance with the instructions given by the Commission. It was noted that the draft definition of prevailing visibility that had been developed by the AMOSSG also catered for automatic observing systems. The meeting noted the fact that prevailing visibility was proposed to be used also in TAF and trend forecasts. With regard to the inclusion of directional variations, the AMOSSG had felt that for safety reasons the minimum visibility, together with the prevailing visibility, should be systematically included under low-visibility conditions (i.e. whenever the lowest visibility was less than 1 500 m).

2.1:1.2.12 In spite of the broad support for the introduction of prevailing visibility that had been expressed by States/Members and international organizations and its endorsement by the AMOSSG, the meeting was made aware of the fact that reservations continued to be expressed *vis-à-vis* its introduction, inter alia due to its complexity. In particular, the meeting noted the view that had been expressed by the Meteorology Group (METG) of the EANPG which had felt that "there was no need to introduce the prevailing visibility but that automated systems, where available, should be used as a complement to human observations to improve the representativeness of observations". Notwithstanding the reservations expressed, the meeting endorsed the concept as a step forward in providing operationally meaningful information during low-visibility conditions, with the understanding that necessary guidance material would be developed to assist States/Members in introducing the new concept.

Coding issues related to METAR derived from fully automatic systems

2.1:1.2.13 The meeting noted that several problems related to coding had arisen when producing METAR derived from fully automatic systems. In particular, the following features could not be indicated in the code:

a) the lack of information on cloud type;

b) the unidirectional nature of visibility observations; and

c) the lack of detection of cloud at a distance from the sensor.

However, it was noted that the algorithms linking the temporal variation of cloud detection by the sensor with cloud amount may mitigate this limitation.

2.1:1.2.14 The meeting agreed that the changes addressing these issues should be made to the appropriate Annex 3/Technical Regulations [C.3.1] provisions and were therefore incorporated in the draft Amendment 73 to Annex 3/Technical Regulations [C.3.1]. The parallel amendment to the WMO Manual on Codes would also be made.

Inclusion of updated provisions related to the observing and reporting of meteorological elements

2.1:1.2.15 The meeting noted that consequential amendments to Annex 2 — *Rules of the Air*, *Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444) and *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (Doc 8400) would be necessary. Following its review of the amendment proposals, the meeting formulated the following recommendation:

RSPP **Recommendation 2/1 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Inclusion of updated provisions related to the observing and reporting of meteorological elements**

That,

a) the proposal to amend Annex 3/Technical Regulations [C.3.1] given in Appendix B to this report be included as part of Amendment 73 to Annex 3/Technical Regulations [C.3.1] with the understanding that necessary guidance material to assist States/Members related to prevailing visibility would be developed in due course; and

b) the consequential draft amendments to Annex 2, the PANS–ATM (Doc 4444) and the PANS–ABC (Doc 8400) given in Appendices F, E and D to this report be included in Amendment 38, Amendment 3 and Amendment 26 to Annex 2, the PANS–ATM (Doc 4444) and the PANS–ABC (Doc 8400), respectively.

Note. — Guidance on prevailing visibility would be included in the proposed

"Manual on Automatic Meteorological Observing Systems at Aerodromes".

2.1:1.3 Need for guidance material related to the use of automatic meteorological observing systems at aerodromes

2.1:1.3.1 The meeting noted that the AMOSSG had identified the need for guidance related to the use of automatic meteorological observing systems. In view of the fairly wide scope of the subject, it was not considered appropriate to include such lengthy and detailed guidance in existing ICAO documents. Therefore, the meeting agreed that the development of dedicated guidance material would be the best solution and that a new Manual on Automatic Meteorological Observing Systems at Aerodromes should be developed, in close coordination with WMO.

2.1:1.3.2 The AMOSSG had developed a draft outline of the content of the proposed manual largely based on the structure of the second edition of the *Manual of Runway Visual Range Observing and Reporting Practices* (Doc 9328). The draft outline is at Appendix G to this report. It was of a preliminary nature and only included the titles for the main chapters. It was emphasized that the proposed titles were not to be regarded as either exclusive or exhaustive.

2.1:1.3.3 In view of the extensive expertise of WMO and its relevant Commissions in this area, the meeting agreed that the involvement of WMO in this undertaking was essential. Following the consideration of this issue, the meeting formulated the following recommendation:

Recommendation 2/2 — Development of a manual on the use of automatic meteorological observing systems at aerodromes

That ICAO develop, in close coordination with WMO, a manual on the use of automatic meteorological observing systems at aerodromes.

Note. — The draft outline of the manual is at Appendix G to this report.

2.1:1.4 Outstanding issues related to meteorological reports and aerodrome forecasts

Discontinuation of the use of the term "CAVOK"

2.1:1.4.1 It was suggested that the existing requirement to use CAVOK when visibility was 10 km or more and there were no clouds below 1 500 m (5 000 ft) did not meet needs of some States/Members and users. In these cases information was required on clouds up to 7 600 m (25 000 ft) and visibility up to 16 km.

2.1:1.4.2 The meeting considered, however, that the impact of discontinuing the use of CAVOK from Annex 3/Technical Regulations [C.3.1] would be extensive in terms of the costs of code and software changes and would also affect other Annexes and PANS. Furthermore, it was noted that the term CAVOK had been in use for decades with safe aircraft operations. In order to make any decisions on this matter, thorough consideration would be required taking into account the operational impacts of such a change.

Harmonization of SPECI and TAF change criteria

2.1:1.4.3 The meeting was made aware of the fact that the criteria for issuance of SPECI and those for including change groups in TAF were not consistent which complicated TAF verification. Therefore, the meeting agreed that this issue should be studied further.

The use of meteorological information from automated systems

2.1:1.4.4 The meeting recalled that Annex 3/Technical Regulations [C.3.1], if amended as proposed, would allow the use of fully automated systems (so-called AUTO METAR) only during non-operational hours. In view of the expected development of automated systems during the next few years, the meeting felt that the expansion of the use of AUTO METAR to include operational hours should be further studied. It was felt that a new concept of "required level of meteorological services" should also be considered.

Present and recent weather phenomena included in meteorological reports

2.1:1.4.5 The meeting was aware of the fact that the AMOSSG had carried out a review of the aeronautical requirements in Chapter 4 to Annex 3/Technical Regulations [C.3.1] and that the initial results had indicated that the requirements as stated currently in Annex 3/Technical Regulations [C.3.1] were still valid and should be retained. This state of affairs had been reflected in Amendment 73.

2.1:1.4.6 With regard to the present and recent weather, it was suggested that the lists of the phenomena were perhaps overly complicated and that another review should be undertaken. The meeting concurred that there was a need to re-evaluate the situation concerning the continuing need to report all existing present and recent weather phenomena as currently required by Annex 3/Technical Regulations [C.3.1].

Definition of "vicinity"

2.1:1.4.7 As discussed in paragraph 2.1:1.2.8 the meeting agreed that the definition of the term "vicinity" should be referred to the AMOSSG for further consideration.

Studies related to meteorological reports and aerodrome forecasts

2.1:1.4.8 Following the consideration of these issues, the meeting formulated the following recommendation:

Recommendation 2/3 — Studies related to meteorological reports and aerodrome forecasts

That ICAO, in consultation with WMO and user organizations, arrange for a suitable body to:

a) re-evaluate the appropriateness of the use of the term "CAVOK" in meteorological reports and aerodrome forecasts, particularly taking into account the operational requirements by ATS units and users, as well as the potential costs of any proposed changes to the requirements;

b) consider the need for harmonizing the criteria for issuance of SPECI and those for including change groups in TAF.

c) study the expansion of the use of meteorological information from fully automatic observing systems to include operational hours, including consideration of using a new concept of “required level of meteorological services”;

d) re-evaluate the need for present and recent weather phenomena in meteorological reports taking into account the capacity of automatic systems; and

e) re-consider the proposed definition for “vicinity”.

2.1:1.5 **Algorithms for the automatic assessment of cloud base height and cloud amount**

2.1:1.5.1 The meeting’s attention was drawn to the fact that the calculation of cloud base height by an automated system (laser ceilometer) was currently done using algorithms developed by the sensor manufacturers or by the meteorological service themselves. Regarding the development and implementation carried out by the manufacturers, assumptions had been made based on backscatter profiles measured by the laser ceilometer. Therefore, the development and implementation of the algorithms to provide the user with information on the height of cloud layers and vertical visibility were based on the manufacturer’s interpretation of the physics of a measured backscatter profile. Generally, only the output was standardized for presentation purposes (observer/end-user) and for report generation. It could therefore be concluded that no generally accepted algorithm for the relation between measured backscatter profile and the height of cloud layers was available within the aeronautical meteorological domain.

2.1:1.5.2 The meeting agreed that the creation of a standard algorithm would be a challenging task and that the feasibility of doing so should be assessed as a first step with a view to the production of a standard algorithm as the next step. The meeting formulated the following recommendation:

Recommendation 2/4 — Development of standard algorithms for the processing of cloud base height and cloud amount to be used in the automation of the aeronautical meteorological observations

That WMO, in coordination with ICAO, investigate the feasibility of creating standard algorithms for the processing of cloud base height and cloud amount taking into account the different aerodrome layouts and the availability of sensors, with a view to developing such a standard algorithm.

Note.— These algorithms, if and when created should be reflected in the appropriate ICAO and WMO documents including the proposed manual on the use of automatic meteorological observing systems at aerodromes called for by Recommendation 2/2.

2.1:1.6 Development of a migration plan concerning the use of table-driven code forms for the dissemination of METAR/SPECI and TAF

2.1:1.6.1 With regard to the use of the BUFR code form for disseminating METAR/SPECI and TAF, the meeting recalled that, according to the *Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization* (Doc 7475), WMO was the organization which was responsible for developing and promulgating all meteorological figure codes, including those employed in the application of meteorology to international air navigation and that WMO had an overall migration plan, approved by the WMO Executive Council, which called for the replacement of all alphanumeric codes by the so-called table-driven codes (i.e. in the BUFR and CREX code forms). The use of table-driven codes would facilitate the introduction of future amendments to aeronautical meteorological codes. Under these circumstances, the meeting agreed that there was an urgent need for a firm and detailed strategy concerning the migration from alphanumeric aeronautical code forms to table-driven code forms taking due account of the associated costs.

2.1:1.6.2 However, to be able to use the table-driven code forms, it would be necessary for States/Members and users that the corresponding encoding and decoding software be developed. Furthermore, to render the migration to the table-driven codes as smooth as practicable, the meeting agreed that on the completion of the development of the migration plan and necessary software, there would be a need to organize training events on the introduction of these code forms in view of their proposed use to disseminate METAR/SPECI and TAF. The meeting formulated the following recommendation:

Recommendation 2/5 — Development of a migration plan concerning the use of table-driven code forms for the dissemination of METAR/SPECI and TAF

That, WMO:

a) develop, in close coordination with ICAO, a detailed migration plan for the use of the table-driven code forms for the dissemination of METAR/SPECI and TAF;

b) complete the development of the necessary BUFR code tables to be used to encode and decode METAR/SPECI and TAF; and

c) on the completion of a) and b) above, organize, in coordination with ICAO, training events on the encoding and decoding METAR/SPECI and TAF in the BUFR code form in order to facilitate a smooth migration from alphanumeric codes to table-driven code forms.

Note.— In this particular context, dissemination would include the exchange of information.

2.2:1 TAILORING METEOROLOGICAL INFORMATION FORMAT, CONTENT AND TIMELINESS TO SUPPORT IMPROVEMENTS IN AIRPORT CAPACITY

2.2:1.1 The meeting considered the progress made by a Project Team on Meteorological Parameters for Airport Operations (PT/METAOP), established in response to a decision by the EANPG in 1999 to perform a regional review of meteorological parameters for aerodrome operations with priority to capacity-related parameters.

2.2:1.2 The meeting noted with satisfaction that the task had been focussed on all weather aerodrome operations and, in particular, the ATS need for improved MET information that might affect aerodrome operations, such as runway changes or low-visibility procedures initiation and/or termination. In this regard, the requirement for obtaining harmonized MET information had been considered to be of great importance. Several issues related to the global provisions in Annex 3/Technical Regulations [C.3.1] had been identified for further review by ICAO in coordination with WMO.

2.2:1.3 The meeting was informed that two questionnaires had been distributed to the EUR States/Members; one in 1999 focussed on RVR, and another complementary one covering all the other parts of Chapter 4 of Annex 3/Technical Regulations [C.3.1] in 2001. The aim of the questionnaires had been to get an overview of the current implementation of the provisions of Annex 3/Technical Regulations [C.3.1], and of the daily practices in the EUR Region. The meeting understood that the results from the latter questionnaire were still under evaluation. The analysis of replies from EUR States/Members to the questionnaire on RVR assessment had shown unexpected large deviations from the provisions in Annex 3/Technical Regulations [C.3.1], concerning both the location of the sensors and the method of calculating RVR.

2.2:1.4 The meeting noted that since RVR had an effect on airport capacity, there had been strong pressure from the user representatives and AOP experts in the project team to harmonize the location of the RVR sensors and the method of calculation of RVR with a view to obtaining comparable RVR values under identical weather conditions on all aerodromes. However, it had been agreed that, prior to implementing an EUR project to harmonize the calculation of RVR and the location of the sensors, a cost/benefit study should be performed. Due to its importance for the airport traffic acceptance rates, a need for RVR forecasts had also been expressed. Development of such forecasts had however been considered as a major task, which could not be undertaken by the project team.

2.2:1.5 The surface wind had been discussed mainly from the point of view of airport capacity. Due to the fact that changes in the surface wind had direct implications on the aerodrome operations, a need for further standardization and harmonization through the ICAO provisions concerning surface wind observations, calculations and threshold values had been identified.

2.2:1.6 It was noted that the project team had examined both the existing definitions concerning observing and reporting of cloud parameters in ICAO and WMO documents, and the needs of the users. It had been considered that the cloud parameters mentioned in Annex 3/Technical Regulations [C.3.1] should be properly defined to avoid misunderstanding and different interpretations when being used in automated observing systems. Moreover, the ICAO and WMO documents did not contain all the necessary definitions of cloud parameters used in aeronautical meteorological observations. The project team had also concluded that there was currently no uniformity in algorithms for the calculation of the cloud base, location of the ceilometer, or representativeness of the measured data in relation to the aerodrome and/or its vicinity which might have an effect on landing operations and consequently on capacity as the same meteorological conditions could result in different reports on a case-by-case basis.

2.2:1.7 The meeting noted in order to support the ATS decisions concerning runway configuration and preparation for low-visibility conditions the project team had developed a new presentation form of an aerodrome capacity MET forecast (ACMET). It had been recognized that this could serve all aeronautical users at an airport and would also fit very well with the concept of collaborative decision-making. The ACMET contained a forecast of visibility, cloud, precipitation, wind for runway selection, winter conditions and thunderstorms in order to cover all MET conditions that could lead to a reduction or improvement of airport capacity.

2.2:1.8 It had been recognized that the parameters to be included in the ACMET were the same as those already included in the TAF. However, the interpretation of the TAF had sometimes been different by the users involved in airport capacity planning and the TAF was consequently not suitable for this purpose. To meet these requirements, software had been developed by the Irish Meteorological Service for the automated conversion of the TAF to the ACMET format with the relevant parameters retrieved and presented in a user-friendly, colour-coded form on a screen at the premises of ATS, airlines and airport authorities. It was noted that this was also a way to reduce the extra workload for the forecasters.

2.2:1.9 The meeting noted with interest that a test conducted during last winter had shown that ATS was generally positive to the operational use of this new product. Several enhancements were planned concerning different forms of precipitation, flexibility in threshold values, etc with the option for further improvement by using all available sources, including nowcasting techniques. Special emphasis would be placed on improvement in the dissemination and presentation of the product to all users at the airports.

2.2:1.10 The meeting was also informed about a new product called “Forecast bulletin for moving to low visibility procedures (LVP)” implemented at Paris/Charles de Gaulle airport. The forecast was expressed in probability terms (certain, probable, improbable or excluded) for four time slots of 30 minutes. On the basis of verification over a period of one year of internal operation, the meteorological service was now able to provide forecasts with an objectively quantified reliability. The ATS had subsequently introduced a strategy based on the probability levels in the bulletin, and satisfaction had been expressed by the users concerned. It was noted that the French experience would be utilized in the further development of products intended for ATM.

2.2:1.11 Information was also provided about another meteorological product used in France called “ASPOC” (Application of reporting and forecasting of thunderstorms for air control). The ASPOC had made it possible to better forecast and present for ATC centres thunderstorm location and movement which could lead to flight path deviations, and to anticipate the measures to be taken to get the best possible flow of traffic. The ASPOC had proved to be highly useful for ATC, both en route and in the approach phase.

2.2:1.12 The meeting agreed that any concept for the next twenty years concerning the meteorological forecasting for the terminal area should include the development of remote sensing techniques and numerical modelling with improved space and time resolution combined with new ways and means to disseminate and present the information. This would support decision making by aviation stake holders.

2.2:1.13 While acknowledging the efforts made by the EUR States/Members in this regard, IATA noted that the development of meteorological products tailored specifically for ATM would undoubtedly result in increased costs and considered that in fact there should be a global standardization of MET products for ATM, except perhaps for some regional products that might be developed by the PIRGs. In order to achieve this, IATA was of the view that the ATM requirements for MET products should be developed by a suitable ICAO body, such as the Air Traffic Management Operational Concept Panel (ATMCP). The meeting agreed that the MET component of CNS/ATM should be addressed on the global level. In this regard, the meeting formulated the following recommendation:

Recommendation 2/6 — Development of the MET component of the global CNS/ATM concept

That ICAO, in coordination with WMO, arrange for a suitable body to develop the MET component of the global CNS/ATM concept in order to meet the ATM requirements in terms of safety, capacity and economy.

Agenda Item 3: Restructuring of Annex 3

3:1 INTRODUCTION

3:1.1 The meeting noted that the 32nd Session of the ICAO Assembly (1998), in Resolution A32-14, had addressed the formulation of Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS). In particular, Resolving Clause 4 of Appendix A to the Resolution stipulated, inter alia, that “for complex systems, SARPs shall, to the extent possible, consist mainly of broad, mature and stable provisions. For such systems, detailed technical requirements and specifications shall be appendices to Annexes or placed in separate documents”. The meeting was informed that these principles, which were subsequently restated in Assembly Resolution A33-14, Appendix A, Resolving Clause 3 had been elaborated by the Air Navigation Commission (ANC) in the *Guidelines to Air Navigation Commission Panels for the development of SARPs material* . These Guidelines had been applied in the restructuring of Annex 10 — *Aeronautical Telecommunications* and, in particular, for the separation of technical specifications from the core SARPs of the Annex into appendices to Annex 10 or into manuals.

3:1.2 The meeting recalled that the Seventh Africa-Indian Ocean Regional Air Navigation (AFI/7 RAN) Meeting (Abuja, 1997) had drawn attention to difficulties encountered by States/Members with the increasing detail and complexity of parts of Annex 3 — *Meteorological Service for International Air Navigation*. As a consequence, difficulties had arisen in the AFI Region in applying some of the provisions of the Annex. The RAN meeting had considered that this problem reflected a situation similar in principle, if not in scale, to that which had prompted the restructuring of Annex 10. In its Recommendation 7/7 — Transfer of detailed technical specifications to an appendix of Annex 3, the meeting had called upon ICAO, in consultation with the WMO, to study the feasibility of transferring detailed technical specifications in Annex 3, especially in relation to Chapters 4 and 9, to an appendix to the Annex. The recommendation was approved by the ICAO Council and the feasibility study was subsequently undertaken.

3:1.3 The meeting recognized that the content of the WMO Technical Regulations [C.3.1] was identical to ICAO Annex 3, in accordance with the *Working Arrangements between ICAO and WMO* (Doc 7475), any change of the structure or content of the Annex must be coordinated with WMO. The feasibility study had, therefore, been coordinated with WMO and the final report sent to the Secretary General of WMO seeking his agreement that the two Secretariats should obtain authorization from their respective governing bodies to proceed with the restructuring of ICAO Annex 3/Technical Regulations [C.3.1]. In their reply WMO stated that they would be in favour of placing the “procedural” and “technical provisions” of ICAO Annex 3/Technical Regulations [C.3.1] in appendices to the document, and of retaining the core SARPs and appendices as two separate parts of one document. The meeting noted in this context that Technical Regulations [C.3.3], Appendix 1, *Flight Documentation — Model Charts and Forms*, was already included in Annex 3 as an appendix and would therefore not be affected by the current restructuring of the Annex except possibly for editorial reasons.

3:1.4 The meeting was informed that the ANC had reviewed the report of the feasibility study and, inter alia, recommended that Annex 3/Technical Regulations [C.3.1] should be restructured as proposed in the report and that the draft restructured Annex 3/Technical Regulations [C.3.1] should be presented for consideration to the conjoint ICAO MET Divisional Meeting (2002) and the WMO Commission for Aeronautical Meteorology (CAeM) Twelfth Session. The ICAO Council subsequently had agreed to the restructuring of Annex 3/Technical Regulations [C.3.1], noting that the draft restructured document would be included in the agenda for consideration by the conjoint meeting.

3:2 THE SEPARATION OF SARPS

3:2.1 The meeting noted that Annex 3/Technical Regulations [C.3.1], as compared to Annex 10, contained little material of a purely technical nature, but rather a substantial number of provisions of a detailed and complex nature mostly, but not entirely, in the form of Recommended Practices. Strict application of the criterion “technical specifications”, as applied for the separation of material in Annex 10, would therefore not have resulted in any substantial improvement to the structure of Annex 3/Technical Regulations [C.3.1]. It had been considered that instead, if the aforementioned detailed and complex provisions were separated from the core SARPs and transferred to appendices, a considerable gain in conciseness and clarity of the document could be achieved.

3:2.2 With regard to the separation of the provisions in Annex 3/Technical Regulations [C.3.1] between core SARPs and those of an operational and technical nature, the meeting noted that a large number of the current SARPs had been formulated in such a manner that a degree of subjectivity would be required when classifying them as core SARPs or appendix material. To minimize this difficulty the following criteria had been used for the separation:

a) the transfer of any text of a provision to an appendix should result in an editorial improvement and an increase in clarity of the core SARPs, while maintaining their consistency;

b) for each subject area, there must be at least one “core” SARP leading into the subject, with which detailed provisions in the corresponding appendix could be associated; and

c) the status of individual SARPs should, as far as possible, be maintained, exceptions being where a sound case could be made for proposing the upgrade of a Recommended Practice to a Standard.

3:2.3 The meeting agreed that the relevant provisions of the Guidelines to ANC panels referred to in paragraph 3:1.1 would be satisfied by retaining the core SARPs on the one hand and the remaining SARPs, appendices and attachments on the other as one document, although clearly separated into two parts It was considered that by the inclusion of appropriate cross references between the two parts, the status of all provisions would be preserved. The meeting agreed that this would facilitate both the amendment process and use of the document by States/Members.

3:2.4 In the course of the separation of the Annex 3/Technical Regulations [C.3.1] SARPs, the meeting noted that some particular provisions combined elements of both a “core SARPs” nature and an operational or technical nature, and therefore had to be split. In order to avoid duplication, while rendering the second part self-contained, some redrafting of the relevant text had been carried out. The meeting was informed in this context that to address the difficulties encountered by States/Members with the increasing complexity of parts of Annex 3/Technical Regulations [C.3.1] identified by the AFI/7 RAN Meeting, a thorough editorial revision of the Annex 3/Technical Regulations [C.3.1] provisions had already been carried out by the Secretariat in the drafting of the proposed restructured document.

3:2.5 Based on the foregoing, the meeting agreed that both parts of Annex 3 should be entitled “Annex 3 — *International Standards and Recommended Practices*”, with the first part bearing the subtitle “*Core SARPs*” and the second, “*Appendices and Attachments to Annex 3*”. It noted in this context that WMO had indicated a preference that the current Technical Regulations [C.3.1] be entitled “*Technical Regulations, Volume II — International Standards and Recommended Practices*” with the first part entitled “*Core SARPs*” and the second part “*Appendices and Attachments to Technical Regulations, Volume II*”.

3:2.6 The meeting noted that the split of the current Annex 3/Technical Regulations [C.3.1] into two parts as described above had resulted in Part I containing about 40 per cent of the current provisions, of which about 80 per cent were Standards. The 60 per cent of the provisions transferred to Part II comprised about 68 per cent of the Recommended Practices.

3:3 CONTENTS OF THE NEW ANNEX 3/TECHNICAL REGULATIONS [C.3.1]

3:3.1 Noting that a number of amendments to Annex 3/Technical Regulations [C.3.1] had been endorsed under Agenda Items 1 and 2, the meeting introduced some additional proposals of a comparatively uncomplicated and straight-forward nature to further enhance the quality and ensure consistency of the document. Thus, a number of Recommended Practices were considered sufficiently mature for upgrading to Standards whereas others were redundant or no longer relevant and proposed for deletion from Annex 3/Technical Regulations [C.3.1].

3:4 FORMAT OF THE NEW ANNEX 3/TECHNICAL REGULATIONS [C.3.1]

3:4.1 The meeting noted that a distinction could be made in the appendices section between those appendices that were Standards from those that were Recommended Practices, by retaining the italics font for the latter, in line with the current practice. The meeting noted that the format of the Recommended Practices, including the word Recommendation in bold type, would be retained in Part II.

3:4.2 The meeting noted that the Guidelines to ANC Panels stipulated that the first section should include, inter alia, general definitions of terms whereas the second section should include specific definitions of technical terms. However, all the terms currently listed in Annex 3/Technical Regulations [C.3.1], Chapter 1. *Definitions* would apply to SARPs in both Part I and Part II, and therefore the complete Chapter 1 would be included in Part I only.

3:5 AMENDMENTS AND SUPPLEMENTS TO ANNEX 3/TECHNICAL REGULATIONS [C.3.1]

3:5.1 As regards amendments to Annex 3/Technical Regulations [C.3.1], Assembly Resolution A33-14, Appendix A, Resolving Clause 6, stated, inter alia, that “subject to the adequacy of the verification and validation process, detailed technical specifications for complex systems may be acted upon by the Council without consultation with States”. However, in the case of Annex 3/Technical Regulations [C.3.1] the meeting agreed that the requirements and specifications in Part II of the proposed new Annex would generally not, from a purely technical viewpoint, lend themselves to such a verification and validation process, and that States/Members would continue to be consulted as hitherto in the amendment process. It was emphasized, therefore, that the procedure for amendment of the two parts of Annex 3/Technical Regulations [C.3.1] would remain as for the current Annex 3/Technical Regulations [C.3.1]. Hence the separation of Annex 3/Technical Regulations [C.3.1] into two parts would not have any effect on the speed of the amendment procedure for Annex 3/Technical Regulations [C.3.1] (which so far had not been the subject of concern to States/Members), but would be undertaken primarily to improve the clarity and usefulness of Annex 3/Technical Regulations [C.3.1].

3:5.2 The meeting considered that the Supplement to Annex 3/Technical Regulations [C.3.1], providing information on differences to the SARPs notified by States/Members, should continue to refer to the whole of Annex 3/Technical Regulations [C.3.1] including both parts.

3:6 AMENDMENT 73 TO ANNEX 3/TECHNICAL REGULATIONS [C.3.1]

3:6.1 In the light of the foregoing discussion, the meeting noted with satisfaction that the proposed restructuring of Annex 3/Technical Regulations [C.3.1] would serve to address the concerns expressed by States/Members in Recommendation 7/7 of the AFI/7 RAN Meeting, by rendering it easier for the different levels of management in Contracting States/Member States to focus on core SARPs, and detailed technical requirements and specifications, as appropriate to their level of responsibility. The meeting endorsed the re-structure of Annex 3/Technical Regulations [C.3.1] into core SARPs and detailed technical requirements and specifications in line with the proposals presented and formulated the following draft recommendation:

RSPP **Recommendation 3/1 — Amendment 73 to Annex 3/Technical Regulations [C.3.1] — Restructuring of Annex 3**

That, in order to facilitate the implementation by States/Members of all parts of Annex 3/Technical Regulations [C.3.1], this document be restructured into two parts, Part I containing core SARPs, and Part II containing detailed technical requirements and specifications, as shown in Appendix B to this report.

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Agenda Item 4: Institutional changes and trends in the provision of meteorological services to international air navigation

4:1 TRENDS IN THE PROVISION OF METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION

4:1.1 The meeting recognized the profound changes and trends in the provision of meteorological services for international air navigation that had taken place since the last conjoint meeting in 1990. Of particular importance in this regard was the increasing tendency for States/Members to move towards the provision of services by more autonomous entities. This, in turn, had led to questions concerning the designation of the meteorological authority and the increasing importance of cost recovery in light of the changing situation.

4:1.2 It was recalled that the introduction of provisions for quality management in Amendment 72 to Annex 3/Technical Regulations [C.3.1] which became applicable in November 2001 had rendered it necessary to consider the development of further guidance material and training focussed specifically on the provision of meteorological services for international air navigation.

4:1.3 It was also recognized that the same period had seen the introduction and dramatic expansion of the Internet. This had prompted questions regarding the operational use of the Internet for the exchange of aeronautical meteorological information.

4:1.4 Another institutional issue that had arisen concerned a proposal to introduce licensing of aeronautical meteorological personnel.

4:2 WORKING ARRANGEMENTS BETWEEN ICAO AND WMO

4:2.1 In the ensuing discussion the meeting kept in mind the *Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization* (Doc 7475) which had delineated the respective spheres of activity of the two organizations in the field of aeronautical meteorology and provided the machinery for their collaboration. In essence, ICAO was responsible for establishing the aeronautical meteorological requirements and WMO was responsible for specifying the technical methods and practices recommended for use in providing aeronautical meteorological service. These arrangements gave States/Members the assurance that the aeronautical requirements for meteorological service for international civil aviation, and the means of providing that service, had the full support of the international aviation and meteorological communities. Moreover, these working arrangements had served the aviation community well, including the past decade that had witnessed many scientific and technological advances.

4:3 DESIGNATED METEOROLOGICAL AUTHORITY

4:3.1 The meeting recognized that the requirement that States/Members shall designate a meteorological authority to provide meteorological service for international air navigation was defined in Annex 3/Technical Regulations [C.3.1], Chapter 2, 2.1.4. This provision stated that "Each Contracting State shall designate the authority, hereinafter referred to as the meteorological authority to provide or to arrange for the provision of meteorological service for international air navigation on its behalf." At the same time, the meeting was aware that, while operational responsibility laid with the designated meteorological authority, the ultimate responsibility for meeting ICAO requirements with respect to the *Convention on International Civil Aviation* (Doc 7300), laid with the State.

4:3.2 It was emphasized that the delegation of the provision of meteorological service for international air navigation to a commercial entity did not relieve the designated meteorological authority of the responsibility for safety through the maintenance of performance standards, including quality assurance and control of the services provided. Moreover, ultimately, the State/Member continued to bear the full responsibility for the services provided by that State/Member to international air navigation.

4:4 RECOVERY OF COSTS

4:4.1 The meeting noted that States/Members had the right to recover from aviation the fair, equitable and agreed costs for providing the required services and facilities for international air navigation. The legal basis for this cost recovery was Article 15 of the Chicago Convention, elaborated upon in the *ICAO's Policies on Charges for Airports and Air Navigation Services* (Doc 9082). The meeting was also aware that internationally agreed guidelines for the recovery of aeronautical meteorological costs developed by the Air Navigation Services Economics Panel (ANSEP) could be found in the ICAO *Manual on Air Navigation Services Economics* (Doc 9161), specifically paragraphs 4.18 and 4.19, and Appendix 6, (Guidance for determining the costs of aeronautical meteorological services), and the WMO *Guide on Aeronautical Meteorological Services Cost Recovery* (WMO-No. 904). It was recalled that the ICAO manual and WMO guide provided practical guidance material to assist those responsible for the management of air navigation services to recover agreed costs in accordance with the foregoing ICAO and WMO documents.

4:4.2 The meeting agreed that the arrangements for cost recovery in a Contracting State/Member State for the provision of meteorological services to international air navigation should include full consultation with the operators.

4:4.3 The meeting noted with satisfaction that WMO, with the support of ICAO, had undertaken several missions and had conducted seminars and workshops, at the invitation of States/Members, on the practical applications of the guidelines concerning the recovery of costs for aeronautical meteorological services. These seminars and workshops had been beneficial to all participants. However, the meeting was aware that problems were still being encountered in this area. The meeting agreed that there was a continued need for organizing further regional cost recovery seminars and for the guidance material to be extended in light of the experience that had been gained from seminars and missions to Contracting States/Member States. The guidance material should also include case studies of cost recovery arrangements developed by States/Members that illustrated a variety of regulatory environments.

4:4.4 Based upon the above considerations, the meeting formulated the following recommendations:

Recommendation 4/1 — Seminars on the cost recovery

That WMO, as a matter of priority, continue to arrange seminars, in close coordination with ICAO, on the recovery of costs for aeronautical meteorological service.

and

Recommendation 4/2 — Extension of guidance material on cost recovery

That ICAO, in close coordination with WMO, extend the current guidance material on cost recovery for meteorological service for international air navigation, taking due account of the experience gained from regional seminars and missions to Contracting States/Member States.

Note 1.— The extension should not affect the existing principles for cost recovery and, in particular, should maintain the current ICAO guidance on the recovery of costs for basic meteorological services. ("Core facilities and services").

Note 2.— Case studies illustrating specific examples of cost recovery arrangements in a variety of regulatory environments should be added to the guidance material.

4:5 QUALITY ASSURANCE

4:5.1 The meeting next moved on to discuss the requirements concerning quality management (including quality assurance and quality control) of meteorological information supplied to users, that had been introduced in Amendment 72 to Annex 3/Technical Regulations [C.3.1]. The meeting was informed that these provisions, as far as possible, had been aligned with "quality system" provisions introduced into Annex 15 — *Aeronautical Information Services* in 1999. The meeting noted that the ICAO quality system provisions recommended conformity with the ISO 9000 series of quality assurance standards, which gave rise to some concern in many Contracting States/Member States. These concerns arose mainly from the likely cost of obtaining and retaining certification and the heavy burden this could place on developing States/Members. It was considered that this could lead to a widening of the gap between developed and developing States.

4:5.2 On the other hand in a number of Contracting States/Member States the meteorological services were in the process of being certificated as International Organization for Standardization (ISO) compliant, or had already been certificated. It was indicated that, in the process of obtaining ISO certification their services had reaped many benefits including increased efficiency, which to some extent offset the cost of certification and led to a better understanding of their own production processes. It was also pointed out that States/Members could achieve ISO certification for all, or any part of their service. If they so decided, the certification could be limited to services provided for international aviation meteorology.

4:5.3 The meeting agreed that guidance was urgently required to assist States/Members in developing quality management systems for the provision of meteorological services for international air navigation. It was understood that such guidance would address the relevant requirements for quality systems specified by ICAO and the means of meeting those requirements specified by WMO. It was agreed that it would be appropriate in this instance to recommend the development of joint ICAO/WMO guidance material. It was also agreed that the guidance material should address all services and products, including the WAFS products, and that guidance would be provided on performance indicators where appropriate.

4:5.4 Based upon the foregoing considerations, the meeting formulated the following recommendation:

Recommendation 4/3 — Guidance material on quality management systems

That ICAO and WMO, develop joint guidance material to assist States/Members in the development of quality management systems for the provision of meteorological services for international air navigation.

4:5.5 The attention of the meeting was drawn by IATA to the need for a standardized TAF verification methodology for international aerodromes. The meeting was aware that the question of TAF verification was currently under consideration by the WMO Commission for Aeronautical Meteorology which had agreed that the implementation of TAF verification should be the responsibility of States/Members, or regionally designated centres. The meeting emphasized the importance of the ICAO requirements for the operationally desirable accuracy of forecasts given in Annex 3/Technical Regulations [C.3.1], Attachment E. It was agreed that in order to permit forecast verification, these requirements should be complete and internally consistent. It was also agreed that the possibility of including information on the "currently attainable accuracy of forecasts" should be investigated. The meeting was advised that a review of Attachment E to Annex 3/Technical Regulations [C.3.1] was already part of an existing ICAO task and that the Secretariat would note the wishes of the meeting in this respect when undertaking the task. In view of this, the meeting agreed that a recommendation was not required.

4:6 TRAINING AND LICENSING

4:6.1 The meeting noted that ICAO Annex 1 — *Personnel Licensing* specified license requirements for aviation personnel, such as flight dispatchers, pilots, and ATS personnel, but purposely did not mention aeronautical meteorological personnel because under the working arrangements between ICAO and WMO, ICAO considered that the entity providing meteorological service for international air navigation came under the relevant regulations of WMO with respect to qualifications and training.

4:6.2 In this respect, the working arrangements between ICAO and WMO stated clearly that WMO was responsible for the training and qualifications of meteorologists engaged in service for international air navigation. The meeting noted that a linkage existed from the WMO regulatory documents through the Member's Permanent Representative to any private entity that might be designated as a State's/Member's meteorological authority for the provision of meteorological service for international civil aviation. If this linkage were accepted, it could be assumed that the respective roles of the two organizations would continue to support the safety of international air navigation through their working arrangements and there would therefore not be any need for including the licensing of aeronautical meteorological personnel in Annex 1.

4:6.3 While recognizing the relation established above, the meeting was aware that an increasing number of States/Members felt, however, that the linkage was perhaps not sufficiently strong and that proper safeguards might not be in place to ensure a continued high quality of aeronautical meteorological service for international air navigation, in particular, when the service was provided by an entity other than the NMS. Therefore, these States/Members considered that it had become necessary for air safety to include aeronautical meteorological personnel under Annex 1 whenever the provision of meteorological service for international air navigation were to be provided by entities other than the NMS.

4:6.4 Some States/Members held the view that to guarantee competency, i.e. the adequate level of qualification of the aeronautical meteorological personnel, relevant provisions should be included in Annex 1. This could cause particular difficulties in the case of licensing of personnel with recognized academic qualifications, although in this case "competency" would be understood to apply to the "job competency" rather than the “academic competency”. The meeting agreed that, in view of the fact that WMO regulations applied directly or indirectly to all entities providing meteorological services for international air navigation in a Contracting State/Member State it was not necessary to include provisions in ICAO Annex 1. It was agreed, however that a note should be included in Annex 1 making reference to the relevant WMO provisions in respect of all aeronautical meteorological personnel. A similar approach had been taken with flight radiotelephone operators whose required knowledge and skills were included in the International Telecommunication Union (ITU) regulations.

4:6.5 Based upon the foregoing considerations, the meeting formulated the following recommendation:

Recommendation 4/4 — Requirements for qualifications and training of aeronautical meteorological personnel

That ICAO, develop a note for inclusion in Annex 1 — *Personnel Licensing* concerning the qualifications and training of aeronautical meteorological personnel making reference to the appropriate WMO provisions.

Note.— The training and qualifications for all aeronautical meteorological personnel would continue to be based on World Meteorological Organization provisions in accordance with Doc 7475, Working Arrangements between the International Civil Aviation Organization and the World Meteorological Organization.

4:7 OPERATIONAL USE OF THE INTERNET

4:7.1 The meeting began its discussion on this subject by noting that Annex 3/Technical Regulations [C.3.1], Chapter 11, 11.1.9 recommended that “The telecommunication facilities used for the exchange of operational meteorological information should be the aeronautical fixed service”. At the same time, the meeting was aware of the exponential growth of the Internet worldwide, which had prompted proposals that the Internet be approved as an operational communication means for the collection, dissemination and acquisition of operational meteorological information. The meeting fully appreciated that the Internet was currently widely used by meteorological information services and operators.

4:7.2 The meeting recognized that some States/Members wished to use the Internet for the exchange of data and information because of its widespread availability, low cost and apparent speed. However it was noted, that the Internet did not always meet the requirements for time-critical meteorological messages. Also, there was concern that the security and integrity of messages exchanged over the Internet could not be guaranteed under all circumstances. While the Internet was quite robust in some parts of the world, in others it was quite limited, or even non-existent, indicating that the Internet was not as reliable as dedicated international lines in some parts of the world.

4:7.3 The meeting was reminded that dedicated aeronautical fixed telecommunication network (AFTN) and the store-and-forward message switching systems of national meteorological centres had been designed, developed and were maintained to meet these needs for time-critical data. The ground-ground portion of the aeronautical telecommunication network (ATN) had also been designed and developed to meet strict aeronautical safety requirements. On the other hand a number of States/Members held the view that the ease of use of the Internet and its rapidly growing availability and improving security rendered it the preferred medium for the exchange of meteorological information.

4:7.4 The meeting noted that some States/Members had developed criteria for the accreditation/qualification of providers of aeronautical meteorological information for aviation purposes via the Internet. These criteria addressed the reliability, accessibility and security requirements to which the Internet service provider should adhere.

4:7.5 Moreover, the meeting noted that WMO had published a guide on Internet practices which included a scenario where the WMO "global telecommunication system (GTS) connections would have continued to be dedicated to the exchange of real-time and critical data and products and the Internet would have been used for the exchange of less time-critical information and for the supply of data and products to other users". This scenario had been implemented by some World Weather Watch (WWW) centres.

4:7.6 Following these discussions the meeting agreed that, currently, the Internet could supplement or "back-up", but not replace ICAO dedicated circuits forming part of the AFS. In this respect, the meeting was aware that the SADIS Provider State had implemented an Internet-based FTP service as a back-up to the SADIS broadcast as recommended by the SADISOPSG. In light of the foregoing considerations, the meeting formulated the following recommendation:

Recommendation 4/5 — Use of the Internet as a backup

That the Internet be considered suitable as a backup to internationally agreed circuits that are designed and developed to provide and to obtain aeronautical meteorological data and information in support of international air navigation.

4:7.7 The meeting agreed that, while the use of the Internet as a "back-up" reflected the current situation, it would also be appropriate to take account of future development of the Internet. In order to achieve this it was agreed that ICAO should request an appropriate body to develop guidance and criteria for the accreditation/qualification of providers of aeronautical meteorological information via the Internet, including the reliability, integrity, accessibility and security issues. In response to a question whether ICAO had developed any other communication guidelines regarding security mechanisms it was confirmed that guidelines on security developed for the ATN could be useful when developing the necessary guidance. In this regard the meeting formulated the following recommendation:

Recommendation 4/6 — Development of guidance and criteria for the accreditation/qualification of providers of aeronautical meteorological information via the Internet

That ICAO, as a matter of urgency, arrange for a suitable body, to develop, in coordination with WMO, guidance and criteria for the accreditation/qualification of providers involved in the exchange and dissemination of aeronautical meteorological information via the Internet, in particular addressing reliability, integrity, accessibility and security issues associated with Internet communications and taking into account the provisions of Annex 3/Technical Regulations [C.3.1].

4:8 COMMERCIAL USE OF OPMET DATA

4:8.1 The meeting recognized that some concern had been expressed that commercial use was being made of aeronautical information outside the aeronautical sector. In particular, the broad availability of aeronautical information via the Internet allowed private companies to conduct commercial activities in many other economic sectors without contributing to the costs of infrastructures, including maintenance and operation, in countries which had implemented such a policy and from which basic information originated.

4:8.2 The European Air Navigation Planning Group (EANPG) and the Third Caribbean/South American Regional Air Navigation Meeting (CAR/SAM/3) had called for an ICAO study of the implications of the commercial use of aeronautical information, in coordination with WMO. Three areas of concern had been identified that could arise from the commercial use of aeronautical meteorological information, namely, safety aspects, loss of revenue, and erosion of State/Member sovereignty as recognized by the Chicago Convention. It was also mentioned that the use of aeronautical meteorological information for non-aeronautical purposes could have eroded the special status given to that information by its dilution into general public use. Aeronautical meteorological information was intended for aeronautical meteorological users, and in most cases paid for by aviation. A number of States/Members considered that it was not appropriate to use this information commercially for non-aeronautical purposes.

4:8.3 The meeting was aware that in this respect the sovereignty of Contracting States/Member States must be respected at all times. It was noted that ICAO policy for the planning for the distribution of aeronautical meteorological information applied to State AFS centre(s) listed in the relevant air navigation plan publications, and the subsequent distribution of such information internally within a Contracting State/Member State was the responsibility of that State/Member. The meeting considered a number of approaches which States/Members and ICAO could take to ameliorate the problem, and which could assist States/Members without infringing upon State's/Member's sovereignty.

4:8.4 It was noted that, for example an "aviation only" server could be set up with restricted access. All OPMET data and all aeronautical information and products, including WAFS products, could be placed on this server. However, if access were to be restricted by use of a password, it would soon become evident that the procedure would be rendered largely ineffective as passwords were readily made available to unauthorized users. An additional approach could be to have the server recognize only certain addresses, e.g. as nationally approved by the designated meteorological authority.

4:8.5 The meeting recalled that guidelines regarding "access" were already in place for the World Area Forecast System (WAFS) satellite broadcast (the ICAO *Guidelines for authorized access to the world area forecast system (WAFS) satellite broadcast*).

4:8.6 The meeting considered that as the password and dedicated server approach alone did not appear to be sufficient it was agreed that guidelines for access to aeronautical meteorological information should be developed by ICAO, in consultation with WMO. The guidelines for access to the satellite broadcasts might assist in this regard, together with the additional approaches discussed.

4:8.7 Based upon the above considerations, the meeting formulated the following recommendation:

Recommendation 4/7 — Development of guidelines for access to aeronautical meteorological information

That ICAO, in consultation with WMO, develop guidelines for access to aeronautical meteorological information for air navigation support purposes only.

Note 1.— The guidelines for access to the satellite broadcasts could assist in this regard.

Note 2.— The guidelines may include other approaches that do not infringe upon State sovereignty.

4:9 OTHER INSTITUTIONAL ISSUES

4:9.1 The meeting was informed by IATA that they had no requirement for any aeronautical meteorological stations to be established at "other points of significance" as stated in Annex 3/Technical Regulations [C.3.1], Chapter 4, 4.1.1. In their opinion such a requirement was long out-dated and if information were to be required from such non-aerodrome locations it could be obtained by remote-sensing technology. A number of States/Members, however, indicated that on the contrary there were situations where such stations were essential. These included, for example, stations located off-aerodrome to provide early indication of fog formation. It was agreed that in certain situations such stations supplemented the aerodrome meteorological stations and thereby assisted in the preparations of TREND and TAF forecasts.

4:9.2 In view of these explanations, IATA proposed that the words "in consultation with operators" should be introduced at the appropriate point in Annex 3/Technical Regulations [C.3.1], Chapter 4, 4.1.1. However, while appreciating IATA's concerns, the meeting agreed that consultation with the operators would normally be taken into account when such off-aerodrome stations were planned. In line with this, the meeting agreed that there was no need to propose any amendment to Annex 3/Technical Regulations [C.3.1], Chapter 4, 4.1.1.

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5.1 STATEMENT BY THE DELEGATIONS OF ASECNA, CAPE VERDE, GAMBIA, GHANA, RUSSIAN FEDERATION, SENEGAL, SOUTH AFRICA AND UNITED REPUBLIC OF TANZANIA

5.1.1 *Recognizing* the importance of delivering on the recommendations of this Meteorology Divisional Meeting, and, in particular, with regard to quality assurance, proposed WAFS Operations Group, cost recovery and the tailoring of services to the requirements of the user;

5.1.2 *Recognizing* the increasing demands and decreasing resources of the national weather services of many States, and in particular those of the developing States, and their ability to provide aeronautical meteorological services;

5.1.3 *Noting* the success and best practices achieved in addressing such difficulties through regional groupings such as: Agency for Air Navigation Safety in Africa and Madagascar (The) (ASECNA), Commonwealth of Independent States (CIS), New Partnership for African Development (NEPAD);

5.1.4 The States listed above urge regional collaboration, partnerships and grouping to foster regional cooperation to implement the recommendations of the Meteorology Divisional Meeting.

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APPENDIX A

DEPICTION OF MULTIPLE JETSTREAMS

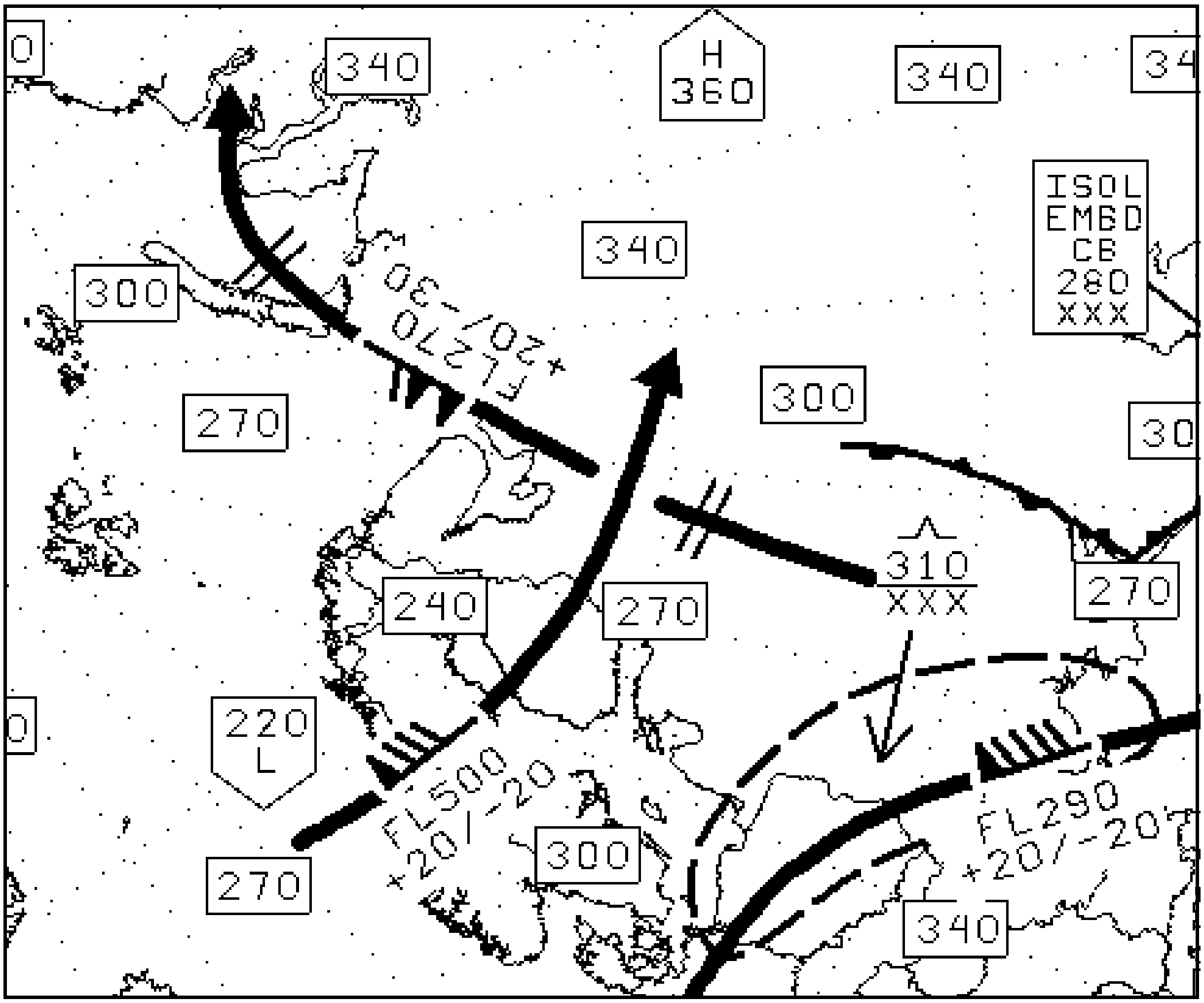

Figure 1. Proposed crossing jet stream depiction

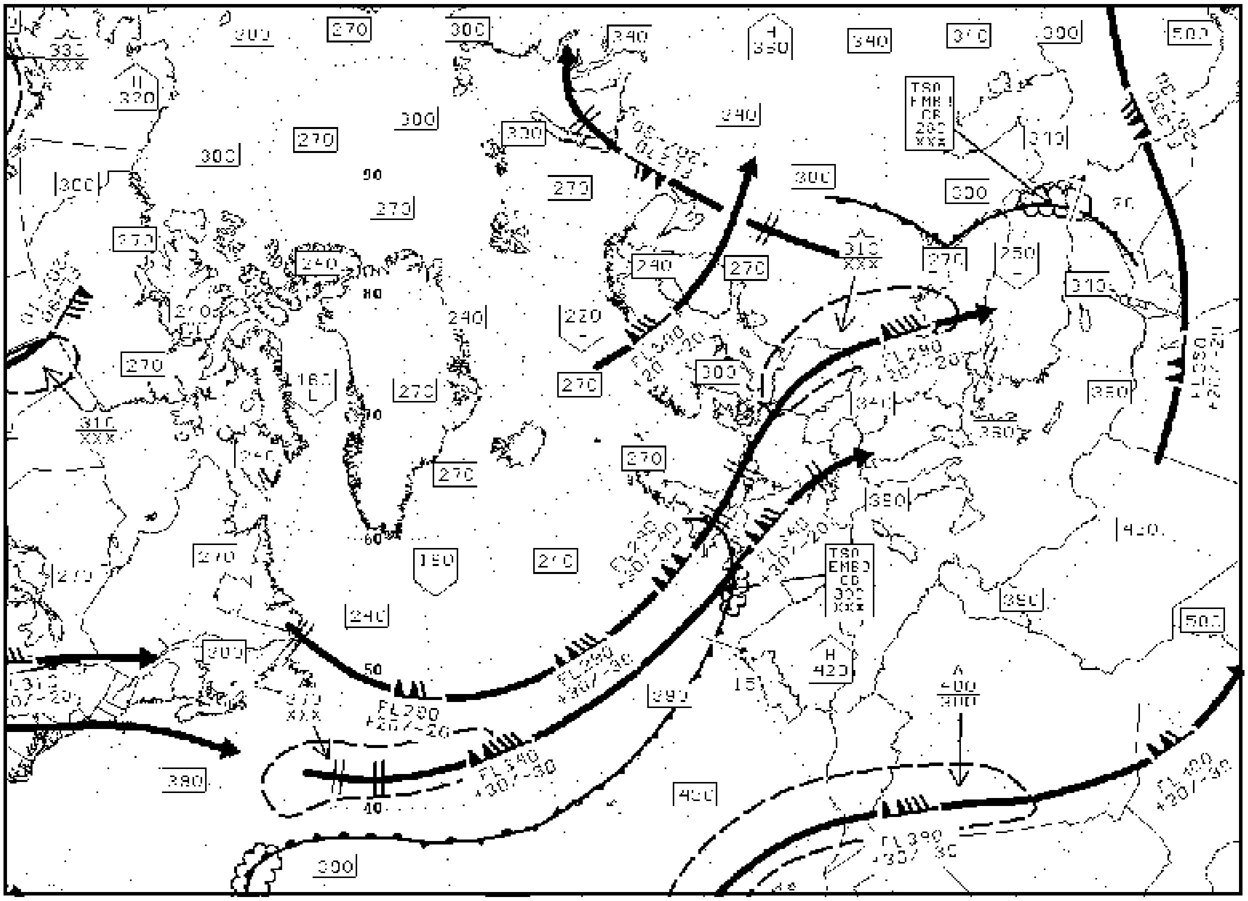

Figure 2. Proposed jet stream vertical displacement depiction

— — — — — — — —

APPENDIX B

PROPOSED AMENDMENT TO

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION

ANNEX 3 TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

FOURTEENTH EDITION — JULY 2001

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT TO ANNEX 3

1. The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

~~Text to be deleted is shown with a line through it.~~	text to be deleted
New text to be inserted is highlighted with grey shading.	new text to be inserted
~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

2. The sources of the proposed amendments have been indicated as follows:

Source	Annotation
Aerodrome Meteorological Observing Systems Study Group (AMOSSG)	$\boxed{\text{AMOSSG}}$
Meteorological Information Data Link Study Group (METLINKSG)	$\boxed{\text{METLINKSG}}$
World Area Forecast System Study Group (WAFSSG)	$\boxed{\text{WAFSSG}}$
Volcanic Ash Warnings Study Group (VAWSG)	$\boxed{\text{VAWSG}}$
Secretariat	$\boxed{\text{Secretariat}}$

International Standards
and Recommended Practices

ANNEX 3
to the Convention on
International Civil Aviation

Meteorological Service for International Air Navigation

(PART I — Core SARPs
PART II —Appendices and Attachments to Annex 3)

Fifteenth Edition
. . . 2004

International Civil Aviation Organization

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

PART I — Core SARPs

CHAPTER 1. DEFINITIONS

Note.— The designation (RR) in these definitions indicates a definition which has been extracted from the Radio Regulations of the International Telecommunication Union (ITU) (see Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies (*Doc 9718)).*

1.1 Definitions

When the following terms are used in the Standards and Recommended Practices for Meteorological Service for International Air Navigation, they have the following meanings:

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome climatological summary. Concise summary of specified meteorological elements at an aerodrome, based on statistical data.

Aerodrome climatological table. Table providing statistical data on the observed occurrence of one or more meteorological elements at an aerodrome.

Aerodrome control tower. A unit established to provide air traffic control service to aerodrome traffic.

Aerodrome elevation. The elevation of the highest point of the landing area.

Aerodrome meteorological office. An office, located at an aerodrome, designated to provide meteorological service for international air navigation.

Aeronautical fixed service (AFS). A telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services.

Aeronautical fixed telecommunication network (AFTN). A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

Aeronautical meteorological station. A station designated to make observations and meteorological reports for use in international air navigation.

Aeronautical mobile service (RR S1.32). A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

Aeronautical telecommunication station. A station in the aeronautical telecommunication service.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Aircraft observation. The evaluation of one or more meteorological elements made from an aircraft in flight.

AIRMET information. Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of low-level aircraft operations and which was not already included in the forecast issued for low-level flights in the flight information region concerned or sub-area thereof.

Air-report. A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/ or meteorological reporting.

Note.— Details of the AIREP form are given in the PANS-ATM (Doc 4444).

Air traffic services unit. A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

Alternate aerodrome. An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing. Alternate aerodromes include the following:

Take-off alternate. An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en route.

ETOPS en-route alternate. A suitable and appropriate alternate aerodrome at which an aeroplane would be able to land after experiencing an engine shut-down or other abnormal or emergency condition while en route in an ETOPS operation.

Destination alternate. An alternate aerodrome to which an aircraft may proceed should it become impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

Approach control unit. A unit established to provide air traffic control service to controlled flights arriving at, or departing from, one or more aerodromes.

Appropriate ATS authority. The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned.

Area control centre. A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

WAFSSG

~~***Area of coverage (world area forecast system).*** A geographical area for which a regional area forecast centre supplies forecasts for flights departing from aerodromes in its service area.~~

~~***Area of responsibility (world area forecast system).*** A geographical area for which a regional area forecast centre prepares significant weather forecasts.~~

Automatic dependent surveillance (ADS). A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position and additional data as appropriate.

Briefing. Oral commentary on existing and/or expected meteorological conditions.

Consultation. Discussion with a meteorologist or another qualified person of existing and/or expected meteorological conditions relating to flight operations; a discussion includes answers to questions.

Control area. A controlled airspace extending upwards from a specified limit above the earth.

Cruising level. A level maintained during a significant portion of a flight.

Elevation. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

Extended range operation. Any flight by an aeroplane with two turbine power-units where the flight time at the one power-unit inoperative cruise speed (in ISA and still air conditions), from a point on the route to an adequate alternate aerodrome, is greater than the threshold time approved by the State of the Operator.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight documentation. Written or printed documents, including charts or forms, containing meteorological information for a flight.

Flight information centre. A unit established to provide flight information service and alerting service.

Flight information region. An airspace of defined dimensions within which flight information service and alerting service are provided.

Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals.

Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:

a) when set to a QNH altimeter setting, will indicate altitude;

b) when set to a QFE altimeter setting, will indicate height above the QFE reference datum; and

c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.

Note 2.— The terms "height" and "altitude", used in Note 1, indicate altimetric rather than geometric heights and altitudes.

Forecast. A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

GAMET area forecast. An area forecast in abbreviated plain language for low-level flights for a flight information region or sub-area thereof, prepared by the meteorological office designated by the meteorological authority concerned and exchanged with meteorological offices in adjacent flight information regions, as agreed between the meteorological authorities concerned.

Grid point data in alphanumeric form. Processed meteorological data for a set of regularly spaced points on a chart, in a code form suitable for manual use.

Grid point data in digital form. Computer processed meteorological data for a set of regularly spaced points on a chart, for transmission from a meteorological computer to another computer in a code form suitable for automated use.

Note.— In most cases such data are transmitted on medium or high speed telecommunications channels.

Height. The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

Human Factors principles. Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

International airways volcano watch (IAVW). International arrangements for monitoring and providing warnings to aircraft of volcanic ash in the atmosphere.

Note.— The IAVW is based on the cooperation of aviation and non-aviation operational units using information derived from observing sources and networks that are provided by States. The watch is coordinated by ICAO with the cooperation of other concerned international organizations.

Level. A generic term relating to vertical position of an aircraft in flight and meaning variously height, altitude or flight level.

Meteorological authority. The authority providing or arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State.

Meteorological bulletin. A text comprising meteorological information preceded by an appropriate heading.

Meteorological information. Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

Meteorological office. An office designated to provide meteorological service for international air navigation.

Meteorological report. A statement of observed meteorological conditions related to a specified time and location.

Meteorological satellite. An artificial Earth satellite making meteorological observations and transmitting these observations to Earth.

Minimum sector altitude. The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in the area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.

Nephanalysis. The graphical depiction of analysed cloud data on a geographical map.

Observation (meteorological). The evaluation of one or more meteorological elements.

Operational control. The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.

Operational flight plan. The operator's plan for the safe conduct of the flight based on considerations of aeroplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes concerned.

Operational planning. The planning of flight operations by an operator.

Operator. A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Pilot-in-command. The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

AMOSSG

Prevailing visibility. The visibility value, observed in accordance with the definition of "visibility", which is reached or exceeded within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.

Note. — This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility.

Prognostic chart. A forecast of a specified meteorological element(s) for a specified time or period and a specified surface or portion of airspace, depicted graphically on a chart.

Quality assurance. All the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality (ISO 8402*).

Quality control. The operational techniques and activities that are used to fulfil requirements for quality (ISO 8402*).

Quality management. All activities of the overall management function that determine the quality policy, objectives and responsibilities, and implementing them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system (ISO 8402*).

* ISO Standard 8402 — *Quality Management and Quality Assurance — Vocabulary*, Second Edition.

Quality system. The organizational structure, procedures, processes and resources needed to implement quality management (ISO 8402*).

Regional air navigation agreement. Agreement approved by the Council of ICAO normally on the advice of a regional air navigation meeting.

WAFSSG

~~***Regional area forecast centre (RAFC)***. A meteorological centre designated to prepare and supply significant weather forecasts and upper wind and temperature charts for flights departing from aerodromes within its service area and to supply grid point data in digital form for up to worldwide coverage.~~

Reporting point. A specified geographical location in relation to which the position of an aircraft can be reported.

Rescue coordination centre. A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Search and rescue services unit. A generic term meaning, as the case may be, rescue coordination centre, rescue subcentre or alerting post.

Service area (world area forecast system). A geographical area within which a ~~regional~~world area forecast centre is responsible for ~~supplying~~issuing area forecasts to meteorological authorities and other users.

SIGMET information. Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.

Standard isobaric surface. An isobaric surface used on a worldwide basis for representing and analysing the conditions in the atmosphere.

Threshold. The beginning of that portion of the runway usable for landing.

Touchdown zone. The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

Tropical cyclone. Generic term for a non-frontal synoptic-scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation.

Secretariat

Tropical cyclone advisory centre (TCAC). A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, world area forecast centres and international OPMET data banks regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of tropical cyclones.

Upper-air chart. A meteorological chart relating to a specified upper-air surface or layer of the atmosphere.

Visibility. Visibility for aeronautical purposes is the greater of:

a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

Note.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).

WAFSSG

Volcanic ash advisory centre (VAAC). A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, area control centres, flight information centres, world area forecast centres~~, relevant regional area forecast centres~~ and international OPMET data banks regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere following volcanic eruptions.

METLINKSG

VOLMET. Meteorological information for aircraft in flight.

Data link-VOLMET ~~data link service~~ (D-VOLMET). Provision of current ~~aerodrome weather reports~~ aerodrome routine meteorological reports (METAR) and aerodrome special meteorological reports (SPECI), aerodrome forecasts (TAF) and SIGMET ~~messages through~~ via data link.

VOLMET broadcast. ~~Routine broadcast containing~~ Provision, as appropriate, of current ~~aerodrome weather reports~~ METAR, SPECI, ~~aerodrome forecasts~~ TAF and SIGMET ~~messages for aircraft in flight~~ by means of continuous and repetitive voice broadcasts.

WAFSSG

World area forecast centre (WAFC). A meteorological centre designated to prepare and ~~supply~~ issue significant weather forecasts and upper-air forecasts in digital ~~and/or pictorial~~ form on a global basis ~~to regional area forecast centres, and~~ direct to States by appropriate means as part of the aeronautical fixed service.

World area forecast system (WAFS). A worldwide system by which world ~~and regional~~ area forecast centres provide aeronautical meteorological en-route forecasts in uniform standardized formats.

1.2 Terms used with a limited meaning

For the purpose of this Annex, the following terms are used with a limited meaning as indicated below:

a) to avoid confusion in respect of the term “service” between the meteorological service considered as an administrative entity and the service which is provided, “meteorological authority” is used for the former and “service” for the latter;

b) “provide” is used solely in connection with the provision of service;

c) “issue” is used solely in connection with cases where the obligation specifically extends to sending out the information to a user;

d) “make available” is used solely in connection with cases where the obligation ends with making the information accessible to a user; and

e) “supply” is used solely in connection with cases where either c) or d) applies.

CHAPTER 2. GENERAL PROVISIONS

Introductory Note 1.— It is recognized that the provisions of this Annex with respect to meteorological information are subject to the understanding that the obligation of a Contracting State is for the supply, under Article 28 of the Convention, of meteorological information and that the responsibility for the use made of such information is that of the user.

Introductory Note 2.— Although the Convention on International Civil Aviation allocates to the State of Registry certain functions which that State is entitled to discharge, or obligated to discharge, as the case may be, the Assembly recognized, in Resolution A23-13, that the State of Registry may be unable to fulfil its responsibilities adequately in instances where aircraft are leased, chartered or interchanged — in particular without crew — by an operator of another State and that the Convention may not adequately specify the rights and obligations of the State of an operator in such instances until such time as Article 83 bis *of the Convention enters into force. Accordingly, the Council urged that if, in the above-mentioned instances, the State of Registry finds itself unable to discharge adequately the functions allocated to it by the Convention, it delegate to the State of the Operator, subject to acceptance by the latter State, those functions of the State of Registry that can more adequately be discharged by the State of the Operator. It was understood that pending entry into force of Article 83* bis *of the Convention the foregoing action would only be a matter of practical convenience and would not affect either the provisions of the Chicago Convention prescribing the duties of the State of Registry or any third State. However, as Article 83* bis *of the Convention entered into force on 20 June 1997, such transfer agreements will have effect in respect of Contracting States which have ratified the related Protocol (Doc 9318) upon fulfilment of the conditions established in Article 83* bis.

Introductory Note 3.— In the case of international operations effected jointly with aeroplanes not all of which are registered in the same Contracting State, nothing in this Annex prevents the States concerned entering into an agreement for the joint exercise of the functions placed upon the State of Registry by the provisions of this Annex.

2.1 Objective, determination and provision of meteorological service

2.1.1 The objective of meteorological service for international air navigation shall be to contribute towards the safety, regularity and efficiency of international air navigation.

2.1.2 This objective shall be achieved by supplying the following users: operators, flight crew members, air traffic services units, search and rescue services units, airport managements and others concerned with the conduct or development of international air navigation, with the meteorological information necessary for the performance of their respective functions.

2.1.3 Each Contracting State shall determine the meteorological service which it will provide to meet the needs of international air navigation. This determination shall be made in accordance with the provisions of this Annex and with due regard to regional air navigation agreements; it shall include the determination of the meteorological service to be provided for international air navigation over international waters and other areas which lie outside the territory of the State concerned.

2.1.4 Each Contracting State shall designate the authority, hereinafter referred to as the meteorological authority, to provide or to arrange for the provision of meteorological service for international air navigation on its behalf. Details of the meteorological authority so designated shall be included in the State aeronautical information publication, in accordance with Annex 15, Appendix 1, GEN 1.1.

2.1.5 Each Contracting State shall ensure that the designated meteorological authority complies with the requirements of the World Meteorological Organization in respect of qualifications and training of meteorological personnel providing service for international air navigation.

Note.— Requirements concerning qualifications and training of meteorological personnel in aeronautical meteorology are given in WMO Publication No. 49, Technical Regulations, *Volume I — General Meteorological Standards and Recommended Practices, Education and Training.*

2.2 Supply, quality assurance and use of meteorological information

2.2.1 Close liaison shall be maintained between those concerned with the supply and those concerned with the use of meteorological information on matters which affect the provision of meteorological service for international air navigation.

2.2.2 **Recommendation.—** *In order to meet the objective of meteorological service for international air navigation, the Contracting State should ensure that the designated meteorological authority referred to in 2.1.4 establishes and implements a properly organized quality system comprising procedures, processes and resources necessary to provide for the quality management of the meteorological information to be supplied to the users listed in 2.1.2.*

2.2.3 **Recommendation.—** *The quality system established in accordance with 2.2.2 should be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards, and certified by an approved organization.*

Note.— International Organization for Standardization (ISO) 9000 series of quality assurance standards provide a basic framework for the development of a quality assurance programme. The details of a successful programme are to be formulated by each State and in most cases are unique to the State organization.

2.2.4 **Recommendation.—** *The quality system should provide the users with assurance that the meteorological information supplied complies with the stated requirements in terms of the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity, as well as the accuracy of measurements, observations and forecasts. Where the quality system indicates that meteorological information to be supplied to the users does not comply with the stated requirements, and automatic error correction procedures are not appropriate, such information should not be supplied to the users unless it is validated with the originator.*

Secretariat

Note 1.— Requirements concerning the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity of meteorological information to be supplied to aeronautical users are given in Chapters 3, 4, 6, 7, ~~8 and~~, 9 and 10 of this Annex and the relevant regional air navigation plans. Guidance concerning the accuracy of measurement and observation, and accuracy of forecasts is given in Attachments ~~B and E~~A and B respectively to this Annex.

Note 2.— Notwithstanding the provisions in 2.2.4, provisional ~~aerodrome forecasts~~ TAF may still be issued, as necessary, in accordance with ~~9.7.4~~Appendix 8, 4.4.3.

2.2.5 **Recommendation.—** *In regard to the exchange of meteorological information for operational purposes, the quality system should include verification and validation procedures and resources for monitoring adherence to the prescribed transmission schedules for individual messages and/or bulletins required to be exchanged, and the times of their filing for transmission. The quality system should be capable of detecting excessive transit times of messages and bulletins received.*

Note.— Requirements concerning the exchange of operational meteorological information are given in Chapter 11 of this Annex.

2.2.6 **Recommendation.—** *Demonstration of compliance of the quality system applied should be by audit. If non-conformity of the system is identified, action should be initiated to determine and correct the cause. All audit observations should be evidenced and properly documented.*

2.2.7 The meteorological information supplied to the users listed in 2.1.2 shall be consistent with Human Factors principles and shall be in forms which require a minimum of interpretation by these users, as specified in the following chapters.

Note.— Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual *(Doc 9683).*

2.3 Notifications required from operators

2.3.1 An operator requiring meteorological service or changes in existing meteorological service shall notify, sufficiently in advance, the meteorological authority or the meteorological office(s) concerned. The minimum amount of advance notice required shall be as agreed between the meteorological authority or meteorological office(s) and the operator.

2.3.2 The meteorological authority shall be notified by the operator requiring service when:

a) new routes or new types of operations are planned;

b) changes of a lasting character are to be made in scheduled operations; and

c) other changes, affecting the provision of meteorological service, are planned.

Such information shall contain all details necessary for the planning of appropriate arrangements by the meteorological authority.

2.3.3 The aerodrome meteorological office, or the meteorological office concerned, shall be notified by the operator or a flight crew member:

a) of flight schedules;

b) when non-scheduled flights are to be operated; and

c) when flights are delayed, advanced or cancelled.

2.3.4 **Recommendation.—** *The notification to the aerodrome meteorological office, or the meteorological office concerned, of individual flights should contain the following information except that, in the case of scheduled flights, the requirement for some or all of this information may be waived by agreement between the meteorological office and the operator:*

a) aerodrome of departure and estimated time of departure;

b) destination and estimated time of arrival;

c) route to be flown and estimated times of arrival at, and departure from, any intermediate aerodrome(s);

d) alternate aerodromes needed to complete the operational flight plan and taken from the relevant list contained in the regional air navigation plan;

e) cruising level;

f) for supersonic flights, the alternative subsonic cruising level and the locations of the transonic acceleration and deceleration areas and of the subsonic climb and descent paths;

g) type of flight, whether under the visual or the instrument flight rules;

h) type of meteorological information requested for a flight crew member, whether flight documentation and/or briefing or consultation; and

i) time(s) at which briefing, consultation and/or flight documentation are required.

CHAPTER 3. WORLD AREA FORECAST SYSTEM AND METEOROLOGICAL OFFICES

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 2.

3.1 Objectives of the world area forecast system

WAFSSG

The objective~~s~~ of the world area forecast system shall be~~:~~

~~a) to supply meteorological offices with forecasts of en-route meteorological conditions concerning upper winds, upper-air temperatures, direction, speed and height of maximum wind, tropopause height and significant weather in pictorial and/or alphanumeric form suitable, as far as practicable, for direct use by operators, flight crew members, air traffic services units and other aeronautical users; and~~

~~b)~~ to supply meteorological authorities and other users with forecasts of global upper wind, upper-air temperature and humidity, direction, speed and height of maximum wind, ~~and~~ tropopause height and temperature ~~forecasts~~ and forecasts of significant weather phenomena ~~for grid points~~ in digital form.

~~These~~ This objective~~s~~ shall be achieved through a comprehensive, integrated, worldwide and, as far as practicable, uniform system, and in a cost-effective manner, taking full advantage of evolving technologies.

3.2 World area forecast centres

3.2.1 A Contracting State, having accepted the responsibility for providing a WAFC within the framework of the world area forecast system, shall arrange for that centre:

a) to prepare global forecasts for grid points in digital form for all required levels and in a standard format; the forecasts shall comprise upper winds, upper-air temperatures and humidity, tropopause heights and temperatures and maximum wind speed, direction and height;

b) to prepare global forecasts of significant weather phenomena in digital form;

c) to issue the forecasts referred to in a) and b) above in digital ~~and/or pictorial~~ form to meteorological authorities and other users in its service area, as approved by the Contracting State on advice from the meteorological authority;

d) to prepare and issue amendments to the forecasts;

e) to receive information concerning the accidental release of radioactive materials into the atmosphere from its associated WMO regional specialized meteorological centre for the provision of transport model products for radiological environmental emergency response, in order to include the information in significant weather forecasts; and

f) to establish and maintain contact with VAACs for the exchange of information on volcanic activity in order to coordinate the inclusion of information on volcanic eruptions in significant weather forecasts.

~~*Note 1.— Criteria for the issuance of amendments to the forecasts are given in 3.2.12 and 3.2.13*~~

Note ~~2~~1.— Specifications for the preparation of significant weather and upper-air prognostic charts are contained in Part II, Appendix 1.

Note 2.— The WAFS service areas are given in the regional air navigation plans.

3.2.2 ~~**Recommendation**.—~~ In case of interruption of the operation of a WAFC, its functions ~~should~~ shall be carried out by the other WAFC.

Note.— Back-up procedures to be used in case of interruption of the operation of a WAFC are given at Attachment C.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 2 and *renumbered* as follows: 3.2.3 as 1.2.1; 3.2.4 to 3.2.6 as 1.3.1 to 1.3.3; 3.2.7 as 1.2.2; 3.2.8 as 1.2.4; 3.2.9 as 1.1; 3.2.10 as 1.2.3; 3.2.13 as 1.4; 3.2.15 as 1.3.4; and *Delete* paragraphs 3.2.11, 3.2.12 and 3.2.14.

~~3.3 Regional area forecast centres~~

Editorial Note.— Delete Section 3.3 in *toto.*

3.~~4~~3 Meteorological offices

3.~~4.1~~3.1 Each Contracting State shall establish one or more aerodrome and/or other meteorological offices which shall be adequate for the provision of the meteorological service required to satisfy operational needs.

3.~~4.2~~3.2 An aerodrome meteorological office shall carry out all or some of the following functions as necessary to meet the needs of flight operations at the aerodrome:

a) prepare and/or obtain forecasts and other relevant information for flights with which it is concerned; the extent of its responsibilities to prepare forecasts shall be related to the local availability and use of en-route and aerodrome forecast material received from other offices;

b) prepare and/or obtain forecasts of local meteorological conditions;

c) maintain a continuous survey of meteorological conditions over the aerodromes for which it is designated to prepare forecasts;

d) provide briefing, consultation and flight documentation to flight crew members and/or other flight operations personnel;

e) supply other meteorological information to aeronautical users;

f) display the available meteorological information;

g) exchange meteorological information with other meteorological offices; and

h) supply information received on pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud, to its associated air traffic services unit, aeronautical information service unit and meteorological watch office as agreed between the meteorological, aeronautical information service and ATS authorities concerned.

Secretariat

3.~~4.3~~3.3 ~~**Recommendation.—**~~The aerodrome meteorological offices at which ~~briefing, consultation and/or~~ flight documentation ~~are~~ is required, as well as the areas ~~and/or air routes~~ to be covered, ~~should~~ shall be determined by regional air navigation agreement ~~and, as necessary, by supplementary agreement between the meteorological authority and the operator concerned~~.

3.~~4.4~~3.4 ~~**Recommendation.—**~~The aerodromes for which landing forecasts are required ~~should~~ shall be determined by regional air navigation agreement.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 2 and *renumbered* as follows:
3.4.5 as 2.1.1;
3.4.6 as 2.2; and
3.4.7 as 2.1.2.

3.~~4.8~~3.5 For aerodromes without meteorological offices:

a) the meteorological authority concerned shall designate one or more meteorological offices to supply meteorological information as required; and

b) the competent authorities shall establish means by which such information can be supplied to the aerodromes concerned.

3.~~5~~4 Meteorological watch offices

3.~~5.1~~4.1 A Contracting State, having accepted the responsibility for providing air traffic services within a flight information region or a control area, shall establish one or more meteorological watch offices, or arrange for another Contracting State to do so.

3.~~5.2~~4.2 A meteorological watch office shall:

a) maintain watch over meteorological conditions affecting flight operations within its area of responsibility;

b) prepare SIGMET and other information relating to its area of responsibility;

c) supply SIGMET information and, as required, other meteorological information to associated air traffic services units;

d) disseminate SIGMET information;

e) when required by regional air navigation agreement, in accordance with 7.~~3.1~~2.1:

1) prepare AIRMET information related to its area of responsibility;

2) supply AIRMET information to associated air traffic services units; and

3) disseminate AIRMET information;

f) supply information received on pre-eruption volcanic activity, a volcanic eruption and volcanic ash cloud for which a SIGMET has not already been issued, to its associated ACC/FIC, as agreed between the meteorological and ATS authorities concerned, and to its associated VAAC as determined by regional air navigation agreement; and

g) supply information received concerning the accidental release of radioactive materials into the atmosphere, in the area for which it maintains watch or adjacent areas, to its associated ACC/FIC, as agreed between the meteorological and ATS authorities concerned, and to aeronautical information service units, as agreed between the meteorological and appropriate civil aviation authorities concerned. The information shall comprise location, date and time of the accident, and forecast trajectories of the radioactive materials.

Note. — The information is provided, at the request of the delegated authority in a State, by WMO regional specialized meteorological centres for the provision of transport model products for radiological environmental emergency response.

Editorial Note.— Paragraph 3.5.3 proposed to be moved to Part II, Appendix 2 and *renumbered* as 3.1.

3.~~5.4~~4.3 **Recommendation.—** *The boundaries of the area over which meteorological watch is to be maintained by a meteorological watch office should, in so far as is practicable, be coincident with the boundaries of a flight information region or a control area or a combination of flight information regions and/or control areas.*

3.~~5.5~~4.4 **Recommendation.—** *Meteorological watch should be maintained continuously; however, in areas with a low density of traffic the watch may be restricted to the period relevant to expected flight operations.*

3.~~6~~5 Volcanic ash advisory centres

~~3.6.1~~3.5.1 A Contracting State, having accepted, by regional air navigation agreement, the responsibility for providing a VAAC within the framework of the international airways volcano watch, shall arrange for that centre to respond to a notification that a volcano has erupted, or is expected to erupt or volcanic ash is reported in its area of responsibility, by arranging for that centre to:

a) monitor relevant geostationary and polar-orbiting satellite data to detect the existence and extent of volcanic ash in the atmosphere in the area concerned; ~~and~~

b) activate the volcanic ash numerical trajectory/dispersion model in order to forecast the movement of any ash "cloud" which has been detected or reported;

Note.— The numerical model may be its own or, by agreement, that of another VAAC.

c) issue advisory information regarding the extent and forecast movement of the volcanic ash "cloud" to:

1) meteorological watch offices, area control centres and flight information centres serving flight information regions in its area of responsibility which may be affected;

2) other VAACs whose areas of responsibility may be affected;

WAFSSG

3) world area forecast centres, ~~relevant regional area forecast centres,~~ international OPMET data banks, international NOTAM offices, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems; and

4) airlines requiring the advisory information through the AFTN address provided specifically for this purpose;

Note.— The AFTN address to be used by the VAACs is given in the Handbook on the International Airways Volcano Watch (IAVW) — Operational Procedures and Contact List *(Doc 9766) and the ICAO Web site at: http://www.icao.int under: Air Navigation Bureau, Meteorology, International Airways Volcano Watch.*

d) issue updated advisory information to the meteorological watch offices, area control centres, flight information centres and VAACs referred to in c), as necessary, but at least every six hours until such time as the volcanic ash "cloud" is no longer identifiable from satellite data, no further reports of volcanic ash are received from the area, and no further eruptions of the volcano are reported.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 2 and *renumbered* as follows: 3.6.2 as 4.1.1; and 3.6.3 as 4.1.2

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3.5.2 Volcanic ash advisory centres shall maintain a 24-hour watch.

3.6 State volcano observatories

Contracting States that maintain volcano observatories monitoring active volcanoes shall arrange that an observatory observing significant pre-eruption volcanic activity, a volcanic eruption and/or volcanic ash in the atmosphere shall send this information as quickly as practicable to its associated ACC, MWO and VAAC, in accordance with regional air navigation agreement.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

3.7 Tropical cyclone advisory centres

~~3.7.1~~ A Contracting State having accepted, by regional air navigation agreement, the responsibility for providing a TCAC shall arrange for that centre to:

a) monitor the development of tropical cyclones in its area of responsibility, using geostationary and polar-orbiting satellite data, radar data and other meteorological information;

b) issue advisory information concerning the position of the cyclone centre, its direction and speed of movement, central pressure and maximum surface wind near the centre; in abbreviated plain language to:

   1) meteorological watch offices in its area of responsibility;

   2) other TCACs whose areas of responsibility may be affected; and

WAFSSG

   3) world area forecast centres, ~~relevant regional area forecast centres~~ and international OPMET data banks, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems.

c) issue updated advisory information to meteorological watch offices for each tropical cyclone, as necessary, but at least every six hours.

Editorial Note.—	Paragraph 3.7.2 proposed to be moved to Part II, Appendix 2 and *renumbered* as 5.1.

CHAPTER 4. METEOROLOGICAL OBSERVATIONS AND REPORTS

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 3.

4.1 Aeronautical meteorological stations and observations

4.1.1 Each Contracting State shall establish at aerodromes and other points of significance to international air navigation, in its territory, such aeronautical meteorological stations as it determines to be necessary. An aeronautical meteorological station may be a separate station or may be combined with a synoptic station.

4.1.2 **Recommendation.—** *Each Contracting State should establish, or arrange for the establishment of, aeronautical meteorological stations on offshore structures or at other points of significance in support of helicopter operations to offshore structures, if required by regional air navigation agreement.*

4.1.3 Aeronautical meteorological stations shall make routine observations at fixed intervals. At aerodromes, the routine observations shall be supplemented by special observations whenever specified changes occur in respect of surface wind, visibility, runway visual range, present weather and/or clouds.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows:
4.1.4 as 1.1;
4.1.5 as 1.2;
4.1.6 as 1.3; and
4.1.7 as 1.4.

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~~4.1.8~~4.1.4 At aerodromes, with runways intended for Category II and III instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range, ~~and cloud~~ height of cloud base, air and dew-point temperatures and atmospheric pressure shall be installed to support approach and landing and take-off operations. These devices shall be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of ~~these~~ integrated automatic systems shall observe Human Factors principles and include back-up procedures~~.~~ ~~Provision shall be made for the manual insertion of meteorological parameters in case of failure of the integrated automatic systems.~~

Note 1.— Categories of precision approach and landing operations are defined in Annex 6, Part I.

Note 2. — Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual *(Doc 9683).*

~~4.1.9~~4.1.5 **Recommendation.—** *At aerodromes, with runways intended for Category I instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range~~, and cloud~~ height of cloud base, air and dew-point temperatures and atmospheric pressure should be installed to support approach and landing and take-off operations . These devices should be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of ~~these~~ integrated automatic systems should observe Human Factors principles and include back-up procedures . ~~Provision should be made for the manual insertion of meteorological parameters in case of failure of the integrated automatic systems~~*

~~4.1.10~~4.1.6 **Recommendation.—** *Where an integrated automatic system is used for the dissemination/display of meteorological information, it should be capable of accepting the manual insertion of data covering those meteorological elements which cannot be observed by automatic means.*

Editorial Note.—	Paragraph 4.1.11 proposed to be moved to Part II, Appendix 3 and *renumbered* as 1.5.

~~4.1.12~~4.1.7 The observations shall form the basis for the preparation of reports to be disseminated at the aerodrome of origin and for reports to be disseminated beyond the aerodrome of origin.

~~4.1.13~~4.1.8 Owing to the variability of meteorological elements in space and time, to limitations of observing techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a report shall be understood by the recipient to be the best approximation to the actual conditions at the time of observation.

Note.— Guidance on the operationally desirable and currently attainable accuracy of measurement or observation is given in Attachment ~~B~~A.

~~4.4 **Coordination of requirements for observations and reports between the meteorological and ATS authorities**~~

4.2 Agreement between air traffic services authorities and meteorological authorities

Recommendation.— *An agreement between the meteorological authority and the appropriate ATS authority should be established to cover, amongst other things:*

a) the provision in air traffic services units of ~~indicators or instruments~~ displays related to ~~of the kind referred to in 4.5.4 (surface wind), 4.7.9 (runway visual range) and 4.11.2 (pressure) or in 4.1.8 (~~integrated automatic systems~~)~~;

b) the calibration and maintenance of these ~~indicators~~displays/instruments;

c) the use to be made of these ~~indicators~~displays/instruments by air traffic services personnel;

d) *as and where necessary, supplementary visual observations (for example, of meteorological phenomena of operational significance in the climb-out and approach areas) if and when made by air traffic services personnel to update or supplement the information supplied by the meteorological station;*

e) *meteorological information obtained from aircraft taking off or landing (for example, on wind shear); and*

f) *if available, meteorological information obtained from ground weather radar.*

Note.— Guidance on the subject of coordination between ATS and aeronautical meteorological services is contained in the Manual on Co-ordination Between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services *(Doc 9377).*

~~4.2~~4.3 Routine observations and reports

~~4.2.1~~4.3.1 At aerodromes, routine observations shall be made throughout the 24 hours each day, except as otherwise agreed between the meteorological authority, the appropriate ATS authority and the operator concerned. Such observations shall be made at intervals of one hour or, if so determined by regional air navigation agreement, at intervals of one half-hour. At other aeronautical meteorological stations, such observations shall be made as determined by the meteorological authority taking into account the requirements of air traffic services units and aircraft operations.

~~4.2.2~~4.3.2 Reports of routine observations shall be issued as:

a) local routine reports~~ in abbreviated plain language in accordance with the template shown in Appendix 2,~~ only for dissemination at the aerodrome of origin, (intended for arriving and departing aircraft); and

b) ~~routine reports in the METAR code form prescribed by the World Meteorological Organization, in accordance with the template shown in Appendix 2~~, METAR for dissemination~~ to other aerodromes~~ beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note 1.— Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local routine report, in accordance with Annex 11, 4.3.6.1 g).

Editorial Note.— Delete Notes 2 and 3.

4.3.3 At aerodromes that are not operational throughout 24 hours in accordance with 4.3.1 above, METAR shall be issued prior to the aerodrome resuming operations in accordance with regional air navigation agreement.

Editorial Note.—	The following paragraph proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.2.3 as 3.2.1; 4.2.4 as 3.1.1; and 4.2.5 as 3.1.2. *Delete* 4.2.6 (the intent of the provision included in new 4.5.2) below.

~~4.3~~4.4 Special observations and reports

~~4.3.1~~4.4.1 A list of criteria for special observations shall be established by the meteorological authority, in consultation with the appropriate ATS authority, operators and others concerned~~. The list shall include the following:~~

Editorial Note.—	Sub-paragraphs a) to e) proposed to be moved to Part II, Appendix 3 and *renumbered* as 2.3.1 a) to e).

~~4.3.2~~4.4.2 Reports of special observations shall be issued as:

a) local special reports, ~~in abbreviated plain language in accordance with the template shown in, Appendix 2,~~ only for dissemination at the aerodrome of origin, (intended for arriving and departing aircraft); and

b) ~~special reports in the SPECI code form prescribed by the World Meteorological Organization, in accordance with the template shown in Appendix 2,~~ SPECI for dissemination ~~to other aerodromes~~ beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note ~~1~~. — Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local special report, in accordance with Annex 11, 4.3.6.1 g).

Editorial Note.—	*Delete* Notes 2 and 3.

4.4.3 At aerodromes that are not operational throughout 24 hours in accordance with 4.3.1 above, SPECI shall be issued, as necessary, upon resumption of the issuance of METAR .

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.3.3 as 3.2.2; 4.3.4 as 2.3.2; 4.3.5 as 2.3.3 4.3.6 as 3.1.3; *Delete* 4.3.7 (the intent of the provision included in Part II, Appendix 3, 3.1.1); *Delete* 4.3.8 (the intent of the provision included in Part II, Appendix 3, 3.1.2); *Delete* 4.3.9 (the intent of the provision included in 4.5.2 below).

~~4.13~~4.5 Contents of reports

4.~~13~~5.1 ~~**Recommendation.—**~~ Local routine and special reports and ~~routine and special reports in the~~ METAR~~/~~ and SPECI ~~code forms should~~ shall contain the following ~~information~~ elements in the order indicated~~, except that local special reports need not contain information as provided for under 4.3.3~~:

a) identification of the type of report;

b) location indicator;

c) time of the observation;

d) identification of an automated or missing report, when applicable;

~~d~~e) surface wind direction and speed;

~~e~~f) visibility;

~~f~~g) runway visual range, when applicable;

~~g~~h) present weather;

~~h~~i) cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds ~~at or near the aerodrome~~) and height of cloud base or vertical visibility;

~~i~~j) air temperature and dew-point temperature;

~~j~~k) QNH and, when applicable, QFE (QFE included only in local routine and special reports ~~by agreement between the meteorological and air traffic services authorities and operators concerned~~);

~~k) supplementary information~~.

Note ~~1~~ .— The location indicators referred to under b) and their significations are published in Doc 7910 — Location Indicators.

~~*Note 2.— For explanation of towering cumulus see note following 4.9.5.*~~

4.5.2 Optional elements shall be included in METAR and SPECI in accordance with regional air navigation agreement.

4.5.3 **Recommendation.** — *In addition to elements listed under 4.5.1 a) to k) above, local routine and special reports and METAR and SPECI should contain supplementary information to be placed after element k) above.*

Editorial Note.— Paragraph 4.13.2 proposed to be moved to Part II, Appendix 3 and *renumbered* as 2.2.

~~4.5~~ 4.6 Observing and reporting ~~of surface wind~~ meteorological elements

Editorial Note.—	Introductory note transferred to Part II, Appendix 3, Section 4.

4.6.1 Surface wind

~~4.5.1~~4.6.1.1~~**Recommendation.—**~~The mean direction and the mean speed of the surface wind ~~should~~ shall be measured, as well as significant variations of the wind direction and speed, and reported to the nearest 10 degrees true and nearest 1 kilometre per hour (or 1 knot), respectively~~. Since, in practice, the surface wind cannot be measured directly on the runway, surface wind observations for take-off and landing should be the best practicable indication of the winds which an aircraft will encounter during take-off and landing.~~

~~4.5.2~~4.6.1.2 **Recommendation.** — *When local routine and special reports are used for departing aircraft, the surface wind observations for these ~~observations~~ reports should be representative of conditions along the runway; when local routine and special reports are used for arriving aircraft, the surface wind observations for these reports should be representative of the touchdown zone. Surface wind observations for local routine and special reports should be representative of conditions at a height of ~~6 to~~ approximately 10 m (~~20 to~~ 30 ft) above the runway.*

4.6.1.3 **Recommendation.**— *~~Surface wind observations made for~~ For ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~, the surface wind observations should be representative of conditions at a height of ~~6 to~~ approximately 10 m (~~20 to~~ 30 ft) above the whole runway where there is only one runway and the whole runway complex where there is more than one runway.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.5.3 as 4.1.1; 4.5.4 as 4.1.2.1; 4.5.5 as 4.1.3.1; 4.5.6 as 4.1.4.1; 4.5.7 as 4.1.2.2; 4.5.8 as 4.1.4.2; and 4.5.9 as 4.1.4.3.

~~4.6 Observing and report of~~~~v~~4.6.2 Visibility

~~4.6.1~~4.6.2.1~~**Recommendation.—**~~The visibility ~~should~~ as defined in Chapter 1 shall be measured or observed ~~by reference to objects or lights whose distance from the point of observation is known~~, and reported in metres and kilometres.

~~*Note 1.— The definition of visibility is given in Chapter 1.*~~

Note ~~2~~ — Guidance on the conversion of instrument readings into visibility is given in Attachment ~~D~~E

~~4.6.2 **Recommendation**.— *Where observations are made using automatic observing equipment, provision should be made for manual insertion of the visibility value(s) in the corresponding displays.*~~

~~4.6.3~~4.6.2.2 **Recommendation.—** *When local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of ~~the take-off/climb-out area~~ conditions along the runway; when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the ~~approach /landing area~~ touchdown zone of the runway.*

4.6.2.3 **Recommendation**.— *~~Visibility observations made for~~ For ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~, the visibility observations should be representative of the aerodrome ~~and its immediate vicinity; in such observations special attention should be given to significant directional variations~~.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.6.4 as 4.2.4.1; and 4.6.5 as 4.2.4.4

~~**4.7 Observing and reporting of r**~~4.6.3 Runway visual range

Editorial Note.—	*Delete* 4.7.1 and *renumber* 4.7.2 as 4.6.3.4.

Note.— Guidance on the subject of runway visual range is contained in the Manual of Runway Visual Range Observing and Reporting Practices *(Doc 9328).*

~~4.7.3~~4.6.3.1 Runway visual range ~~observations~~ as defined in Chapter 1 shall be ~~made~~ observed on all runways intended for Category II and III instrument approach and landing operations.

~~4.7.4~~4.6.3.2 **Recommendation.—** *Runway visual range ~~observations~~ as defined in Chapter 1 should be ~~made~~ observed on all runways intended for use during periods of reduced visibility, including:*

a) precision approach runways intended for Category I instrument approach and landing operations; and

b) runways used for take-off and having high-intensity edge lights and/or centre line lights.

Note.— Precision approach runways are defined in Annex 14, Volume I, Chapter 1, under "Instrument runway".

Editorial Note.—	Paragraph 4.7.5 proposed to be moved to Part II, Appendix 3 and *renumbered* as 4.3.1.2.

~~4.7.6~~4.6.3.3 ~~**Recommendation.—**~~ The runway visual range ~~should~~ observations made in accordance with 4.6.3.1 and 4.6.3.2 above, shall be reported in metres throughout periods when either the ~~horizontal~~ visibility or the runway visual range is ~~observed to be~~ less than 1 500 m.

~~4.7.2~~4.6.3.4 Runway visual range observations shall be representative of:

a) the touchdown zone of the runway intended for non-precision or Category I instrument approach and landing operations;

b) the touchdown zone and~~, depending on the category of operation for which the runway is intended and the length of the runway,~~ ~~of~~ the mid-point of the runway intended for Category II instrument approach and landing operations; and

c) the touchdown zone, the mid-point and stop-end of the runway intended for Category III instrument approach and landing operations.

~~4.7.12~~4.6.3.5 ~~**Recommendation.—**~~The units providing air traffic service and aeronautical information service for an aerodrome ~~should~~ shall be kept informed without delay of changes in the serviceability status of the runway visual range observing system.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.7.7 as 4.3.2.1; 4.7.8 as 4.3.2.2; 4.7.9 as 4.3.3.1; 4.7.10 as 4.3.4; 4.7.11 as 4.3.5; 4.7.13 as 4.3.6.1; 4.7.14 as 4.3.6.2; 4.7.15 as 4.3.3.2; 4.7.16 as 4.3.6.4; 4.7.17 as 4.3.6.5; and 4.7.18 as 4.3.6.6.

~~**4.8 Observing and reporting of p**~~4.6.4 Present weather

~~4.8.1~~4.6.4.1 ~~**Recommendation.—**~~The present weather occurring at~~ and/or near~~ the aerodrome and/or its vicinity ~~should~~ shall be observed and reported as necessary~~. When local routine and special reports are used for departing aircraft, the present weather information should be representative of the take-off and climb-out area; when local routine and special reports are used for arriving aircraft, the present weather information should be representative of the approach and landing area. Observations of present weather made for reports in the METAR/SPECI code forms should be representative of the aerodrome and its immediate vicinity~~.

4.6.4.2 **Recommendation.**— ~~*The present weather occurring at and/or near the aerodrome should be observed.*~~ *When local routine and special reports are used for departing aircraft, the present weather information should be representative of the take-off~~ and climb-out~~ areas; when local routine and special reports are used for arriving aircraft, the present weather information should be representative of the~~ approach and~~ landing area .*

4.6.4.3 **Recommendation.**— ~~*Observations of present weather made for reports in the METAR/SPECI code forms*~~ *For METAR and SPECI , the present weather information should be* *representative of conditions at the aerodrome and, for certain specified present weather phenomena, in its ~~immediate~~ vicinity.*

~~4.8.2~~4.6.4.4 **Recommendation.—** *Where observations are made using automatic observing ~~equipment~~ systems, provision should be made for manual insertion ~~in the corresponding displays~~ of those present weather elements which cannot be determined adequately by that equipment.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.8.3 as 4.4.2.1; 4.8.4 as 4.4.2.2; 4.8.5 as 4.4.2.3; 4.8.6 as 4.4.2.4; and 4.8.7 as 4.4.2.5.

~~**4.9 Observing and report of c**~~4.6.5 Clouds

~~4.9.1~~4.6.5.1~~**Recommendation.—**~~Cloud amount, cloud type and height of cloud base ~~should~~ shall be observed, and reported as necessary to describe the ~~general~~ cloud distribution of operational significance. When the sky is obscured, vertical visibility shall be observed in lieu of cloud amount, cloud type and height of cloud base. The height of cloud base and vertical visibility shall be reported in metres (feet).

Editorial Note.—	Paragraph 4.9.2 *renumbered* as 4.6.5.4.

~~4.9.3~~4.6.5.2 **Recommendation.—** *Cloud observations for local routine and special reports should be representative of the approach area .~~or, in the case of aerodromes with precision approach runways, of the middle marker site of the instrument landing system.~~*

~~*Note.— Specifications concerning the middle marker site of an instrument landing system are given in Annex 10, Volume I, Chapter 3 and Attachment C, Table C-5.*~~

4.6.5.3 **Recommendation**.— *Cloud observations ~~made~~ for ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~ should be representative of the aerodrome and its ~~immediate~~ vicinity.*

~~4.9.2~~4.6.5.4 **Recommendation.—***Where ~~ceilometers~~ observations of cloud amount and/or the height of cloud base are made ~~used as a part of automated~~ using automatic observing ~~equipment to measure height of cloud base~~ systems, provision should be made for manual insertion of cloud amounts and, where appropriate, cloud type~~(s)~~, together with the heights of those layers or masses not directly measurable by ~~the ceilometer(s)~~ that equipment.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.9.4 as 4.5.2; and 4.9.5 as 4.5.3.1.

~~**4.10 Observing and reporting ofa**~~ 4.6.6 Air temperature and dew-point temperature

~~4.10.1 **Recommendation.—**~~ 4.6.6.1 The air temperature and the dew-point temperature ~~should~~ shall be measured and reported to the nearest whole degree Celsius, with observed values involving 0.5°C rounded up to the next higher whole degree Celsius~~. For example, +2.5°C should be rounded off to +3°C, −2.5°C should be rounded off to −2°C.~~

~~4.10.2~~4.6.6.2 **Recommendation.** — *Observations of air temperature and dew-point temperature for local routine and special reports and METAR and SPECI should be representative of the whole runway complex.*

Editorial Note.—	Paragraph 4.10.3 proposed to be moved to Part II, Appendix 3 and *renumbered* as 4.6.1.

~~4.11 Observing and reporting of~~ 4.6.7 Atmospheric pressure ~~values~~

~~4.11.1 **Recommendation.—**~~ The atmospheric pressure ~~should~~ shall be measured and QNH and~~/or~~, QFE values ~~should~~ shall be computed in tenths of a hectopascal. QNH and QFE shall be reported in hectopascals, using four digits, rounded down to the nearest lower whole hectopascal.

Editorial Note.—	*Delete* 4.11.2

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.11.3 as 4.7.2; 4.11.4 as 4.7.3.1; 4.11.5 as 4.7.3.2.

~~4.12 Observing and reporting of~~4.6.8 Supplementary information

~~4.12.1~~4.6.8.1 **Recommendation.—***Observations made at aerodromes should include the available supplementary information concerning significant meteorological conditions, particularly those in the approach and climb-out areas~~, and specifically the location of cumulonimbus or thunderstorm, moderate or severe turbulence, wind shear, hail, severe squall line, moderate or severe icing, freezing precipitation, severe mountain waves, sandstorm, duststorm, blowing snow or funnel cloud (tornado or waterspout)~~. Where practicable, the information should identify the location, ~~vertical extent and direction and rate of movement~~ of the ~~phenomenon~~ meteorological condition. ~~As icing, turbulence and to a large extent, wind shear, for the time being cannot be satisfactorily observed from the ground, evidence of their existence should be derived from aircraft observations during the climb-out or approach phases of flight to be made in accordance with Chapter 5, 5.5 and 5.6.~~*

~~*Note.— The preparation and dissemination of warnings of wind shear in the climb-out and approach paths is dealt with in Chapter 7, 7.6.1 to 7.6.6.*~~

~~4.12.2~~4.6.8.2**Recommendation**.—*Where observations are made using automatic observing ~~equipment~~ systems, provision should be made for manual insertion of information concerning significant meteorological conditions which cannot be determined adequately by that equipment.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 3 and *renumbered* as follows: 4.12.3 as 4.8.1.1; 4.12.4 as 4.8.1.2; 4.12.5 as 4.8.1.3; 4.12.6 and 4.12.7 as 4.8.1.4.

Editorial Note.—	Section 4.13 *renumbered* as 4.5

4.7 Reporting of meteorological information from automatic observing systems

Recommendation. — *METAR and SPECI from automatic observing systems should only be used during non-operational hours of the aerodrome. These METAR and SPECI should be identified with the word "AUTO".*

~~4.14~~ 4.8 Observations and reports of volcanic activity

Recommendation.— *The occurrence of pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud should be reported without delay to the associated air traffic services unit, aeronautical information services unit and meteorological watch office. The report should be made in the form of a volcanic activity report comprising the following information in the order indicated:*

a) message type, VOLCANIC ACTIVITY REPORT;

b) station identifier, location indicator or name of station;

c) date/time of message;

d) location of volcano and name if known; and

e) concise description of event including, as appropriate, level of intensity of volcanic activity, occurrence of an eruption and its date and time and the existence of a volcanic ash cloud in the area together with direction of ash cloud movement and height.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

CHAPTER 5. AIRCRAFT OBSERVATIONS AND REPORTS

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 4.

5.1 Obligations of States

Each Contracting State shall arrange, according to the provisions of this chapter, for observations to be made by aircraft of its registry operating on international air routes and for the recording and reporting of these observations.

5.2 Types of ~~A~~aircraft observations

~~5.2.1~~ The following aircraft observations shall be made:

a) routine aircraft observations during en-route and climb-out phases of the flight; and

b) special and other non-routine aircraft observations during any phase of the flight.

Editorial Note.— Section 5.3 *renumbered* as 5.7

~~5.4~~5.3 Routine aircraft observations — designation

~~5.4.1~~5.3.1 **Recommendation.—** *When air-ground data link is used and automatic dependent surveillance (ADS) is being applied, automated routine observations should be made every 15 minutes during the en-route phase and every 30 seconds during the climb-out phase for the first 10 minutes of the flight.*

~~5.4.2~~5.3.2 When voice communications are used, routine observations shall be made during the en-route phase in relation to those air traffic services reporting points or intervals:

a) at which the applicable air traffic services procedures require routine position reports; and

b) which are those separated by distances corresponding most closely to intervals of one hour of flying time.

~~5.4.3~~5.3.3 **Recommendation.—** *For helicopter operations to and from aerodromes on offshore structures, routine observations should be made from helicopters at points and times as agreed between the meteorological authorities and the helicopter operators concerned.*

~~5.4.4~~5.3.4 In the case of air routes with high-density air traffic (e.g. organized tracks), an aircraft from among the aircraft operating at each flight level shall be designated, at approximately hourly intervals, to make routine observations in accordance with ~~5.4.1~~ 5.3.1 or ~~5.4.2~~5.3.2 above, as appropriate. The designation procedures shall be subject to regional air navigation agreement.

~~5.4.5~~5.3.5 In the case of the requirement to report during the climb-out phase, an aircraft shall be designated, at approximately hourly intervals, at each aerodrome to make routine observations in accordance with ~~5.4.1~~ 5.3.1 above.

5.4 Routine aircraft observations — exemptions

~~5.4.6~~5.4.1 When voice communications are used, an aircraft shall be exempted from making the routine observations specified in ~~5.4.2~~ 5.3.2 when:

a) the aircraft is not equipped with RNAV equipment; or

b) the flight duration is 2 hours or less; or

c) the aircraft is at a distance equivalent to less than one hour of flying time from the next intended point of landing; or

d) the altitude of the flight path is below 1 500 m (5 000 ft).

~~5.4.7~~5.4.2 **Recommendation.—** *When voice communications are used, additional exemptions may be prescribed by regional air navigation agreement for flights over routes and areas with high-density air traffic and/or with adequate synoptic networks. Such procedures should take the form of exemption or designation procedures and should:*

a) make it possible for the minimum requirements for aircraft observations of all meteorological offices concerned to be met; and

b) be as simple as possible to implement and preferably not involving consideration of individual cases.

5.5 Special aircraft observations

Special observations shall be made by all aircraft whenever the following conditions are encountered or observed:

a) severe turbulence; or

b) severe icing; or

c) severe mountain wave; or

d) thunderstorms, without hail, that are obscured, embedded, widespread or in squall lines; or

e) thunderstorms, with hail, that are obscured, embedded, widespread or in squall lines; or

f) heavy duststorm or heavy sandstorm; or

g) volcanic ash cloud; or

h) pre-eruption volcanic activity or a volcanic eruption.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

In addition, in the case of transonic and supersonic flights:

i) moderate turbulence; or

j) hail; or

k) cumulonimbus clouds.

5.6 Other non-routine aircraft observations

5~~.6.1~~ When other meteorological conditions not listed under 5.5 above, e.g. wind shear, are encountered and which, in the opinion of the pilot-in-command, may affect the safety or markedly affect the efficiency of other aircraft operations, the pilot-in-command shall advise the appropriate air traffic services unit as soon as practicable.

Note— ~~According to Chapter 4, 4.12.1 and Chapter 7, 7.6.2~~ ~~i~~ Icing, turbulence and, to a large extent, wind shear, are elements which, for the time being, cannot be satisfactorily observed from the ground and for which in most cases aircraft observations represent the only available evidence.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 4 and *renumbered* as follows: 5.6.2 as 4.1.1; and 5.6.3 as 4.1.2.

~~5.3~~5.7 Reporting of aircraft observations during flight

~~5.3.1~~5.7.1 Aircraft observations shall be reported by air-ground data link. Where air-ground data link is not available or appropriate, aircraft observations during flight shall be reported by voice communications.

~~5.3.2~~5.7.2 Aircraft observations shall be reported during flight at the time the observation is made or as soon thereafter as is practicable.

5.7.3 Aircraft observations shall be reported as air-reports.

~~5.7 Contents of air-reports~~

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 4 and *renumbered* as follows: 5.7.1 as 1.3; 5.7.2 as 1.1.1; 5.7.3 as 1.1.2; and 5.7.4 as 1.2.

~~5.8 Criteria for reporting meteorological and related parameters in automated air-reports~~

Editorial Note.— Paragraph 5.8 proposed to be moved to Part II, Appendix 4 and *renumbered* as 2.1.

~~5.9~~5.8 ~~Exchange~~ Relay of air-reports by ATS units

~~5.9.1~~ The meteorological authority concerned shall make arrangements with the appropriate ATS authority to ensure that, on receipt by the ATS units of:

a) routine and special air-reports by voice communications, the ATS units relay them without delay to their associated meteorological watch office;

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b) routine air-reports by data link communications, the ATS units relay them without delay to WAFCs ~~and, as appropriate, to RAFCs;~~ and

c) special air-reports by data link communications, the ATS units relay them without delay to their associated meteorological watch office and, WAFCs ~~and, as appropriate, to RAFCs~~.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 4 and *renumbered* as follows:
5.9.2 as 3.1.1;
5.9.3 as 3.1.2;
5.9.4 as 3.1.3;
5.9.5 as 3.1.4;
5.9.6 as 3.2;
5.9.7 as 3.3; and
5.9.8 as 3.4.

~~5.10~~5.9 Recording and post-flight reporting of aircraft observations of volcanic activity

~~5.10.1~~ Special aircraft observations of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud shall be recorded on the special air-report of volcanic activity form. A copy of the form shall be included with the flight documentation provided to flights operating on routes which, in the opinion of the meteorological authority concerned, could be affected by volcanic ash clouds.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 4 and *renumbered* as follows:
5.10.2 as 4.2.1; and
5.10.3 as 4.2.2.

CHAPTER 6. FORECASTS

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 5.

6.1 Interpretation and use of forecasts

6.1.1 Owing to the variability of meteorological elements in space and time, to limitations of forecasting techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a forecast shall be understood by the recipient to be the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time of occurrence or change of an element is given in a forecast, this time shall be understood to be the most probable time.

Note.— Guidance on the operationally desirable accuracy of forecasts is given in, Attachment ~~E~~B.

6.1.2 The issue of a new forecast by a meteorological office, such as a routine aerodrome forecast, shall be understood to cancel automatically any forecast of the same type previously issued for the same place and for the same period of validity or part thereof.

6.2 Aerodrome forecasts

6.2.1 An aerodrome forecast shall be prepared by the meteorological office designated by the meteorological authority concerned.

6.2.2 An aerodrome forecast shall be issued at a specified time and consist of a concise statement of the expected meteorological conditions at an aerodrome for a specified period.

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6.2.3 Aerodrome forecasts and amendments thereto shall be issued ~~in accordance with the template shown in Appendix 4 and exchanged in the TAF code form~~ as TAF and include the following information in the order indicated:

a) ~~code name TAF/TAF AMD~~ identification of the type of forecast;

b) location indicator;

c) date and time of ~~origin~~issue of forecast;

d) date and period of validity of forecast;

e) surface wind;

f) visibility;

g) weather;

h) cloud; and

i) expected significant changes to one or more of these elements during the period of validity.

Additional elements shall be included in ~~aerodrome forecasts~~ TAF in accordance with regional air navigation agreement.

Note . — The visibility included in TAF refers to the forecast prevailing visibility.

Editorial Note.— *Delete* Notes 1 and 2.

6.2.4 Meteorological offices preparing ~~aerodrome forecasts~~TAF shall keep the forecasts under continuous review and, when necessary, shall issue amendments promptly. The length of the forecast messages and the number of changes indicated in the forecast shall be kept to a minimum.

6.2.5 TAF that cannot be kept under continuous review shall be cancelled.

Editorial Note.— Paragraph 6.2.5 proposed to be moved to Part II, Appendix 5 and *renumbered* as 1.3.1.

Secretariat

6.2.6 **Recommendation.**— *The period of validity of a routine ~~aerodrome forecasts~~ TAF should be not less than 9 hours nor more than 24 hours; this period should be determined by regional air navigation agreement. ~~The period of validity should be subdivided, as necessary, in accordance with 6.2.11.~~ Routine ~~aerodrome forecasts~~ TAF valid for less than 12 hours should be issued every 3 hours and those valid for 12 to 24 hours should be issued every 6 hours.*

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 5 and *renumbered* as follows:

6.2.7 as 1.3.2;
6.2.8 as 1.3.3;
6.2.9 as 1.3.4;
6.2.10 as 1.4;
6.2.11 as 1.3.5;
6.2.12 as 1.2.1;
6.2.13 as 1.2.2;
6.2.14 as 1.2.3;
6.2.15 as 1.2.4;
6.2.16 as 1.2.5; and
6.2.17 as 1.5.

6.3 Landing forecasts

6.3.1 A landing forecast shall be prepared by the meteorological office designated by the meteorological authority concerned; such forecasts are intended to meet requirements of local users and of aircraft within about one hour's flying time from the aerodrome.

6.3.2 Landing forecasts shall be prepared in the form of a trend~~-type~~ forecast ~~in accordance with the template shown in Appendix 2~~, as determined by regional air navigation agreement.

~~*Note.— Examples of trend forecasts are given in Appendix 2.*~~

6.3.3 A trend-type landing forecast shall consist of a local routine or local special report, or a ~~routine or special report in the~~ METAR or ~~/~~SPECI ~~code forms~~, for an aerodrome to which is appended a concise statement of the expected ~~trend of~~ significant changes in the meteorological conditions at that aerodrome. The period of validity of a trend-type landing forecast shall be 2 hours from the time of the report which forms part of the landing forecast. ~~The trend-type landing forecast shall indicate significant changes in respect of one or more of the elements surface wind, visibility, weather and cloud. Only those elements shall be included for which a significant change is expected. However, in the case of significant changes in respect of cloud, all cloud groups, including layers or masses not expected to change, shall be indicated. In the case of a significant change in visibility, the phenomenon causing the reduction of visibility shall also be indicated. When no change is expected to occur, this shall be indicated by the term "NOSIG".~~

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 5 and *renumbered* as follows: 6.3.3 (latter part) as 2.2.1 6.3.4 as 2.3.1; 6.3.5 as 2.3.2; 6.3.6 as 2.3.3; 6.3.7 as 2.4; 6.3.8 as 2.2.2; 6.3.9 as 2.2.3; 6.3.10 as 2.2.4; 6.3.11 as 2.2.5; 6.3.12 as 2.2.6; and 6.3.13 as 2.2.7.

~~6.3.14 The order of the elements and the terminology, units and scales used in the trend part of the trend-type landing forecast shall be the same as those used in the report to which it is appended.~~

6.4 Forecasts for take-off

6.4.1 A forecast for take-off shall be prepared by the meteorological office designated by the meteorological authority concerned.

6.4.2 **Recommendation.—** *A forecast for take-off should refer to a specified period of time and should contain information on expected conditions over the runway complex in regard to surface wind direction and speed and any variations thereof, temperature, pressure (QNH), and any other elements as agreed locally.*

6.4.3 **Recommendation.—** *A forecast for take-off should be supplied to operators and flight crew members on request within the 3 hours before the expected time of departure*.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 5 and *renumbered* as follows: 6.4.4 as 3.1 ; and 6.4.5 (latter part) as 3.2

~~6.4.5~~6.4.4 **Recommendation.—** *Meteorological offices preparing forecasts for take-off should keep the forecasts under continuous review and, when necessary, should issue amendments promptly*~~*. The criteria for the issuance of amendments for forecasts for take-off for surface wind direction and speed, temperature and pressure and any other elements agreed locally should be agreed between the meteorological authority and the operators concerned. The criteria should be consistent with the corresponding criteria for special reports established for the aerodrome in accordance with 4.3.1*~~

6.5 Area and route forecasts, other than forecasts issued within the framework of the world area forecast system

Note.— Provisions concerning forecasts issued within the framework of the world area forecast system are contained in Chapter 3 and those concerning area forecasts for low-level flights, under Section 6.6.

6.5.1 Area and route forecasts shall contain upper winds, upper-air temperatures, significant en-route weather phenomena and associated clouds. Other elements may be added as required. This information shall cover the flight operations for which they are intended in respect of time, altitude and geographical extent.

6.5.2 Meteorological offices preparing area and route forecasts shall keep the forecasts under continuous review and issue amendments as necessary.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 5 and *renumbered* as follows: 6.5.3 as 4.2.1; 6.5.4 as 4.2.2 6.5.5 as 4.1.1; 6.5.6 as 4.1.2; and 6.5.7 as 4.1.3.

6.6 Area forecasts for low-level flights

6.6.1 ~~**Recommendation.—**~~When the density of traffic operating below flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) warrants the routine issue and dissemination of area forecasts for such operations, the frequency of issue, the form and the fixed time or period of validity of those forecasts and the criteria of amendments thereto ~~should~~ shall be determined by the meteorological authority in consultation with the users.

6.6.2 When the density of traffic operating below flight level 100 warrants the issuance of AIRMET information in accordance with 7.3.1, area forecasts for such operations shall be exchanged between meteorological offices responsible for the issuance of flight documentation for low-level flights in the flight information regions concerned.

6.6.3 Area forecasts for low-level flights exchanged between meteorological offices in support of the issuance of AIRMET information shall be prepared in a format agreed upon between the meteorological authorities concerned. When abbreviated plain language is used, the forecast shall be prepared as a GAMET area forecast, employing approved ICAO abbreviations and numerical values. The area forecasts shall be issued to cover the layer between the ground and flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) and shall contain information on en-route weather phenomena hazardous to low-level flights, in support of the issuance of AIRMET information, and additional information required by low-level flights. ~~When prepared in GAMET format, they shall contain two sections: Section I related to information on en-route weather phenomena hazardous to low-level flights, prepared in support of the issuance of AIRMET information, and Section II related to additional information required by low-level flights. The area forecasts shall contain the following information as necessary and, when prepared in GAMET format, in the order indicated. Additional elements in Section II shall be included in accordance with regional air navigation agreement:~~

Editorial Note.—	The latter part of paragraph 6.6.3 proposed to be moved to Part II, Appendix 5 and *renumbered* as 5.1 a) to w)) and 5.2.

6.6.4 Area forecasts for low-level flights exchanged between meteorological offices in support of the issuance of AIRMET information shall be issued every 6 hours for a period of validity of 6 hours and transmitted to meteorological offices concerned not later than one hour prior to the beginning of their validity period.

~~*Note.— The requirements for flight documentation for low-level flights are stated in 9.6.3 and 9.8.3*~~

Editorial Note.—	The Example of GAMET Area Forecast proposed to be moved to Part II, Appendix 5 and *renumbered* as Example A5-2.

CHAPTER 7. SIGMET AND AIRMET INFORMATION, AERODROME WARNINGS AND WIND SHEAR WARNINGS

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 6.

Editorial Note.—	The introductory note following the title proposed to be moved to Part II at the beginning of Appendix 6.

7.1 SIGMET information~~ — general provisions~~

7.1.1 SIGMET information shall be issued by a meteorological watch office and shall give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which may affect the safety of aircraft operations, and of the development of those phenomena in time and space. ~~The information shall be indicated using one of the following as appropriate:~~

Editorial Note.—	Sub-paragraphs a) and b) proposed to be moved to Part II, Appendix 6 and *renumbered* as 1.1.4 (sub-paragraphs a) and b).

~~*Note.— Guidance on the preparation of SIGMET messages is given in Appendix 5.*~~

Editorial Note.—	Paragraph 7.1.2 proposed to be moved to Part II, Appendix 6 and *renumbered* as 1.1.5.

7.1.~~3~~2 SIGMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

~~7.2 Format and exchange of SIGMET messages~~

Editorial Note.—	Paragraph 7.2.1 proposed to be moved to Part II, Appendix 6 and *renumbered* as 1.1.1.

Editorial Note.—	*Delete* 7.2.2.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 6 and *renumbered* as follows: 7.2.3 as 1.1.6; 7.2.4 as 1.1.2; and 7.2.5 as 1.1.3.

~~7.2.6~~7.1.3 ~~**Recommendation.—**~~ The period of validity of a SIGMET message ~~should~~ shall be not more than 6 hours, and preferably not more than 4 hours. ~~It should be indicated by the term "VALID" in accordance with the template in Appendix 5~~

~~7.2.7~~7.1.4 **Recommendation.—** *In the special case of SIGMET messages for volcanic ash cloud and tropical cyclones, an outlook should be included giving information for up to 12 hours beyond the period of validity specified in ~~7.2.6~~7.1.3 above, concerning the trajectory of the volcanic ash cloud and positions of the tropical cyclone centre.*

~~7.2.8~~7.1.5 **Recommendation.—** *SIGMET messages issued in accordance with ~~7.2.7~~ 7.1.4 above, concerning volcanic ash cloud and tropical cyclones should be based on advisory information provided by VAACs and TCACs respectively, designated by regional air navigation agreement.*

~~7.2.9~~7.1.6 Close coordination shall be maintained between the meteorological watch office and the associated area control centre/flight information centre to ensure that information on volcanic ash included in SIGMET and NOTAM messages is consistent.

~~7.2.10~~7.1.7 ~~**Recommendation.—**~~A SIGMET message relating to the expected occurrence of weather phenomena listed in ~~7.1.1~~ Appendix 6, 1.1.4, with the exception of volcanic ash cloud and tropical cyclones, ~~should~~ shall be issued not more than 6 hours, and preferably not more than 4 hours, before the expected time of occurrence of that phenomenon.

7.1.8 **Recommendation. —***SIGMET messages concerning volcanic ash cloud or tropical cyclones expected to affect a flight information region should be issued up to 12 hours before the commencement of the period of validity or as soon as practicable if such advance warning of the existence of these phenomena is not available. SIGMET messages for volcanic ash and tropical cyclones should be updated at least every 6 hours.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 5 and *renumbered* as follows: 7.2.11 as 1.2.1; and 7.2.12 as 1.2.2.

7.~~3~~2 AIRMET information

7.~~3~~2.1 AIRMET information shall be issued by a meteorological watch office in accordance with regional air navigation agreement, taking into account the density of air traffic operating below flight level 100. AIRMET information shall give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which have not been included in Section I of the area forecast for low-level flights issued in accordance with Chapter 6, Section6.6 and which may affect the safety of low-level flights, and of the development of those phenomena in time and space. ~~The information shall be indicated using one of the following as appropriate:~~

Editorial Note.—	Latter part of paragraph 7.3.1 proposed to be moved to Part II, Appendix 6 and *renumbered* as 2.1.4.

~~*Note.— Guidance on the preparation of AIRMET messages is given in Appendix 5.*~~

Editorial Note.—	Paragraph 7.3.2 proposed to be moved to Part II, Appendix 6 and *renumbered* as 2.1.5.

~~7.3.3~~7.2.2 AIRMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

Editorial Note.—	Paragraph 7.4.1 proposed to be moved to Part II, Appendix 6 and *renumbered* as 2.1.1.

Editorial Note.—	*Delete* 7.4.2.

Editorial Note.—	Paragraph 7.4.3 proposed to be moved to Part II, Appendix 6 and *renumbered* as 2.1.2.

~~7.4.4~~7.2.3 ~~**Recommendation**.—~~The period of validity of an AIRMET message ~~should~~ shall be not more than 6 hours, and preferably not more than 4 hours~~. It should be indicated by the term "VALID" in accordance with the template in Appendix 5.~~

Editorial Note.—	Paragraph 7.4.5 proposed to be moved to Part II, Appendix 6 and *renumbered* as 2.2.

~~7.5~~7.3 Aerodrome warnings

METLINKSG

7.~~5.1~~3.1 Aerodrome warnings shall give concise information~~, in plain language,~~ of meteorological conditions which could adversely affect aircraft on the ground, including parked aircraft, and the aerodrome facilities and services.~~ The warnings shall be issued in accordance with local arrangements to operators, aerodrome services and to others concerned, by the meteorological office designated to provide service for that aerodrome.~~

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 6 and *renumbered* as follows: 7.5.1 (latter part) as 5.1.1; 7.5.2 as 5.1.2; and 7.5.3 as 5.2.

7.3.2 **Recommendation.—** *Aerodrome warnings should be cancelled when the conditions are no longer occurring and/or no longer expected to occur at the aerodrome.*

~~7.6~~ 7.4 Wind shear warnings

7.~~6.1~~4.1 Wind shear warnings shall give concise information of the observed or expected existence of wind shear which could adversely affect aircraft on the approach path or take-off path or during circling approach between runway level and 500 m (1 600 ft) above that level and aircraft on the runway during the landing roll or take-off run~~. The warnings shall be prepared and disseminated for aerodromes where wind shear is considered a factor in accordance with local arrangements with the appropriate ATS authority and operators concerned and by the meteorological office designated to provide service for the aerodrome or disseminated directly from automated ground-based wind shear remote-sensing or detection equipment referred to in 7.6.2 a) and b).~~ Where local topography has been shown to produce significant wind shears at heights in excess of 500 m (1 600 ft) above runway level, then 500 m (1 600 ft) shall not be considered restrictive.

Editorial Note.—	Notes 1 and 3 proposed to be moved to Part II, Appendix 6 under paragraphs 6.1 and 6.2, respectively.

Note ~~2~~.— Guidance on the subject of wind shear is contained in the Circular Wind Shear *(Circ. 186).*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 6 and *renumbered* as follows: 7.6.1 (latter part) as 6.2.1; 7.6.2 as 6.1; 7.6.3 as 6.2.2; 7.6.4 as 6.2.3; and 7.6.5 (including the notes) as 6.2.4.

7.~~6.6~~4.2 **Recommendation.—** Wind shear warnings for arriving aircraft and/or departing aircraft should be cancelled when aircraft reports indicate that wind shear no longer exists, or alternatively, after an agreed elapsed time. The criteria for the cancellation of a wind shear warning should be defined locally for each aerodrome, as agreed between the meteorological authority, the appropriate ATS authority and the operators concerned.

CHAPTER 8. AERONAUTICAL CLIMATOLOGICAL INFORMATION

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 7.

8.1 General provisions

Note.— In cases where it is impracticable to meet the requirements for aeronautical climatological information on a national basis, the collection, processing and storage of observational data may be effected through computer facilities available for international use, and the responsibility for the preparation of the required aeronautical climatological information may be delegated by agreement between the meteorological authorities concerned.

8.1.1 Aeronautical climatological information required for the planning of flight operations shall be prepared in the form of aerodrome climatological tables and aerodrome climatological summaries. Such information shall be supplied to aeronautical users as agreed between the meteorological authority and those users.

Note.— Climatological data required for aerodrome planning purposes are set out in Annex 14, Volume I, 3.1.3 and Attachment A.

8.1.2 **Recommendation.**— *Aeronautical climatological information should normally be based on observations made over a period of at least five years and the period should be indicated in the information supplied.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 7 and *renumbered* as follows: 8.1.3 as 2; and 8.1.4 as 1.

8.1.~~5~~3 **Recommendation.**— *Climatological data related to sites for new aerodromes and to additional runways at existing aerodromes should be collected starting as early as possible before the commissioning of those aerodromes or runways.*

8.2 Aerodrome climatological tables

~~8.2.1~~ **Recommendation.**— *Each Contracting State should make arrangements for collecting and retaining the necessary observational data and have the capability:*

a) *to prepare aerodrome climatological tables for each regular and alternate international aerodrome within its territory; and*

b) *to make available such climatological tables to an aeronautical user within a time period as agreed between the meteorological authority and that user.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 7 and *renumbered* as follows: 8.2.2 as 3.1.1; 8.2.3 as 3.1.2.

8.3 Aerodrome climatological summaries

~~8.3.1~~ **Recommendation**.— *Aerodrome climatological summaries should follow the procedures prescribed by the World Meteorological Organization. Where computer facilities are available to store, process and retrieve the information, the summaries should be published, or otherwise made available to aeronautical users on request. Where such computer facilities are not available, the summaries should be prepared using the models specified by the World Meteorological Organization, and should be published and kept up to date as necessary.*

Editorial Note.—	Paragraph 8.3.2 proposed to be moved to Part II, Appendix 6 and *renumbered* as 3.2.

8.4 Copies of meteorological observational data

Each meteorological authority, on request and to the extent practicable, shall make available to any other meteorological authority, to operators and to others concerned with the application of meteorology to international air navigation, meteorological observational data required for research, investigation or operational analysis.

CHAPTER 9. SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

Secretariat

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 8.

9.1 General provisions

9.1.1 Meteorological information shall be supplied to operators and flight crew members for:

a) pre-flight planning by operators;

b) in-flight re-planning by operators using centralized operational control of flight operations;

c) use by flight crew members before departure; and

d) aircraft in flight.

9.1.2 Meteorological information supplied to operators and flight crew members shall cover the flight in respect of time, altitude and geographical extent. Accordingly, the information shall relate to appropriate fixed times, or periods of time, and shall extend to ~~that~~ the aerodrome of intended landing~~ at which new information is to be supplied. On request, or whenever conditions impose doubt as to the practicability of landing at that aerodrome, additional information shall be included~~, also covering the meteorological conditions expected between the aerodrome of intended landing and one alternate aerodrome designated by the operator. In addition, if agreed between the meteorological authority and the operator, information up to a further aerodrome ~~may~~ shall be supplied.

9.1.3 Meteorological information supplied to operators and flight crew members shall include upper winds and upper-air temperatures, significant en-route weather phenomena, ~~meteorological reports, aerodrome forecasts~~METAR, SPECI, TAF, forecasts for take-off, landing forecasts, SIGMET information and those special air-reports not covered by a SIGMET, and AIRMET information, which are available at the meteorological office and which are relevant to the planned flight operations.

Editorial Note.—	Paragraph 9.1.4 proposed to be moved to Part II, Appendix 8 and *renumbered* as 1.3.

9.1.~~5~~4 Where necessary, the meteorological authority of the State providing service for operators and flight crew members shall initiate coordinating action with the meteorological authorities of other States with a view to obtaining from them the reports and/or forecasts required.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.1.6 as 1.1; and 9.1.7 as 1.2.

~~9.1.8~~9.1.5 Meteorological information shall be supplied to operators and flight crew members at the location to be determined by the meteorological authority, after consultation with the operators and at the time to be agreed upon between the meteorological office and the operator concerned. The service shall normally be confined to flights originating within the territory of the State concerned, unless otherwise agreed between the meteorological authority and the operator concerned. At an aerodrome without a meteorological office, arrangements for the supply of meteorological information shall be as agreed upon between the meteorological authority and the operator concerned.

9.2 Information for operators for pre-flight planning and for in-flight re-planning under centralized operational control

9.2.1 Meteorological information for pre-flight planning and in-flight re-planning by operators shall include the following information, as required:

a) current and forecast upper winds, and upper-air temperatures~~, tropopause heights and maximum wind information~~ and amendments thereto;

b) existing and expected significant en-route weather phenomena~~ and jetstream information~~ and amendments thereto;

c) a forecast for take-off;

d) ~~reports in the~~ METAR~~ code form~~ and, where available, ~~reports in the~~ SPECI~~ code form~~ for the aerodrome of departure, take-off and en-route alternate aerodromes, the aerodrome of intended landing and destination alternate aerodromes, as determined by regional air navigation agreement;

e) ~~aerodrome forecasts~~ TAF and amendments thereto for the aerodromes of departure and intended landing, and for take-off, en-route and destination alternate aerodromes as determined by regional air navigation agreement;~~ and~~

f) SIGMET information and appropriate special air-reports relevant to the whole of the routes concerned as determined by regional air navigation agreement~~.~~ and

Note.— Appropriate special air-reports will be those not already used in preparation of SIGMET messages.

g) AIRMET information for low-level flights.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows:
9.3.2 as 2.2; and
9.2.3 as 2.3.

~~9.2.4~~9.2.2 When upper-air information is supplied in chart form, it shall consist of charts for standard ~~isobaric surfaces and/or other types of upper-air charts as applicable~~flight levels.

Editorial Note.—	Paragraph 9.2.5 proposed to be moved to Part II, Appendix 8 and *renumbered* as 2.1.

~~9.2.6~~9.2.3 **Recommendation.—** *The upper wind and upper-air temperature information and the significant en-route weather information requested for pre-flight planning and in-flight re-planning by the operator should ~~normally~~ be supplied as soon as it becomes available, but not later than 3 hours before departure. Other meteorological information requested for pre-flight planning and in-flight re-planning by the operator should ~~normally~~ be supplied as soon as is practicable.*

9.3 Briefing, consultation and display

Note.— The requirements for the use of automated pre-flight information systems in providing briefing, consultation and display are given in ~~9.9~~9.5.

9.3.1 Briefing and/or consultation shall be provided, on request, to flight crew members and/or other flight operations personnel. Its purpose shall be to supply the latest available information on existing and expected meteorological conditions along the route to be flown, at the aerodrome of intended landing, alternate aerodromes and other aerodromes as relevant, either to explain and amplify the information contained in the flight documentation or, if so agreed between the meteorological authority and the operator, in lieu of flight documentation.

9.3.2 Meteorological information used for briefing and consultation shall include any or all of the information listed in 9.2.1.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.3.3 as 3.1; and 9.3.4 as 3.2.

~~9.3.5~~9.3.3 If the meteorological office expresses an opinion on the development of the meteorological conditions at an aerodrome which differs appreciably from the aerodrome forecast included in the flight documentation, the attention of flight crew members shall be drawn to the divergence. The portion of the briefing dealing with the divergence shall be recorded at the time of briefing and this record shall be made available to the operator.

~~9.3.6~~9.3.4 The required briefing, consultation, display and/or flight documentation shall normally be provided by the meteorological office associated with the aerodrome of departure. At an aerodrome where these services are not available, arrangements to meet the requirements of flight crew members shall be as agreed upon between the meteorological authority and the operator concerned. In exceptional circumstances, such as an undue delay, the meteorological office associated with the aerodrome shall provide or, if that is not practicable, arrange for the provision of a new briefing, consultation and/or flight documentation as necessary.

~~9.3.7~~9.3.5 **Recommendation.**— *The flight crew member or other flight operations personnel for whom briefing, consultation and/or flight documentation has been requested should visit the meteorological office at the time agreed upon between the meteorological office and the operator concerned. Where local circumstances at an aerodrome make personal briefing or consultation impracticable, the meteorological office should provide those services by telephone or other suitable telecommunications facilities.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.3.8 as 3.3.1; and 9.3.9 as 3.3.2.

9.4 Flight documentation ~~— general~~

Note .— The requirements for the use of automated preflight information systems in providing flight documentation are given in ~~9.9.~~9.5.

9.4.1 **Recommendation.—** *Flight documentation should cover the whole route to be flown and comprise information listed under 9.2.1 a) to b) and d) to g). ~~on:~~*

~~*a) upper winds and upper-air temperatures;*~~

~~*b) expected significant en-route weather phenomena and, if relevant, tropopause heights and jetstreams;*~~

~~*c) aerodrome forecasts;*~~

~~*d) reports in the METAR and SPECI code forms for destination aerodromrs and take-off, en-route and destination alternate aerodromes;*~~

~~*Note.— The requirement to specify take-off alternate aerodromes is given in Annex 6, Part I, 4.3.4.1.1.*~~

~~*e) SIGMET information and appropriate special air-reports to the whole of the route concerned; and*~~

~~*Note.— Appropriate special air-reports will be those not already used in the preparation of SIGMET messages.*~~

~~*f) AIRMET information for low-level flights.*~~

However, in accordance with regional air navigation agreement, or in the absence thereof when agreed between the meteorological authority and operator concerned, flight documentation for flights of two hours' duration or less, after a short stop or turnaround ~~may~~ should be limited to the information operationally needed, but in all cases the flight documentation should at least comprise information on 9.2.1 ~~c),~~ d), e), f) and, if appropriate, ~~f)~~g) above.

WAFSSG

9.4.2 **Recommendation.—** *Meteorological offices should, ~~as far as practicable,~~ provide information received within the framework of the world area forecast system for flight documentation. The flight documentation should be presented in the form of charts, tabular forms, or abbreviated plain-language texts. ~~Aerodrome forecasts~~ TAF should be presented ~~in the TAF code~~ in accordance with the template in Appendix 5, or in abbreviated plain-language text using a tabular presentation.*

Note.— Models of charts and forms for use in the preparation of flight documentation are given in Appendix 1. These models and methods for their completion are developed by the World Meteorological Organization on the basis of relevant operational requirements stated by the International Civil Aviation Organization.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.4.3 as 4.1.1.1; 9.4.4 as 4.1.1.2; 9.4.5 as 4.1.1.3; 9.4.6 as 4.1.2.1; 9.4.7 as 4.1.2.2; and *Delete* 9.4.8.

Secretariat

~~9.2.7~~9.4.3~~**Recommendation.—**~~Whenever it becomes apparent that the meteorological information to be included in the flight documentation will differ materially from that made available for pre-flight planning and in-flight re-planning, the operator ~~should~~ shall be advised immediately and, if practicable, be supplied with the revised information.

~~9.4.9~~9.4.4 **Recommendation**.— *Whenever necessary and possible, the flight documentation should be brought up to date, in writing or orally, before it is supplied to flight crew members. In cases where a need for amendment arises after the flight documentation has been supplied, and before take-off of the aircraft, the meteorological office should, as agreed locally, issue the necessary amendment or updated information to the operator or to the local air traffic services unit, for transmission to the aircraft.*

Editorial Note.—	Paragraph 9.4.10 proposed to be moved to Part II, Appendix 8 and *renumbered* as 4.1.3.

~~9.4.11~~9.4.5 **Recommendation**.— *The forms and charts included in flight documentation should be printed in English, French, Russian or Spanish; they should, wherever practicable, be completed in the language requested by the operator, preferably using one of those languages. Where appropriate, approved abbreviations should be used. The units employed for each element should be indicated; they should ~~normally be those employed by the meteorological authority concerned.~~ in accordance with Annex 5.*

~~9.4.12~~9.4.6 The meteorological authority shall retain information supplied to flight crew members, either as printed copies or in computer files, for a period of at least 30 days from the date of issue. This information shall be made available, on request, for inquiries or investigations and, for these purposes, shall be retained until the inquiry or investigation is completed.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.5.1 as 4.2.1.1; 9.5.2 as 4.2.1.2; and 9.5.3 as 4.2.2.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.6.1 as 4.3.1.1; 9.6.2 as 4.3.1.2; and 9.6.3 as 4.3.1.3.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.7.1 as 4.4.1.1; 9.7.2 as 4.4.1.2; 9.7.3 as 4.4.1.3; 9.7.4 as 4.4.3; and 9.7.5 as 4.4.2.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.8.1 as 4.3.2; 9.8.3 as 4.5.1; 9.8.4 as 4.5.2; and *Delete* 9.8.2.

9.~~9~~5 Automated pre-flight information systems for briefing, consultation, flight planning and flight documentation

9.~~9.1~~5.1 Where the meteorological authority uses automated pre-flight information systems to supply and display meteorological information to operators and flight crew members for self-briefing, flight planning and flight documentation purposes~~ in accordance with 9.1.6~~, the information supplied and displayed shall comply with the relevant provisions in 9.1 to 9.~~8~~4 inclusive.

9.~~9.2~~5.2 **Recommendation**.— *Automated pre-flight information systems providing for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned should be established by an agreement between the meteorological authority and the relevant civil aviation authority or the agency to which the authority to provide service has been delegated in accordance with Annex 15, 3.1.1 c).*

Note.— The meteorological and aeronautical information services information concerned is specified in Annex 3, 9.1 to 9.~~8~~4 and Annex 15, 8.1 and 8.2, respectively.

9.~~9.3~~5.3 Where automated pre-flight information systems are used to provide for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned, the meteorological authority concerned shall remain responsible for the quality control and quality management of meteorological information provided by means of such systems in accordance with Chapter 2, 2.2.2.

Note.— The responsibilities relating to aeronautical information services information and the quality assurance of the information are given in Annex 15, Chapter 3.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.9.4 as 5.1; and 9.9.5 as 5.2.

9.~~10~~6 Information for aircraft in flight

9.~~10.1~~6.1 Meteorological information for use by aircraft in flight shall be supplied by a meteorological office to its associated air traffic services unit and through D-VOLMET or VOLMET broadcasts. Meteorological information for planning by the operator for aircraft in flight shall be supplied on request, as agreed between the meteorological authority or authorities and the operator concerned.

9.~~10.2~~6.2 Meteorological information for use by aircraft in flight shall be supplied to air traffic services units in accordance with the specifications of Chapter 10.

9.~~10.3~~6.3 ~~**Recommendation**.—~~ Meteorological information ~~should~~ shall be supplied through D-VOLMET or VOLMET broadcasts as determined by regional air navigation agreement, and in accordance with the specifications of Chapter 11.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 8 and *renumbered* as follows: 9.10.4 as 6.1; 9.10.5 as 6.3; and 9.10.6 as 6.2.

CHAPTER 10. INFORMATION FOR AIR TRAFFIC SERVICES, SEARCH AND RESCUE SERVICES AND AERONAUTICAL INFORMATION SERVICES

Secretariat

Note. — Technical specifications and detailed criteria related to this Chapter are given in Appendix 9.

10.1 Information for air traffic services units

10.1.1 The meteorological authority shall designate a meteorological office to be associated with each air traffic services unit. The associated meteorological office shall, after coordination with the air traffic services unit, supply, or arrange for the supply of up-to-date meteorological information to the unit as necessary for the conduct of its functions.

10.1.2 R**ecommendation**.— *The associated meteorological office for an aerodrome control tower or approach control office should be an aerodrome meteorological office.*

10.1.3 The associated meteorological office for a flight information centre or an area control centre shall be a meteorological watch office.

10.1.4 **Recommendation**.— *Where, owing to local circumstances, it is convenient for the duties of an associated meteorological office to be shared between two or more meteorological offices, the division of responsibility should be determined by the meteorological authority in consultation with the appropriate ATS authority.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 9 and *renumbered* as follows: 10.1.5 as 1.1; 10.1.6 as 1.2; 10.1.7 as 1.3; 10.1.8 as 1.4.1; and 10.1.9 as 1.4.2.

~~10.1.10~~10.1.5 Any meteorological information requested by an air traffic services unit in connexion with an aircraft emergency shall be supplied as rapidly as possible.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 9 and *renumbered* as follows: 10.1.11 as 1.5; 10.1.12 as 1.6; 10.1.13 as 1.7.1; and 10.1.14 as 1.7.2.

10.2 Information for search and rescue services units

~~10.2.1~~ Meteorological offices designated by the meteorological authority in accordance with regional air navigation agreement shall supply search and rescue services units with the meteorological information they require in a form established by mutual agreement. For that purpose, the designated meteorological office shall maintain liaison with the search and rescue services unit throughout a search and rescue operation.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 9 and *renumbered* as follows: 10.2.2 as 2.1; 10.2.3 as 2.2.1; 10.2.4 as 2.2.2; and 10.2.5 as 2.2.3.

10.3 Information for aeronautical information services units

~~10.3.1 **Recommendation**~~.— The meteorological authority, in coordination with the appropriate civil aviation authority, ~~should~~ shall arrange for the supply of up-to-date meteorological information to relevant aeronautical information services units, as necessary, for the conduct of their functions.

Editorial Note.—	Paragraph 10.3.2 proposed to be moved to Part II, Appendix 9 and *renumbered* as 3.1.

CHAPTER 11. REQUIREMENTS FOR AND USE OF COMMUNICATIONS

Secretariat

Note 1.— Technical specifications and detailed criteria related to this Chapter are given in Appendix 10.

~~*Introductory*~~ *Note 2.— It is recognized that it is for each Contracting State to decide upon its own internal organization and responsibility for implementing the telecommunications facilities referred to in this Chapter.*

11.1 Requirements for communications

11.1.1 Suitable telecommunications facilities shall be made available to permit aerodrome meteorological offices and, as necessary, aeronautical meteorological stations to supply the required meteorological information to air traffic services units on the aerodromes for which those offices and stations are responsible, and in particular to aerodrome control towers, approach control offices and the aeronautical telecommunications stations serving these aerodromes.

Editorial Note.— Note moved from 11.1.10.

Note.— Circuits of the aeronautical fixed service are used for the collection and regional and inter-regional exchanges of operational meteorological information as well as for access to international operational meteorological data banks. Three aeronautical fixed service satellite distribution systems providing for global coverage are used to support the regional and inter-regional exchanges of operational meteorological information. Provisions relating to the satellite distribution systems are given in Annex 10, Volume III, Part 1, 10.1 and 10.2.

11.1.2 Suitable telecommunications facilities shall be made available to permit meteorological watch offices to supply the required meteorological information to air traffic services and search and rescue services units in respect of the flight information regions, control areas and search and rescue regions for which those offices are responsible, and in particular to flight information centres, area control centres and rescue coordination centres and the associated aeronautical telecommunications stations.

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11.1.3 Suitable telecommunications facilities shall be made available to permit world ~~and regional~~ area forecast centres to supply the required world area forecast system products to meteorological offices, meteorological authorities and other users.

Editorial Note.— Paragraph 11.1.4 proposed to be moved to Part II, Appendix 10 and *renumbered* as follows:
11.1.4 as 2.2.1.

~~11.1.5~~11.1.4 Telecommunications facilities between meteorological offices and, as necessary, aeronautical meteorological stations and aerodrome control towers or approach control offices shall permit communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds.

~~11.1.6~~11.1.5 **Recommendation.—** *Telecommunications facilities between meteorological offices and flight information centres, area control centres, rescue coordination centres and aeronautical telecommunications stations should permit:*

a) communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds; and

b) printed communications, when a record is required by the recipients; the message transit time should not exceed 5 minutes.

Note.— In 11.1.~~5~~4 and ~~11.1.6~~11.1.5 "approximately 15 seconds" refers to telephony communications involving switchboard operation and "5 minutes" refers to printed communications involving retransmission.

~~11.1.7~~11.1.6 **Recommendation.—** *The telecommunications facilities required in accordance with 11.1.~~5~~4 and 11.1.~~6~~5 should be supplemented, as and where necessary, by other forms of visual or audio communications, for example, closed-circuit television or separate information processing systems.*

~~11.1.8~~11.1.7 **Recommendation.—** *As agreed between the meteorological authority and operators, provision should be made to enable operators to establish suitable telecommunications facilities for obtaining meteorological information from aerodrome meteorological offices or other appropriate sources.*

~~11.1.9~~11.1.8 Suitable telecommunications facilities shall be made available to permit meteorological offices to exchange operational meteorological information with other meteorological offices.

~~11.1.10~~11.1.9 **Recommendation.—** *The telecommunication facilities used for the exchange of operational meteorological information should be the aeronautical fixed service.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows: 11.1.11 as 1.1; 11.1.12 as 1.2.1; and 11.1.13 as 1.2.2.

11.2 Use of aeronautical fixed service communications — meteorological bulletins in alphanumeric format

~~11.2.1~~ Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service shall be originated by the appropriate meteorological office or aeronautical meteorological station.

Note .— Meteorological bulletins containing operational meteorological information authorized for transmission via the aeronautical fixed service are listed in Annex 10, Volume II, Chapter 4, together with the relevant priorities and priority indicators.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows: 11.2.2 as 2.1.1; 11.2.3 as 2.1.2; 11.2.4 as 2.1.3; and 11.2.5 as 2.1.4.

11.3 Use of aeronautical fixed service communications — world area forecast system products

~~11.3.1~~ **Recommendation.—** *World area forecast system products in ~~grid point or chart forms~~ digital form should be transmitted using binary data communications ~~or digital facsimile~~ techniques. The method and channels used for the dissemination of the products should be as determined by regional air navigation agreement.*

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows: 11.3.2 as 2.2.2; 11.3.3 as 2.2.3; and 11.3.4 as 2.2.4.

11.4 Use of aeronautical mobile service communications

The content and format of meteorological information transmitted to aircraft and by aircraft shall be consistent with the provisions of this Annex.

Editorial Note.—	The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows: 11.4.1 as 3.1.1; 11.4.2 as 3.1.2; and 11.4.3 as 3.2.

11.5 Use of aeronautical data link service — contents of D-VOLMET

~~11.5.1~~ D-VOLMET shall contain current ~~reports in the~~ METAR and SPECI ~~code forms~~, together with trend forecasts where available, ~~aerodrome forecasts~~TAF and SIGMET ~~messages,~~ special air-reports not covered by a SIGMET and, where available, AIRMET ~~messages~~.

Note.— The requirement to provide ~~current reports in the~~ METAR and SPECI ~~code forms~~ may be met by the data link flight information service (D-FIS) application entitled "Data link-~~Aviation~~aerodrome routine ~~weather~~meteorological report (D-METAR) service"; the requirement to provide ~~aerodrome forecasts~~TAF may be met by the D-FIS application entitled "Data link-Aerodrome forecast (D-TAF) service"; and the requirement to provide SIGMET and AIRMET messages may be met by the D-FIS application entitled "Data link-SIGMET (D-SIGMET) service". The details of these data link services are specified in the Manual of Air Traffic Services Data Link Applications (Doc 9694).

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows:
11.5.2 as 4.1.1 ;
11.5.3 as 4.1.2;
11.5.4 as 4.2.1;
11.5.5 as 4.2.2;
11.5.6 as 4.2.3; and
11.5.7 as 4.3.

11.6 Use of aeronautical broadcasting service — contents of VOLMET broadcasts

~~11.6.1~~11.6.1 Continuous VOLMET broadcasts, normally on very high frequencies (VHF), shall contain current ~~reports in the~~ METAR and SPECI ~~code forms~~, together with trend forecasts where available.

~~11.6.2~~11.6.2 Scheduled VOLMET broadcasts, normally on high frequencies (HF), shall contain current ~~reports in the~~ METAR and SPECI ~~code forms~~, with trend ~~parts~~ forecasts where available and, where so determined by regional air navigation agreement, ~~aerodrome forecasts~~ TAF and SIGMET.

Editorial Note.— The following paragraphs proposed to be moved to Part II, Appendix 10 and *renumbered* as follows:
11.6.3 as 5.1.1;
11.6.4 as 5.2.1;
11.6.5 as 5.2.2;
11.6.6 as 5.1.2;
11.6.7 as 5.3.1; and
11.6.8 as 5.3.2.

Editorial Note.—	Appendix 1 proposed to be moved to Part II as Appendix 1 Appendix 2 proposed to be moved to Part II as part of Appendix 3 Appendix 3 proposed to be moved to Part II as part of Appendix 4 Appendix 4 proposed to be moved to Part II as part of Appendix 5 Appendix 5 proposed to be moved to Part II as part of Appendix 6.

Editorial Note.—	Attachments A to E proposed to be moved to Part II

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INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

PART II — *Appendices and Attachments to Annex 3*

APPENDIX 1. FLIGHT DOCUMENTATION — MODEL CHARTS AND FORMS

[Not available.
To be updated by appropriate WMO bodies for inclusion in Amendment 73 to Annex 3]

WAFSSG

APPENDIX 2. TECHNICAL SPECIFICATIONS RELATED TO WORLD AREA FORECAST SYSTEM AND METEOROLOGICAL OFFICES

(See Chapter 3 of this Annex)

1. WORLD AREA FORECAST SYSTEM

1.1 Formats and codes

~~3.2.9~~ WAFCs shall adopt uniform formats and codes for the supply of forecasts and amendments.

1.2 Upper-air wind, temperature and humidity information

~~3.2.3~~1.2.1 ~~**Recommendation.—**~~The forecasts of upper winds ~~and~~; upper-air temperatures; ~~;~~ and humidity; direction, speed and height of maximum winds and tropopause heights and temperatures prepared four times daily by a WAFC ~~should~~ shall be valid for 6, 12, 18, 24, 30 and 36 hours after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based and ~~should~~ shall be available for start of transmission in the above order ~~as soon as technically feasible but~~ not later than 6 hours after standard time of observation.

~~3.2.7~~1.2.2 **Recommendation.—** *The grid point forecasts prepared by a WAFC should comprise:*

a) *wind and temperature data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 300 (300 hPa), 340 (250 hPa), 390 (200 hPa) and 450 (150 hPa);*

b) *tropopause height and temperature, and direction, speed and height of maximum wind;*

~~*d)*~~*c)* *humidity data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa) and 180 (500 hPa)~~.~~ ;and*

d) *wind and temperature data for flight levels 530 (100 hPa) and 600 (70 hPa) when and where required~~; and~~.*

~~*d) humidity data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa) and 180 (500 hPa).*~~

~~3.2.10~~1.2.3 ~~**Recommendation.—**~~The foregoing grid point forecasts ~~of upper winds, upper-air temperatures, direction, speed and height of maximum winds and tropopause heights should~~ shall be issued by a WAFC in binary code form using the GRIB code form prescribed by WMO.

Note 1.— The GRIB code form is contained in WMO Publication No. 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

Note 2.— WAFCs continue to issue forecasts of upper-air wind and temperature in chart form in accordance with regional air navigation plans until 1 July 2005.

~~3.2.8~~1.2.4 ~~**Recommendation.—**~~ The foregoing grid point forecasts ~~of upper winds and upper-air temperatures, direction, speed and height of maximum winds and tropopause heights should~~ shall be prepared by a WAFC in a fixed grid with a horizontal resolution of 140 km.

Note.— 140 km represents a distance of about 1.25E of latitude.

1.3 Significant weather information

~~3.2.4~~1.3.1 ~~**Recommendation.—**~~Forecasts of significant weather phenomena prepared by WAFCs ~~should~~ shall be issued four times a day for fixed valid times of 0000, 0600, 1200 and 1800 UTC. The transmission of each forecast ~~should~~ shall be completed as soon as technically feasible but ~~at least nine hours before its validity time when issued in chart form and~~ at least twelve hours before its validity time ~~when issued in the BUFR code form~~.

~~3.2.5~~1.3.2 ~~**Recommendation.—** When the f~~ Forecasts of significant weather phenomena ~~are~~ shall be issued in binary code form, using the BUFR code form ~~should be used~~ prescribed by WMO.

Note 1.— The BUFR code form is contained in WMO Publication No 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

Note 2.— WAFCs continue to issue forecasts of significant weather in chart form in accordance with regional air navigation plans until 1 July 2005.

~~3.2.6~~ 1.3.3~~**Recommendation.—**~~ Forecasts of significant weather phenomena ~~should~~shall include all the items listed in ~~9.6.1~~Appendix 8, 4.3.1.1. ~~When t~~The forecasts ~~are issued in chart form or in the BUFR code form, they should be in agreement with the specifications in 3.3.7~~shall be issued for the following flight levels: ~~3.3.7 **Recommendation.** — The significant weather charts should include the phenomena listed in 9.6.1 between:~~

a) between flight levels 250 ~~and~~ to 630; and

b) between flight levels 100 to ~~and~~ 250 for limited geographical areas, as determined by regional air navigation agreement. If the average elevation of the topography of the area could extend a significant topographical effect to flight level 100, a higher level should be specified for the base of the charts, in consultation with the ~~RAFC or~~ WAFC concerned, and in accordance with regional air navigation agreement.

~~3.2.15~~1.3.4 **Recommendation.—** *Amendments to forecasts of significant weather phenomena should be issued with the minimum possible delay in accordance with the criteria in ~~3.2.13~~1.4 below and supplied in the form of ~~abbreviated plain-language messages~~amended BUFR files.*

~~*Note.— Guidance on the preparation of abbreviated plain- language significant weather forecast messages is given in Attachment A.*~~

1.4 Criteria for amendments to WAFS products

~~3.2.13~~**Recommendation.—** *WAFCs should apply the following criteria for the amendment of significant en-route weather forecasts:*

~~*Aircraft icing and turbulence*~~:

~~*Newly expected occurrence; error in expected position of phenomena; intensity increasing; intensity decreasing from severe to light or nil, or from moderate to nil.*~~

~~*Jet streams:*~~

~~*Newly expected occurrence or disappearance; error in expected position > 400 km; error in speed > 20 per cent; error in core height > 900 m (3 000 ft)*~~.

~~*Other significant en-route weather phenomena, and any new information concerning*~~

~~*Newly expected occurrence; no longer expected*~~.

SWH forecasts:

turbulence, and occasional, frequent or embedded cumulonimbus

Newly expected, occurrence or non-occurrence

SWM forecasts:

aircraft icing, turbulence, cumulonimbus, and sandstorms/duststorms

Newly expected occurrence or non-occurrence

~~*v*~~*Volcanic eruptions or the accidental release of radioactive materials into the atmosphere, of significance to aircraft operations*

Inclusion or removal of volcanic activity symbol, or radiation symbol.

2. METEOROLOGICAL OFFICES

2.1 Use of WAFS products

~~3.4.5~~2.1.1 The extent to which an aerodrome meteorological office prepares forecasts and/or makes use of products from WAFCs ~~and/or RAFCs~~ and other sources shall be determined by the meteorological authority concerned.

3.~~4.7~~2.1.2 **Recommendation.—** *Aerodrome meteorological offices should use ~~as far as practicable~~ output products of the world area forecast system in the preparation of flight documentation.*

2.1.3 In order to ensure uniformity and standardization of flight documentation, the WAFS GRIB and BUFR data received shall be decoded into standard WAFS charts in accordance with relevant provisions in this Annex, and the content and identification of the originator of the WAFS forecasts shall not be amended.

2.2 Notification of WAFC concerning significant discrepancies

~~3.4.6~~ Meteorological offices using WAFS GRIB and/or BUFR data ~~and/or WAFS forecast charts~~ shall notify the WAFC ~~and RAFC~~ concerned immediately if significant discrepancies in accordance with ~~3.2.12, 3.2.13 and 3.3.10~~ 1.4 are detected or reported in respect of WAFS data and products. The WAFC receiving the message shall acknowledge its receipt to the originator, together with a brief comment on the report and any action taken, using the same means of communication employed by the originator. If it is considered necessary to issue an amendment, an appropriate ADMIN message shall be transmitted to all users through satellite broadcasts. There is no requirement for meteorological offices to report incidents of radiological emergencies

Note: — Guidance on reporting significant discrepancies is provided in the Manual of Aeronautical Meteorological Practice *(Doc 8896)*

3. METEOROLOGICAL WATCH OFFICES

3.1 Use of WAFS products

~~3.5.3~~ The extent to which a meteorological watch office makes use of products from WAFCs ~~and/or RAFCs~~ and other sources shall be determined by the meteorological authority concerned.

4. VOLCANIC ASH ADVISORY CENTRES (VAAC)

4.1 Volcanic ash advisory information

METLINKSG

~~3.6.2~~4.1.1 **Recommendation.—** *The advisory information on volcanic ash issued in abbreviated plain language, using approved ICAO abbreviations and numerical values of self-explanatory nature, should ~~comprise the following in the order indicated:~~ be in accordance with the template shown in Table A2-1. When no approved ICAO abbreviations are available, English plain language text, to be kept to a minimum, should be used.*

Editorial Note.— Delete items 1 to 18 and Notes 1 to 4 and *insert* new text as follows:

Table A2-1. Template for advisory message for volcanic ash

Key:	M	=	inclusion mandatory, part of every message;
	O	=	inclusion optional;
	=	=	a double line indicates that the text following it should be placed on the subsequent line

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for volcanic ash are shown in Appendix 6, Table A6-4.

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes *(PANS-ABC, Doc 8400).*

Note 3.— Inclusion of a "colon" after each element heading and insertion of a "return" between items 7 and 8; 13 and 14; and 16 and 17 are mandatory.

Note 4.— The numbers 1 to 18 are included only for clarity and they are not part of the advisory message, as shown in the example.

Element		*Detailed content*	*Template*		*Examples*	
1	Identification of the type of message (M)	Type of message	VOLCANIC ASH ADVISORY		VOLCANIC ASH ADVISORY	
2	Year, date and time of origin (M)	Year month date time in UTC *or* date month year time in UTC	ISSUED:	nnnnnnnn/nnnnZ *or* nn*month*[1]nnnn/nnnnZ	ISSUED: ISSUED:	20000402/0700Z 02APR2000/0700Z
3	Name of VAAC (M)	Name of VAAC	VAAC:	nnnnnnnnnnnn	VAAC:	TOKYO
4	Name of volcano (M)	Name and IAVCEI[2] number of volcano	VOLCANO:	nnnnnnnnnnnnnnnnnnnnn [nnnnnn] *or* UNKNOWN *or* UNNAMED	VOLCANO: VOLCANO:	USUZAN 805-03 UNNAMED
5	Location of volcano (M)	Location of volcano in degrees and minutes	LOCATION:	Nnnnn *or* Snnnn Wnnnnn *or* Ennnnn *or* UNKNOWN *or* UNNAMED	LOCATION: LOCATION:	N4230 E14048 UNKNOWN
6	State or region (M)	State, or region if ash is not reported over a State	AREA:	nnnnnnnnnnnnnnnn	AREA:	JAPAN
7	Summit elevation (M)	Summit elevation in m (or ft)	SUMMIT ELEVATION:	nnnnM (*or* nnnnnFT)	SUMMIT ELEVATION:	732M
8	Advisory number (M)	Advisory number: year in full and message number (separate sequence for each volcano)	ADVISORY NUMBER:	nnnn/nnnn	ADVISORY NUMBER:	2000/432
9	Information source (M)	Information source using free text	INFORMATION SOURCE:	*free text up to 32 characters*	INFORMATION SOURCE:	GMS-JMA
10	Colour code (O)	Aviation colour code	AVIATION COLOUR CODE:	RED *or* ORANGE *or* YELLOW *or* GREEN *or* UNKNOWN *or* NOT GIVEN *or* NIL	AVIATION COLOUR CODE:	RED
11	Eruption details (M)	Eruption details (including date/time of eruption(s))	ERUPTION DETAILS:	free text *up to 64 characters* *or* UNKNOWN	ERUPTION DETAILS:	ERUPTED 20000402/0641Z ERUPTION OBS ASH TO ABV FL300
12	Time of observation of ash (M)	Date and time (in UTC) of observation of volcanic ash	OBS ASH DATE/TIME:	nn/nnnnZ	OBS ASH DATE/TIME:	02/0645Z

Element		*Detailed content*	*Template*		*Examples*	
13	Observed ash cloud (M)	Horizontal (in degrees an minutes) and vertical extent of the observed ash cloud or, if the base is unknown, the top of the observed ash cloud; movement of the observed ash cloud	OBS ASH CLOUD:	TOP FLnnn *or* SFC/FLnnn *or* FLnnn/nnn Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][3] TOP FLnnn *or* SFC/FLnnn *or* FLnnn/nnn MOV N nnKMH (*or* KT) *or* MOV NE nnKMH (*or* KT) *or* MOV E nnKMH (*or* KT) *or* MOV SE nnKMH(*or* KT) *or* MOV S nnKMH (*or* KT) *or* MOV SW nnKMH(*or* KT) *or* MOV W nnKMH (*or* KT) *or* MOV NW nnKMH (*or* KT)[4] *or*[4] ASH NOT IDENTIFIABLE FROM SATELLITE DATA WINDS FLnnn/nnn nnn/nn[n] KMH (KT)[3]	OBS ASH CLOUD:	FL150/350 N4230 E14048 - N4300 E14130 - N4246 E14230 - N4232 E14150 - N4230 E14048 SFC/FL150 MOV NE 25KT FL150/350 MOV E 30KT TOP FL240 MOV W 40KMH
14	Forecast height and position of the ash clouds (+ 6 HR) (M)	Date and time (in UTC) (6 hours from the "Time of observation of ash" given in Item 12 above); Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+6HR:	nn/nnnnZ SFC *or* FLnnn/[FL]nnn Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][3] *or* NO ASH EXP	FCST ASH CLOUD+6HR:	02/1245Z SFC/FL200 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL200/350 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL350/600 NO ASH EXP
15	Forecast height and position of the ash clouds (+12 HR) (M)	Date and time (in UTC) (12 hours from the "Time of observation of ash" given in Item12 above); Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+12HR:	nn/nnnnZ SFC *or* FLnnn/[FL]nnn Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][3] *or* NO ASH EXP	FCST ASH CLOUD+12HR:	02/1845Z SFC/FL300 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL300/600 NO ASH EXP

Element		*Detailed content*	*Template*		*Examples*	
16	Forecast height and position of the ash clouds (+18 HR) (M)	Date and time (in UTC) (18 hours from the "Time of observation of ash" given in Item 12 above); Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+18HR:	nn/nnnnZ SFC *or* FLnnn/[FL]nnn Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][3] *or* NO ASH EXP	FCST ASH CLOUD+18HR:	03/0045Z SFC/FL600 NO ASH EXP
17	Next advisory (M)	Year, month, date and time in UTC *or* date month year time in UTC of issuance of next advisory	NEXT ADVISORY:	nnnnnnnn/nnnnZ *or* nn*month*[1]nnn/nnnnZ *or* NO LATER THAN nnnnnnnn/nnnnZ *or* nn*month*[1]nnnn/nnnnZ *or* NO FURTHER ADVISORIES *or* WILL BE ISSUED BY nnnnnnnn/nnnnZ *or* nn*month*[1]nnnn/nnnnZ	NEXT ADVISORY:	20000402/1300Z
18	Remarks (M)	Remarks, as necessary	REMARKS:	*Free text up to 256 characters* *or* NIL	REMARKS:	ASH CLD CAN NO LONGER BE DETECTED ON SATELLITE IMAGE

Notes. —

1. Use abbreviations for months of the year from the PANS-ABC (Doc 8400), for example, "JAN";
2. International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI);
3. Up to 4 selected layers; and
4. If ash reported (e.g. AIREP) but not identifiable from satellite data.

End of new text.

Editorial Note.— Example from Appendix 5 to Annex 3.

Example A2-1. Advisory message for ~~VA~~ volcanic ash

VOLCANIC ASH ADVISORY
ISSUED: 20000402/0700Z
VAAC: TOKYO
VOLCANO: USUZAN 805-03
LOCATION: N4230 E14048

AREA:	JAPAN
SUMMIT ELEVATION:	732M
ADVISORY NUMBER:	2000/432
INFORMATION SOURCE:	GMS JMA
AVIATION COLOUR CODE:	RED
ERUPTION DETAILS:	ERUPTED 20000402/0614Z ERUPTION OBS ASH TO ABV FL300
OBS ASH DATE/TIME:	02/0645Z
OBS ASH CLD:	FL150/350 N4230 E14048 – N4300 E14130 – N4246 E14230 – N4232 E14150 – N4230 E14048 SFC/FL150 MOV NE 25KT FL150/350 MOV E 30KT
FCST ASH CLD + 6 HR:	02/1245Z SFC/FL200 N4230 E14048 – N4232 E14150 – N4238 E14300 – N4246 E14230 FL200/350 N4230 E14048 – N4232 E14150 N4238 E14300 – N4246 E14230 FL350/600 NO ASH EXP
FCST ASH CLD + 12 HR:	02/1845Z SFC/FL300 N4230 E14048 – N4232 E14150 – N4238 E14300 – N4246 E14230 FL300/600 NO ASH EXP
FCST ASH CLD + 18 HR:	03/0045Z SFC/FL600 NO ASH EXP
NEXT ADVISORY:	20000402/1300Z
REMARKS:	ASH CLD CAN NO LONGER BE DETECTED ON SATELLITE IMAGE

VAWSG

~~3.6.3~~4.1.2 **Recommendation.—** *The volcanic ash advisory information listed in ~~3.6.2~~ Table A2-1, when issued in graphical format should be as specified in Appendix1. When issued in binary format the BUFR code form should be used.*

Note.— The BUFR code form is contained in WMO Publication No 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

5. VOLCANO OBSERVATORIES

5.1 Information from volcano observatories

Recommendation.— *The information required to be sent by volcano observatories to their associated ACCs, MWO and VAAC should comprise for:*

a) significant pre-eruption volcanic activity: the date/time (UTC) of report; name and, if known, number of the volcano; location (latitude/longitude) and; description of volcanic activity;

b) volcanic eruption: the date/time (UTC) of report and time of eruption (UTC) if different from time of report; name and, if known, number of the volcano; location (latitude/longitude); and description of the eruption including whether an ash column was ejected and, if so, an estimate of height of ash column and the extent of any visible volcanic ash cloud, during and following an eruption.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

METLINKSG

6. TROPICAL CYCLONE ADVISORY CENTRES (TCAC)

6.1 Tropical cyclone advisory information

~~3.7.2~~6.1.1 **Recommendation.—** *The advisory information on tropical cyclones should ~~comprise the following in the order indicated:~~ be in accordance with the template shown in Table A2-2.*

Editorial Note: — Delete items 1 to 16 and Notes 1 to 2.

Editorial Note: — Insert new text as follows:

Table A2-2. Template for advisory message for tropical cyclones

Key: = = a double line indicates that the text following it should be placed on the subsequent line

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for volcanic ash are shown in Appendix 6, Table A6-4.

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Note 3.— All the elements are mandatory.

Note 4.— Inclusion of a "colon" after each element heading is mandatory.

Note 5.— The numbers 1 to 16 are included only for clarity and they are not part of the advisory message, as shown in the example.

Element		*Detailed content*	*Template*		*Examples*	
1	Identification of the type of message	Type of message	TC ADVISORY		TC ADVISORY	
2	Year, date and time of origin	Year, month, date time in UTC of issue	DTG:	nnnnnnnn/nnnnZ	DTG:	20040925/1600Z
3	Name of TCAC	Name of TCAC (location indicator or full name)	TCAC:	nnnn *or* nnnnnnnnnn	TCAC: TCAC:	YUFO[1] MIAMI

Element		*Detailed content*	*Template*		*Examples*	
4	Name of tropical cyclone	Name of tropical cyclone	TC:	nnnnnnnnnnnn	TC:	GLORIA
5	Advisory number	Advisory number (starting with “01” for each cyclone)	NR:	nn	NR:	1
6	Position of the centre	Position of the centre of the tropical cyclone (in degrees and minutes)	PSN:	Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]	PSN:	N2706 W07306
7	Direction and speed of movement	Direction and speed of movement respectively to at least eight compass points in km/h (or kt), or stationary	MOV:	N nnKMH (*or* KT) *or* NE nnKMH (*or* KT) *or* E nnKMH (*or* KT) *or* SE nnKMH (*or* KT) *or* S nnKMH (*or* KT) *or* SW nnKMH (*or* KT) *or* W nnKMH (*or* KT) *or* NW nnKMH (*or* KT) *or* STNR	MOV:	NW 20KMH
8	Central pressure	Central pressure (in hPa)	C:	nnnHPA	C:	965HPA
9	Maximum surface wind	Maximum surface wind near the centre (mean over 10 minutes, in km/h (or kt))	MAX WIND:	nn[n]KMH (*or* nn[n]KT)	MAX WIND:	90KMH
10	Forecast of centre position (+12 HR)	Date and time (in UTC) (12 hours from the “DTG” given in Item 2 above); Forecast position (in degrees and minutes) of the centre of the tropical cyclone	FCST PSN +12 HR:	nnnnnn Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]	FCST PSN +12 HR:	260400 N2830 W07430
11	Forecast of maximum surface wind (+12 HR)	Forecast of maximum surface wind (12 hours after the “DTG” given in Item 2 above)	FCST MAX WIND +12 HR:	nn[n]KMH (*or* nn[n]KT)	FCST MAX WIND +12 HR:	90KMH

	Element	*Detailed content*	*Template*		*Examples*	
12	Forecast of centre position (+18 HR)	Date and time (in UTC) (18 hours from the "DTG" given in Item 2 above); Forecast position (in degrees and minutes) of the centre of the tropical cyclone	FCST PSN +18 HR:	nnnnnn Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]	FCST PSN +18 HR:	261000 N2852 W07500
13	Forecast of maximum surface wind (+18 HR)	Forecast of maximum surface wind (18 hours after the "DTG" given in Item 2 above)	FCST MAX WIND +18 HR:	nn[n]KMH (*or* nn[n]KT)	FCST MAX WIND +18 HR:	85KMH
14	Forecast of centre position (+24 HR)	Date and time (in UTC) (24 hours from the "DTG" given in Item 2 above); Forecast position (in degrees and minutes) of the centre of the tropical cyclone	FCST PSN +24 HR:	nnnnnn Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]	FCST PSN +24 HR:	261600 N2912 W07530
15	Forecast of maximum surface wind (+24 HR)	Forecast of maximum surface wind (24 hours after the "DTG" given in Item 2 above)	FCST MAX WIND +24 HR:	nn[n]KMH (*or* nn[n]KT)	FCST MAX WIND +24 HR:	80KMH
16	Expected time of issuance of next advisory	Expected year, month, date and time (in UTC) of issuance of next advisory	NXT MSG:	[BFR] nnnnnnnn/nnnnZ *or* NO MSG EXP	NXT MSG:	20040925/2000Z

Notes. —

1. Fictitious location.

End of new text.

Editorial Note.— Example from Appendix 5 to Annex 3.

Example A2-2. Advisory message for ~~TC~~ tropical cyclones

TC ADVISORY

DTG:	19970925/1600Z
TCAC:	YUFO
TC:	GLORIA
NR:	01
PSN:	N2706 W07306
MOV:	NW 20KMH
C:	965HPA
MAX WIND:	90KMH
FCST PSN + 12 HR:	260400 N2830 W07430
FCST MAX WIND + 12 HR:	90KMH
FCST PSN + 18 HR:	261000 N2852 W07500
FCST MAX WIND + 18 HR:	85KMH
FCST PSN + 24 HR:	261600 N2912 W07530
FCST MAX WIND + 24 HR:	80KMH
NXT MSG:	19970925/2000Z

VAWSG

6.1.2 **Recommendation.—** *When the tropical cyclone advisory information is issued in binary format, the BUFR code form should be used.*

Note.— The BUFR code form is contained in WMO Publication No 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

Secretariat

APPENDIX 3. TECHNICAL SPECIFICATIONS ~~FOR LOCAL ROUTINE REPORTS, LOCAL SPECIAL REPORTS AND REPORTS IN THE METAR/SPECI CODE FORMS~~ RELATED TO METEOROLOGICAL OBSERVATIONS AND REPORTS

(See Chapter 4 of this Annex)

1. GENERAL PROVISIONS RELATED TO METEOROLOGICAL OBSERVATIONS

~~4.1.4~~.1.1 **Recommendation.—** *The meteorological instruments used at an aerodrome should be situated in such a way as to supply data which are representative of the area for which the measurements are required.*

Note.— Specifications concerning the siting and construction of equipment and installations on operational areas, aimed at reducing the hazard to aircraft to a minimum, are contained in Annex 14, Volume I, Chapter 8.

~~4.1.5~~1.2 **Recommendation.—** *Meteorological instruments at aeronautical meteorological stations should be exposed, operated and maintained in accordance with the practices, procedures and specifications promulgated by the World Meteorological Organization.*

~~4.1.6~~1.3 **Recommendation.—** *The observers at an aerodrome should be located, in so far as is practicable, so as to supply data which are representative of the area for which the observations are required.*

~~4.1.7~~1.4 **Recommendation.—** *Each Contracting State should arrange for its aeronautical meteorological stations to be inspected at sufficiently frequent intervals to ensure that a high standard of observations is maintained, that instruments and all their indicators are functioning correctly, and to check whether the exposure of the instruments has changed significantly.*

~~4.1.11~~1.5 **Recommendation.—** *Where ~~automatic observing~~ automated equipment forms part of an integrated semi-automatic observing system, displays of data which are made available to the local ATS units should be a subset of and displayed parallel to those available in the local meteorological service unit. In those displays, each meteorological element should be annotated to identify, as appropriate, the locations for which the element is representative.*

AMOSSG

2. GENERAL CRITERIA RELATED TO METEOROLOGICAL REPORTS

2.1 Format of meteorological reports

2.1.1 Local routine and special reports shall be issued in abbreviated plain language, in accordance with the template shown in Table A3-1.

2.1.2 METAR and SPECI shall be issued in accordance with the template shown in Table A3-2 and disseminated in the METAR and SPECI code forms prescribed by the World Meteorological Organization.

Note.— The METAR and SPECI and BUFR code forms are contained in WMO Publication No. 306, Manual on Codes, *Volume I.1, Part A — Alphanumeric Codes and Volume I.2, Part B — Binary Codes, respectively.*

2.2 Use of CAVOK

~~4.13.2~~ When the following conditions occur simultaneously at the time of observation:

a) visibility, 10 km or more;

b) no cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, and no cumulonimbus;

c) no weather of significance to aviation as given in ~~4.8.4 and 4.8.5~~4.4.2.2 and 4.4.2.3 below;

information on visibility, runway visual range, present weather and cloud amount, type and height shall be replaced in all meteorological reports by the term “CAVOK”.

2.3 Criteria for issuance of local special reports and SPECI

2.3.1 The list of criteria for the issuance of local special reports shall include the following:

~~4.3.1~~ a) those values which most closely correspond with the operating minima of the operators using the aerodrome;

b) those values which satisfy other local requirements of the air traffic services units and of the operators;

c) an increase in air temperature of 2°C or more from that given in the latest report, or an alternative threshold value as agreed between the meteorological authority, the appropriate ATS authority and operators concerned;

d) the available supplementary information concerning the occurrence of significant meteorological conditions in the approach and climb-out areas as given in ~~4.12.1~~ Table A3-1; and

e) those values which constitute criteria for ~~special reports in the~~ SPECI ~~code form~~.

~~4.3.4~~2.3.2 **Recommendation.—** *~~Special reports in the~~ SPECI ~~code form~~ should be issued whenever changes in accordance with the following criteria occur:*

a) when the mean surface wind direction has changed by 60° or more from that given in the latest report, the mean speed before and/or after the change being 20 km/h (10 kt) or more;

b) when the mean surface wind speed has changed by 20 km/h (10 kt) or more from that given in the latest report;

c) when the variation from the mean surface wind speed (gusts) has increased by 20 km/h (10 kt) or more from that given in the latest report, the mean speed before and/or after the change being 30 km/h (15 kt) or more;

d) when the wind changes through values of operational significance. The threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:

1) require a change in runway(s) in use; and

2) indicate that the runway tailwind and crosswind components have changed through values representing the main operating limits for typical aircraft operating at the aerodrome;

e) when the prevailing visibility is improving and changes to or passes through one or more of the following values, or when the prevailing visibility is deteriorating and passes through one or more of the following values:

1) 800, 1 500 or 3 000 m;

2) 5 000 m, in cases where significant numbers of flights are operated in accordance with the visual flight rules;

f) when the runway visual range is improving and changes to or passes through one or more of the following values, or when the runway visual range is deteriorating and passes through one or more of the following values: 150, 350, 600 or 800 m;

g) when the onset, cessation or change in intensity of any of the following weather phenomena or combinations thereof occurs:

— freezing precipitation
— freezing fog
— moderate or heavy precipitation (including showers thereof)
— low drifting dust, sand or snow
— blowing dust, sand or snow (including snowstorm)

— *duststorm*
— *sandstorm*
— *thunderstorm (with or without precipitation)*
— *squall*
— *funnel cloud (tornado or waterspout);*

h) *when the height of base of the lowest cloud layer of BKN or OVC extent is lifting and changes to or passes through one or more of the following values, or when the height of base of the lowest cloud layer of BKN or OVC extent is lowering and passes through one or more of the following values:*

1) *30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft);*

2) *450 m (1 500 ft), in cases where significant numbers of flights are operated in accordance with the visual flight rules;*

i) *when the amount of a cloud layer below 450 m (1 500 ft) changes:*

1) *from SKC, FEW or SCT to BKN or OVC; or*

2) *from BKN or OVC to SKC, FEW or SCT;*

j) *when the sky is obscured and the vertical visibility is improving and changes to or passes through one or more of the following values, or when the vertical visibility is deteriorating and passes through one or more of the following values: 30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft).*

~~4.3.5~~2.3.3 When a deterioration of one weather element is accompanied by an improvement in another element, a single ~~special report in the SPECI code form~~ SPECI shall be issued; it shall then be treated as a deterioration report.

3. DISSEMINATION OF METEOROLOGICAL REPORTS

3.1 METAR and SPECI

~~4.2.4~~ 3.1.1~~Routine reports in the~~ METAR and SPECI ~~code form~~ shall be disseminated to international OPMET data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

~~4.2.5~~3.1.2 ~~Routine reports in the~~ METAR and SPECI ~~code form~~ shall be disseminated to other aerodromes in accordance with regional air navigation agreement.

~~4.3.6~~3.1.3 **Recommendation—** *~~A special report in the~~ SPECI ~~code form~~ representing a deterioration in conditions should be disseminated immediately after the observation. A ~~special report in the~~ SPECI ~~code form~~ representing an improvement in conditions should be disseminated only after the improvement has been maintained for 10 minutes; it should be amended before dissemination, if necessary, to indicate the conditions prevailing at the end of that 10-minute period. A ~~special report in the~~ SPECI ~~code form~~ representing a deterioration of one weather element and an improvement in another element should be disseminated immediately after the observation.*

3.2 Local routine and special reports

~~4.2.3~~3.2.1 Local routine reports shall be transmitted to local air traffic services units and shall be made available to the operators and to other users at the aerodrome.

~~4.3.3~~3.2.2 Local special reports shall be transmitted to local air traffic services units as soon as the specified conditions occur. However, by agreement between the meteorological authority and the appropriate ATS authority, they need not be issued in respect of:

a) any element for which there is in the local air traffic services unit ~~an indicator~~ a display corresponding to the one in the meteorological station, and where arrangements are in force for the use of this ~~indicator~~ display to make observations to meet the needs for local routine and special reports; and

b) runway visual range, when all changes of one or more steps on the reporting scale in use are being reported to the local air traffic services unit by an observer on the aerodrome.

Local special reports shall also be made available to the operators and to other users at the aerodrome.

4. OBSERVING AND REPORTING OF METEOROLOGICAL ELEMENTS

Introductory Note.— Selected criteria applicable to meteorological information referred to under 3.2 for inclusion in aerodrome reports are given in tabular form in Attachment D.

4.1 Surface wind

4.1.1 Siting

~~4.5.3~~ **Recommendation.—***Representative surface wind observations should be obtained by the use of sensors appropriately sited ~~as determined by local conditions~~. Sensors for surface wind observations for local routine and special reports should be sited to give the best practicable indication of conditions along the runway~~, e.g. lift-off~~ and touchdown zones. At aerodromes where topography or prevalent weather conditions cause significant differences in surface wind at various sections of the runway, additional sensors should be provided.*

Note.— Since, in practice, the surface wind cannot be measured directly on the runway, surface wind observations for take-off and landing are expected to be the best practicable indication of the winds which an aircraft will encounter during take-off and landing.

4.1.2 Displays

~~4.5.4~~4.1.2.1 Surface wind ~~indicators~~ displays relating to each sensor shall be located in the meteorological station with corresponding ~~indicators~~ displays in the appropriate air traffic services units. The ~~indicators~~ displays in the meteorological station and in the air traffic services units shall relate to the same sensors, and where separate sensors are required as specified in ~~4.5.3~~, 4.1.1 above, the ~~indicators~~ displays shall be clearly marked to identify the runway and section of runway monitored by each sensor

~~4.5.7~~4.1.2.2 **Recommendation.—** *Where multiple sensors are installed, the ~~2-minute time averages~~ mean values of, and significant variations in, the surface wind direction and speed for each sensor ~~used in local routine and special reports~~ should be ~~monitored~~ derived and displayed by ~~automatic~~ automated equipment.*

4.1.3 Averaging

~~4.5.5 **Recommendation.—**~~ 4.1.3.1 The averaging period for surface wind observations ~~should~~ shall be:

~~b~~a) 2 minutes for local routine and special reports and for wind ~~indicators~~ displays in air traffic services units; and

~~a~~b) 10 minutes for ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~, except that when the 10-minute period includes a marked discontinuity in the wind direction and/or speed, only data occurring since the discontinuity should be used for obtaining mean values, hence the time interval in these circumstances should be correspondingly reduced.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in wind direction of 30° or more, with a wind speed of 20 km/h (10 kt) before or after the change, or a change in wind speed of 20 km/h (10 kt) or more, lasting at least 2 minutes.

4.1.3.2 **Recommendation.—** *The averaging period for measuring variations from the mean wind speed (gusts) reported in accordance with 4.1.4.1 c) should be 3 seconds for local routine and special reports and for METAR and SPECI.*

4.1.4 Reporting

~~4.5.6~~4.1.4.1 ~~**Recommendation.—**~~ In local routine reports and ~~special reports~~ METAR and SPECI:~~,~~

a) the units of measurement used for the wind speed shall be indicated;

b) variations ~~in~~from the mean wind direction ~~should~~ during the past 10 minutes shall be ~~given~~ reported as follows, if the total variation is 60° or more~~;~~:

1) when the total variation is between 60° and 180° and the wind speed is 6 km/h (3 kt) or more such directional variations ~~should be expressed~~ shall be reported as the two extreme directions between which the surface wind has varied ~~during the past 10 minutes.~~

2) when the total variation is between 60° and 180° and the wind speed is less than 6 km/h (3 kt), the wind direction shall be reported as variable with no mean wind direction; or

3) when the total variation is 180° or more, the wind direction shall be reported as variable with no mean wind direction.

c) variations from the mean wind speed (gusts) during the past 10 minutes ~~should~~ shall be reported ~~only~~ when ~~the variation from~~ the maximum wind speed exceeds the mean speed ~~is~~ by 20 km/h (10 kt) or more;~~ such speed variations (gusts) should be expressed as the maximum and minimum speeds attained;~~

d) when a wind speed of 200 km/h (100 kt) or more is reported, it shall be indicated as 200 km/h (100 kt); and

e) when the 10-minute period includes a marked discontinuity in the wind direction and/or speed, only variations ~~in~~ from the mean wind direction and mean wind speed occurring since the discontinuity ~~should~~ shall be reported~~. The variations in direction and speed should be derived:~~

~~a) for non-automated systems from the wind direction and speed indicators or from the anemograph recorder trace if available; and/or~~

~~b) for automated systems from the actual measured values of wind direction and speed, and not from the 2-minute and 10-minute running averages required under 4.5.5.~~

Note.— See note under ~~4.5.5~~4.1.3.1 above.

~~4.5.8~~4.1.4.2 ~~**Recommendation.—**~~ In local routine and special reports:~~,~~

~~the name of the element should be given. The wind direction and speed and significant variations thereof should be given; the wind direction should be given in three figures rounded to the nearest 10 degrees true; this should be followed by "/" and by the wind speed; the units used for speed should be kilometres per hour or knots and should be indicated in the written form of the message.~~

a) if the surface wind is observed from more than one location along the runway, the locations for which these values are representative ~~should~~ shall be indicated~~, as necessary~~;

b) when there is more than one runway in use and the surface wind related to these runways is observed, the available wind values for each runway ~~should~~ shall be given~~, as necessary~~, and the runways to which the values refer ~~should~~ shall be reported~~.~~;

c) when ~~directional~~ variations from the mean wind direction are ~~to be~~ reported in accordance with 4.1.4.1 b) 2) above, the two extreme directions between which the surface wind has varied ~~should~~ shall be reported ~~in degrees.~~;

d) when variations from the mean speed (gusts) are ~~to be~~ reported in accordance with 4.1.4.1 c) above, they ~~should~~ shall be reported as the maximum and minimum values of the wind speed attained ~~in kilometres per hour or knots. When the wind speed is less than 2 km/h (1 kt), this should be indicated as calm. When a wind speed of 200 km/h (100 kt) or more is reported, it should be indicated as 200 km/h (100 kt). No mean wind direction should be indicated for variable winds with a total variation of 60° or more when:~~;

~~a) variations in wind direction are less than 180° and the mean wind speed is 6 km/h (3 kt) or less ; the two extreme directions between which the wind has varied should be indicated; or~~

~~b) variations in wind direction are 180° or more; or where it is not possible to report a mean wind direction, for example, when a thunderstorm passes over the aerodrome; the wind should be indicated as variable with no reference to the two extreme directions between which the wind has varied.~~

~~4.5.9~~4.1.4.3**~~Recommendation.—~~** In ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~, when variations from the mean wind speed (gusts) are reported in accordance with 4.1.4.1 c) above, ~~a) variations from the mean wind direction should be given if the total variation is 60° or more but less than 180° with mean speeds above 6 km/h (3 kt); b)~~ the maximum value of the wind speed ~~should~~ attained shall be ~~included only if it exceeds the mean speed by 20 km/h (10 kt) or more; c) minimum wind speed should not be given~~ reported.

4.2 Visibility

4.2.1 Siting

Recommendation. — *When instrumented systems are used for the measurement of visibility, representative visibility observations should be obtained by the use of sensors appropriately sited. Sensors for visibility observations for local routine and special reports should be sited to give the best practicable indications of visibility along the runway and touchdown zone. The visibility should be measured at a height of approximately 2.5 m (7.5 ft).*

4.2.2 Displays

Recommendation. —*When instrumented systems are used for the measurement of visibility, visibility displays relating to each sensor should be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensors, and where separate sensors are required as specified in 4.2.1 above, the displays should be clearly marked to identify the area, e.g. runway and section of runway, monitored by each sensor.*

4.2.3 Averaging

Recommendation. —*When instrumented systems are used for the measurement of visibility, the averaging period should be*

a) 1 minute for local routine and special reports and for visibility displays in air traffic services units; and

b) 10 minutes for METAR and SPECI except when the 10-minute period immediately preceding the observation includes a marked discontinuity in the visibility, only those values occurring after the discontinuity should be used for obtaining mean values.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in visibility, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of SPECI reports given in 2.3 above.

4.2.4 Reporting

~~4.6.4~~4.2.4.1 ~~**Recommendation.—**~~ In local routine and special reports and METAR and SPECI, ~~the name of the element should be given and the units used for visibility should be specified clearly.~~ the visibility shall be reported in steps of 50 m when ~~When~~ the visibility is less than 800 m; ~~it should be expressed in steps of 50 m~~ in steps of 100 m, when it is 800 m or more but less than 5 km ~~in steps of 100 m~~; in kilometre steps, when the visibility is 5 km or more but less than 10 km ~~in kilometre steps~~; and it shall be given as 10 km when ~~it~~ the visibility is 10 km or more~~, it should be given as 10 km~~, except when the conditions for the use of CAVOK apply. Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale.

Note.— Specifications concerning the use of CAVOK are given in 2.2 above.

4.2.4.2 In local routine and special reports, the units of measurement used for visibility shall be specified.

4.2.4.3 **Recommendation.—** *In local routine and special reports, when instrumented systems are used for the measurement of visibility:*

a) *if the visibility is observed from more than one location along the runway as specified in Chapter 4, 4.6.~~3~~2.2 the values representative of the touchdown zone should be reported first, followed, as necessary, by the values representative of the mid-point and stop-end of the runway, ~~these~~ and the locations for which these values are representative should be indicated~~, as necessary.~~; and*

b) *when there is more than one runway in use and the visibility is observed related to these runways, the available visibility values for each runway should be ~~given~~ reported, ~~as necessary,~~ and the runways to which the values refer should be indicated.*

~~*Note 1.— Specifications concerning the use of CAVOK are given in 4.13.2.*~~

~~*Note 2.— Guidance on currently attainable accuracy for observing visibility is given in Attachment B.*~~

~~4.6.5~~4.2.4.4 **Recommendation.—** *In ~~reports in the~~ METAR~~/~~and SPECI ~~code forms, when the visibility is not the same in different directions~~:*

a) *the ~~lowest~~ prevailing visibility should be reported~~.~~; ~~When the visibility is not the same in different directions and~~*

b) *when the lowest visibility is less than 1 500 m or ~~visibility in one or more directions is more~~ less than 50 per cent ~~above~~ of the ~~lowest~~ prevailing visibility, the lowest visibility observed should also be reported and its general direction in relation to the ~~site of the meteorological station~~ aerodrome indicated by reference to one of the eight points of the compass. If the lowest visibility is observed in more than one direction, then the most operationally significant direction should be reported~~.~~; and*

~~*Directional variations in visibility should be reported when the lowest visibility is less than 1 500 m and the visibility in another direction is more than 5 000 m. Where such variations in visibility are observed in more than one direction, then the most operationally significant direction should be reported.*~~

c) *when the visibility is fluctuating rapidly, and ~~significant directional variations~~ the prevailing visibility cannot be ~~given~~ determined, only the lowest visibility should be reported, with no indication of direction.*

4.3 Runway visual range

4.3.1 Siting

4.3.1.1 **Recommendation. —***Runway visual range should be observed at a height of approximately 2.5 m (7.5 ft).*

~~4.7.5~~4.3.1.2**Recommendation.—** *Runway visual range ~~observations~~ should be ~~carried out~~ observed at a lateral distance from the runway centre line of not more than 120 m. The site for observations to be representative of the touchdown zone should be located about 300 m along the runway from the threshold. The sites for observations to be representative of the mid-point and stop-end of the runway should be located at a distance of 1000 to 1500 m along the runway from the threshold and at a distance of about 300 m from the other end of the runway. The exact position of these sites and, if necessary, additional sites should be decided after considering aeronautical, meteorological and climatological factors such as long runways, swamps and other fog-prone areas.*

4.3.2 Instrumented systems

~~4.7.7~~4.3.2.1 Instrumented systems based on transmissometers or forward-scatter meters shall be used to assess runway visual range on runways intended for Category II and III instrument approach and landing operations.

~~4.7.8~~4.3.2.2**Recommendation.—** *Instrumented systems based on transmissometers or forward-scatter meters should be used to assess runway visual range on runways intended for Category I instrument approach and landing operations.*

Note.— Since accuracy can vary from one instrument design to another, performance characteristics are to be checked before selecting an instrument for assessing RVR. The calibration of a forward-scatter meter has to be traceable and verifiable to a transmissometer standard, the accuracy of which has been verified over the intended operational range. Guidance on the use of transmissometers and forward-scatter meters in instrumented RVR systems is given in the Manual of Runway Visual Range Observing and Reporting Practices *(Doc 9328).*

4.3.3 Display

~~4.7.9~~4.3.3.1 Where runway visual range is determined by instrumented ~~means~~ systems, one ~~indicator~~ display or more if required, shall be located in the meteorological station with corresponding ~~indicators~~ displays, in the appropriate air traffic services units. The ~~indicators~~ displays in the meteorological station and in the air traffic services units shall be ~~connected~~ related to the same ~~measuring device(s)~~ sensors, and where separate sensors are required as specified in 4.3.1.2 above, the displays shall be clearly marked to identify the runway and section of runway monitored by each sensor.

~~4.7.15~~4.3.3.2 **Recommendation.—** *Where runway visual range is determined by human observers, ~~R~~runway visual range should be reported to the appropriate local air traffic services units, whenever there* *is a change in the value to be reported in accordance with the reporting scale (except where the provisions of ~~4.3.2~~ Chapter 4, 3.2.2 a) or b) apply). The transmission of such reports should normally be completed within 15 seconds after the termination of the observation.*

4.3.4 Averaging

~~4.7.10~~ ~~**Recommendation.—**~~ Where instrumented systems are used for the assessment of runway visual range, their output ~~should~~ shall be updated at least every 60 seconds to permit the provision of current, representative values. The averaging period for runway visual range values ~~should~~ shall be:

~~b~~a) 1 minute for local routine and special reports and for runway visual range ~~indicators~~ displays in air traffic services units; and

~~a~~b) 10 minutes for ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~ except when the 10-minute period immediately preceding the observation includes a marked discontinuity in runway visual range values, only those values occurring after the discontinuity ~~should~~ shall be used for obtaining mean values~~; and~~.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in runway visual range, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of ~~special reports in the SPECI code form~~SPECI reports given in ~~4.3.4~~2.3.2 f) above.

4.3.5 Runway light intensity

~~4.7.11~~ **Recommendation.—** *When instrumented systems are used for the assessment of runway visual range, computations should be made separately for each available runway. ~~Whatever intensities are used,~~ RVR should not be computed for a light intensity of 3 per cent or less of the maximum light intensity available on a runway. For local routine and special reports, the light intensity to be used for the computation should be:*

a) for a runway with the lights switched on, the light intensity actually in use on that runway;

b) for a runway with lights switched off (or at the lowest setting pending the resumption of operations), the optimum light intensity that would be appropriate for operational use in the prevailing conditions.

In ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~, the runway visual range should be based ~~on the same light intensity settings as those appropriate for use during take-off and landing at the time the report is made~~ on the maximum light intensity available on the runway~~, but excluding any temporary changes in the light intensity settings~~.

Note.— Guidance on the conversion of instrumented readings into runway visual range is given in Attachment ~~D~~E.

4.3.6 Reporting

~~4.7.13~~4.3.6.1 In local routine and special reports and in METAR and SPECI, the reporting scale shall consist of increments of 25 m for runway visual range below 400 m, increments of 50 m for runway visual range between 400 m and 800 m and increments of 100 m for runway visual range above 800 m. Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale.

~~4.7.14~~4.3.6.2 **Recommendation.**~~—~~*Fifty metres should be considered the lower limit and ~~1 500~~ 2 000 metres the upper limit for ~~assessments of~~ runway visual range. Outside of these limits ~~reports~~ local routine and special reports and METAR and SPECI should merely indicate that the runway visual range is less than 50 m or more than ~~1 500~~ 2 000 m.*

4.3.6.3 In local routine and special reports and in METAR and SPECI:

a) when runway visual range is above the maximum value that can be determined by the system in use, it shall be reported using the abbreviation "ABV" in local routine and special reports and the abbreviation "P" in METAR and SPECI, followed by the maximum value that can be determined by the system; and

b) when the runway visual range is below the minimum value that can be determined by the system in use, it shall be reported using the abbreviation "BLW" in local routine and special reports and the abbreviation "M" in METAR and SPECI followed by the minimum value that can be determined by that system.

~~4.7.16~~4.3.6.4 ~~**Recommendation.—**~~In local routine and special reports ~~the name of the element should be given in abbreviated form and~~:

a) the units of measurement used ~~should~~ shall be included~~. When runway visual range is above the maximum value which can be determined by the system in use, it should be reported using the term "ABV" followed by the maximum value that can be determined by the system. When the runway visual range is below the minimum value which can be determined by the system in use, it should be reported using the term "BLW" followed by the minimum value that can be determined by that system.~~

b) if runway visual range is observed from only one location along the runway, ~~about 300 m from the threshold~~ i.e. the touchdown zone, it ~~should~~ shall be included without any indication of location~~.~~;

c) if the runway visual range is observed from more than one location along the runway, the value representative of the touchdown zone ~~should~~ shall be ~~given~~ reported first, followed by the values representative of the mid-point and stop-end~~. The~~ and the locations for which these values are representative ~~should~~ shall be indicated ~~as "TDZ", "MID" and "END", respectively.~~; and

d) when there is more than one runway in use, the available runway visual range values for each runway ~~should~~ shall be ~~given~~ reported and the runways to which the values refer ~~should~~ shall be indicated~~; if more than one runway is in use, but runway visual range is available only for one runway, that information should be indicated~~.

~~4.7.17~~4.3.6.5 **Recommendation.—** *In ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~:*

a) only the value representative of the touchdown zone should be ~~given~~ reported and no indication of location on the runway should be included~~.~~;

b) *where there is more than one runway available for landing, touchdown zone runway visual range values should be included for all such runways, up to a maximum of four, and the runways to which the values refer should be indicated.*

~~4.7.18~~4.3.6.6 **Recommendation. —***In METAR and SPECI when ~~Where~~ instrumented systems are used for the assessment of runway visual range, the variations in runway visual range during the 10-minute period immediately preceding the observation should be included ~~in reports in the METAR/SPECI code forms~~ as follows:*

a) *if the runway visual range values during the 10-minute period have shown a distinct tendency, such that the mean during the first 5 minutes varies by 100 m or more from the mean during the second 5 minutes of the period, this should be indicated. When the variation of the runway visual range values shows an upward or downward tendency this should be indicated by the abbreviation "U" or "D" respectively. In circumstances when actual fluctuations during the 10-minute period ~~indicate~~ show no distinct tendency this should be indicated ~~reported~~ using the abbreviation "N". When indications of tendency are not available, no~~ne of the foregoing~~ abbreviations should be included; and*

b) *if the one-minute runway visual range values during the 10-minute period vary from the mean value by more than 50 m or more than 20 per cent of the mean value, whichever is greater, the one-minute mean minimum and the one-minute mean maximum values should be reported instead of the 10-minute mean value. If the 10-minute period immediately preceding the observation includes a marked discontinuity in runway visual range values, only those values occurring after the discontinuity should be used to obtain variations.*

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in runway visual range, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of ~~special reports in the SPECI code form~~ SPECI given in ~~4.3.4~~2.3.2 f) above.

4.4 Present weather

4.4.1 Siting

Recommendation. —*When instrumented systems are used for observing present weather phenomena listed under 4.4.2.2 and 4.4.2.3 below, representative information should be obtained by the use of sensors appropriately sited.*

4.4.2 Reporting

~~4.8.3~~4.4.2.1 ~~**Recommendation.—**~~In local routine and special reports and in METAR and SPECI, observed present weather phenomena ~~should~~ shall be reported in terms of type and characteristics and qualified with respect to intensity or proximity to the aerodrome, as appropriate.

~~4.8.4~~4.4.2.2**Recommendation.**— *In local routine and special reports and in METAR and SPECI , the types of present weather phenomena which should be reported, their respective abbreviations and relevant criteria for their reporting of significance to aviation are as follows:*

a) *Precipitation*

Drizzle	*DZ*
Rain	*RA*
Snow	*SN*
Snow grains	*SG*
Ice pellets	*PL*
Ice crystals (very small ice crystals in suspension, also known as diamond dust)	*IC*
— Reported only when associated visibility is 5 000 m or less.	
Hail	*GR*
— Reported when diameter of largest hailstones is 5 mm or more.	
Small hail and/or snow pellets	*GS*
— Reported when diameter of largest hailstones is less than 5 mm.	

b) *Obscurations (hydrometeors)*

Fog	*FG*
— Reported when visibility is less than 1 000 m, except when qualified by "MI", "BC", "PR" or "VC" (see ~~4.8.5~~4.4.2.3and ~~4.8.6~~4.4.2.4 below).	
Mist	*BR*
— Reported when visibility is at least 1 000 m but not more than 5 000 m.	

c) *Obscurations (lithometeors)*

The following should be used only when the obscuration consists predominantly of lithometeors and the visibility is 5 000 m or less except "SA" when qualified by "DR" (see ~~4.8.5~~ 4.4.2.3 below) and volcanic ash.

Sand	*SA*
Dust (widespread)	*DU*
Haze	*HZ*
Smoke	*FU*
Volcanic ash	*VA*

d) *Other phenomena*

Dust/sand whirls (dust devils)	*PO*
Squall	*SQ*
Funnel cloud (tornado or waterspout)	*FC*
Duststorm	*DS*
Sandstorm	*SS*

~~4.8.5~~4.4.2.3**Recommendation.—** *In local routine and special reports and in METAR and SPECI, the characteristics of the present weather phenomena which should be reported, as necessary, and their respective abbreviations are as follows:*

Thunderstorm	*TS*

— *Used to report a thunderstorm with rain "TSRA", snow "TSSN", ice pellets "TSPL", hail "TSGR" or small hail and/or snow pellets "TSGS" or combinations thereof, for example,* *"TSRASN". When thunder is heard or lightning is detected at the aerodrome during the 10-minute period preceding the time of observation but no precipitation is observed at the aerodrome, the abbreviation "TS" should be used without qualification.*

Shower — *SH*

— *Used to report showers of rain "SHRA", snow "SHSN", ice pellets "SHPL", hail "SHGR", small hail and/or snow pellets "SHGS", or combinations thereof, for example "SHRASN". Showers observed in the vicinity of the aerodrome (see ~~4.8.6~~4.4.2.4) should be reported as "VCSH" without qualification regarding type or intensity of precipitation.*

Freezing (supercooled water droplets or precipitation, used only with FG, DZ and RA) — *FZ*

Blowing — *BL*

— *Used to report DU, SA or SN ~~(including snowstorm)~~ raised by the wind to a height of 2 m (6 ft) or more above the ground; in the case of snow, also used to report snow falling from a cloud and mixed with snow raised by the wind from the ground.*

Low drifting (used with DU, SA or SN raised by the wind to less than 2 m (6 ft) above ground level) — *DR*

Shallow (less than 2 m (6 ft) above ground level) — *MI*

Patches (fog patches randomly covering the aerodrome) — *BC*

Partial (a substantial part of the aerodrome covered by fog while the remainder is clear) — *PR*

~~4.8.6~~4.4.2.4 **Recommendation.—** *In local routine and special reports and in METAR and SPECI, the relevant intensity or, as appropriate, the proximity to the aerodrome of the reported present weather phenomena should be indicated as follows:*

	(~~abbreviated plain language~~ local routine and special reports)	*(METAR and SPECI)*
Light	*FBL*	*–*
Moderate	*MOD*	*(no indication)*
Heavy	*HVY*	*+*

— *Used only with~~: precipitation; SH and TS~~ DZ, GR, GS, PL, RA, SG and SN (or in combinations involving these present weather types; ~~(~~in these cases intensity refers to precipitation in accordance with ~~4.8.7~~4.4.2.5); ~~BLDU; BLSA; BLSN;~~ DS; and SS~~; and PO, FC (~~in ~~these~~ the cases ~~HVY means well developed~~ of DS and SS only moderate and heavy intensities to be indicated).*

Vicinity — *VC*

— *~~Not at the aerodrome but not further away than approximately 8 km from the aerodrome perimeter~~ Between approximately 8 and 16 km of the aerodrome reference point and used only in METAR and SPECI with DS, SS, FG, FC, SH, PO, BLDU, BLSA, BLSN ~~and~~, TS and VA when not reported under ~~4.8.5~~4.4.2.3.*

~~4.8.7~~4.4.2.5**Recommendation.—***In local routine and special reports and in METAR and SPECI, one or more up to a maximum of three of the present weather abbreviations given in ~~4.8.4 and 4.8.5~~4.4.2.2 and 4.4.2.3 should be used, as necessary, together with an indication, where appropriate, of the characteristics and intensity or proximity to the aerodrome, so as to convey a complete description of the present weather ~~at or near the aerodrome~~ of significance to flight operations at the aerodrome and its vicinity. In reporting this information, the indication of intensity or proximity as appropriate, should be reported first followed respectively by the characteristics and the type of weather phenomena. Where two different types of weather are observed, they should be reported in two separate groups, where the intensity or proximity indicator refers to the weather phenomenon which follows the indicator. However, different types of precipitation occurring at the time of observation should be reported as one single group with the dominant type of precipitation reported first and preceded by only one intensity qualifier which refers to the intensity of the total precipitation.*

4.5 Clouds

4.5.1 Siting

Recommendation. —.*When instrumented systems are used for the measurement of the cloud amount and the height of cloud base, representative observations should be obtained by the use of sensors appropriately sited. Sensors for cloud amount and height of cloud base observations for local routine and special reports should be sited to give the best practicable indications of the height of cloud base and cloud amount at the middle marker site of the instrument landing system or, at aerodromes where a middle marker beacon is not used, at a distance of 900 to 1 200 m (3 000 to 4 000 ft) from the landing threshold at the approach end of the runway.*

Note.— Specifications concerning the middle marker site of an instrument landing system are given in Annex 10, Volume I, Chapter 3 and Attachment C, Table C-5.

4.5.2 Reference level

~~4.9.4~~ **Recommendation.—** *The height of ~~the~~ cloud base ~~of cloud~~ should normally be reported above aerodrome elevation. When a precision approach runway is in use which has a threshold elevation 15 m (50 ft) or more below the aerodrome elevation, local arrangements should be made in order that the height of cloud~~s~~ bases reported to arriving aircraft should refer to the threshold elevation. In the case of reports from off-shore structures the height of ~~the~~cloud base ~~of cloud~~ should be given above mean sea level.*

4.5.3 Reporting

~~4.9.5~~4.5.3.1 **Recommendation.—** *In local routine and special reports and in METAR and SPECI, ~~the name of the element should be given together with~~*

a) *cloud amount should be reported using the abbreviations "FEW" (1 to 2 oktas), "SCT" (3 to 4 oktas), "BKN" (5 to 7 oktas) or "OVC" (8 oktas)~~.~~;*

b) *cumulonimbus clouds and towering cumulus clouds should be indicated as "CB" and "TCU", respectively;*

c) *the height of cloud base should be reported in steps of 30 m (100 ft) up to 3 000 m (10 000 ft) and in steps of 300 m (1 000 ft) above 3 000 m (10 000 ft);*

d) *the vertical visibility should be reported in steps of 30 m (100 ft) up to 600 m (2 000 ft);*

e) *if there are no clouds and no restriction on vertical visibility and the abbreviation "CAVOK" is not appropriate, the abbreviation "SKC"should be used~~.~~;*

f) *if there are no clouds of operational significance, i.e. below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, no cumulonimbus and no restriction on vertical visibility and the abbreviations "CAVOK" and "SKC" are not appropriate, the abbreviation "NSC" should be used~~. When the sky is obscured and information on vertical visibility is available, it should be reported. as shown in the template in Appendix 2.~~;*

g) *when several layers or masses of cloud of operational significance are observed, their amount and height~~ should~~ of cloud base should be reported in the following order:*

~~a~~1) *the lowest layer or mass, regardless of amount to be reported as FEW, SCT, BKN or OVC as appropriate;*

~~b~~2) *the next layer or mass, covering more than 2/8 to be reported as SCT, BKN or OVC as appropriate;*

~~c~~3) *the next higher layer or mass, covering more than 4/8 to be reported as BKN or OVC as appropriate;*

~~d~~4) *cumulonimbus ~~(CB)~~ and/or towering cumulus clouds ~~(TCU)~~, whenever observed and not reported in a) to c) above~~.~~;*

~~The type of cloud should be identified only for cumulonimbus and towering cumulus when observed at or near the aerodrome. The height of the base of cloud should be reported in steps of 30 m (100 ft) up to 3 000 m (10 000 ft) together with the units used and in steps of 300 m (1 000 ft) above 3 000 m (10 000 ft).~~

h) *when the cloud base is diffuse or ragged or fluctuating rapidly, the minimum height of ~~the~~ cloud base, or cloud fragments, should be reported; and ~~given, followed by the relevant abbreviation~~*

i) *when an individual layer (mass) of cloud is composed of cumulonimbus and towering cumulus clouds with a common cloud base, the type of cloud should be reported as cumulonimbus only.*

Note.— Towering cumulus ~~is used to~~ indicates cumulus congestus clouds of great vertical extent.

4.5.3.2 In local routine and special reports,

a) the units of measurement used for the height of cloud base and vertical visibility shall be indicated;

b) when there is more than one runway in use and ~~cloud~~the heights of cloud bases are observed by instruments for these runways, the available ~~cloud~~ heights of cloud bases ~~values~~ for each runway ~~should~~ shall be reported ~~given, as necessary,~~ and the runways to which the values refer ~~should~~ shall be indicated~~.~~

4.6 Air temperature and dew-point temperature

4.6.1 Reporting

~~4.10.3~~ ~~**Recommendation.—**~~In local routine and special reports and in METAR and SPECI, ~~the air temperature should be identified by "T" and the dew-point temperature by "DP". For~~ a temperature below 0°C ~~the value should~~ shall be preceded by ~~"MS"~~ "M".

4.7 Atmospheric pressure

4.7.1 Display

When automated equipment is used for the measurement of pressure, QNH and, if required in accordance with 4.7.3.1 b), QFE displays relating to the barometer shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. When QFE values are displayed for more than one runway, as specified in 4.7.3.1 d), the displays shall be clearly marked to identify the runway to which the QFE value displayed refers.

4.7.2 Reference level

~~4.11.3~~ **Recommendation.—** *The reference level for the computation of QFE should be the aerodrome elevation. For non-precision approach runways, the thresholds of which are 2 m (7 ft) or more below the aerodrome elevation, and for precision approach runways, the QFE, if required, should refer to the relevant threshold elevation.*

4.7.3 Reporting

~~4.11.4~~4.7.3.1 ~~**Recommendation.—**~~In local routine and special reports:

a) QNH ~~should~~ shall be included ~~regularly and~~;

b) QFE ~~should~~ shall be included ~~either on request~~ if required by users or, if so agreed locally between the meteorological and air traffic services authorities and operators concerned, on a regular basis;

c) ~~. Those~~ the units of measurement used for QNH and QFE values ~~should~~ shall be included; and ~~rounded down to the nearest lower whole hectopascal and given in four digits together with the units used~~.

d) If QFE values are required for more than one runway, the required QFE values ~~should be indicated using four digits~~ for each runway shall be reported and the runways to which the values refer shall be indicated.

~~4.11.5~~4.7.3.2 ~~**Recommendation.—**~~ In ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~ only QNH values ~~should~~ shall be included ~~and the values should be rounded down to the nearest lower whole hectopascal~~.

4.8 Supplementary information

4.8.1 Reporting

~~4.12.3~~4.8.1.1 **Recommendation.** *In local routine and special reports, and in METAR and SPECI , ~~When any of~~ the following recent weather phenomena ~~or combinations thereof~~, i.e. weather phenomena ~~were~~ observed at the aerodrome during the period since the last issued routine report or last hour, whichever is the shorter, but not at the time of observation, ~~this~~ should be reported, up to a maximum of three groups, in the supplementary information:*

—	*freezing precipitation*	*REFZDZ, REFZRA*
—	*moderate or heavy precipitation (including showers thereof)*	*REDZ, RERA, RESN, RESG, REGR, REGS, REPL, RESHRA, RESHSN, RESHSG, RESHGR, RESHGS, REIC*
—	*moderate or heavy blowing snow ~~(including snowstorm)~~*	*REBLSN*
—	*duststorm or sandstorm*	*REDS, RESS*
—	*thunderstorm*	*RETS*
—	*funnel cloud (tornado or water spout)*	*REFC*
—	*volcanic ash*	*REVA.*

~~4.12.4~~4.8.1.2 **Recommendation.—** *~~The available supplementary information should be included~~ In local routine and special reports, ~~using~~ the following ~~abbreviations, or combinations thereof, for~~ significant meteorological conditions, or combinations thereof, should be reported in supplementary information:*

~~a) cumulonimbus cloud and significant meteorological conditions:~~

—	*cumulonimbus clouds*	*~~“~~CB~~”,~~*
—	*thunderstorm*	*~~“~~TS~~”,~~*
—	*moderate or severe turbulence*	*~~“~~MOD TURB~~”~~, ~~“~~SEV TURB~~”,~~*
—	*wind shear*	*~~“~~WS~~”,~~*
—	*hail*	*~~“~~GR~~”,~~*
—	*severe squall line*	*~~“~~SEV SQL~~”,~~*
—	*moderate or severe icing*	*~~“~~MOD ICE~~”~~, ~~“~~SEV ICE~~”,~~*
—	*freezing precipitation*	*~~“~~FZDZ~~”~~, ~~“~~FZRA~~”,~~*
—	*severe mountain waves*	*~~“~~SEV MTW~~”,~~*
—	*duststorm or sandstorm*	*DS, ~~“~~SS~~”, “DS”,~~*
—	*blowing snow*	*~~“~~BLSN~~” or~~*
—	*funnel cloud (tornado or water spout)*	*~~“~~FC~~”;~~.*

~~*b)*~~ *The location of the* ~~*phenomenon*~~ *condition should be indicated.*~~*: "IN APCH", "IN CLIMB-OUT" or "INC"*~~*.*~~*; and*~~

~~*c) recent weather: "REFZDZ", "REFZRA", "REDZ", "RERA", "RESN", "RESG", "REGR", "REGS", "REPL", "RESHRA", "RESHSN", "RESHSG", "RESHPL", "RESHGR", "RESHGS", "REIC", "REBLSN", "RESS", "REDS", "RETS", "REFC" or "REVA".*~~

Where necessary, additional information should be included using abbreviated plain language.

~~4.12.5~~4.8.1.3 **Recommendation.—***In* ~~*reports in the*~~ *METAR*~~*/*~~ *and SPECI* ~~*code forms information on recent weather of operational significance, as given in 4.12.3, observed at the aerodrome within the period since the last issued routine report or last hour, whichever is the shorter, but not at the time of observation and,*~~ *where local circumstances so warrant, information on wind shear should be added*~~*, while other supplementary information should be added in such reports only in accordance with regional air navigation agreement*~~*.*

Note.— The local circumstances referred to in ~~*4.12.5*~~*4.8.1.3 above include, but are not necessarily limited to, wind shear of a non-transitory nature such as might be associated with low-level temperature inversions or local topography.*

~~4.12.6~~4.8.1.4 **Recommendation.—***In METAR and SPECI, the following information should be included in the supplementary information, in accordance with regional air navigation agreement:*

a) information on sea-surface temperature and the state of the sea ~~*should be included in reports in the METAR/SPECI code forms*~~ *from aeronautical meteorological stations established on off-shore structures in support of helicopter operations*~~*, as determined by regional air navigation agreement.*~~*; and*

~~4.12.7 **Recommendation.—**~~

b) information on the state of the runway provided by the appropriate airport authority ~~*should be included in reports in the METAR/SPECI code forms in accordance with regional air navigation agreement*~~*.*

Note 1.— The state of the sea is specified in WMO Publication No. 306, Manual on Codes, *Volume I.1, Part A — Alphanumeric Codes, Code Table 3700.*

Note 2.— The state of the runway is specified in WMO Publication No. 306, Manual on Codes, *Volume I.1, Part A — Alphanumeric Codes, Code Tables 0366, 0519, 0919 and 1079.*

Insert new text as follows:

4.9 Meteorological information from automatic observing systems

4.9.1 Reporting

4.9.1.1 **Recommendation**. — *In automated METAR and SPECI, surface wind, runway visual range, air temperature and dew-point temperature, and atmospheric pressure should be reported in accordance with provisions relevant to METAR and SPECI included in Sections 4.1, 4.3, 4.6, and 4.7, respectively.*

4.9.1.2 **Recommendation**. — *In automated METAR and SPECI, visibility should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.2. However, when visibility sensors are sited in such a manner that no directional variations can be given, visibility value reported should be folowed by the abbreviation "U".*

4.9.1.3 **Recommendation.—** *In automated METAR and SPECI, present weather should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.4. However, in addition to the precipitation types listed under 4.4.2.2 a), the abbreviation UP should be used for unidentified precipitation when the type of precipitation cannot be identified by the automatic observing system.*

4.9.1.4 **Recommendation**. — *In automated METAR and SPECI, clouds and vertical visibility should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.5. However,*

a) when the cloud type cannot be observed by the automatic observing system, the cloud type in each cloud group should be replaced by "///";

b) when no clouds are detected by the automatic observing system, it should be indicated by using the abbreviation "NCD".

4.9.1.5 **Recommendation.—** *In automated METAR and SPECI, supplementary information should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.8. However, in addition to the recent weather phenomena listed under 4.8.1.2, the abbreviation REUP should be used for recent precipitation when the type of precipitation cannot be identified by the automatic observing system.*

End of new text.

~~APPENDIX 2. TECHNICAL SPECIFICATIONS FOR LOCAL ROUTINE REPORTS, LOCAL SPECIAL REPORTS AND REPORTS IN THE METAR/SPECI CODE FORMS~~

~~*(See Chapter 4 of this Annex)*~~

Table A~~2-1~~3-1. Template for the local routine (MET REPORT) and local special (SPECIAL) report

Key: M = inclusion mandatory, part of every message
C = inclusion conditional, dependent on meteorological conditions
O = inclusion optional

Note 1. — The ranges and resolutions for the numerical elements included in the local routine and special reports are shown in Table 4 of this appendix.

Note 2.— The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes *(PANS-ABC, Doc 8400).*

Element as specified in Chapter 4	*Detailed content*	*Template(s)*			*Examples*
Identification of the type of report (M)	Type of report	MET REPORT or SPECIAL			MET REPORT SPECIAL
Location indicator (M)	ICAO location indicator (M)	nnnn			YUDO[1]
Time of the observation(M)	Date and time of the observation in UTC	nnnnnnZ			221630Z
Surface wind (M)	Name of the element (M)	WIND			WIND 240/15KMH (WIND 240/8KT)
	Runway (O)[2]	[RWY nnn]			WIND RWY 18 TDZ 190/22KMH (WIND RWY 18 TDZ 190/11KT)
	Runway section (O)[3]	[TDZ]			
	Wind direction (M)	nnn/	VRB BTN nnn/ AND nnn/ *or* VRB	CALM	WIND VRB6KMH WIND CALM (WIND VRB3KT) WIND VRB BTN 350/ AND 050/6KMH (WIND VRB BTN 350/ AND 050/3KT)
	Wind speed (M)	[ABV] nn[n]KMH (*or* [ABV] nnKT)			WIND 270/ABV 199KMH (WIND 270/ABV 99KT)
	Significant speed variations (C)[4]	MAX [ABV] nn [n] MNMnn			WIND 120/12KMH MAX35 MNM8 (WIND 120/6KT MAX18 MNM4)
	Significant directional variations (C)[5]	VRB BTN nnn/ AND nnn/	—		WIND 020/20KMH VRB BTN 350/ AND 070/ (WIND 020/10KT VRB BTN 350/ AND 070/)
	Runway section (O)[3]	[MID]			WIND RWY 14R MID 140/22KMH (WIND RWY 14R MID 140/11KT)
	Wind direction (M)	nnn/	VRB BTN nnn/ AND nnn/ or VRB	CALM	
	Wind speed (M)	[ABV] nn[n]KMH (*or* [ABV] nnKT)			

Element as specified in Chapter 4	*Detailed content*	*Template(s)*			*Examples*
	Significant speed variations (C)[4]	MAX [ABV] nn [n] MNMnn			
	Significant directional variations (C)[5]	VRB BTN nnn/ AND nnn/	—		
	Runway section (O)[3]	[END]			WIND RWY 27 TDZ 240/32KMH MAX54 MNM20 END 250/28KMH (WIND RWY 27 TDZ 240/16KT MAX27 MNM10 END 250/14KT)
	Wind direction (M)	nnn/	VRB BTN nnn/ AND nnn/ or VRB	CALM	
	Wind speed (M)	[ABV] nn[n] KMH (*or* [ABV] nnKT)			
	Significant speed variations (C)[4]	MAX [ABV] nn [n] MNMnn			
	Significant directional variations (C)[5]	VRB BTN nnn/ AND nnn/	—		
Visibility (M)	Name of the element (M)	VIS		CAVOK	VIS 350M CAVOK VIS 7KM VIS 10KM
	Runway (O)[2]	[RWY nnn]			VIS RWY 09 TDZ 800M END1200M
	Runway section (O)[3]	[TDZ]			
	Visibility (M)	nnnnM *or* nnKM			
	Runway section (O)[3]	[MID]			
	Visibility (M)	nnnnM *or nn*KM			
	Runway section (O)[3]	[END]			VIS RWY 18 TDZ 6KM RWY27 TDZ 4000M
	Visibility (M)	nnnnM *or* nnKM			
RVR (C)[~~5~~6]	Name of the element (M)	RVR			RVR RWY 32 400M RVR RWY 20 500M
	Runway (C)[7]	RWY nnn			
	Runway section (C)[8]	[TDZ]			
	RVR (M)	[ABV *or* BLW] nnnnM			RVR RWY 10 BLW 50M RVR RWY 14 ABV ~~1500~~2000M RVR RWY 10 BLW 150M RVR RWY 12 ABV 1200M
	Runway section (C)[8]	[MID]			RVR RWY 12 TDZ 1100M MID ABV 1400M
	RVR (M)	[ABV *or* BLW] nnnnM			
	Runway section (C)[8]	[END]			
	RVR (M)	[ABV *or* BLW] nnnnM			RVR RWY 16 TDZ 600M MID 500M END 400M RVR RWY 26 500M RWY 20 800M

Element as specified in Chapter 4	*Detailed content*	*Template(s)*				*Examples*
Present weather (C)[9,10]	Intensity or proximity of present weather (C)~~[11]~~[9]	FBL *or* MOD *or* HVY	—	~~VC~~		
	Characteristics and type of present weather (M)~~[12]~~[11]	DZ *or* RA *or* SN *or* SG *or* PL *or* ~~IC *or*~~ GR *or* GS *or* DS *or* SS *or* ~~TS *or*~~ TSRA *or* TSSN *or* TSPL *or* TSGR *or* TSGS *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or* BLSN *or* BLSA *or* BLDU *or* PO *or* FC~~	IC *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or* PRFG	~~FG *or* PO *or* FC *or* DS *or* SS *or* TS *or* SH *or* BLSN *or* BLSA *or* BLDU~~		MOD RA HZ ~~VCFG;~~ HVY TSRA FG ~~VCSH;~~ HVY DZ VA ~~VCTS~~; FBL SN MIFG ~~VCBLSA~~; HVY TSRASN FBL SNRA FBL DZ FG HVY SHSN ~~MOD~~ BLSN
Cloud (M)~~[13]~~[12]	Name of the element (M)	CLD				
	Runway (O)[2]	[RWY nnn]				
	Cloud amount (M) or vertical visibility (O)[9]	FEW *or* SCT *or* BKN *or* OVC	OBSC	SKC *or* NSC		CLD SCT 300M OVC 600M CLD NSC (CLD SCT 1000FT OVC 2000FT) CLD OBSC VER VIS 150M CLD SKC (CLD OBSC VER VIS 500FT) ~~CLD NSC~~
	Cloud type (C)[9]	CB *or* TCU	—			CLD BKN TCU 270M (CLD BKN TCU 900FT)
	Height of cloud base or the value of vertical visibility (C)[9]	nnnnM ~~[DIF *or* RAG *or* FLUC]~~ (*or* nnnnFT) ~~[DIF *or* RAG *or* FLUC]~~	[VER VIS nnnM (*or* VER VIS nnnnFT)]			CLD RWY 08 BKN 60M RWY 26 BKN 90M (CLD RWY 08 BKN 200FT RWY 26 BKN 300FT)
Air temperature (M)	Name of the element (M)	T				T17 ~~TMS8~~ TM08
	Air temperature (M)	[~~MS~~][M]nn				
Dew-point temperature (M)	Name of the element (M)	DP				DP15 ~~DPMS~~DPM18
	Dew-point temperature (M)	~~MS]~~[M]nn				

<table>
<tr><th>Element as specified in Chapter 4</th><th>Detailed content</th><th colspan="5">Template(s)</th><th>Examples</th></tr>
<tr><td rowspan="4">Pressure values (M)</td><td>Name of the element (M)</td><td colspan="5">QNH</td><td rowspan="2">QNH 0995HPA
QNH 1009HPA</td></tr>
<tr><td>QNH (M)</td><td colspan="5">nnnnHPA</td></tr>
<tr><td>Name of the element (O)[~~14~~]</td><td colspan="5">QFE</td><td rowspan="2">QNH 1022HPA QFE 1001HPA
QNH 0987HPA QFE RWY18 0956HPA RWY24 0955HPA</td></tr>
<tr><td>QFE (O)[~~1~~]</td><td colspan="5">[RWY nnn] nnnnHPA [RWYnnn nnnnHPA]</td></tr>
<tr><td rowspan="3">Supplementary information (C)[9]</td><td>Significant meteorological phenomena (C)[9]</td><td colspan="5">CB or TS or MOD TURB or SEV TURB or WS or GR or SEV SQL or MOD ICE or SEV ICE or FZDZ or FZRA or SEV MTW or SS or DS or BLSN or FC[~~15~~13]</td><td rowspan="2">FC IN APCH
WS IN APCH 60M -WIND ~~AT 60M~~ : 360/50KMH
WS RWY 12</td></tr>
<tr><td>Location of the phenomenon (C)[9]</td><td colspan="5">~~IN APCH or IN CLIMB-OUT or RWYnnn~~
IN APCH [nnnM-WIND nnn/nnKMH] or
IN CLIMB-OUT [nnnM-WIND nnn/nnKMH]
(IN APCH [nnnFT-WIND nnn/nnKT] or
IN CLIMB-OUT [nnnFT-WIND nnn/nnKT]) or

RWYnnn</td></tr>
<tr><td>Recent weather (C)[9, 10]</td><td colspan="5">REFZDZ or REFZRA or REDZ or RE[SH]RA or RE[SH]SN or RE[SH]SG or RE[SH]PL or REIC or RE[SH]GR or RE[SH]GS or REBLSN or RESS or REDS or RETS or REFC or REVA</td><td>REFZRA
CB IN CLIMB-OUT RETS</td></tr>
<tr><td rowspan="6">Trend forecast (O)[~~16~~14]</td><td>Name of the element (M)</td><td colspan="5">TREND</td><td rowspan="3">TREND NOSIG
TREND BECMG FEW 600M
(TREND BECMG FEW 2000FT)</td></tr>
<tr><td>Change indicator (M)[15]</td><td rowspan="5">NOSIG</td><td colspan="4">BECMG or TEMPO</td></tr>
<tr><td>Period of change (C)[9]</td><td colspan="4">FMnnnn and/or TLnnnn
or
ATnnnn</td></tr>
<tr><td>Wind (C)[9]</td><td colspan="4">nnn/ [ABV] nn[n]KMH [MAX[ABV]nn[n]] or
(nnn/ [ABV] nnKT [MAX[ABV]nn])</td><td>TREND TEMPO 250/70KMH MAX 100
(TREND TEMPO 250/35KT MAX 50)</td></tr>
<tr><td>Visibility (C)[9]</td><td colspan="3">VIS nnnnM or
VIS nnKM</td><td rowspan="2">CAVOK</td><td>TREND BECMG AT1800 VIS 10KM NSW
TREND BECMG TL1700 VIS 800M FG
TREND BECMG FM1030 TL1130 CAVOK</td></tr>
<tr><td>Weather phenomenon: intensity (C)[~~11~~9]</td><td>FBL or
MOD or
HVY</td><td>—</td><td>NSW</td><td>TREND TEMPO TL1200 VIS 600M
BECMG AT~~1200~~1230 VIS 8KM NSW NSC</td></tr>
</table>

Element as specified in Chapter 4	*Detailed content*	*Template(s)*					*Examples*
	Weather phenomenon: characteristics and type (C)[9, 10, 12]		DZ *or* RA *or* SN *or* SG *or* PL *or* ~~IC *or*~~ GR *or* GS *or* DS *or* SS ~~*or* TS~~ *or* TSRA *or* TSSN *or* TSPL *or* TSGR *or* TSGS *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or* BLSN *or* BLSA *or* BLDU *or* PO *or* FC~~	IC *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or* PRFG			TREND TEMPO FM0300 TL0430 MOD FZRA TREND BECMG FM1900 VIS 500M HVY SNRA TREND BECMG FM1100 MOD SN TEMPO FM1130 ~~MOD~~ BLSN
	Cloud amount and vertical visibility (C)[9]		FEW *or* SCT *or* BKN *or* OVC	OBSC	SKC *or* NSC		TREND BECMG AT1130 OVC 300M (TREND BECMG AT1130 OVC 1000FT)
	Cloud type (C)[9]		CB *or* TCU	—			TREND TEMPO TL1530 HVY SHRA BKN CB 360M (TREND TEMPO TL1530 HVY SHRA BKN CB 1200FT)
	Height of cloud base or the value of vertical visibility (C)[9]		nnnnM (*or* nnnnFT)	[VER VIS nnnM (*or* VER VIS nnnnFT)]			

Notes.—

1. Fictitious location;
2. Optional values for one or more runways;
3. Optional values for one or more sections of the runway;
4. To be included ~~if the maximum is exceeding the mean speed by 20 km/h (10 kt)~~ in accordance with 4.1.4.1 c);
5. To be included ~~if the directional variations $ 60Ebut < 180°and the wind speed > 6 km/h (3 kt)~~ in accordance with 4.1.4.1 b) 1);
6. To be included if visibility or RVR < 1500 m;
7. To be included ~~if more than one runway in use~~ in accordance with 4.3.7.4 d);
8. To be included ~~if RVR is observed from more than one location along the runway~~ in accordance with 4.3.7.3 c);
9. To be included whenever applicable;
10. One or more, up to a maximum of three groups in accordance with 4.4.2.5, 4.8.1.1 and Appendix 5, 2.2.4;

~~11. To be included whenever applicable; only qualifiers MOD and HVY (i.e. well-developed) to be used with PO and FC;~~

~~12.~~11. Precipitation types ~~DZ, RA, SN, SG, PL, IC, GR and GS~~ listed under 4.4.2.2 a) may be combined~~, where appropriate~~ in accordance with 4.4.2.5 and Appendix 5, 2.2.4. Only moderate or heavy precipitation to be indicated in trend forecasts in accordance with Appendix 5, 2.2.4;

~~13.~~12. Up to four cloud layers in accordance with 4.5.3.1 g);

~~14. Optional element;~~

~~15~~13. ~~Any of the phenomena, or combinations thereof.~~ Abbreviated plain language ~~to~~ may be used ~~to amplify the phenomena, as necessary~~ in accordance with 4.8.1.2;

~~16~~14. To be included ~~subject to Regional Air Navigation Agreement~~ in accordance with Chapter 6, 6.3.2;

15. Number of change indicators to be kept to a minimum in accordance with Appendix 5, 2.2.1, normally not exceeding three groups.

Table A~~2-2~~3-2. Template for ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~

Key: M = inclusion mandatory, part of every message
C = inclusion conditional, dependent on meteorological conditions or method of observation
O = inclusion optional

Note 1. — The ranges and resolutions for the numerical elements included in ~~reports in the~~ METAR~~/~~ and SPECI ~~code forms~~ are shown in Table 5 of this appendix.

Note 2.—The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes *(PANS-ABC, Doc 8400).*

Element as specified in Chapter 4	*Detailed content*	*Template(s)*		*Examples*
Identification of the type of report (M)	Type of report (M)	METAR, METAR COR, SPECI *or* SPECI COR		METAR METAR COR SPECI
Location indicator (M)	ICAO location indicator (M)	nnnn		YUDO[1]
Time of the observation (M)	Date and time of the observation in UTC (M)	nnnnnnZ		221630Z
Identification of an automated or missing report (C)[2]	Automated or missing report identifier (C)	AUTO *or* NIL		AUTO NIL
END OF METAR IF THE REPORT IS MISSING				
Surface wind (M)	Wind direction (M)	nnn	VRB	24015KMH VRB06KMH (24008KT) (VRB03KT) 19022KMH (19011KT) 00000KMH (00000KT) 140P199KMH (140P99KT)
	Wind speed (M)	[P]nn[n]		
	Significant speed variations (C)[~~2~~3]	G[P]nn[n]		12012G35KMH (12006G18KT) 24032G54KMH (24016G27KT)
	Units of measurement (M)	KMH (*or* KT)		
	Significant direction al variation s (C)[~~3~~4]	nnnVnnn	—	02020KMH 350V070 (02010KT 350V070)
Visibility (M)	~~Minimum~~ Prevailing or minimum[5] visibility (M)	nnnn	C A V O K	0350 CAVOK 7000 9999
	~~Direction of the minimum~~Unidirectional visibility (C)[~~4~~6]	~~N *or* NE *or* E *or* SE *or* S *or* SW *or* W *or* NW~~ U		800
	~~Maximum~~ Minimum visibility (C)[~~5~~7]	nnnn		~~1100SE 7000NW~~ ~~1200S 6000W~~ 2000 1200NW 6000 2800E
	Direction of the ~~maximum~~ minimum visibility (C)[~~5~~7]	N *or* NE *or* E *or* SE *or* S *or* SW *or* W *or* NW		

Element as specified in Chapter 4	*Detailed content*	*Template(s)*			*Examples*
RVR (C)[~~6~~8]	Name of the element (M)	R			R32/0400
	Runway (M)	nn[n]/			R10/M0050 R14L/P1500
	RVR (M)	[P *or* M]nnnn			R16L/0650 R16C/0500 R16R/0450 R17L/0450
	RVR variations (C)[~~7~~9]	V[P *or* M]nnnn			R20/0700V1200 R19/0350VP1200
	RVR past tendency (C)[~~8~~10]	U, D *or* N			R12/1100U R26/0550N R20/0800D R09/0375V0600U R10/M0150V0500D
Present weather (C)[~~9~~2,11]	Intensity or proximity of present weather (C)[~~11~~12]	*–or +*	—	*VC*	
	Characteristics and type of present weather (M)[~~12~~13]	DZ *or* RA *or* SN *or* SG *or* PL *or* ~~IC *or*~~ GR *or* GS *or* DS *or* SS *or* ~~TS *or*~~ TSRA *or* TSSN *or* TSPL *or* TSGR *or* TSGS *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or*~~ ~~BLSN *or*~~ ~~BLSA *or*~~ ~~BLDU *or*~~ ~~PO *or* FC~~ *or* UP[6] *or* FZUP	IC *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or* PRFG	FG *or* PO *or* FC *or* DS *or* SS *or* TS *or* SH *or* BLSN *or* BLSA *or* BLDU *or* VA	RA HZ VCFG +TSRA FG VCSH +DZ VA VCTS -SN MIFG VCBLSA +TSRASN -SNRA -DZ FG +SHSN BLSN
Cloud (M)[~~13~~14]	Cloud amount and height of cloud base or vertical visibility (M)	FEWnnn *or* SCTnnn *or* BKNnnn *or* OVCnnn	VVnnn *or* VV///	SKC *or* NSC *or* NCD[6]	FEW015 VV005 SKC OVC030 VV/// NSC SCT010 OVC020
	Cloud type (C)[~~9~~2]	CB *or* TCU *or* ///	—		BKN009TCU SCT008 BKN025CB
Air and dew-point temperature (M)	Air and dew-point temperatures (M)	[M]nn/[M]nn			17/10 02/M08 M01/M10
Pressure values (M)	Name of the element (M)	Q			Q0995 Q1009 Q1022 Q0987
	QNH (M)	nnnn			

Element as specified in Chapter 4	*Detailed content*		*Template(s)*	*Examples*
Supplementary information (C)[~~9~~]	Recent weather (C)[~~9,~~2 ~~10~~11]		REFZDZ *or* REFZRA *or* REDZ *or* RE[SH]RA *or* RE[SH]SN *or* RE[SH]SG *or* RE[SH]PL *or* REIC *or* RE[SH]GR *or* RE[SH]GS *or* REBLSN *or* RESS *or* REDS *or* RETS *or* REFC *or* REVA *or* REUP	REFZRA RETS
	Wind shear (C)[~~9~~2]		WS RWYnn[n] *or* WS ALL RWY	WS RWY03 WS ALL RWY
	Sea-surface temperature and state of the sea (C)[~~14~~15]		W[M]nn/Sn	W15/S2
	State of the runway (C)[~~14~~16]	Runway designator (M)	nn; SNOCLO	99421594 SNOCLO 14CLRD//
		Runway deposits (M)	n *or* /; CLRD//	
		Extent of runway contamination (M)	n *or* /	
		Depth of deposit (M)	nn *or* //	
		Friction coefficient or braking action (M)	nn *or* //	
Trend forecast (O)[~~14~~17]	Change indicator (M)[~~15~~18]		NOSIG; BECMG *or* TEMPO	NOSIG BECMG FEW020
	Period of change (C)[~~9~~2]		FMnnnn *and/or* TLnnnn *or* ATnnnn	
	Wind (C)[~~9~~2]		nnn[P]nn[n][G [P]nn[n]]KMH (*or* nnn[P]nn[G[P] nn]KT)	TEMPO 25070G100KMH (TEMPO 25035G50KT)
	Prevailing ~~V~~visibility (C)[~~9~~2]		nnnn; CAVOK	BECMG FM1030 TL1130 CAVOK BECMG TL1700 0800 FG BECMG AT1800 9000 NSW BECMG FM1900 0500 +SNRA BECMG FM1100 SN TEMPO FM1130 BLSN TEMPO FM0330 TL0430 FZRA
	Weather phenomenon: intensity (C)[~~11~~12]		–*or* +; —; NSW	

Element as specified in Chapter 4	*Detailed content*	*Template(s)*					*Examples*
	Weather phenomenon: characteristics and type (C)[~~9~~2,~~10~~11,~~12~~13]		DZ *or* RA *or* SN *or* SG *or* PL ~~*or* IC~~ *or* GR *or* GS *or* DS *or* SS ~~*or* TS~~ *or* TSRA *or* TSSN *or* TSPL *or* TSGR *or* TSGS *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or* BLSN *or* BLSA *or* BLDU *or* PO *or* FC~~	IC *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or* PRFG			
	Cloud amount and height of cloud base or vertical visibility (C)[~~9~~2]		FEWnnn *or* SCTnnn or BKNnnn *or* OVCnnn	VVnnn *or* VV///	SKC *or* NSC		TEMPO TL1200 0600 BECMG AT1200 8000 NSW NSC BECMG AT1130 OVC010
	Cloud type (C)[~~9~~2]		CB *or* TCU	—			TEMPO TL1530 +SHRA BKN012CB

Notes.—

1. Fictitious location;
~~9.~~2. To be included whenever applicable;
~~2.~~3. To be included ~~if the maximum is exceeding the mean speed by 20 km/h (10 kt)~~ in accordance with 4.1.4.1 c);
~~3.~~4. To be included ~~if the directional variations $ 60Ebut < 180°and the wind speed > 6 km/h (3 kt)~~ in accordance with 4.1.4.1 b) 1);
~~4.~~5. To be included ~~if the visibility in one or more directions is more than 50 per cent above the minimum visibility~~ in accordance with 4.2.4.4 c);
6. For automated reports only, in accordance with Section 4.9.
~~5.~~7. To be included ~~if the minimum visibility is less than 1500 m and the visibility in another direction is more than 5000m~~ in accordance with 4.2.4.4 b);
~~6.~~8. To be included if visibility or RVR < 1500 m; for up to a maximum of four runways in accordance with 4.3.7.5 b) ;
~~7.~~9. To be included ~~if the one-minute RVR values during the 10-minute period immediately preceding the observation vary from the mean value more than 50 m or more than 20 per cent, whichever is greater; the one-minute mean minimum and the one-minute mean maximum values are reported (instead of the 10-minute mean value)~~ in accordance with 4.3.7.6 b);
~~8.~~10. To be included ~~if the RVR values during the 10-minute period preceding the observation have shown a distinct tendency such that the mean RVR during the first 5 minutes varies by 100 m or more from the mean during the second 5 minutes of the period. No tendency indication where not available~~ in accordance with 4.3.7.6 a);
~~9. To be included whenever applicable;~~
~~10.~~11. One or more, up to a maximum of three, groups in accordance with 4.4.2.5, 4.8.1.1 and Appendix 5, 2.2.4;
~~11.~~12. To be included whenever applicable; no qualifier for *moderate* intensity in accordance with 4.4.2.4~~. No qualifier for *moderate* intensity; only qualifier "+" (i.e. well-developed) to be used with PO and FC~~;
~~12.~~13. Precipitation types ~~DZ, RA, SN, SG, PL, IC, GR and GS~~ listed under 4.4.2.2 a) may be combined~~, where appropriate~~ in accordance with 4.4.2.5 and Appendix 5, 2.2.4. Only moderate or heavy precipitation to be indicated in trend forecasts in accordance with Appendix 5, 2.2.4;
~~13.~~14. Up to four cloud layers in accordance with 4.5.3.1 g);
~~14.~~15. To be included ~~subject to Regional Air Navigation Agreement~~ in accordance with 4.8.1.4 a);
16 To be included in accordance with in accordance with 4.8.1.4.b);
17. To be included in accordance with Chapter 6, 6.3.2;
~~15.~~18 Number of change indicators to be kept to a minimum in accordance with Appendix 5, 2.2.1; normally not exceeding three groups~~.~~

Table A~~2-3~~3-3. Use of change indicators in trend forecasts

Change indicator	*Time indicator and period*	*Meaning*	
NOSIG	—	no significant changes are forecast	
BECMG	FM$n_1n_1n_1n_1$ TL$n_2n_2n_2n_2$	the change is forecast to	commence at $n_1n_1n_1n_1$ UTC and be completed by $n_2n_2n_2n_2$ UTC
	TLnnnn		commence at the beginning of the trend forecast period and be completed by nnnn UTC
	FMnnnn		commence at nnnn UTC and be completed by the end of the trend forecast period
	ATnnnn		occur at nnnn UTC (specified time)
	—		a) commence at the beginning of the trend forecast period and be completed by the end of the trend forecast period; *or* b) the time is uncertain
TEMPO	FM$n_1n_1n_1n_1$ TL$n_2n_2n_2n_2$	temporary fluctuations are forecast to	commence at $n_1n_1n_1n_1$ UTC and cease by $n_2n_2n_2n_2$ UTC
	TLnnnn		commence at the beginning of the trend forecast period and cease by nnnn UTC
	FMnnnn		commence at nnnn UTC and cease by the end of the trend forecast period
	—		commence at the beginning of the trend forecast period and cease by the end of the trend forecast period

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~~EXAMPLES OF REPORTS~~

~~*Example 1. Routine report*~~ **Example A3-1. Routine report**

~~a~~b) METAR for YUDO (Donlon/International)*:

METAR YUDO 221630Z 24015KMH 0600 R12/1000U DZ FG ~~DZ~~ SCT010 OVC020 17/16 Q1018 BECMG TL1700 0800FG BECMG AT1800 9999 NSW

~~b~~a) *Local routine report (same location and weather conditions as METAR):*

MET REPORT YUDO 221630Z WIND 240/15KMH VIS 600M RVR RWY 12 TDZ 1000M MOD DZ FG ~~MOD DZ~~ CLD SCT 300M OVC 600M T17 DP16 QNH 1018 TREND BECMG TL1700 VIS 800M FG BECMG AT1800 VIS 10KM NSW

~~c)~~ *Meaning of both reports:*

Routine report for Donlon/International* issued on the 22nd of the month at 1630 UTC; surface wind direction 240degrees; wind speed 15 kilometres per hour; visibility 600 metres; runway visual range representative of the touchdown zone for runway 12 is 1 000 metres and the runway visual range values have shown an upward tendency during previous 10 minutes (RVR tendency to be included in METAR only); ~~fog~~ and moderate drizzle and fog; scattered cloud at 300 metres; overcast at 600 metres; air temperature 17 degrees Celsius; dew-point temperature 16 degrees Celsius; QNH 1018 hectopascals; trend during next two hours visibility becoming 800 metres in fog by 1700 UTC; at 1800 UTC visibility becoming 10 kilometres or more and nil significant weather.

*Fictitious location

Note. In this example, the primary units "kilometre per hour" and "metre" were used for wind speed and height of cloud base respectively. However, in accordance with Annex 5, the corresponding non-SI alternative units "knot" and "foot" may be used instead.

~~*Example 2. Special report*~~ **Example A3-2. Special report**

~~a~~b) *SPECI for YUDO (Donlon/International)**

SPECI YUDO 151115Z 05025G37KT ~~NE1200 S6000~~1200NE 6000S + TSRA BKN005CB 25/22 Q1008 TEMPO TL1200 0600 BECMG AT1200 8000 NSW NSC

~~b~~a) *Local special report (same location and weather conditions as SPECI):*

SPECIAL YUDO 151115Z WIND 050/25KT MAX37 MNM10 VIS 1200M HVY TSRA CLD BKN CB 500FT T25 DP22 QNH 1008 TREND TEMPO TL1200 VIS 600M BECMG AT1200 VIS 8KM NSW NSC

~~c)~~ *Meaning of both reports:*

Selected special report for Donlon/International* issued on the 15th of the month at 1115 UTC; surface wind direction 050 degrees; wind speed 25 knots gusting between 10 and 37 knots (minimum wind speed not to be included in SPECI); visibility lowest to north east at 1 200 metres, visibility 6 000 metres to south (directional variations to be included in SPECI only; visibility representative of the runway included in the local special report); heavy thunderstorm with rain; broken cumulonimbus cloud at 500 feet; air temperature 25 degrees Celsius; dew-point temperature 22 degrees Celsius; QNH 1008 hectopascals; trend during next two hours, visibility temporarily 600 metres from 1115 to 1200, becoming at 1200 UTC visibility 8 km, thunderstorm ceases and nil significant weather and nil significant cloud.

*Fictitious location

Note. In this example, the non-SI alternative units "knot" and "foot" were used for wind speed and height of cloud base respectively. However, in accordance with Annex 5, the corresponding primary units "kilometre per hour" and "metre" may be used instead.

Table A~~2-4~~3-4. Ranges and resolutions for the numerical elements included in~~ the~~ local ~~meteorological message~~ reports

Element as specified in Chapter 4		*Range*	*Resolution*
Runway		01 - 36	1
Wind direction:	°true	010 - 360	10
Wind speed:	KMH KT	1 - 399* 1 - 199*	1 1
Visibility:	M M KM	0 - 800 800 - 5 000 5 - 10	50 100 1
RVR:	M M M	0 - 400 400 - 800 800 - ~~1 500~~2000	25 50 100
Vertical visibility:	M FT	0 - 600 0 - 2 000	30 100
Clouds: height of cloud	M	0 - 3 000	30

Element as specified in Chapter 4		*Range*	*Resolution*
base:	M FT FT	3 000 - 20 000 0 - 10 000 10 000 - 60 000	300 100 1 000
Air temperature; Dew-point temperature:	°C	-80 - +60	1
QNH; QFE:	hPa	0500 - 1 100	1

* There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary.

Table A~~2-5~~3-5. Ranges and resolutions for the numerical elements included ~~in meteorological message in the~~ METAR~~/~~ and SPECI ~~code forms~~

Element as specified in Chapter 4			*Range*	*~~Range~~Resolution*
Runway:		(no units)	01 - 36	1
Wind direction:		° true	000 - 360	10
Wind speed:		KMH KT	00 - 399* 00 - 199*	1 1
Visibility:		M M M M	0000 - 0800 0800 - 5 000 5 000 - 9 000 9 000 - 9 999	50 100 1 000 999
RVR:		M M M	0000 - 0400 0400 - 0800 0800 - ~~1 500~~2000	25 50 100
Vertical visibility:		30's M (100's FT)	000 - 020	1
Clouds: height of cloud base:		30's M (100's FT) 30's M (100's FT)	000 - 100 100 - 600**	1 10
Air temperature; Dew-point temperature:		°C	-80 - +60	1
QNH:		hPa	0850 - 1 100	1
Sea-surface temperature:		°C	-10 - +40	1
State of the sea:		(no units)	0 - 9	1
State of the runway	Runway designator:	(no units)	01 - 36; 51 - 86; 88; 99	1
	Runway deposits:	(no units)	0 - 9	1
	Extent of runway contamination:	(no units)	1; 2; 5; 9	—
	Depth of deposit:	(no units)	00 - 90; 92 - 99	1
	Friction coefficient/braki	(no units)	00 - 95; 99	1

Element as specified in Chapter 4		*Range*	*~~Range~~Resolution*
	ng action:		
* There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary. ** 100 - 200 in trend forecasts.			

~~*Example 3. Volcanic activity report*~~ **Example A3-3. Volcanic activity report**

VOLCANIC ACTIVITY REPORT YUSB* 231500 MT TROJEEN* VOLCANO N5605 W12652 ERUPTED 231445 LARGE ASH CLOUD EXTENDING TO APPROX 30000 FEET MOVING SW

Meaning: Volcanic activity report issued by Siby/Bistock meteorological station at 1500 UTC on the 23rd of the month. Mt Trojeen volcano 56 degrees 5 minutes north 126 degrees 52 minutes west erupted at 1445 UTC on the 23rd; a large ash cloud was observed extending to approximately 30 000 feet and moving in a south-westerly direction.

*Fictitious locations

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APPENDIX ~~3.~~4 ~~CRITERIA FOR REPORTING METEOROLOGICAL AND RELATED PARAMETERS IN AUTOMATED AIR-REPORTS~~
4. TECHNICAL SPECIFICATIONS RELATED TO AIRCRAFT OBSERVATIONS AND REPORTS
(See Chapter 5 of this Annex)

1. CONTENTS OF AIR-REPORTS

1.1 Routine air-reports by air-ground data link

~~5.7.2~~1.1.1 When air-ground data link is used and automatic dependent surveillance (ADS) is being applied, the elements contained in routine air-reports shall be:

Message type designator
Aircraft identification

Data block 1
- Latitude
- Longitude
- Level
- Time

Data block 2
- Wind direction
- Wind speed
- Wind quality flag
- Temperature
- Turbulence (if available)
- Humidity (if available)

Note.— When ADS is being applied, the requirements of routine air-reports may be met by the combination of the basic ADS data block (data block 1) and the meteorological information data block (data block 2), available from ADS reports. The ADS message format is specified in the PANS-ATM (Doc 4444), Part II, Section 14.4 and in Annex 10, Volume III, Part I — Digital Data Communication Systems.

~~5.7.3~~1.1.2 When air-ground data link is used while ADS is not being applied, the elements contained in routine reports shall be in accordance with ~~5.7.1~~ 1.3 below.

Note.— When air-ground data link is used while ADS is not being applied, the requirements of routine air-reports may be met by the controller-pilot data link communication (CPDLC) application entitled "Position report". The details of this data link application are specified in the Manual of Air Traffic Services Data Link Applications *(Doc 9694) and in Annex 10 , Volume III, Part I.*

1.2 Special air-reports by air-ground data link

~~5.7.4~~ When air-ground data link is used, the elements contained in special air-reports shall be:

Message type designator
Aircraft identification

Data block 1
Latitude
Longitude
Level
Time

Data block 2
Wind direction
Wind speed
Wind quality flag
Temperature
Turbulence (if available)
Humidity (if available)

Data block 3
Condition prompting the issuance of a special
air-report (one condition
to be selected from the list presented ~~under 5.5~~ in Table A4-3.

Note 1.— The requirements of special air-reports may be met by the data link flight information service (D-FIS) application entitled "Special air-report service". The details of this data link application are specified in Doc 9694.

Note 2.— In the case ~~of the transmission~~ of a special air-report of pre-eruption volcanic activity, volcanic eruption or volcanic ash cloud, additional requirements are indicated in ~~5.10~~ 4.2.

1.3 Routine air-reports by voice communications

~~5.7.1~~ When voice communications are used, the elements contained in routine ~~and special~~ air-reports shall be

~~*Routine air-reports*~~

Message type designator

Section 1
(Position information)
Aircraft identification
Position or latitude and longitude
Time
Flight level or altitude
Next position and time over
Ensuing significant point

Section 2
(Operational information)
Estimated time of arrival
Endurance

Section 3
(Meteorological information)
Air temperature
Wind direction
Wind speed
Turbulence
Aircraft icing
Humidity (if available)

1.4 Special air-reports by voice communications

When voice communications are used, the elements contained in special air-reports shall be

~~Special air-reports~~

Message type designator

Section 1
(Position information)
Aircraft identification
Position or latitude and longitude
Time
Flight level or altitude

Section 3
(Meteorological information)
Condition prompting the issuance of a special air-report, to be selected from the list presented ~~under 5.5~~ in Table A4-3.

Note 1.— Air-reports are considered routine by default. The message type designator for special air-reports is specified in the PANS-RAC (Doc 4444), Appendix 1.

Note 2.— In the case of ~~the transmission of~~ a special air-report of pre-eruption volcanic activity, volcanic eruption or volcanic ash cloud, additional requirements are indicated in ~~5.10~~ 4.2 .

2. CRITERIA FOR REPORTING

~~5.8~~2.1 When air-ground data link is used, the wind direction, wind speed, wind quality flag, temperature, turbulence and humidity included in air-reports shall be reported in accordance with the following criteria ~~shown in Appendix 3.~~

~~1~~2.2 Wind direction

The wind direction shall be reported in terms of degrees true, rounded to the nearest whole degree.

~~2~~2.3 Wind speed

The wind speed shall be reported in kilometres per hour or knots, rounded to the nearest 2 km/h (1 knot). The units used shall be indicated.

~~3~~2.4 Wind quality flag

The wind quality flag shall be reported as 0 when the roll angle is less than 5 degrees and as 1 when the roll angle is 5 degrees or more.

~~4~~2.5 Temperature

The temperature shall be reported to the nearest tenth of a degree Celsius.

~~5~~2.6 Turbulence

The turbulence shall be observed in terms of the eddy dissipation rate (EDR).

2.6.1 Routine air-reports

The turbulence shall be reported during the en-route phase of the flight and shall refer to the 15-minute period immediately preceding the observation. Both the average and peak value of turbulence, together with the time of occurrence of the peak value to the nearest minute, shall be observed. The average and peak values shall be reported in terms of a turbulence index comprising seven intensity levels of EDR as indicated in Table ~~A3-1~~A4-1. The time of occurrence of the peak value shall be reported as indicated in Table ~~A3-2~~A4-2.

2.6.2 Interpretation of the turbulence index

Turbulence shall be considered:

a) severe when the turbulence index is between 15 and 27 (i.e. the peak value of the EDR is exceeding 0.5);

b) moderate when the turbulence index is between 6 and 14 (i.e. the peak value of the EDR is exceeding 0.3 while not exceeding 0.5);

c) light when the turbulence index is between 1 and 5 (i.e. the peak value of the EDR is between 0.1 and 0.3); and

d) nil when the turbulence index is 0 (i.e. the peak value of the EDR is less than 0.1).

Note.— The EDR is an aircraft-independent measure of turbulence. However, the relationship between the EDR index and the perception of turbulence is a function of aircraft type, and the mass, altitude, configuration and airspeed of the aircraft.

2.6.3 Special air-reports

Special air-reports on turbulence shall be made during any phase of the flight whenever the peak value exceeds the EDR value of 0.5. The special air-report on turbulence shall be made with reference to the 1-minute period immediately preceding the observation. Both the average and peak value of turbulence shall be observed. The average and peak values shall be reported in terms of a turbulence index as indicated in the shaded part of Table A~~3-1~~4-1. Special air-reports shall be issued every minute until such time that the peak values of turbulence fall below the EDR value of 0.5.

~~6~~2.7 Humidity

The humidity shall be reported as the relative humidity, rounded to the nearest whole per cent.

Note.—The ranges and resolutions for the meteorological elements included in air-reports are shown in Table A~~3-3~~4-4.

Table A~~3-1~~4-1. Turbulence index to be reported as a function of the average and peak value of turbulence
(Classes corresponding to severe turbulence are shaded)

	Peak value of turbulence							
Average value of turbulence	*EDR ($m^{2/3}$ s^{-1})*							*Nil report*
EDR ($m^{2/3}$ s^{-1})	< 0. 1	0.1 - 0.2	0.2 - 0.3	0.3 - 0.4	0.4 - 0.5	0.5 - 0.8	> 0 .8	
< 0.1	0	1	3	6	10	15	21	
0.1 - 0.2		2	4	7	11	16	22	
0.2 - 0.3			5	8	12	17	23	
0.3 - 0.4				9	13	18	24	
0.4 - 0.5					14	19	25	
0.5 - 0.8						20	26	
> 0.8							27	
Nil report								28

Table A~~3-2~~4-2. Time of occurrence of the peak value to be reported

Peak value of turbulence occurring during the one-minute period .... minutes prior to the observation	*Value to be reported*
0 - 1	0
1 - 2	1
2 - 3	2
. . .	. . .
13 - 14	13
14 - 15	14
No timing information available	15

Editorial Note.— Insert new Table A4-3 as follows:

METLINKSG

Table A4-3. Template for the special air-report (downlink).

Key: M = mandatory, part of every message;
C = inclusion conditional; included whenever available.

Note. Message to be prompted by the pilot-in-command. Currently only the condition "SEV TURB" can be automated (see 5.4).

Element as specified in Chapter 5	*Detailed content*	*Template(s)*	*Examples*
Message type designator (M)	Type of the air-report (M)	ARS	ARS
Aircraft identification (M)	Aircraft radiotelephony call sign (M)	nnnnnn	VA812
DATA BLOCK 1			
Latitude (M)	Latitude in degrees and minutes (M)	Nnnnn *or* Snnnn	S4506
Longitude (M)	Longitude in degrees and minutes (M)	Wnnnnn *or* Ennnnn	E01056
Level (M)	Flight level (M)	FLnnn	FL330
Time (M)	Time of occurrence in hours and minutes (M)	OBS AT nnnnZ	OBS AT 1216Z
DATA BLOCK 2			
Wind direction (M)	Wind direction in degrees true (M)	nnn/	262/
Wind speed (M)	Wind speed in kilometres per hour (or knots) (M)	nnnKMH (*or* nnnKT)	158KMH (079KT)
Wind quality flag (M)	Wind quality flag (M)	n	1
Temperature (M)	Air temperature in tenths of degrees C (M)	T[M]nnn	T127 TM455
Turbulence (C)	Turbulence index and the time of occurrence of the peak value (C)[4]	EDRnn/nn	EDR16/08
Humidity (C)	Relative humidity in per cent (C)	RHnnn	RH054

Element as specified in Chapter 5	*Detailed content*	*Template(s)*	*Examples*
DATA BLOCK 3			
Condition prompting the issuance of a special air-report (M)		SEV TURB [EDRnn][5] *or* SEV ICE *or* SEV MTW *or* TS GR [1] *or* TS [1] *or* HVY SS[2] *or* VA CLD [FL nnn/nnn] *or* VA[3] [MT nnnnnnnnnnnnnnnnnnnn]	SEV TURB EDR16; VA CLD FL050/100

Notes. —

1. Obscured, embedded or widespread thunderstorms or thunderstorms in squall lines;
2. Duststorm or sandstorm;
3. Pre-eruption volcanic activity or a volcanic eruption;
4. The index and the time of occurrence to be reported in accordance with Tables A4-1 and A4-2, respectively; and
5. The turbulence index to be reported in accordance with 2.5.3 and Table A4-1.

End of new text.

Table A~~3-3.~~4-4. Ranges and resolutions for the meteorological elements included in air-reports

Element as specified in Chapter 5		*Range*	*Resolution*
Wind direction:	°true	000 - 360	1
Wind speed:	KMH KT	00 - 500 00 - 250	2 1
Wind quality flag:	(index)*	0 - 1	1
Temperature:	°C	- 80 -+60	0.1
Turbulence: routine air-report:	(index)* (time of occurrence)*	0 - 28 0 - 15	1 1
Turbulence: special air-report:	(index)*	15 - 27	1
Humidity:	%	0 - 100	1
*Non-dimensional			

WAFSSG

3. EXCHANGE OF AIR-REPORTS

3.1 Responsibilities of the meteorological watch offices

~~5.9.2~~3.1.1 The meteorological watch offices shall assemble the routine air-reports received by voice communications and shall disseminate them to WAFCs~~ and, as appropriate, RAFCs,~~ and other meteorological offices in accordance with regional air navigation agreement.

Note.— The exchange of collectives on an hourly basis may be found desirable when reports are numerous.

~~5.9.3~~3.1.2 The meteorological watch office shall transmit without delay the special air-reports received by voice communications to WAFCs~~ and, as appropriate, RAFCs~~.

~~5.9.4~~3.1.3 The meteorological watch office shall transmit without delay special air-reports of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud received to the associated VAACs.

~~5.9.5~~3.1.4 When a special air-report is received at the meteorological watch office but the forecaster considers that the phenomenon causing the report is not expected to persist and, therefore, does not warrant issuance of a SIGMET, the special air-report shall be disseminated in the same way that SIGMET messages are disseminated in accordance with~~ 7.2.11~~ Appendix 6, 1.2.1, i.e. to meteorological watch offices, WAFCs, and other meteorological offices in accordance with regional air navigation agreement.

3.2 Responsibilities of world area forecast centres

~~5.9.6~~ Air-reports received at WAFCs~~ and RAFCs~~ shall be further disseminated as basic meteorological data.

Note.— The dissemination of basic meteorological data is normally carried out on the WMO global telecommunication system.

3.3 Supplementary dissemination of air-reports

~~5.9.7~~ **Recommendation.—** *Where supplementary dissemination of air-reports is required to satisfy special aeronautical or meteorological requirements, such dissemination should be arranged between the meteorological authorities concerned.*

3.4 Format of air-reports

~~5.9.8~~ Air-reports shall be exchanged in the format in which they are received, except that when voice communications are used, if the position is given by reference to an ATS reporting point, it shall be converted, by the meteorological watch office, into the corresponding latitude and longitude.

4. SPECIFIC PROVISIONS RELATED TO REPORTING WIND SHEAR AND VOLCANIC ASH

4.1 Reporting of wind shear

~~5.6.2~~4.1.1 **Recommendation.—** *When reporting aircraft observations of wind shear encountered during the climb-out and approach phases of flight, the aircraft type should be included.*

~~5.6.3~~4.1.2 **Recommendation.—** *Where wind shear conditions in the climb-out or approach phases of flight were reported or forecast but not encountered, the pilot-in-command should advise the appropriate air traffic services unit as soon as practicable unless the pilot-in-command is aware that the appropriate air traffic services unit has already been so advised by a preceding aircraft.*

4.2 Post-flight reporting of volcanic activity

Note.— The detailed instructions for recording and reporting volcanic activity observations are given in the PANS-ATM (Doc 4444), Appendix 1.

~~5.10.2~~4.2.1On arrival of a flight at an aerodrome, the completed report of volcanic activity shall be delivered by the operator or a flight crew member, without delay, to the aerodrome meteorological office, or if such office is not easily accessible to arriving flight crew members, the completed form shall be dealt with in accordance with local arrangements made by the meteorological authority and the operator.

~~5.10.3~~4.2.2The completed report of volcanic activity received by a meteorological office shall be transmitted without delay to the meteorological watch office responsible for the provision of meteorological watch for the flight information region in which the volcanic activity was observed.

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APPENDIX ~~4~~5. TECHNICAL SPECIFICATIONS ~~FOR AERODROME~~ RELATED TO FORECASTS ~~IN THE TAF CODE FORM~~

(See Chapter 6 of this Annex)

1. CRITERIA RELATED TO TAF

1.1. TAF format

TAF shall be issued in accordance with the template shown in Table A5-1 and disseminated in the TAF code form prescribed by the World Meteorological Organization.

Note.— The TAF code form are contained in WMO Publication No. 306, Manual on Codes, *Volume I.1, Part A — Alphanumeric Codes.*

1.2 Inclusion of meteorological elements in TAF

Note.— Guidance on operationally desirable accuracy of forecasts is given in Attachment B.

1.2.1 Surface wind

~~6.2.12~~ **Recommendation.**— *In forecasting surface wind, the expected prevailing direction should be given. When it is not possible to forecast a prevailing surface wind direction due to its expected variability, for example, during light wind conditions (less than 6 km/h (3 kt) ~~or less~~) or thunderstorms, the forecast wind direction should be indicated as variable using "VRB". When the wind is forecast to be less than 2 km/h (1 kt) the forecast wind speed should be indicated as calm. When the forecast maximum speed exceeds the forecast mean wind speed by 20 km/h (10 kt) or more, the forecast maximum wind speed should be indicated. When a wind speed of 200 km/h (100 kt) or more is forecast, it should be indicated as 200 km/h (100 kt).*

Secretariat

1.2.2 Visibility

~~6.2.13~~ **Recommendation.—** *When the visibility is forecast to be less than 800 m it should be expressed in steps of 50 m; when it is forecast to be 800 m or more but less than 5 km, in steps of 100 m; 5 km or more but less than 10 km in kilometre steps and when it is forecast to be 10 km, or more it should be expressed as 10 km, except when conditions of CAVOK are forecast to apply. When visibility is forecast to vary in different directions the lowest forecast visibility should be given.*

~~*Note.— Guidance on operationally desirable accuracy of forecasts of visibility is given in Attachment E.*~~

1.2.3 Weather phenomena

~~6.2.14~~ **Recommendation.—** *One or more, up to a maximum of three, of the ~~The~~ following weather phenomena or combinations thereof, together with their characteristics and, where appropriate, intensity should be forecast if they are expected to occur at the aerodrome:*

— *freezing precipitation*
— *freezing fog*
— *moderate or heavy precipitation (including showers thereof)*
— *low drifting dust, sand or snow*
— *blowing dust, sand or snow (including snowstorm)*
— *duststorm*
— *sandstorm*
— *thunderstorm (with or without precipitation)*
— *squall*
— *funnel cloud (tornado or waterspout)*
— *other weather phenomena given in ~~4.8.4~~ Appendix 3, 4.4.2.2 only if they are expected to cause a significant change in visibility.*

The expected end of occurrence of those phenomena should be indicated by the abbreviation "NSW".

1.2.4 Cloud

~~6.2.15~~ **Recommendation.—** *Cloud amount should be forecast using the abbreviations "FEW", "SCT", "BKN" or "OVC" as necessary. If no clouds are forecast, and the abbreviation "CAVOK" is not appropriate, the abbreviation "SKC" should be used. When it is expected that the sky will remain or become obscured and clouds cannot be forecast and information on vertical visibility is available at the aerodrome, the vertical visibility should be forecast in the form "VV" followed by the forecast value of the vertical visibility and the units used. When several layers or masses of cloud are forecast, their amount and height of base should be included in the following order:*

a) *the lowest layer or mass regardless of amount, to be forecast as FEW, SCT, BKN or OVC as appropriate;*

b) *the next layer or mass covering more than 2/8, to be forecast as SCT, BKN or OVC as appropriate;*

c) *the next higher layer or mass covering more than 4/8, to be forecast as BKN or OVC as appropriate; and*

d) *cumulonimbus clouds, whenever forecast and not already included under a) to c).*

Cloud information should be limited to cloud of operational significance, i.e. cloud below 1 500 m (5 000 ft) or the highest minimum sector altitude whichever is greater, and cumulonimbus whenever forecast. In applying this limitation, when no cumulonimbus and no cloud below 1 500 m (5 000 ft) or below the highest *minimum sector altitude whichever is greater are forecast, and "CAVOK" or "SKC" are not appropriate, the abbreviation "NSC" should be used.*

1.2.5 Temperature

~~6.2.16~~ **Recommendation**.— *When forecast temperatures are included in accordance with regional air navigation agreement, the maximum and minimum temperatures expected to occur during the period of validity of the ~~aerodrome forecast~~ TAF should be given, together with their corresponding times of occurrence.*

1.3 Use of change groups

~~6.2.5~~1.3.1 **Recommendation**.— *The criteria used for the inclusion of change groups in ~~aerodrome forecasts~~ TAF or for the amendment of ~~aerodrome forecasts~~ TAF should be based on the following:*

a) when the surface wind is forecast to change through values of operational significance the threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:

1) require a change in runway(s) in use; and

2) indicate that the runway tailwind and crosswind components will change through values representing the main operating limits for typical aircraft operating at the aerodrome;

b) when the visibility is forecast to improve and change to or pass through one or more of the following values, or when the visibility is forecast to deteriorate and pass through one or more of the following values:

1) 150, 350, 600, 800, 1 500 or 3 000 m;

2) 5 000 m in cases where significant numbers of flights are operated in accordance with the visual flight rules;

c) when any of the following weather phenomena or combinations thereof are forecast to begin or end or change in intensity:

- *freezing precipitation*
- *freezing fog*
- *moderate or heavy precipitation (including showers thereof)*
- *low drifting dust, sand or snow*
- *blowing dust, sand or snow (including snowstorm)*
- *duststorm*
- *sandstorm*
- *thunderstorm (with or without precipitation)*
- *squall*
- *funnel cloud (tornado or waterspout)*
- *other weather phenomena given in ~~4.8.4~~ Appendix 3, 4.4.2.2 only if they are expected to cause a significant change in visibility;*

d) *when the height of base of the lowest layer or mass of cloud of BKN or OVC extent is forecast to lift and change to or pass through one or more of the following values, or when the height of the lowest layer or mass of cloud of BKN or OVC extent is forecast to lower and pass through one or more of the following values:*

1) *30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft); or*

2) *450 m (1 500 ft), in cases where significant numbers of flights are operated in accordance with the visual flight rules;*

e) *when the amount of a layer or mass of cloud below 450 m (1 500 ft) is forecast to change:*

1) *from SKC, FEW or SCT to BKN or OVC; or*

2) *from BKN or OVC to SKC, FEW or SCT;*

f) *when cumulonimbus clouds are forecast to develop or dissipate;*

g) *when the vertical visibility is forecast to improve and change to or pass through one or more of the following values, or when the vertical visibility is forecast to deteriorate and pass through one or more of the following values:30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft);*

h) *any other criteria based on local aerodrome operating minima, as agreed between the meteorological authority and the operators.*

~~6.2.7~~1.3.2 **Recommendation**.— *When a change in any of the elements given in ~~6.2.2~~ Chapter 6,1.2 is required to be indicated in accordance with the criteria given in ~~6.2.5~~1.3.1 above, the change indicators "BECMG" or "TEMPO" should be used followed by the time period during which the change is expected to occur. The time period should be indicated as the beginning and end of the period in whole hours UTC. Only those elements for which a significant change is expected should be included following a change indicator. However, in the case of significant changes in respect of cloud, all cloud groups, including layers or masses not expected to change, should be indicated.*

~~6.2.8~~1.3.3 **Recommendation**.— *The change indicator "BECMG" and the associated time group should be used to describe changes where the meteorological conditions are expected to reach or pass through specified threshold values at a regular or irregular rate and at an unspecified time during the time period. The time period should normally not exceed 2 hours but in any case should not exceed 4 hours.*

~~6.2.9~~1.3.4 **Recommendation**.— *The change indicator "TEMPO" and the associated time group should be used to describe expected frequent or infrequent temporary fluctuations in the meteorological conditions which reach or pass specified threshold values and last for a period of less than one hour in each instance and, in the aggregate, cover less than one-half of the forecast period during which the fluctuations are expected to occur. If the temporary fluctuation is expected to last one hour or longer, the change group "BECMG" should be used in accordance with ~~6.2.8~~1.3.3 above or the validity period should be subdivided in accordance with ~~6.2.11~~1.3.5 below.*

~~6.2.11~~1.3.5**Recommendation**.— *Where one set of prevailing weather conditions is expected to change significantly and more or less completely to a different set of conditions, the period of validity should be subdivided into self-contained periods using the abbreviation "FM" followed immediately by a four-figure time group in whole hours and minutes UTC indicating the time the change is expected to occur. The* *subdivided period following the abbreviation "FM" should be self-contained and all forecast conditions given before the abbreviation should be superseded by those following the abbreviation.*

1.4 Use of probability groups

~~6.2.10~~ **Recommendation**.— *The probability of occurrence of an alternative value of a forecast element or elements should be indicated, as necessary, by use of the abbreviation "PROB" followed by the probability in tens of per cent and the time period during which the alternative value(s) is (are) expected to apply. The probability information should be placed after the element or elements forecast and be followed by the alternative value of the element or elements. The probability of a forecast of temporary fluctuations in meteorological conditions should be indicated, as necessary, by use of the abbreviation "PROB" followed by the probability in tens of per cent, placed before the change indicator "TEMPO" and associated time group. A probability of an alternative value or change of less than 30 per cent should not be considered sufficiently significant to be indicated. A probability of an alternative value or change of 50 per cent or more, for aviation purposes, should not be considered a probability but instead should be indicated, as necessary, by use of the change indicators "BECMG" or "TEMPO"or by subdivision of the validity period using the abbreviation "FM". The probability group should not be used to qualify the change indicator "BECMG" nor the time indicator "FM".*

1.5 Dissemination of TAF

~~6.2.17 Aerodrome forecasts in the~~ TAF ~~code form~~ and amendments thereto shall be disseminated to international OPMET data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

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Table A~~4-1.~~5-1. Template for ~~aerodrome forecasts in the~~ TAF ~~code form~~

Key: M = inclusion mandatory, part of every message
C = inclusion conditional, dependent on meteorological conditions or method of observation
O = inclusion optional

Note 1.— The ranges and resolutions for the numerical elements included in ~~aerodrome forecasts in the~~ TAF ~~code form~~ are shown in Table A~~4-3~~5-3 of this appendix.

Note 2.— The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes *(PANS-ABC, Doc 8400).*

Element as specified in Chapter 6	*Detailed content*	*Template(s)*	*Examples*
Identification of the type of report (M)	Type of report (M)	TAF or TAF AMD or TAF COR	TAF TAF AMD
Location indicator (M)	ICAO location indicator (M)	nnnn	YUDO[1]
Date and time of origin of forecast	Date and time of the origin of the forecast in UTC (M)	nnnnnnZ	160000Z

Element as specified in Chapter 6	*Detailed content*	*Template(s)*				*Examples*
(M)						
Identification of a missing forecast (C)	Missing forecast identifier (C)	NIL				NIL
END OF TAF IF THE FORECAST IS MISSING						
Date and period of validity of forecast (M)	Date and period of the validity of the forecast in UTC (M)	nnnnnn				160624 080918
Identification of a cancelled forecast (C)	Cancelled forecast identifier(C)	CNL				CNL
END OF TAF IF THE FORECAST IS CANCELLED						
Surface wind (M)	Wind direction (M)	nnn *or* VRB[3]				24015KMH; VRB06KMH (24008KT); (VRB03KT) 19022KMH (19011KT)
	Wind speed (M)	[P]nn[n]				00000KMH (00000KT) 140P199KMH (140P99KT)
	Significant speed variations (C)[2]	G[P]nn[n]				12012G35KMH (12006G18KT) 24032G54KMH (24016G27KT)
	Units of measurement (M)	KMH (*or* KT)				
Visibility (M)	~~Minimum~~ Prevailing visibility (M)	nnnn			C A V O K	0350 7000 9000 9999 CAVOK
Weather (C)[4, 5]	Intensity of weather phenomena (C)[6]	– *or* +		—		
	Characteristics and type of weather phenomena (M)[7].	DZ *or* RA *or* SN *or* SG *or* PL *or* ~~IC *or*~~ GR *or* GS *or* DS *or* SS *or* ~~TS *or*~~ TSRA *or* TSSN *or* TSPL *or* TSGR *or* TSGS *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or* BLSN *or* BLSA *or* BLDU *or* PO *or* FC~~		IC *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or* PRFG		RA HZ +TSRA FG – FZDZ PRFG +TSRASN SNRA FG
Cloud (M)[8]	Cloud amount and height of base or vertical visibility (M)	FEWnnn *or* SCTnnn *or* BKNnnn *or* OVCnnn	VVnnn *or* VV ///	SKC *or* NSC		FEW010 VV005 SKC OVC020 VV/// NSC SCT005 BKN012
	Cloud type (C)[4]	CB	—			SCT008 BKN025CB
Temperature (O)[9]	Name of the element (M)	TX				TX25/13Z TN09/05Z
	Maximum temperature (M)	nn/				

Element as specified in Chapter 6	*Detailed content*	*Template(s)*				*Examples*
	Time of occurrence of the maximum temperature (M)	nnZ				
	Name of the element (M)	TN				
	Minimum temperature (M)	nn/				
	Time of occurrence of the minimum temperature (M)	nnZ				
Expected significant changes to one or more of the above elements during the period of validity (C)[4,10]	Change or probability indicator (M)[11]	PROB30 [TEMPO] *or* PROB40 [TEMPO]		BECMG *or* TEMPO	FM	
	Period of occurrence or change (C)[4]	nnnn				
	Wind (C)[4]	nnn[P]nn[n][G[P] nn[n]]KMH *or* VRBnnKMH (*or* nnn[P]nn[G[P]nn]KT *or* VRBnnKT)				TEMPO 1518 25070G100KMH (TEMPO 1518 25035G50KT) TEMPO 1214 17025G~~0~~50KMH 1000 TSRA SCT010CB BKN020 (TEMPO 1214 17012G~~0~~25KT 1000 TSRA SCT010CB BKN020)
	Prevailing visibility (C)[4]	nnnn			C A V O K	BECMG 1011 00000KMH 2400 OVC010 (BECMG 1011 00000KT 2400 OVC010) PROB30 1214 0800 FG
	Weather phenomenon: intensity (C)[6]	- *or* +	—	NSW		BECMG 1214 RA TEMPO 0304 FZRA ~~FM1030 SN~~ TEMPO 1215 BLSN PROB40 TEMPO 0608 0500 FG
	Weather phenomenon: characteristics and type (C)[4, 7, ~~10~~]	DZ *or* RA *or* SN *or* SG *or* PL ~~*or* IC *or* GR *or* GS~~ *or* DS *or* SS *or* ~~TS *or*~~ TSRA *or* TSSN ~~*or* TSPL *or* TSGR *or* TSGS~~ *or* SHRA *or* SHSN *or* SHPL *or* SHGR *or* SHGS *or* FZRA *or* FZDZ ~~*or* BLSN *or* BLSA *or* BLDU *or* PO *or* FC~~	IC *or* GR *or* GS *or* FG *or* BR *or* SA *or* DU *or* HZ *or* FU *or* VA *or* SQ *or* PO *or* FC *or* TS *or* TSGR *or* TSGS *or* FZFG *or* BLSN *or* BLSA *or* BLDU *or* DRSN *or* DRSA *or* DRDU *or* MIFG *or* BCFG *or*			
	Cloud amount and height of base or vertical visibility (C)[4]	FEWnnn *or* SCTnnn *or* BKNnnn *or* OVCnnn	VVnnn *or* VV///	SKC *or* NSC		FM1230 15015KMH 9999 BKN020 BKN100 (FM1230 15008KT 9999 BKN020 BKN100) BECMG 1820 8000 NSW NSC
	Cloud type (C)[4]	CB	—			BECMG 0608 SCT015CB BKN020

Notes.—

1. Fictitious location;
2. To be included ~~if the maximum is exceeding the mean speed by 20 km/h (10 kt)~~ in accordance with 1.2.1;
3. To be used ~~only if the wind speed # 6 km/h (3 kt)~~ in accordance with.1.2.1;
4. To be included whenever applicable;
5. One or more, up to a maximum of three, groups in accordance with 1.2.3;
6. To be included whenever applicable in accordance with 1.2.3. No qualifier for *moderate* intensity; ~~only qualifier "+" (i.e. well-developed to be used with PO and FC;~~
7. ~~Precipitation types DZ, RA, SN, SG, PL, IC, GR and GS~~ Weather phenomena may be combined~~, where appropriate~~ in accordance with 1.2.3. Only moderate or heavy precipitation should be indicated in accordance with 1.2.3;
8. Up to four cloud layers in accordance with 1.2.4;
9. To be included ~~subject to Regional Air Navigation Agreement~~ in accordance with 1.2.5;
10. To be included ~~when a change in some or all of the elements forecast is expected to occur; may be placed after any element forecast, as appropriate~~ in accordance with. 1.3.2; and
11. Number of change indicators to be kept to a minimum in accordance with 1.3.2; normally not exceeding five groups.

Table ~~A4-2~~A5-2. Use of change and time indicators in ~~aerodrome forecasts in the~~ TAF ~~code form~~

Change or time indicator		*Time period*	*Meaning*	
FM		$n_hn_hn_mn_m$	used to indicate a significant change in most weather elements occurring at n_hn_h hours and n_mn_m minutes (UTC); all the elements given before "FM" are to be included following "FM" (i.e. they are all superseded by those following the abbreviation)	
BECMG		$n_1n_1n_2n_2$	the change is forecast to commence at n_1n_1 hours (UTC) and be completed by n_2n_2 hours (UTC); only those elements for which a change is forecast are to be given following "BECMG"; the time period $n_1n_1n_2n_2$ should normally be less than 2 hours and in any case should not exceed 4hours	
TEMPO		$n_1n_1n_2n_2$	temporary fluctuations are forecast to commence at n_1n_1 hours (UTC) and cease by n_2n_2 hours (UTC); only those elements for which fluctuations are forecast are to be given following "TEMPO"; temporary fluctuations should not last more than one hour in each instance, and in the aggregate, cover less than half of the period $n_1n_1n_2n_2$	
PROBnn	—	$n_1n_1n_2n_2$	probability of occurrence (in %) of an alternative value of a forecast element or elements; nn = 30 or nn = 40 only; to be placed after the element(s) concerned	—
	TEMPO	$n_1n_1n_2n_2$		probability of occurrence of temporary fluctuations

~~EXAMPLE OF AN AERODROME FORECAST~~
Example A5-1. TAF

TAF for YUDO (Donlon/International):*

TAF YUDO 160000Z 160624 13018KMH 9000 BKN020 BECMG 0608 SCT015CB BKN020 TEMPO 0812 17025G40KMH 1000 TSRA SCT010CB BKN020 FM1230 15015KMH 9999 BKN020 BKN100

Meaning of the forecast:

~~Aerodrome forecast~~TAF for Donlon/International* issued on the 16th of the month at 0000 UTC valid from 0600 UTC to 2400UTC on the 16th of the month; surface wind direction 130 degrees; wind speed 18 kilometres per hour; visibility 9kilometres, broken cloud at 600 metres; becoming between 0600 UTC and 0800 UTC, scattered cumulonimbus cloud at 450metres and broken cloud at 600 metres; temporarily between 0800 UTC and 1200 UTC surface wind direction 170degrees; wind speed 25 kilometres per hour gusting to 40 kilometres per hour; visibility 1 000 metres in a ~~moderate~~ thunderstorm with moderate rain, scattered cumulonimbus cloud at 300 metres and broken cloud at 600 metres; from 1230 UTC surface wind direction 150 degrees; wind speed 15 kilometres per hour; visibility 10 km or more; broken cloud at 600metres and broken cloud at 3 000 metres.

*Fictitious location

Note. — In this example, the primary units "kilometre per hour" and "metre" were used for wind speed and height of cloud base respectively. However, in accordance with Annex 5, the corresponding non-SI alternative units "knot" and "foot" may be used instead.

Example A5–2. Cancellation of TAF

Cancellation of TAF for YUDO (Donlon/International):*

TAF AMD YUDO 161500Z 160624 CNL

Meaning of the forecast:

Amended TAF for Donlon/International* issued on the 16th of the month at 1500 UTC cancelling the previously issued TAF valid from 0600 UTC to 2400 UTC on the 16th of the month.

*Fictitious location

Table ~~A4-3~~A5-3. Ranges and resolutions for the numerical elements ~~—~~included in ~~meteorological messages in the~~ TAF ~~code form~~

Element as specified in Chapter 6		*Range*	*Resolution*
Wind direction:	° true	000 - 360	10
Wind speed:	KMH KT	00 - 399* 00 - 199*	1 1
Visibility:	M M M M	0000 - 0800 0800 - 5000 5000 - 9000 9000 - 9999	50 100 1000 999
Vertical visibility:	30's M (100's FT)	000 - 020	1
Cloud: height of base:	30's M (100's FT) 30's M (100's FT)	000 - 100 100 - 200	1 10
Air temperature (maximum and minimum):	°C	-80 - +60	1

*There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary.

Secretariat

2. CRITERIA RELATED TO TREND FORECASTS

2.1. Format of trend forecasts

Trend forecasts shall be issued in accordance with the template shown in Appendix 3, Tables A3–1 and A3– 2.

Note.— Examples of trend forecasts are given in Appendix 3.

2.2 Inclusion of meteorological elements in trend forecasts

2.2.1 General provisions

The trend forecast shall indicate significant changes in respect of one or more of the elements surface wind, visibility, weather and clouds. Only those elements shall be included for which a significant change is expected. However, in the case of significant changes in respect of cloud, all cloud groups, including layers or masses not expected to change, shall be indicated. In the case of a significant change in visibility, the phenomenon causing the reduction of visibility shall also be indicated. When no change is expected to occur, this shall be indicated by the term "NOSIG".

Note. — The visibility included in trend forecasts refers to the forecast prevailing visibility.

2.2.2 Surface wind

~~6.3.8~~ The trend ~~part of the trend-type landing~~ forecast shall indicate changes in the surface wind which involve:

a) a change in the mean wind direction of 60° or more, the mean speed before and/or after the change being 20 km/h (10 kt) or more;

b) a change in mean wind speed of 20 km/h (10 kt) or more; and

c) changes in the wind through values of operational significance. The threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:

   1) require a change in runway(s) in use; and

   2) indicate that the runway tailwind and crosswind components will change through values representing the main operating limits for typical aircraft operating at the aerodrome.

2.2.3 Visibility

~~6.3.9~~ When the visibility is expected to improve and change to or pass through one or more of the following values, or when the visibility is expected to deteriorate and pass through one or more of the following values: 150, 350, 600, 800. 1 500 or 3 000 m, the trend ~~part of the trend-type landing~~ forecast shall indicate the change. When significant numbers of flights are conducted in accordance with the visual flight rules, the forecast shall additionally indicate changes to or passing through 5 000 m.

2.2.4 Weather phenomena

~~6.3.10~~ The trend ~~part of the trend-type landing~~ forecast shall indicate the expected onset, cessation or change in intensity of one or more, up to a maximum of three, of the following weather phenomena or combinations thereof:

- freezing precipitation
- freezing fog
- moderate or heavy precipitation (including showers thereof)
- low drifting dust, sand or snow
- blowing dust, sand or snow (including snowstorm)
- duststorm
- sandstorm
- thunderstorm (with or without precipitation)
- squall
- funnel cloud (tornado or waterspout)
- other weather phenomena given in ~~4.8.4~~ Appendix 3, 4.4.2.2, only if they are expected to cause a significant change in visibility.

The expected end of occurrence of those phenomena shall be indicated by the abbreviation “NSW”.

2.2.5 Clouds

~~6.3.11~~ When the height of the base of a cloud layer of BKN or OVC extent is expected to lift and change to or pass through one or more of the following values, or when the height of the base of a cloud layer of BKN or OVC extent is expected to lower and pass through one or more of the following values: 30, 60, 150, 300 and 450 m (100, 200, 500, 1 000 and 1 500 ft), the trend ~~part of the trend-type landing~~ forecast shall indicate the change. When the height of the base of a cloud layer is below, is expected to fall below or rise above 450 m (1 500 ft), the trend ~~part of the trend-type landing~~ forecast shall also indicate changes in cloud amount from SKC, FEW, or SCT increasing to BKN or OVC, or changes from BKN or OVC decreasing to SKC, FEW or SCT. When no cumulonimbus and no cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, are forecast and “CAVOK” and “SKC” are not appropriate, the abbreviation “NSC” shall be used.

2.2.6 Vertical visibility

~~6.3.12~~ When the sky is expected to remain or become obscured and vertical visibility observations are available at the aerodrome, and the vertical visibility is forecast to improve and change to or pass. through one or more of the following values, or when the vertical visibility is forecast to deteriorate and pass through one or more of the following values: 30, 60, 150 or 300 (100, 200, 500 or 1 000 ft),the trend ~~part of the trend-type landing~~ forecast shall indicate the change.

2.2.7 Additional criteria

~~6.3.13~~ Criteria for the indication of changes based on local aerodrome operating minima, additional to those specified in ~~6.3.8 to 6.3.12~~ 2.2.2 to 2.2.6, shall be used as agreed between the meteorological authority and the operator(s) concerned.

2.3 Use of change indicators

~~6.3.4~~2.3.1 When a change is expected to occur, the trend ~~part of the trend-type~~ forecast ~~message~~ shall begin with one of the change indicators "BECMG" or "TEMPO".

~~6.3.5~~2.3.2 The change indicator "BECMG" shall be used to describe forecast changes where the meteorological conditions are expected to reach or pass through specified values at a regular or irregular rate. The period during which, or the time at which, the change is forecast to occur shall be indicated, using the abbreviations "FM", "TL", or "AT", as appropriate, each followed by a time group in hours and minutes. When the change is forecast to begin and end wholly within the trend forecast period, the beginning and end of the change shall be indicated by using the abbreviations "FM" and "TL" respectively with their associated time groups. When the change is forecast to commence at the beginning of the trend forecast period but be completed before the end of that period, the abbreviation "FM" and its associated time group shall be omitted and only "TL" and its associated time group shall be used. When the change is forecast to begin during the trend forecast period and be completed at the end of that period, the abbreviation "TL" and its associated time group shall be omitted and only "FM" and its associated time group shall be used. When the change is forecast to occur at a specified time during the trend forecast period, the abbreviation "AT" followed by its associated time group shall be used. When the change is forecast to commence at the beginning of the trend forecast period and be completed by the end of that period or when the change is forecast to occur within the trend forecast period but the time is uncertain, the abbreviations "FM", "TL" or "AT" and their associated time groups shall be omitted and the change indicator "BECMG" shall be used alone.

~~6.3.6~~2.3.3 The change indicator "TEMPO" shall be used to describe forecast temporary fluctuations in the meteorological conditions which reach or pass specified values and last for a period of less than one hour in each instance and, in the aggregate, cover less than one-half of the period during which the fluctuations are forecast to occur. The period during which the temporary fluctuations are forecast to occur shall be indicated, using the abbreviations "FM" and/or "TL", as appropriate, each followed by a time group in hours and minutes. When the period of temporary fluctuations in the meteorological conditions is forecast to begin and end wholly within the trend forecast period, the beginning and end of the period of temporary fluctuations shall be indicated by using the abbreviations "FM" and "TL" respectively with their associated time groups. When the period of temporary fluctuations is forecast to commence at the beginning of the trend forecast period but cease before the end of that period, the abbreviation "FM" and its associated time group shall be omitted and only "TL" and its associated time group shall be used. When the period of temporary fluctuations is forecast to begin during the trend forecast period and cease by the end of that period, the abbreviation "TL" and its associated time group shall be omitted and only "FM" and its associated time group shall be used. When the period of temporary fluctuations is forecast to commence at the beginning of the trend forecast period and cease by the end of that period, both abbreviations "FM" and "TL" and their associated time groups shall be omitted and the change indicator "TEMPO" shall be used alone.

2.4 Use of the probability indicator

~~6.3.7~~ The indicator "PROB" shall not be used in trend~~- type landing~~ forecasts.

3. CRITERIA RELATED TO FORECASTS FOR TAKE-OFF

3.1 Format of forecasts for take-off

~~6.4.4~~ **Recommendation.—** *The format of the forecast should be as agreed between the meteorological authority and the operator concerned. The order of the elements and the terminology, units and scales used in forecasts for take-off should be the same as those used in reports for the same aerodrome.*

3.2 Amendments to forecasts for take-off

Recommendation. —*The criteria for the issuance of amendments for forecasts for take-off for surface wind direction and speed, temperature and pressure and any other elements agreed locally should be agreed between the meteorological authority and the operators concerned. The criteria should be consistent with the corresponding criteria for special reports established for the aerodrome in accordance with ~~4.3.1~~ Appendix 3, 2.3.1.*

4. CRITERIA RELATED TO AREA AND ROUTE FORECASTS, OTHER THAN FORECASTS ISSUED WITHIN THE FRAMEWORK OF THE WORLD AREA FORECAST SYSTEM

4.1 Format of area and route forecasts

~~6.5.5~~4.1.1 Area and route forecasts and amendments thereto, disseminated locally, shall be in one of the forms prescribed for the exchange of such information between meteorological offices or in another form as agreed locally.

~~6.5.6~~4.1.2 ~~Area and~~ Route forecasts and amendments thereto which are exchanged between meteorological offices in a code form prescribed by the World Meteorological Organization shall be in the ~~WINTEM or~~ ROFOR code form.

Note.— The ~~WINTEM and~~ ROFOR code forms ~~are~~is contained in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes.

~~6.5.7~~4.1.3 **Recommendation**.— *The order of the elements in area and route forecasts (or amendments thereto) in abbreviated plain language should normally follow that of the corresponding coded* *form of message. The terminology and units employed should be consistent with those used in the related aerodrome reports and forecasts. The identifier employed should be "AREA FCST" or "ROUTE FCST" respectively, preceded in the case of amendments by "AMD". The CAVOK procedure applied in ~~aerodrome forecasts~~ TAF should not be used in area and route forecasts.*

4.2 Amendments to area and route forecasts

~~6.5.3~~4.2.1 A list of criteria to be used for amendments to area and route forecasts shall be established by the meteorological authority, in consultation with operators and other users concerned.

~~6.5.4~~4.2.2 ~~**Recommendation.—**~~ Amendments to area and route forecasts ~~should~~ shall be issued in accordance with criteria in ~~3.2.12 and 3.2.13~~Appendix 2, 1.4.

5. CRITERIA RELATED TO AREA FORECASTS FOR LOW-LEVEL FLIGHTS

5.1 Format and content of GAMET area forecasts

When prepared in GAMET format, they shall contain two sections: Section I related to information on en-route weather phenomena hazardous to low-level flights, prepared in support of the issuance of AIRMET information, and Section II related to additional information required by low-level flights. The area forecasts shall contain the following information as necessary and, when prepared in GAMET format, in the order indicated. Additional elements in Section II shall be included in accordance with regional air navigation agreement:

a) location indicator of the air traffic services unit serving the flight information region(s) to which the area forecast for low-level flights refers; for example, "YUCC";

b) message identification using the abbreviation "GAMET";

c) date-time groups indicating the period of validity in UTC; for example, "VALID 220600/221200";

d) location indicator of the meteorological office originating the message, followed by a hyphen to separate the preamble from the text; for example, "YUDO-";

e) on the next line, name of the flight information region, or a sub-area thereof, for which the area forecast for low-level flights is issued; for example "AMSWELL FIR/2 BLW FL120";

f) on the next line, indication of the beginning of the first section of the area forecast using the abbreviation "SECN I";

g) widespread mean surface wind speed exceeding 60 km/h (30 kt); for example, "SFC WSPD: 10/12 65 KMH";

h) widespread areas of surface visibility below 5 000 m including the weather phenomena causing the reduction of visibility; for example, “SFC VIS: 06/08 3000 M BR N OF 51 DEG N”;

i) significant weather conditions encompassing thunderstorms and heavy sand- and duststorm (except for phenomena for which a SIGMET message has already been issued); for example, “SIGWX: 11/12 ISOL TS”;

j) mountain obscuration; for example, “MT OBSC: MT PASSES S OF 48 DEG N”;

k) widespread areas of broken or overcast cloud with height of base less than 300 m (1 000 ft) above ground level (AGL) or above mean sea level (AMSL) and/or any occurrence of cumulonimbus (CB) or towering cumulus (TCU) clouds, giving height indications of their bases and tops; for example, “SIG CLD: 06/09 OVC 800/1100 FT AGL N OF N51 10/ 12 ISOL TCU 1200/8000 FT AGL”;

l) icing (except for that occurring in convective clouds and for severe icing for which a SIGMET message has already been issued); for example, “ICE: MOD FL050/080”;

m) turbulence (except for that occurring in convective clouds and for severe turbulence for which a SIGMET message has already been issued); for example, “TURB: MOD ABV FL090”;

n) mountain wave (except for severe mountain wave for which a SIGMET message has already been issued); for example, “MTW: MOD ABV FL080 E OF 63 DEG N”;

o) SIGMET messages applicable to the FIR concerned or the sub-area thereof, for which the area forecast is valid; for example, “SIGMET APPLICABLE: 3,5”.

p) on the next line, indication of the beginning of the second section of the area forecast using the abbreviation “SECN II”;

q) pressure centres and fronts and their expected movements and developments; for example, “PSYS: 06 L 1004 HPA 51.5 DEG N 10.0 DEG E MOV NE 25 KT WKN”;

r) upper winds and upper-air temperatures for at least the following altitudes: 600, 1 500 and 3 000 m (2 000, 5 000 and 10 000 ft); for example, “WIND/T: 2000 FT 270/70 KMH PS03 5000 FT 250/80 KMH MS02 10000 FT 240/85 KMH MS11”;

s) cloud information not included under k), giving cloud amount, type and height indications of the bases and tops above ground level (AGL) or above mean sea level (AMSL); for example, “CLD: BKN SC 2500/8000 FT AGL”;

t) height indication of 0° C level(s) above ground level (AGL) or above mean sea level (AMSL), if lower than the top of the airspace for which the forecast is supplied; for example, “FZLVL: 3000 FT AGL”;

u) forecast lowest QNH during the period of validity; for example, “MNM QNH: 1004 HPA”;

v) sea-surface temperature and state of the sea if required by regional air navigation agreement; for example, “SEA: T15 HGT 5 M”; and

w) location of volcanic eruptions which are producing ash clouds of significance to aircraft operations, name of volcano and time of first eruption, if known; for example, "VA: MT. HOKKAIDO KOMAGATAKE PSN N4292 E14040 ERUPTED VA CLD TOP 4900 FT MOV SE".

Each of the items g) to o) and q) to w) shall, when applicable, be included in the GAMET area forecast beginning on a new line and include an indication of the location (referring where possible, to latitude and longitude and/or locations or geographic features well known internationally) and level, where appropriate. Items g) to o) for which no hazardous phenomenon is expected to occur, or which are already covered by a SIGMET message, shall be omitted from the area forecast. When no weather phenomena hazardous to low-level flights occur and no SIGMET information is applicable, the term "HAZARDOUS WX NIL" shall replace all items listed under g) to o).

5.2 Amendments to GAMET area forecasts

When a weather phenomenon hazardous to low-level flights has been included in the GAMET area forecast and the phenomenon forecast does not occur, or is no longer forecast, a GAMET AMD shall be issued, amending only the weather element concerned.

Note.— Specifications regarding the issuance of AIRMET information amending the area forecast in respect of weather phenomena hazardous for low-level flights are given in ~~7.3.1~~Appendix 6.

~~EXAMPLE OF GAMET AREA FORECAST~~
Example A5-2. GAMET area forecast

YUCC GAMET VALID 220600/221200 YUDO
AMSWELL FIR/2 BLW FL100
SECN I
SFC WSPD: 10/12 65 KMH
SFC VIS: 06/08 3000 M BR N OF N51
SIGWX: 11/12 ISOL TS
SIG CLD: 06/09 OVC 800/1100 FT AGL N OF N51 10/12 ISOL TCU 1200/8000 FT AGL
ICE: MOD FL050/080
TURB: MOD ABV FL090
SIGMETS APPLICABLE: 3,5
SECN II
PSYS: 06 L 1004 HPA N51.5 E10.0 MOV NE 25 KT WKN
WIND/T: 2000 FT 270/70 KMH PS03 5000 FT 250/80 KMH MS02 10000 FT 240/85 KMH MS11
CLD: BKN SC 2500/8000 FT AGL
FZLVL: 3000 FT AGL
MNM QNH: 1004 HPA
SEA: T15 HGT 5M
VA: NIL

Meaning: An area forecast for low-level flights (GAMET) issued for sub-area two of the Amswell* flight information region (identified by YUCC Amswell area control centre) for below flight level 100 by the Donlon/International* meteorological office (YUDO); the message is valid from 0600 UTC to 1200 UTC on the 22nd of the month.

Section I:	
surface wind speeds:	between 1000 UTC and 1200 UTC 65 kilometres per hour;
surface visibility:	between 0600 UTC and 0800 UTC 3 000 metres north of 51 degrees north (due to mist);
significant weather phenomena:	between 1100 UTC and 1200 UTC isolated thunderstorms without hail;
significant clouds:	between 0600 UTC and 0900 UTC overcast base 800, top 1100 feet above ground level north of 51 degrees north; between 1000 UTC and 1200 UTC isolated towering cumulus base 1200, top 8000 feet above ground level;
icing:	moderate between flight level 050 and 080;
turbulence:	moderate above flight level 090 (at least up to flight level 100);
SIGMET messages:	3 and 5 applicable to the validity period and subarea concerned;
Section II:	
pressure systems:	at 0600 UTC low pressure of 1004 hectopascals at 51.5 degrees north 10.0 degrees east, expected to move north-eastwards at 25 knots and to weaken;
winds and temperatures:	at 2 000 feet above ground level wind direction 270 degrees; wind speed 70 kilometres per hour, temperature plus 3 degrees Celsius; at 5000 feet above ground level wind direction 250 degrees; wind speed 80 kilometres per hour, temperature minus 2 degrees Celsius; at 10000 feet above ground level wind direction 240 degrees; wind speed 85 kilometres per hour, temperature minus 11 degrees Celsius;
clouds:	broken stratocumulus, base 2 500 feet, top 8 000 feet above ground level;
freezing level:	3 000 feet above ground level;
minimum QNH:	1004 hectopascals;
sea:	surface temperature 15 degrees Celsius; and state of sea 5 metres;
volcanic ash:	nil.

* Fictitious locations

Secretariat

APPENDIX ~~5~~ 6. TECHNICAL SPECIFICATIONS ~~FOR~~ RELATED TO SIGMET AND AIRMET ~~MESSAGES AND SPECIAL AIR-REPORTS~~ INFORMATION, AERODROME WARNINGS AND WIND SHEAR WARNINGS

(See Chapter 7 of this Annex)

Note.— Data type designators to be used in abbreviated headings for SIGMET, AIRMET, tropical cyclone and volcanic ash advisory messages are given in WMO Publication No. 386, Manual on the Global Telecommunication System.

1. SPECIFICATIONS RELATED TO SIGMET INFORMATION

1.1 Format of SIGMET messages

~~7.2.1~~1.1.1 The content and order of elements in a SIGMET message shall be in accordance with the template shown in ~~Appendix 5~~, Table A6-1.

~~7.2.4~~1.1.2 Messages containing SIGMET information for subsonic aircraft shall be identified as "SIGMET", those containing SIGMET information for supersonic aircraft during transonic or supersonic flight shall be identified as "SIGMET SST".

~~7.2.5~~1.1.3 The sequence number referred to in the template in ~~Appendix 5~~ Table A6-1 shall correspond with the number of SIGMET messages issued for the flight information region since 0001 UTC on the day concerned. Separate series of sequence numbers shall be used for "SIGMET" and "SIGMET SST" messages.

1.1.4 In accordance with the template in Table A6-1, only one of the following phenomena shall be included in a SIGMET message, using the abbreviations as indicated below:

~~7.1.1~~ a) at a subsonic cruising levels:

thunderstorm

— obscured	OBSC TS
— embedded	EMBD TS
— frequent	FRQ TS
— squall line	SQL TS
— obscured with hail	OBSC TS GR
— embedded with hail	EMBD TS GR
— frequent, with hail	FRQ TS GR
— squall line with hail	SQL TS GR

tropical cyclone

— tropical cyclone with 10-minute mean surface wind speed of 63 km/h (34 kt) or more — TC (+ cyclone name)

turbulence

— severe turbulence — SEV TURB

icing

— severe icing — SEV ICE

— severe icing due to
freezing rain SEV ICE (FZRA)

mountain wave

— severe mountain wave — SEV MTW

duststorm

— heavy duststorm — HVY DS

sandstorm

— heavy sandstorm — HVY SS

volcanic ash

— volcanic ash — VA (+ volcano name, if known)

b) at transonic levels and supersonic cruising levels:

turbulence

— moderate turbulence — MOD TURB

— severe turbulence — SEV TURB

cumulonimbus

— isolated cumulonimbus — ISOL CB

— occasional cumulonimbus — OCNL CB

— frequent cumulonimbus — FRQ CB

hail

— hail — GR

volcanic ash

— volcanic ash — VA (+ volcano name, if known)

~~7.1.2~~1.1.5 SIGMET information shall not contain unnecessary descriptive material. In describing the weather phenomena for which the SIGMET is issued, no descriptive material additional to that given in ~~7.1.1~~ 1.1.4 above shall be included. SIGMET information concerning thunderstorms or a tropical cyclone shall not include references to associated turbulence and icing.

~~7.2.3~~1.1.6 **Recommendation.**— *Meteorological watch offices in a position to do so should issue SIGMET information for volcanic ash cloud and tropical cyclones in graphical format using the WMO BUFR* *code form, in addition to the issuance of this SIGMET information in abbreviated plain language in accordance with ~~7.2.2.~~1.1.1.*

Note.— The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

1.2 Dissemination of SIGMET messages

WAFSSG

~~7.2.11~~1.2.1 SIGMET messages shall be disseminated to meteorological watch offices, WAFCs and, ~~as appropriate, RAFCs and~~ to other meteorological offices, in accordance with regional air navigation agreement. SIGMET messages for volcanic ash shall also be disseminated to VAACs.

~~7.2.12~~1.2.2 SIGMET messages shall be ~~transmitted~~disseminated to international ~~operational meteorological~~ OPMET data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

Secretariat

2. SPECIFICATIONS RELATED TO AIRMET INFORMATION

2.1 Format of AIRMET messages

~~7.4.1~~2.1.1 The content and order of elements in an AIRMET message shall be in accordance with the template shown in ~~Appendix 5~~, Table A6-1.

~~7.4.3~~2.1.2 The sequence number referred to in the template in ~~Appendix 5~~ Table A6-1 shall correspond with the number of AIRMET messages issued for the flight information region since 0001 UTC on the day concerned.

2.1.3 The flight information region shall be divided in sub-areas, as necessary.

2.1.4 In accordance with the template in Table A6-1, only one of the following phenomena shall be included in an AIRMET message, using the abbreviations as indicated below:

~~7.3.1~~ At cruising levels below flight level 100 (or below flight level 150 in mountainous areas, or higher, where necessary):

— surface wind speed

— widespread mean surface wind speed above	SFC WSPD (+ wind speed and units)

60 km/h (30 kt)

— surface visibility

— widespread areas affected by reduction of visibility to less than 5 000 m, including the weather phenomenon causing the reduction of visibility — SFC VIS (+ visibility) (+ one of the following weather phenomena ~~to be selected from the list in 4.8.4~~: DZ, RA, SN, SG, PL, IC, GR, GS, FG, BR, SA, DU, HZ, FU, VA, PO, SQ, FC, DS or SS)

— thunderstorms

— isolated thunderstorms without hail	ISOL TS
— occasional thunderstorms without hail	OCNL TS
— isolated thunderstorms with hail	ISOL TSGR
— occasional thunderstorms with hail	OCNL TSGR

— mountain obscuration

— mountains obscured	MT OBSC

— cloud

— widespread areas of broken or overcast cloud with height of base less than 300 m (1 000 ft) above ground level:

— broken	BKN CLD (+ height of the base and top and units)
— overcast	OVC CLD (+ height of the base and top and units)

— cumulonimbus clouds which are:

— isolated	ISOL CB
— occasional	OCNL CB
— frequent	FRQ CB

— towering cumulus clouds which are:

— isolated	ISOL TCU
— occasional	OCNL TCU
— frequent	FRQ TCU

— icing

— moderate icing (except for icing in convective clouds)	MOD ICE

— turbulence

— moderate turbulence (except for turbulence in convective clouds)	MOD TURB

— mountain wave

— moderate mountain wave	MOD MTW

~~7.3.2~~2.1.5 AIRMET information shall not contain unnecessary descriptive material. In describing the weather phenomena for which the AIRMET is issued, no descriptive material additional to that given in ~~7.3.1~~ 2.1.3 shall be included. AIRMET information concerning thunderstorms or cumulonimbus clouds shall not include references to associated turbulence and icing.

Note.— The specifications for SIGMET information which is also applicable to low-level flights are given in ~~7.1.1~~ 1.1.4.

2.2 Dissemination of AIRMET messages

~~7.4.5~~2.2.1 **Recommendation**.— *AIRMET messages should be disseminated to meteorological watch offices in adjacent flight information regions and to other meteorological offices, as agreed by the meteorological authorities concerned.*

~~7.2.12~~2.2.2 **Recommendation**.— *~~SIGMET~~AIRMET messages shall be transmitted to international operational meteorological data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.*

Insert new text as follows:

3. SPECIFICATIONS RELATED TO SPECIAL AIR-REPORTS

Note.— This Appendix deals with the uplink of special air-reports. The general specifications related to special air-reports are in Appendix 4.

Editorial Note.— The following text is based on the existing footnotes related to the template for SIGMET and AIRMET messages and special air-reports

3.1 **Recommendation. —***Special air-reports should be uplinked for 60 minutes after their issuance.*

3.2 **Recommendation. —***Information on wind and temperature included in automated special air-reports should not be uplinked to other aircraft in flight.*

4. DETAILED CRITERIA RELATED TO SIGMET AND AIRMET MESSAGES AND SPECIAL AIR-REPORTS (UPLINK)

4.1 Identification of the flight information region

Recommendation. — *In cases where the airspace is divided into a flight information region (FIR) and an upper flight information region (UIR), the SIGMET should be identified by the location indicator of the air traffic services unit serving the FIR.*

Note.— The SIGMET message applies to the whole airspace within the lateral limits of the FIR, i.e. to the FIR and to the UIR. The particular areas and/or flight levels affected by the meteorological phenomena causing the issuance of the SIGMET are given in the text of the message.

4.2 Criteria related to phenomena included in SIGMET and AIRMET messages and special air-reports (uplink)

4.2.1 **Recommendation. —***An area of thunderstorms and cumulonimbus clouds should be considered:*

c) obscured (OBSC) if it is obscured by haze or smoke or cannot be readily seen due to darkness;

d) embedded (EMBD) if it is embedded within cloud layers and cannot be readily recognized;

e) isolated (ISOL) if it consists of individual features which affect, or are forecast to affect, an area with a maximum spatial coverage less than 50 per cent of the area concerned (at a fixed time or during the period of validity); and

f) occasional (OCNL) if it consists of well-separated features which affect, or are forecast to affect, an area with a maximum spatial coverage between 50 and 75 per cent of the area concerned (at a fixed time or during the period of validity).

4.2.2 **Recommendation. —** *An area of thunderstorms should be considered frequent (FRQ) if within that area there is little or no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity).*

4.2.3 **Recommendation. —** *Squall line (SQL) should indicate a thunderstorm along a line with little or no space between individual clouds*

4.2.4 **Recommendation. —** *Hail (GR) should be used as a further description of the thunderstorm, as necessary.*

4.2.5 **Recommendation. —** *Severe and moderate turbulence (TURB) should refer only to: low-level turbulence associated with strong surface winds; rotor streaming; or turbulence whether in cloud or not in cloud (CAT) ~~near to jet streams~~. Turbulence should not be used in connection with convective clouds.*

4.2.6 Turbulence shall be considered:

a) severe whenever the turbulence index is between 15 and 27 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.5); and

b) moderate whenever the turbulence index is between 6 and 14 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.3 while not exceeding 0.5).

4.2.7 **Recommendation. —** *Severe and moderate icing (ICE) should refer to severe icing in other than convective clouds. Freezing rain (FZRA) should refer to severe icing conditions caused by freezing rain.*

4.2.8 **Recommendation. —** *A mountain wave (MTW) should be considered:*

a) severe whenever an accompanying downdraft of 3.0 m/s (600 ft/min) or more and/or severe turbulence is observed or forecast; and

b) moderate whenever an accompanying downdraft of 1.75–3.0 m/s (350–600 ft/min) and/or moderate turbulence is observed or forecast.

4.2.9 **Recommendation. —** *In the outlook of SIGMET messages for volcanic ash, up to four layers or levels should be included.*

METLINKSG

Table A5~~-1~~6-1. Template for SIGMET and AIRMET messages and special air-reports (uplink)

Key:M = inclusion mandatory, part of every message
C =inclusion conditional, included whenever applicable
= =a double line indicates that the text following it should be placed on the subsequent line

Note.— The ranges and resolutions for the numerical elements included in SIGMET/AIRMET messages and in special air-reports are shown in Table A5~~-2~~6-4 of this appendix.

Element as specified in Chapters 5 and 7	*Detailed content*	*Template(s)*				*Examples*
		SIGMET	*SIGMET SST*[1]	*AIRMET*	*SPECIAL AIR-REPORT*[2]	
Location indicator of FIR/CTA (M)[3]	ICAO location indicator of the ATS unit serving the FIR or CTA to which the SIGMET/ AIRMET refers (M)	nnnn			—	YUCC[4] YUDD[4]
Identification (M)	Message identification and sequence number[5] (M)	SIGMET [nn]n	SIGMET SST [nn]n	AIRMET [nn]n	ARS	SIGMET 5 SIGMET A3 SIGMET SST 1 AIRMET 2 ARS
Validity period (M)	Date-time groups indicating the period of validity in UTC (M)	VALID nnnnnn/nnnnnn			— [6]	VALID 221215/221600 VALID 101520/101800 VALID 251600/252200
Location indicator of MWO (M)	Location indicator of MWO originating the message with a separating hyphen (M)	nnnn–				YUDO — [4] YUSO — [4]
Name of the FIR/ CTA *or* aircraft identification (M)	Name of the FIR/ CTA[7] for which the SIGMET/AIRMET is issued *or* aircraft radiotelephony call sign (M)	nnnnnnnnnn FIR[/UIR] or nnnnnnnnnn CTA		nnnnnnnnnn FIR[/n]	nnnnnn	AMSWELL FIR[4] SHANLON FIR/UIR[4] AMSWELL FIR/2[4] SHANLON FIR[4] VA812
IF THE SIGMET IS TO BE CANCELLED SEE FOR DETAILS AT THE END OF THE TEMPLATE						
Phenomenon (M)[8]	Description of phenomenon causing the issuance of SIGMET/AIRMET (C)	OBSC[9] TS [GR[10]] EMBD[12] TS [GR] FRQ[13] TS [GR] SQL[14] TS [GR] TC nnnnnnnnnn SEV TURB[11] SEV ICE[19] SEV ICE (FZRA)[20] SEV MTW[21] HVY DS HVY SS VA[ERUPTION] [MT nnnnnnnnnn] [LOC Nnn[nn] *or* Snn[nn] Ennn[nn] *or* Wnnn[nn]] VA CLD	MOD TURB[11] SEV TURB ISOL[15] CB[16] OCNL[18] CB FRQ[13] CB GR VA[ERUPTION] [MT nnnnnnnnnn] [LOC Nnn[nn] or Snn[nn] Ennn[nn] *or* Wnnn[nn]] VA CLD	SFC WSPD nn[n]KMH (SFC WSPD nn[n]KT) SFC VIS nnnnM (nn)[17] ISOL[15] TS[GR][10] OCNL[18] TS[GR] MT OBSC BKN CLD nnn/[ABV]nnnnM (BKN CLD nnn/[ABV]nnnnFT) OVC CLD nnn/[ABV]nnnnM (OVC CLD	TS TSGR SEV TURB SEV ICE SEV MTW HVY SS VA CLD [FL nnn/nnn] VA [MT nnnnnnnnnn] MOD TURB[11]	SEV TURB FRQ TS OBSC TSGR ~~EMD~~EMBD TSGR TC GLORIA VA ERUPTION MT ASHVAL LOC S15 E073 VA CLD MOD TURB MOD MTW ISOL CB BKN CLD 120/900M (BKN CLD 400/3000FT) OVC CLD

Element as specified in Chapters 5 and 7	*Detailed content*	*Template(s)*				*Examples*
		SIGMET	*SIGMET SST*[1]	*AIRMET*	*SPECIAL AIR-REPORT*[2]	
				nnn/[ABV]nnnnFT) ISOL[15] CB[16] OCNL[18] CB FRQ[13] CB ISOL[15] TCU[16] OCNL[18] TCU1[6] FRQ[13] TCU MOD TURB[11] MOD ICE[19] MOD MTW[21]	GR[10] CB[16]	270/ABV3000M (OVC CLD 900/ ABV10000FT) SEV ICE
Observed or forecast phenomenon (M)	Indication whether the information is observed and expected to continue, *or* forecast (M)	OBS [AT nnnnZ] FCST OBS [AT nnnnZ] AND FCST			OBS AT nnnnZ —	OBS AT 1210Z OBS OBS AND FCST ~~OBS AT 2245Z~~
Location (C)	Location (referring to latitude and longitude (in degrees and minutes) *or* locations or geographic features well known internationally)	[N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] [Nnn[nn]][Wnnn[nn]] or [N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] [Nnn[nn]][Ennn[nn]] or [N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] [Snn[nn]][Wnnn[nn]] or [N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] [Snn[nn]][Ennn[nn]] or [N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] nnnnnnnnnnnn			NnnnnWnnnnn or NnnnnWnnnnn or SnnnnWnnnnn or SnnnnEnnnnn	S OF N54 N OF N50 N2020 W07005 YUSB[4] N2706 W07306 N48 E010
Level (C)	Flight level *and* extent[22](C)	FLnnn *or* FLnnn/nnn *or* TOP FLnnn *or* [TOP] ABV FLnnn *or*[TOP] BLW FLnnn *or*[23] CB TOP [ABV] FLnnn WI nnnKM OF CENTRE (CB TOP [ABV] FLnnn WI nnnNM OF CENTRE) or CB TOP [BLW] FLnnn WI nnnKM OF CENTRE (CB TOP [BLW] FLnnn WI nnnNM OF CENTRE) *or*[24] FLnnn/nnn [APRX nnnKM BY nnnKM] [Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] (FLnnn/nnn [APRX nnnNM BY nnnNM] [Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]])			FLnnn	FL180 FL050/080 TOP FL390 BLW FL200 TOP ABV FL100 FL310/450 CB TOP FL500 WI 270KM OF CENTRE (CB TOP FL500 WI 150NM OF CENTRE) FL310/350 APRX 220KM BY 35KM FL390

Element as specified in Chapters 5 and 7	*Detailed content*	*Template(s)*				*Examples*
		SIGMET	*SIGMET SST*[1]	*AIRMET*	*SPECIAL AIR-REPORT*[2]	
Movement or expected movement (C)	Movement or expected movement with reference to one of the eight points of compass, or stationary (C)	MOV N [nnKMH] *or* MOV NE [nnKMH] *or* MOV E [nnKMH] *or* MOV SE [nnKMH] *or* MOV S [nnKMH] *or* MOV SW [nnKMH] *or* MOV W [nnKMH] *or* MOVNW[nnKMH] *or* (MOV N [nnKT] or MOV NE [nnKT] *or* MOV E [nnKT] *or* MOV SE [nnKT] *or* MOVS[nnKT] *or* MOV SW [nnKT] *or* MOV W [nnKT] *or* MOV NW [nnKT]) *or* STNR			—	MOV E 40KMH (MOV E 20KT) MOV SE STNR
Changes in intensity (C)	Expected changes in intensity (C)	INTSF *or* WKN or NC			—	WKN
Forecast position (C)[22]	Forecast position of volcanic ash cloud *or* the centre of the TC at the end of the validity period of the SIGMET message (C)	FCST nnnnZ TC CENTRE Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] *or* FCST nnnnZ VA CLD Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]]		—	—	FCST 2200Z TC CENTRE N2740 W07345 FCST 1700Z VA CLD S15 E075 ~~TO~~ – S15 E081 ~~TO~~ – S17 E083 ~~TO~~ – S18 E079 ~~TO~~ – S15 E75
Outlook[22] (C)	Outlook providing information beyond the period of validity of the trajectory of the volcanic ash cloud and positions of the tropical cyclone centre (C)	OTLK nnnnnn TC CENTRE Nnnnn *or* SnnnnWnnnnn *or* Ennnnn nnnnnn TC CENTRE Nnnnn *or* SnnnnWnnnnn *or* Ennnnn *or* OTLK nnnnn VA CLD APRX [Flnnn/nnn][25] Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] nnnnnn VA CLD APRX Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] ~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]] [~~TO~~ – Nnn[nn] *or* Snn[nn]Wnnn[nn] *or* Ennn[nn]]				OTLK 260400 TC CENTRE N28030 W07430 261000 TC CENTRE N3100 W07600 OTLK 212300 VA CLD APRX S16 E078 ~~TO~~ – S17 E084 ~~TO~~ – S18 E089 ~~TO~~ – S19 E081 ~~TO~~ – S16 E078 220300 VA CLD APRX S17E81 ~~TO~~ – S18 E86 ~~TO~~ – S20 E92 ~~TO~~ – S21E84 ~~TO~~ – S17 E81

OR

Cancellation of SIGMET/ AIRMET[26] (C)	cancellation of SIGMET/ AIRMET referring to its identification	CNL SIGMET [nn]n nnnnnn/nnnnnn *or* CNL SIGMET [nn]n nnnnnn/nnnnnn [VA MOV TO nnnn FIR][24]	CNL SIGMET SST [nn]n nnnnnn/nnnnnn	CNL AIRMET [nn]n nnnnnn/nnnnnn	—		CNL SIGMET 2 101200/101600[26]; CNL SIGMET 3 251030/251430 VA MOV TO YUDO FIR[26]; CNL SIGMET SST 1 212330/220130[26]; CNL AIRMET 151520/151800[20];

Notes.–

1. ~~Only for transonic and supersonic flights~~ In accordance with 1.1.2.
2. ~~Automated special air-reports also include information on~~ No wind and temperature ~~which does not need~~ to be uplinked to other aircraft in flight in accordance with 3.1.
3. ~~In cases where the airspace is divided into a flight information region (FIR) and an upper flight information region (UIR), the SIGMET is identified by the location indicator of the air traffic services unit serving the FIR; nevertheless, the SIGMET message applies to the whole airspace within the lateral limits of the FIR, i.e. to the FIR and to the UIR. The particular areas and/or flight levels affected by the meteorological phenomena causing the issuance of the SIGMET are given in the text of the message.~~ See 4.1.
4. Fictitious location.
5. ~~Corresponding with the number of SIGMET/AIRMET messages issued for the FIR/CTA since 0001 UTC on the day concerned.~~ In accordance with 1.1.3 and 2.1.2.
6. ~~Special air-reports are to be uplinked for 60 minutes after their issuance.~~ See 3.2
7. ~~Or a sub-area thereof in the case of AIRMET messages~~ See 2.1.3.
8. ~~Only one of the weather phenomena listed should be selected and included in each SIGMET.~~ In accordance with 1.1.4 and 2.1.3.
9. ~~Obscured (OBSC) indicates that the thunderstorm (including, if necessary, cumulonimbus cloud which is not accompanied by a thunderstorm) is obscured by haze or smoke or cannot be readily seen due to darkness~~ In accordance with 4.2.1 a).
10. ~~Hail (GR) may be used as a further description of the thunderstorm as necessary~~ In accordance with 4.2.4.
11. ~~Severe and moderate turbulence (TURB) refers only to: low-level turbulence associated with strong surface winds; rotor streaming; or turbulence whether in cloud or not in cloud (CAT) near to jet streams. Turbulence is not required to be used in connection with convective clouds. Turbulence is considered:~~
    ~~a) severe whenever the turbulence index is between 15 and 27 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.5); and~~
    ~~b) moderate whenever the turbulence index is between 6 and 14 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.3 while not exceeding 0.5).~~ In accordance with 4.2.5 and 4.2.6
12. ~~Embedded (EMBD) indicates that the thunderstorm (including cumulonimbus cloud which is not accompanied by a thunderstorm) is embedded within cloud layers and cannot be readily recognized.~~ In accordance with 4.2.1 b).
13. ~~Frequent (FRQ) indicates an area of thunderstorms within which there is little or no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity)~~ In accordance with 4.2.2.
14. ~~Squall line (SQL) indicates thunderstorm along a line with little or no space between individual clouds~~ In accordance with 4.2.3.
15. ~~Isolated (ISOL) indicates an area of individual cumulonimbus and/or thunderstorms with a maximum spatial coverage less than 50 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity)~~ In accordance with 4.2.1 c).
16. The use of cumulonimbus, CB, is restricted to AIRMETs and SIGMETs related to SST flight during transonic and supersonic cruise; the use of towering cumulus, TCU, is restricted to AIRMETs in accordance with 1.1.4 and 2.1.4.
17. ~~The weather phenomenon causing the reduction in visibility in brackets; choose one from the following list: DZ, RA, SN, SG, PL, IC, GR, GS, FG, BR, SA, DU, HZ, FU, VA, PO, SQ, FC, DS or SS~~ In accordance with 2.1.4.
18. ~~Occasional (OCNL) indicates an area of well-separated cumulonimbus and/or thunderstorms with a maximum spatial coverage between 50 and 75 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity)~~ In accordance with 4.2.1 d).
19. ~~Severe and moderate icing (ICE) refers to severe icing in other than convective clouds~~ In accordance with 4.2.7.
20. ~~Freezing rain (FZRA) refers to severe icing conditions caused by freezing rain~~ In accordance with 4.2.7.
21. ~~A mountain wave (MTW) is considered:~~
    ~~a) severe whenever an accompanying downdraft of 3.0 m/s (600 ft/min) or more and/or severe turbulence is observed or forecast;~~
    ~~b) moderate whenever an accompanying downdraft of 1.75–3.0 m/s (350–600 ft/min) and/or moderate turbulence is observed or forecast.~~ In accordance with 4.2.8

22 Only for SIGMET messages for volcanic ash cloud and tropical cyclones.
23. Only for SIGMET messages for tropical cyclones.

24. Only for SIGMET messages for volcanic ash.
25. Up to four layers (or levels) ~~to be included in the SIGMET outlook for volcanic ash~~ in accordance with 4.2.9.
26. End of the message (as the SIGMET/AIRMET message is being cancelled).

Secretariat

General Note.— In accordance with 1.1.5 and 2.1.5 severe or moderate icing and severe or moderate turbulence (SEV ICE, MOD ICE, SEV TURB, MOD TURB) associated with thunderstorms, cumulonimbus clouds or tropical cyclones should not be included.

~~EXAMPLES~~

Example A6-1. SIGMET and AIRMET message and the corresponding cancellations

SIGMET
YUDD SIGMET 2 VALID 101200/101600 YUSO-
SHANLON FIR/UIR OBSC TS FCST ~~TOP FL390~~
S OF N54 TOP FL390 MOV E WKN

Cancellation of SIGMET
YUDD SIGMET 3 VALID 101345/101600 YUSO-
SHANLON FIR/UIR CNL SIGMET 2 101200/101600

AIRMET
YUDD AIRMET 1 VALID 151520/151800 YUSO-
SHANLON FIR ISOL TS OBS ~~TOP ABV FL100~~
N OF S50 TOP ABV FL100 STNR WKN

Cancellation of AIRMET
YUDD AIRMET 2 VALID 151650/151800 YUSO-
SHANLON FIR CNL AIRMET 1 151520/151800

Example A6-2. SIGMET ~~FOR TC~~ message for tropical cyclone

YUCC SIGMET 3 VALID 251600/252200 YUDO-
AMSWELL FIR TC GLORIA OBSN2706 W07306 AT 1600Z CB TOP FL500 WI 150NM OF CENTRE MOV NW
10KT NC FCST 2200Z TC CENTRE N2740 W07345
OTLK TC CENTRE 260400 N2830 W07430 261000 N2912 W07530

Example A6-3. SIGMET ~~FOR VA~~ message for volcanic ash

YUDD SIGMET 2 VALID 211100/211700 YUSO-
SHANLON FIR/UIR VA ERUPTION MT ASHVAL LOC E S1500 E07348 VA CLD OBS AT 1100Z FL310/450 APRX
220KM BY 35KM S1500 E07348E ~~TO~~ – S1530 E07642 MOV ESE 65KMH FCST 1700Z VA CLD APRX S1506 E07500
~~TO~~ – S1518 E08112 ~~TO~~ – S1712 E08330 ~~TO~~ – S1824 E07836
OTLK 212300Z VA CLD APRX S1600 E07806 ~~TO~~ – S1642 E08412 ~~TO~~ – S1824 E08900 ~~TO~~ – S1906 E08100 220500Z
VA CLD APRX S1700 E08100 ~~TO~~ – S1812 E08636 ~~TO~~ – S2000 E09224 ~~TO~~ – S2130 E08418

Example A6-4. ~~EXAMPLE OF~~ SIGMET message for severe turbulence

YUCC SIGMET 5 VALID 221215/221600 YUDO-
AMSWELL FIR SEV TURB OBS AT 1210Z YUSB FL250 MOV E 40KMH WKN

Meaning: The fifth SIGMET message issued for the AMSWELL* flight information region (identified in abbreviated plain language and by YUCC Amswell area control centre) by the Donlon/International* meteorological watch office (YUDO) since 0001 UTC; the message is valid from 1215 UTC to 1600 UTC on the 22nd of the month; severe turbulence was observed at

1210 UTC over Siby/Bistock* aerodrome (YUSB) at flight level 250; the turbulence is expected to move eastwards at 40 kilometres per hour and to weaken in intensity.

* Fictitious locations

Example A6-5. ~~EXAMPLE OF~~ AIRMET message for moderate mountain wave

YUCC AIRMET 2 VALID 221215/221600 YUDO-
AMSWELL FIR MOD MTW OBS AT 1205Z AND FCST N48 E10 FL080 STNR NC

Meaning: The second AIRMET message issued for the AMSWELL* flight information region (identified in abbreviated plain language and by YUCC Amswell area control centre) by the Donlon/International* meteorological watch office (YUDO) since 0001 UTC; the message is valid from 1215 UTC to 1600 UTC on the 22nd of the month; moderate mountain wave was observed at 1205 UTC at 48 degrees north and 10 degrees east at flight level 080; the mountain wave is expected to remain stationary and not to undergo any changes in intensity.

* Fictitious locations

5. SPECIFICATIONS RELATED TO AERODROME WARNINGS

5.1 Format and dissemination of aerodrome warnings

METLINKSG

~~7.5.1~~5.1.1 The aerodrome warnings shall be issued in accordance with the template in Table A6-2 where required by operators or aerodrome services, and shall be disseminated in accordance with local arrangements to ~~operators, aerodrome services and to others~~ those concerned, by the meteorological office designated to provide the service for that aerodrome.

~~7.5.2~~5.1.2 **Recommendation.—** *In accordance with the template in Table A6-2, aerodrome warnings should relate to the occurrence or expected occurrence of one or more of the following phenomena:*

— *tropical cyclone*
  — *tropical cyclone to be included if the 10-minute mean surface wind speed at the aerodrome is expected to be 63 km/h (34 kt) or more*
— *thunderstorm*
— *hail*
— *snow (including the expected or observed snow accumulation)*
— *freezing precipitation*
— *hoar frost or rime*
— *sandstorm*
— *duststorm*
— *rising sand or dust*
— *strong surface wind and gusts*
— *squall*
— *frost*

— *volcanic ash*
— *other phenomena as agreed locally*.

5.1.3 **Recommendation. —** *The use of text additional to the abbreviations listed in the template in Table A6-2 should be kept to a minimum. The additional text should be prepared in abbreviated plain language using approved ICAO abbreviations and numerical values. If no ICAO approved abbreviations are available English plain language text should be used.*

5.2 Quantitative criteria for aerodrome warnings

~~7.5.3~~ **Recommendation.—** *When quantitative criteria are necessary for the issue of aerodrome warnings covering, for example, the expected maximum wind speed or the expected total snowfall, the criteria should be established by agreement between the meteorological office and the users of the warnings.*

Insert new text as follows:

Table A6-2. Template for aerodrome warnings

M = inclusion mandatory, part of every message
C = inclusion conditional, included whenever applicable

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for volcanic ash are shown in Table A6-6 of this appendix.

Note 2. — The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Element	*Detailed content*	*Template*	*Example*
Location indicator of the aerodrome (M)	Location indicator of the aerodrome	nnnn	YUCC[1]
Identification of the type of message (M)	Type of message and sequence number	AD WRNG n	AD WRNG 2
Year, date and time of origin and, if appropriate, the validity of the warning(M)	Year month date time in UTC *or* date month year time in UTC	VALID nnnnnn/nnnnnn	VALID 211230/211530

Element	*Detailed content*	*Template*	*Example*
Phenomenon (M)[4]	Description of phenomenon causing the issuance of the aerodrome warning	TC[5] nnnnnnnnnn *or* [HVY] TS *or* GR *or* [HVY] SN [nnCM][2] *or* [HVY] FZRA *or* [HVY] FZDZ *or* RIME[3] *or* [HVY] SS *or* [HVY] DS *or* SA *or* DU *or* SFC WSPD nn[n]KMH MAX nn[n] (SFC WSPD nn[n]KT MAX nn[n]) *or* SQ *or* FROST *or* VA *or* *free text up to 32 characters*[6]	TC ANDREW HVY SN 25CM SFC WDSPD 80KMH MAX 120 VA
Observed or forecast phenomenon (M)	Indication whether the information is observed and expected to continue, *or* forecast	OBS [AT nnnnZ] *or* FCST *or* OBS [AT nnnnZ] AND FCST	OBS AT 1200Z OBS OBS AT 1220Z AND FCST
Changes in intensity (C)	Expected changes in intensity	INTSF *or* WKN *or* NC	WKN

OR

Cancellation of aerodrome warning	Cancellation of aerodrome warning referring to its identification	CNL AD WRNG n nnnnnn/nnnnnn	CNL AD WRNG 2 211230/211530

Notes. —

1. Fictitious location;
2. In accordance with 5.1.2;
3. Hoar frost *or* rime in accordance with 5.1.2;
4. One phenomenon or a combination thereof, in accordance with 5.1.2;
5. In accordance with 5.1.2;
6. In accordance with 5.1.3.

End of new text.

6. SPECIFICATIONS RELATED TO WIND SHEAR WARNINGS

6.1 Detection of wind shear

~~7.6.2~~ **Recommendation**.— *Evidence of the existence of wind shear should be derived from:*

a) *ground-based wind shear remote-sensing equipment, for example, Doppler radar;*

b) *ground-based wind shear detection equipment, for example, a system of surface wind and/or pressure sensors located in an array monitoring a specific runway or runways and associated approach and departure paths;*

c) *aircraft observations during the climb-out or approach phases of flight to be made in accordance with Chapter 5~~, 5.6.1~~ of Annex 3; or*

d) *other meteorological information, for example, from appropriate sensors located on existing masts or towers in the vicinity of the aerodrome or nearby areas of high ground.*

Note.— Wind shear conditions are normally associated with the following phenomena:

— *thunderstorms, microbursts, funnel cloud (tornado or waterspout), and gust fronts*
— *frontal surfaces*
— *strong surface winds coupled with local topography*
— *sea breeze fronts*
— *mountain waves (including low-level rotors in the terminal area)*
— *low-level temperature inversions.*

6.2 Format and dissemination of wind shear warnings

Note.— Information on wind shear is also to be included as supplementary information in local routine and special reports and ~~routine and special reports in the~~ METAR~~/~~ and SPECI ~~code forms~~ in accordance with ~~4.12.1, 4.12.4 and 4.12.5~~ the templates in Table A3-1 and A3-2.

~~7.6.1~~6.2.1 The wind shear warnings shall be prepared in abbreviated plain language in accordance with the template in Table A6-3 and disseminated for aerodromes where wind shear is considered a factor in accordance with local arrangements with the appropriate ATS authority and operators concerned and by the meteorological office designated to provide service for the aerodrome or disseminated directly from automated ground-based wind shear remote-sensing or detection equipment referred to in ~~7.6.2~~ 6.1 a) and b).

~~7.6.3~~6.2.2 **Recommendation**.— *~~Wind shear warnings should be prepared in abbreviated plain language. Wind shear in the approach area should be reported, for example, as "WS WRNG SURFACE WIND 320/20KMH WIND AT 60M 360/ 50KMH IN APCH" or "WS WRNG SURFACE WIND 320/10KT WIND AT 60M 360/25KT IN APCH"~~. Where microbursts are observed, reported by pilots or detected by ground-based wind shear detection or remote-sensing equipment, the wind shear warning should include a specific reference to microburst~~, for example, "WS WRNG MBST APCH RWY 26"~~.*

~~7.6.4~~6.2.3 **Recommendation**.— *Where information from ground-based wind shear detection or remote-sensing equipment is used to prepare a wind shear warning, the warning should, if practicable, relate to specific sections of the runway and distances along the approach path or take-off path as agreed between the meteorological authority, the appropriate ATS authority and the operators concerned~~, for example, "WS WRNG 30KT AIRSPEED LOSS 2NM FINAL RWY 13" or "WS WRNG 60KMH AIRSPEED LOSS 4KM FINAL RWY 13"~~.*

~~7.6.5~~6.2.4 **Recommendation**.— *When an aircraft report is used to prepare a wind shear warning, or to confirm a warning previously issued, the corresponding aircraft report, including the aircraft type, should be given unchanged in the warning~~, for example, "WS WRNG B747 REPORTED MOD WS IN APCH RWY 34 AT 1510"~~.*

Note 1.— Following reported encounters by both arriving and departing aircraft two different wind shear warnings may exist, one for arriving aircraft and one for departing aircraft.

Note 2.— Specifications for reporting the intensity of wind shear are still undergoing development. It is recognized, however, that pilots, when reporting wind shear, may use the qualifying terms "moderate", "strong" or "severe", based to a large extent on their subjective assessment of the intensity of the wind shear encountered. In accordance with ~~7.6.5~~ 6.2.4 above, such reports are to be incorporated unchanged in wind shear warnings.

Insert new text as follows:

6.2.5 **Recommendation. —** *The use of text additional to the abbreviations listed in the template in Table A6-3 should be kept to a minimum. The additional text should be prepared in abbreviated plain language using approved ICAO abbreviations and numerical values. If no ICAO approved abbreviations are available English plain language text should be used.*

Table A6-3. Template for windshear warnings

M = inclusion mandatory, part of every message
C = inclusion conditional, included whenever applicable

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for volcanic ash are shown in Table 6 of this appendix.

Note.2 — The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Element	*Detailed content*	*Template*	*Example*
Location indicator of the aerodrome (M)	Location indicator of the aerodrome	nnnn	YUCC[1]
Identification of the type of message (M)	Type of message and sequence number	WS WRNG [nn]	WS WRNG 01
Date and time of origin and validity period (M)	Date and time of issue and, where applicable, validity period in UTC	nnnnnn [VALID TL nnnnnn]	211230 VALID TL 211330

Element	*Detailed content*	*Template*	*Example*
Phenomenon (M)	Identification of the phenomenon and its location	[MOD] *or* [SEV] WS IN APCH *or* [MOD] *or* [SEV] WS [APCH] RWYnnn *or* [MOD] *or* [SEV] WS IN CLIMB-OUT *or* [MOD] *or* [SEV] WS CLIMB-OUT RWYnnn *or* MBST IN APCH *or* MBST [APCH] RWYnnn *or* MBST IN CLIMB-OUT *or* MBST CLIMB-OUT RWYnnn	WS APCH RWY12 MOD WS RWY34 WS IN CLIMB-OUT MBST APCH RWY26 MBST IN CLIMB-OUT
Details of the phenomenon (C)[2]	Description of phenomenon causing the issuance of the windshear warning	SFC WIND: nnn/nnKMH (nnn/nnKT) nnnM (nnnFT)-WIND: nnn/nnKMH (nnn/nnKT) *or* nnKMH (nnKT) ASPEEDL nnKM (nnNM) FNA RWYnn *or* nnKMH (nnKT) ASPEEDG nnKM (nnNM) FNA RWYnn *or* REP ATnnnn nnnnnnnn	SFC WIND: 320/20KMH 60M-WIND: 360/50KMH (SFC WIND: 320/10KT 200FT-WIND: 360/25KT) 60KMH ASPEEDL 4KM FNA RWY13 (30KT ASPEEDL 2NM FNA RWY13) REP AT 1510 B747

OR

Cancellation of windshear warning	Cancellation of windshear warning referring to its identification	CNL WS WRNG n nnnnnn/nnnnnn	CNL WS WRNG 1 211230/211330

Notes. —

1. Fictitious location; and
2. In accordance with 4.2.5.

End of new text.

Table A~~5-2~~6-4. Ranges and resolutions for the numerical elements included in volcanic ash and tropical cyclone advisory messages, SIGMET/AIRMET messages and aerodrome and wind shear warnings

Element as specified in Chapter 7		*Range*	*Resolution*
Summit elevation	M FT	000 - 8100 000 - 27000	1 1
Advisory number	for VA (index)* for TC (index)*	000 - 2000 00 - 99	1 1
Maximum surface wind	KMH KT	00 - 399 00 - 199	1 1
Central pressure	hPa	850 - 1050	1
Surface wind speed:	KMH KT	60 - 199 30 - 99	1 1
Surface visibility:	M M	0000 - 0800 0800 - 5000	50 100
Cloud: height of base:	M FT	000 - 300 000 - 1000	30 100
Cloud: height of top:	M M FT FT	000 - 3000 3000 - 20000 000 - 10 000 10000 - 60 000	30 300 100 1000
Latitudes:	° (degrees) ‘ (minutes)	00 - 90 00 - 60	1 1
Longitudes:	° (degrees) ‘ (minutes)	000 - 180 00 - 60	1 1
Flight levels		000 - 650	10
Movement:	KMH KT	0 - 100 0 - 50	10 5
* non-dimensional			

Secretariat

APPENDIX 7. TECHNICAL SPECIFICATIONS RELATED TO AERONAUTICAL CLIMATOLOGICAL INFORMATION

(See Chapter 8 of this Annex)

1. PROCESSING OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

~~8.1.4~~ **Recommendation**.— *Meteorological observations for regular and alternate aerodromes should be collected, processed and stored in a form suitable for the preparation of aerodrome climatological information.*

2. EXCHANGE OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

~~8.1.3~~ **Recommendation**.— *Aeronautical climatological information should be exchanged on request between meteorological authorities. Operators and other aeronautical users desiring such information should normally apply to the meteorological authority responsible for its preparation.*

3. CONTENT OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

3.1 Aerodrome climatological tables

~~8.2.2~~3.1.1 **Recommendation**.— *An aerodrome climatological table should give as applicable:*

a) *mean values and variations therefrom, including maximum and minimum values, of meteorological elements (for example, of air temperature); and/or*

b) *the frequency of occurrence of present weather phenomena affecting flight operations at the aerodrome (for example, of sandstorms); and/or*

c) *the frequency of occurrence of specified values of one, or of a combination of two or more, elements (for example, of a combination of low visibility and low cloud).*

~~8.2.3~~3.1.2 **Recommendation**.— *Aerodrome climatological tables should include information required for the preparation of aerodrome climatological summaries in accordance with ~~8.3.2~~3.2 below.*

3.2 Aerodrome climatological summaries

~~8.3.2~~**Recommendation**.— *Aerodrome climatological summaries should cover:*

a) *frequencies of the occurrence of runway visual range/visibility and/or height of the base of the lowest cloud layer of BKN or OVC extent below specified values at specified times;*

b) *frequencies of visibility below specified values at specified times;*

c) *frequencies of the height of the base of the lowest cloud layer of BKN or OVC extent below specified values at specified times;*

d) *frequencies of occurrence of concurrent wind direction and speed within specified ranges;*

e) *frequencies of surface temperature in specified ranges of 5°C at specified times; and*

f) *mean values and variations therefrom, including maximum and minimum values of meteorological elements required for operational planning purposes, including take-off performance calculations.*

Note.— Models of climatological summaries related to a) to e) are given in WMO Publication No. 49, Technical Regulations, *Vol. II, C.3.2.*

Secretariat

APPENDIX 8. TECHNICAL SPECIFICATIONS RELATED TO SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

(See Chapter 9 of this Annex)

Note.— Specifications related to flight documentation (including the model charts and forms) are in Appendix 1.

1. MEANS OF SUPPLY AND FORMAT OF METEOROLOGICAL INFORMATION

~~9.1.6~~1.1 Meteorological information shall be supplied to operators and flight crew members by one or more of the following, as agreed between the meteorological authority and operator concerned, and with the order shown below not implying priorities:

a) written or printed material, including specified charts and forms;

b) ~~grid point~~ data in digital form;

c) briefing;

d) consultation;

e) display; or

f) in lieu of a) to e) above, by means of an automated pre-flight information system providing self-briefing and flight documentation facilities while retaining access by operators and aircrew members to consultation, as necessary, with the meteorological office, in accordance with ~~9.9.4~~5.1below

~~9.1.7~~1.2 The meteorological authority, in consultation with the operator, shall determine:

a) the type and format of meteorological information to be supplied; and

b) methods and means of supplying that information.

~~9.1.4~~1.3 **Recommendation.—** *On request by the operator, the meteorological information supplied for flight planning should include data for the determination of the lowest usable flight level.*

2. SPECIFICATIONS RELATED TO INFORMATION FOR PRE-FLIGHT PLANNING AND IN-FLIGHT RE-PLANNING

2.1 Format of upper-air information

~~9.2.5~~ ~~**Recommendation.—**~~ When upper-air information is supplied by WAFCs for pre-flight and in-flight re-planning in grid point format it ~~should~~ shall be in the GRIB code form.

Note.— The GRIB code is contained in WMO Publication No. 306, Manual on Codes, *Volume I.2, Part B — Binary Codes.*

2.2 Specific needs of supersonic aircraft

~~9.2.2~~ **Recommendation.**— *Meteorological information for pre-flight planning and in-flight re-planning by operators for supersonic aircraft should include data covering the levels used for transonic and supersonic flight, together with the levels that may be used for subsonic flight. Particular mention should be made of occurrence and expected occurrence, location and vertical extent of cumulonimbus clouds, turbulence and precipitation.*

2.3 Specific needs of helicopter operations

~~9.2.3~~ **Recommendation.**— *Meteorological information for pre-flight planning and in-flight re-planning by operators of helicopters flying to offshore structures should include data covering the layers from sea level to flight level 100. Particular mention should be made of the expected surface visibility, the amount, type (where available), base and tops of cloud below flight level 100, sea state and sea surface temperature, mean sea-level pressure, and the occurrence and expected occurrence of turbulence and icing, as determined by regional air navigation agreement.*

3. SPECIFICATIONS RELATED TO BRIEFING AND CONSULTATION

3.1 Specific needs of supersonic aircraft

~~9.3.3~~ **Recommendation**.— *Briefing and/or consultation for flight crew members of supersonic aircraft should include meteorological information covering the flight levels of transonic and supersonic flight. Particular mention should be made of occurrence and expected occurrence, location and vertical extent of cumulonimbus clouds, turbulence and precipitation.*

3.2 Specific needs of low-level flights

~~9.3.4~~ **Recommendation**.— *Briefing and/or consultation for low-level flights, including those in accordance with the visual flight rules, should include meteorological information covering altitudes up to flight level 100 (or up to flight level 150 in mountainous areas or higher, where necessary). Particular mention should be made of the occurrence or expected occurrence of any phenomena causing widespread reduction of visibility to less than 5 000 m, as well as the occurrence or expected occurrence of clouds which may affect the flight.*

3.3 Information required to be displayed

~~9.3.8~~3.3.1 To assist the flight crew members and others concerned with the preparation of the flight and for use in briefing and consultation, the meteorological office shall display the latest available:

a) ~~reports in the~~ METAR and SPECI ~~code forms~~;

b) ~~aerodrome and landing~~ TAF and trend forecasts;

c) aerodrome warnings relating to the local aerodrome;

d) forecasts for take-off;

e) SIGMET and AIRMET information and special air-reports not covered by a SIGMET;

f) current and prognostic charts;

g) meteorological satellite images or mosaics and/or nephanalyses; and

h) ground-based weather radar information.

~~9.3.9~~3.3.2 **Recommendation**.— *The material displayed should be readily accessible to the flight crew members or other flight operations personnel concerned. By agreement between the meteorological authority and the user, the display may be used in lieu of briefing and/or consultation.*

4. SPECIFICATIONS RELATED TO FLIGHT DOCUMENTATION

4.1 General

4.1.1 Presentation of flight documentation

~~9.4.3~~4.1.1.1 **Recommendation**.— *Charts included in flight documentation should have a high standard of clarity and legibility and should have the following physical characteristics:*

a) *for convenience, the largest size of charts should be about 42 x 30 cm (standard size A3) and the smallest size should be about 21 x 30 cm (standard size A4). The choice between these sizes should depend on the route lengths and the amount of detail that needs to be given in the charts as agreed between meteorological authorities and users;*

b) *major geographical features, such as coastlines, major rivers and lakes should be depicted in a way that makes them easily recognizable;*

c) *for charts prepared by computer, meteorological data should take preference over basic chart information, the former cancelling the latter wherever they overlap;*

d) *major aerodromes should be shown as a dot and identified by the first letter of the name of the city the aerodrome serves as given in Table AOP of the relevant regional air navigation plan;*

e) *a geographical grid should be shown with meridians and parallels represented by dotted lines at each 10° latitude and longitude; dots should be spaced one degree apart;*

f) *latitude and longitude values should be indicated at various points throughout the charts (i.e. not only at the edges); and*

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g) *labels on the charts for flight documentation should be clear and simple and should present the name of the ~~regional~~ world area forecast centre~~;~~ or, for non-WAFS products, the originating centre, the type of chart, date and valid time and, if necessary, the types of units used in an unambiguous way.*

~~9.4.4~~4.1.1.2**Recommendation**.— *Meteorological information included in flight documentation should be represented as follows:*

a) *winds on charts should be depicted by arrows with feathers and shaded pennants on a 0sufficiently dense grid;*

b) *temperatures should be depicted by figures on a sufficiently dense grid;*

c) *wind and temperature data selected from the data sets received from a world area forecast centre should be depicted in a sufficiently dense latitude/longitude grid; and*

d) *wind arrows should take precedence over temperatures and either should take precedence over chart background.*

~~9.4.5~~4.1.1.3**Recommendation**.— *For short-haul flights charts should be prepared covering limited areas at a scale of 1:15 x 10^6 as required and subject to regional air navigation agreement.*

4.1.2 Set of charts to be provided

~~9.4.6~~4.1.2.1 **Recommendation.**— *The minimum number of charts for flights between flight level 250 and flight level ~~450~~630 should include a high-level significant weather chart (flight level 250 to flight level ~~450~~630) and a forecast 250 hPa wind and temperature chart. The actual charts provided for pre-flight and in-flight planning and for flight documentation should be as agreed between meteorological authorities and other users ~~and the appropriate regional area forecast centre(s) concerned~~ within a service area.*

~~9.4.7~~4.1.2.2 **Recommendation.**— *The set of charts to be provided under the world area forecast system for flights below flight level 250 ~~and for flights above flight level 450 including supersonic flights~~ should be as agreed between user States and other users ~~and the regional area forecast centre concerned within a service area~~.*

4.1.3 Height indications

~~9.4.10~~ **Recommendation.**— *In flight documentation height indications should be given as follows:*

a) *all references to en-route meteorological conditions, such as height indications of upper winds, turbulence or bases and tops of clouds, should preferably be expressed in flight levels; they may also be expressed in pressure, altitude, pressure, altitude or, for low-level flights, height above ground level; and*

b) *all references to aerodrome meteorological conditions, such as height indications of the bases of clouds, should be expressed in height above the aerodrome elevation.*

Secretariat

4.2 Specifications related to upper wind and upper-air temperature information

4.2.1 In chart form

~~9.5.1~~4.2.1.1 Where upper wind and upper-air temperature information is supplied in chart form to flight crew members before departure, the charts shall be fixed time prognostic charts for standard ~~isobaric surfaces~~flight levels. In tropical areas, or for short flights, current charts may be provided in lieu of prognostic charts; in such cases, the levels depicted shall correspond to the standard isobaric levels.

~~9.5.2~~4.2.1.2 Upper wind and upper-air temperature charts for low-level flights shall be supplied for points separated by no more than 500 km (300 NM) and for at least the following altitudes: 600, 1 500 and 3 000 m (2 000, 5 000 and 10 000 ft).

4.2.2 In tabular form

~~9.5.3~~ **Recommendation**.— *Where upper wind and upper-air temperature information is supplied in tabular form, it should include data for the same flight levels as for upper-air charts. This information should be given for spot locations on a regular grid.*

Note.— Examples of the form of presentation of tabular forecasts of upper winds and upper-air temperatures are given in the Appendix 1.

4.3 Specifications related to significant weather information

4.3.1 In chart form

~~9.6.1~~4.3.1.1 Where information on significant en-route weather phenomena is supplied in chart form to flight crew members before departure, the charts shall be significant weather charts valid for a specified fixed time. Such charts shall show, as appropriate to the flight:

a) thunderstorms;

b) tropical cyclone;

c) severe squall lines;

d) moderate or severe turbulence (in cloud or clear air);

e) moderate or severe icing;

f) widespread sandstorm/duststorm;

g) for flight level 100 to flight level 250, clouds associated with a) to f) above;

h) above flight level 250, cumulonimbus cloud associated with a) to f) above;

i) surface position of well-defined convergence zones;

j) surface positions, speed and direction of movement of frontal systems when associated with significant en-route weather phenomena ;

k) tropopause heights;

l) jetstreams;

m) information on the location of volcanic eruptions which are producing ash clouds of significance to aircraft operations, including those producing only steam, comprising: volcanic eruption symbol at the location of the volcano and, at the side of the chart, the volcano eruption symbol, the name of the volcano, its international number, latitude/longitude, the date and time of first eruption, if known, and a ~~reminder to users that~~ reference ~~should be made~~ to SIGMETs and NOTAM or ASHTAM issued for the area concerned; and

n) information on the location of an accidental release of radioactive materials into the atmosphere of significance to aircraft operations, comprising: the radioactivity symbol at the site of the accident and, at the side of the chart, the radioactivity symbol, latitude/longitude of the site of the accident, date and time of the accident and a reminder to users to check NOTAM for the area concerned.

Note 1. — For aircraft operating above flight level 250,items a) to f) are only required if expected to be above that level, and in the case of item a), only those thunderstorms which warrant the issuance of a SIGMET as given in Appendix 6~~7.1.1 a)~~. Guidance on the use of term "FRQ TS" is given in Appendix ~~5~~6.

Note 2.— The abbreviation "CB" should only be included where it refers to the occurrence or expected occurrence of an area of widespread cumulonimbus clouds or cumulonimbus along a line with little or no space between individual clouds, or to cumulonimbus embedded in cloud layers or concealed by haze. It does not refer to isolated or scattered cumulonimbus not embedded in cloud layers or concealed by haze.

Note 3.— Where a volcanic eruption or the accidental release of radioactive materials into the atmosphere warrants the inclusion of the volcanic activity symbol or the radioactivity symbol on significant weather charts, the symbols are to be included on all such charts (low, medium and high) irrespective of the height to which the ash column or radioactive material is reported or expected to reach.

Note 4.— The international volcano number is allocated by the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) and is listed in the Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds *(Doc 9691).*

~~9.6.2~~4.3.1.2 **Recommendation**.— *On significant weather charts, the inclusion of "CB" or the thunderstorm symbol should be understood to include all weather phenomena normally associated with cumulonimbus or thunderstorm, namely, moderate or severe icing, moderate or severe turbulence and hail.*

~~9.6.3~~4.3.1.3 **Recommendation**.— *Significant weather charts for low-level flights, including those in accordance with the visual flight rules, operating up to flight level 100 (up to flight level 150 in mountainous areas or higher, where necessary) should show, as appropriate to the flight:*

a) the phenomena warranting the issuance of a SIGMET as given in Appendix 6 ~~7.1.1~~ and which are expected to affect low-level flights; and

b) the elements included in area forecasts for low-level flights as given in ~~6.6.3~~Appendix 5 except elements r) and u) concerning upper winds and upper-air temperatures and forecast lowest QNH, respectively.

Note 1.— Examples of the form of presentation of significant weather charts are given in Appendix 1.

Note 2.— Guidance on the use of terms "ISOL", "OCNL" and "FRQ" referring to cumulonimbus clouds and thunderstorms is given in Appendix ~~5~~ 6.

4.3.2 In other forms

~~9.8.1~~ **Recommendation**.— *Where flight documentation covering the significant en-route weather conditions is not supplied in chart form, it should be presented in tabular form and/or as an abbreviated plain-language text.*

Note.— Examples of the form of presentation of tabular forecasts are given in the Appendix 1.

4.4 Specifications related to aerodrome forecasts

4.4.1 Requirements for aerodrome forecasts

~~9.7.1~~4.4.1.1 The flight documentation shall in all cases include the ~~aerodrome forecasts~~ TAF for the aerodrome of departure, and for the aerodrome of intended landing. In addition, the flight documentation shall include ~~aerodrome forecasts~~ TAF for one or more suitable alternate aerodromes, as needed to complete the operational flight plan and as selected by agreement between the meteorological authority and the operators, and taken from the list of aerodromes contained in the relevant regional air navigation plan.

~~9.7.3~~4.4.1.2 ~~Aerodrome forecasts~~ TAF received from other meteorological offices shall be included in flight documentation without change in substance.

~~9.7.2~~4.4.1.3**Recommendation**.— *By agreement between the meteorological authority and the operator the flight documentation should include TAF ~~forecasts~~ for ~~a limited number of~~ alternate aerodromes en route and of aerodromes where intermediate stops are planned. ~~In such cases use should be made of available forecasts for regular aerodromes.~~*

4.4.2 Presentation of TAF

~~9.7.5~~ **Recommendation**.— ~~Aerodrome forecasts~~ *TAF should be presented ~~in the TAF code form~~ in accordance with the template in Appendix 5; they may also be presented in tabular form or in the form of an abbreviated plain-language text. ~~Where presentation in the TAF code form is used, t~~ The location indicators and the abbreviations used should be explained in the flight documentation. If several ~~aerodrome forecasts~~ TAF are included ~~in the TAF code form~~, they should be presented in a manner which permits the ready identification of the beginning and end of each forecast.*

Note.— Examples of the form of presentation of ~~aerodrome forecasts~~ TAF are given in the Appendix 1.

4.4.3 Issuance of provisional TAF

~~9.7.4~~ **Recommendation**.— *When ~~an aerodrome forecast~~ a TAF is not received in time, the meteorological office associated with the aerodrome of departure should make all practicable efforts to obtain the forecast but, if unobtainable, the office should, if possible, prepare a provisional forecast. The* *meteorological office should inform the flight crew member that the forecast is provisional and record its origin in the flight documentation.*

4.5 Specifications related to low-level flights

4.5.1 In chart form

~~9.8.3~~ **Recommendation**.— *Where the forecasts are supplied in chart form, flight documentation for low-level flights, including those in accordance with the visual flight rules, operating up to flight level 100 (or up to flight level 150 in mountainous areas or higher, where necessary), should contain the following as appropriate to the flight:*

a) *information from relevant SIGMET and AIRMET messages;*
b) *upper wind and upper-air temperature charts as given in ~~9.5.2~~4.2.1.2 above; and*

c) *significant weather charts as given in ~~9.6.3~~4.3.1.3 above.*

4.5.2 In abbreviated plain language

~~9.8.4~~ **Recommendation**.— *Where the forecasts are not supplied in chart form, flight documentation for low-level flights, including those in accordance with the visual flight rules, operating up to flight level 100 (up to flight level 150 in mountainous areas or higher, where necessary), should contain the following information as appropriate to the flight:*

a) *SIGMET and AIRMET information; and*

b) *information included in the area forecasts for low-level flights as given in ~~6.6.3~~ Appendix 5 or, where the forecasts are issued in the form of an abbreviated plain-language text, the GAMET area forecasts.*

Note.— An example of the GAMET area forecast is given in ~~Chapter 6~~ Appendix 5.

5. SPECIFICATIONS RELATED TO AUTOMATED PRE-FLIGHT INFORMATION SYSTEMS FOR BRIEFING, CONSULTATION, FLIGHT PLANNING AND FLIGHT DOCUMENTATION

5.1 Access to the systems

~~9.9.4~~ Automated pre-flight information systems providing self-briefing facilities shall provide for access by operators and flight crew members to consultation, as necessary, with a meteorological office by telephone or other suitable telecommunications means

5.2 Detailed specifications of the systems

~~9.9.5~~ **Recommendation**.— *Automated pre-flight information systems for the supply of meteorological information for self-briefing, pre-flight planning and flight documentation should*:

a) *provide for the continuous and timely updating of the system database and monitoring of the validity and integrity of the meteorological information stored;*

b) *permit access to the system by operators and flight crew members and also by other aeronautical users concerned through suitable telecommunications means;* ~~*and*~~

c) *use access and interrogation procedures based on abbreviated plain language and, as appropriate, ICAO location indicators, and aeronautical meteorological code data-type designators prescribed by the WMO, or based on a menu-driven user interface, or other appropriate mechanisms as agreed between the meteorological authority and operators concerned; and*

d) *provide for rapid response to a user request for information.*

Note.— ICAO abbreviations and codes and location indicators are given respectively in the PANS-ABC (Doc 8400) and Location Indicators (Doc 7910). Aeronautical meteorological code data-type designators are given in the WMO Publication No. 386, Manual on the Global Telecommunication System.

6. SPECIFICATIONS RELATED TO INFORMATION FOR AIRCRAFT IN FLIGHT

6.1 Supply of information requested by an aircraft in flight

~~9.10.4~~ **Recommendation**.— *If*~~*, in exceptional circumstances,*~~ *an aircraft in flight requests meteorological information, the meteorological office which receives the request should arrange to supply the information with the assistance, if necessary, of another meteorological office.*

6.2 Information for in-flight planning by the operator

~~9.10.6~~ **Recommendation**.— *Meteorological information for planning by the operator for aircraft in flight should be supplied during the period of the flight and should normally consist of any or all of the following:*

a) *meteorological reports,* ~~*aerodromeforecasts*~~ *TAF and landing forecasts;*

b) *SIGMET and AIRMET information and special air-reports relevant to the flight, unless the latter have been the subject of a SIGMET message; and*

c) *upper wind and upper-air temperature information.*

6.3 Information for supersonic flights

~~9.10.5~~ **Recommendation**.— *For supersonic aircraft in flight the meteorological office serving the aerodrome of intended landing should, on request by the operator, supply a forecast covering the transonic deceleration and subsonic descent phases. This forecast should be transmitted to the area control centre or flight information centre concerned within the two hours before arrival. The operator should advise the meteorological office, in good time, of the location of the descent path and of the time at which the aircraft is expected to commence the descent.*

Secretariat

APPENDIX 9. TECHNICAL SPECIFICATIONS RELATED TO INFORMATION FOR AIR TRAFFIC SERVICES, SEARCH AND RESCUE SERVICES AND AERONAUTICAL INFORMATION SERVICES
(See Chapter 10 of this Annex)

1. INFORMATION TO BE PROVIDED FOR AIR TRAFFIC SERVICES UNITS

1.1 List of information for the aerodrome control tower

~~10.1.5~~ The following meteorological information shall be supplied, as necessary, to an aerodrome control tower by its associated aerodrome meteorological office:

a) local routine and special reports, ~~routine reports in the~~ METAR and SPECI ~~code form and special reports in the SPECI code form~~, ~~including current pressure data, aerodrome~~ TAF and ~~landing~~ trend forecasts and amendments thereto, for the aerodrome concerned;

b) SIGMET and AIRMET information, wind shear warnings and aerodrome warnings;

c) any additional meteorological information agreed upon locally, such as forecasts of surface wind for the determination of possible runway changes; and

d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned.

1.2 List of information for the approach control office

~~10.1.6~~ The following meteorological information shall be supplied, as necessary, to an approach control office by its associated aerodrome meteorological office:

a) local routine and special reports, ~~routine reports in the~~ METAR and SPECI, ~~code form and special reports in the SPECI code form,~~ including current pressure data, ~~aerodrome~~ TAF and ~~landing~~ trend forecasts and amendments thereto, for the aerodrome(s) with which the approach control office is concerned;

b) SIGMET and AIRMET information, wind shear warnings and appropriate special air-reports for the airspace with which the approach control office is concerned and aerodrome warnings;

c) any additional meteorological information agreed upon locally; and

d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned.

1.3 List of information for the flight information centre

~~10.1.7~~ The following meteorological information shall be supplied, as necessary, to a flight information centre or an area control centre by its associated meteorological watch office:

a) ~~routine reports in the~~ METAR and SPECI ~~code form and special reports in the SPECI code form~~, including current pressure data for aerodromes and other locations, ~~aerodrome forecasts~~ TAF and ~~landing~~ trend forecasts and amendments thereto, covering the flight information region or the control area and, if required by the flight information centre or area control centre, covering aerodromes in neighbouring flight information regions, as determined by regional air navigation agreement;

b) forecasts of upper winds, upper-air temperatures and significant en-route weather phenomena and amendments thereto, particularly those which are likely to make operation under visual flight rules impracticable, SIGMET and AIRMET information and appropriate special air-reports for the flight information region or control area and, if determined by regional air navigation agreement and required by the flight information centre or area control centre, for neighbouring flight information regions;

c) any other meteorological information required by the flight information centre or area control centre to meet requests from aircraft in flight; if the information requested is not available in the associated meteorological watch office, that office shall request the assistance of another meteorological office in supplying it;

d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned; and

e) information received concerning the accidental release of radioactive materials into the atmosphere, as agreed between the meteorological and ATS authorities concerned.

1.4 Specific provisions related to the supply of information on volcanic ash and volcanic eruptions

~~10.1.8~~1.4.1 Volcanic ash advisory information issued by a VAAC shall be supplied to area control centres and flight information centres concerned in its area of responsibility.

~~10.1.9~~1.4.2 Information received on pre-eruption volcanic activity and/or a volcanic eruption shall be supplied, as necessary, to an ATS unit by its corresponding associated meteorological office as agreed between the meteorological and ATS authorities concerned.

1.5 Specific provisions related to the supply of information for supersonic aircraft

~~10.1.11~~ **Recommendation**.— *The information supplied to flight information centres and area control centres for supersonic aircraft should cover the levels used for transonic and supersonic flight and should include forecasts for subsonic descent paths to aerodromes in the flight information region.*

1.6 Supply of information to aeronautical telecommunications stations

~~10.1.12~~ Where necessary for flight information purposes, current meteorological reports and forecasts shall be supplied to designated aeronautical telecommunication stations. A copy of such information shall be forwarded, if required, to the flight information centre or the area control centre.

1.7 Format of information

~~10.1.13~~1.7.1 **Recommendation**.— *Local routine and special reports,~~ routine reports in the~~ METAR and SPECI, ~~code form and special reports in the SPECI code form, aerodrome~~ TAF and ~~landing~~ trend forecasts, SIGMET and AIRMET information, upper wind and upper-air temperature forecasts and amendments thereto should be supplied to air traffic services units in the form in which they are prepared, disseminated to other meteorological offices or received from other meteorological offices, unless otherwise agreed locally.*

~~10.1.14~~1.7.2 **Recommendation**.— *When computer-processed upper-air data for grid points are made available to air traffic services units in digital form for use by air traffic services computers, the contents, format and transmission arrangements should be as agreed between the meteorological authority and the appropriate ATS authority. The data should normally be supplied as soon as is practicable after the processing of the forecasts has been completed.*

2. INFORMATION TO BE PROVIDED FOR SEARCH AND RESCUE SERVICES UNITS

2.1 List of information

~~10.2.2~~ Information to be supplied to rescue coordination centres shall include the meteorological conditions that existed in the last known position of a missing aircraft and along the intended route of that aircraft with particular reference to:

a) significant en-route weather phenomena;

b) cloud amount and type, particularly cumulonimbus; height indications of bases and tops;

c) visibility and phenomena reducing visibility;

d) surface wind and upper wind;

e) state of ground, in particular, any snow cover or flooding;

f) sea-surface temperature, state of the sea, ice cover if any and ocean currents, if relevant to the search area; and

g) sea-level pressure data.

2.2 Information to be provided on request

~~10.2.3~~2.2.1 **Recommendation**.— *On request from the rescue coordination centre, the designated meteorological office should arrange to obtain details of the flight documentation which was supplied to the missing aircraft, together with any amendments to the forecast which were transmitted to the aircraft in flight.*

~~10.2.4~~2.2.2 **Recommendation**.— *To facilitate search and rescue operations the designated meteorological office should, on request, supply:*

a) complete and detailed information on the current and forecast meteorological conditions in the search area; and

b) current and forecast conditions en route, covering flights by search aircraft from and returning to the aerodrome from which the search is being conducted.

~~10.2.5~~2.2.3 **Recommendation**.— *On request from the rescue coordination centre the designated meteorological office should supply, or arrange for the supply of meteorological information required by ships undertaking search and rescue operations.*

3. INFORMATION TO BE PROVIDED FOR AERONAUTICAL INFORMATION SERVICES UNITS

3.1 List of information

~~10.3.2~~ The following information shall be supplied, as necessary, to an aeronautical information services unit:

a) information on meteorological service for international air navigation, intended for inclusion in the aeronautical information publication(s) concerned;

Note.— Details of this information are given in Annex 15, Appendix 1, Part 1, 3.5 and Part 3, 2.2, 2.11, 3.2 and 3.11.

b) information necessary for the preparation of NOTAM or ASHTAM including, in particular, information on:

1) the establishment, withdrawal and significant changes in operation of aeronautical meteorological services. This information is required to be provided to the aeronautical information services unit sufficiently in advance of the effective date to permit issuance of NOTAM in compliance with Annex 15, 5.1.1 and 5.1.1.1;

2) the occurrence of volcanic activity;

Note.— The specific information required is given in Chapter 3, 3.~~4~~3.3 and ~~4.14~~ Chapter 4,4.8 of ~~this~~ Annex 3.

3) accidental release of radioactive materials into the atmosphere, as agreed between the meteorological and appropriate civil aviation authorities concerned.

Note.— The specific information required is given in Chapter 3, 3.~~5~~4.2 g).

c) information necessary for the preparation of aeronautical information circulars including, in particular, information on:

1) expected important changes in aeronautical meteorological procedures, services and facilities provided; and

2) effect of certain weather phenomena on aircraft operations.

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APPENDIX10. TECHNICAL SPECIFICATIONS RELATED TO REQUIREMENTS FOR AND USE OF COMMUNICATIONS

(See Chapter 11 of this Annex)

1. SPECIFIC REQUIREMENTS FOR COMMUNICATIONS

1.1 Required transit times of meteorological information

~~11.1.11~~ **Recommendation.—** *Unless otherwise determined by regional air navigation agreement, AFTN messages and bulletins containing operational meteorological information should achieve transit times of less than the following:*

SIGMET and AIRMET messages, volcanic ash and tropical cyclone advisory information and special air-reports		*5 minutes*
Abbreviated plain-language amendments to significant weather and upper air forecasts		*5 minutes*
Amended ~~aerodrome forecasts~~ TAF and corrections to aerodrome forecasts		*5 minutes*
~~Reports in the~~ METAR ~~code form~~ *Trend-type landing forecasts*	*0-900 km (500 NM)*	*5 minutes*
~~Aerodrome forecasts~~TAF *~~Reports in the~~ SPECI ~~code form~~*	*more than 900 km (500 NM)*	*10 minutes*
		-
~~WINTEM messages~~		*~~15 minutes~~*
~~Abbreviated plain-language significant weather forecast messages~~		*~~15 minutes~~*

1.2 Grid point data for ATS and operators

~~11.1.12~~1.2.1**Recommendation.—** *When upper-air data for grid points in digital form are made available for use by air traffic services computers, the transmission arrangements should be as agreed between the meteorological authority and the appropriate ATS authority.*

~~11.1.13~~1.2.2 **Recommendation.—** *When upper-air data for grid points in digital form are made available to operators for flight planning by computer, the transmission arrangements should be as agreed among the world ~~or regional~~ area forecast centre concerned, the meteorological authority and the operators.*

Secretariat

2. USE OF AERONAUTICAL FIXED SERVICE COMMUNICATIONS

2.1 Meteorological bulletins in alphanumeric format

2.1.1 Composition of bulletins

~~11.2.2~~ **Recommendation.—** *Whenever possible, exchanges of operational meteorological information should be made in consolidated bulletins of the same types of meteorological information.*

2.1.2 Filing times of bulletins

~~11.2.3~~ **Recommendation.—** *Meteorological bulletins required for scheduled transmissions should be filed regularly and at the prescribed scheduled times. ~~Reports in the~~ METAR ~~code form~~ should be filed for transmission not later than 5 minutes after the actual time of observation. ~~Aerodrome forecasts~~ TAF should be filed for transmission at least one hour before the commencement of their period of validity, unless otherwise determined by regional air navigation agreement.*

2.1.3 Heading of bulletins

~~11.2.4~~ Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service facilities shall contain a heading consisting of:

a) an identifier of four letters and two figures;

b) the ICAO four-letter location indicator corresponding to the geographical location of the meteorological office originating or compiling the meteorological bulletin;

c) a date-time group; and

d) if required, a three-letter indicator.

Note 1.— Detailed specifications on format and contents of the heading are given in the WMO Manual on the Global Telecommunications System, *Volume I and are reproduced in the* Manual of Aeronautical Meteorological Practice *(Doc 8896).*

Note 2.— ICAO location indicators are listed in Doc 7910, Location Indicators.

2.1.4 Structure of bulletins

~~11.2.5~~ Meteorological bulletins containing operational meteorological information to be transmitted via the AFTN shall be encapsulated in the text part of the AFTN message format.

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2.2 World area forecast system products

2.2.1 Telecommunications for the supply of WAFS products

~~11.1.4~~ **Recommendation.—** *The telecommunications facilities used for the supply of world area forecast system products should be~~:~~*

~~a) *for world area forecast centres,*~~ *the aeronautical fixed service~~; and~~*

~~b) *for regional area forecast centres, the aeronautical fixed service, except as otherwise determined by regional air navigation agreement*~~*.*

2.2.2 Quality requirements for charts

~~11.3.2~~ **Recommendation.—** *Where world area forecast system products are disseminated in chart form, the quality of the charts received should be such as to permit reproduction in a sufficiently legible form for flight planning and documentation. Charts received should be legible over 95 per cent of their area.*

2.2.3 Quality requirements for transmissions

~~11.3.3~~ **Recommendation.—** *Transmissions should be such as to ensure that their interruption should not exceed 10 minutes during any period of 6 hours.*

2.2.4 Heading of bulletins containing WAFS products

~~11.3.4~~ Meteorological bulletins containing WAFS products in digital form to be transmitted via aeronautical fixed service facilities shall contain a heading as given in ~~11.2.4~~2.1.3 above.

Secretariat

3. USE OF AERONAUTICAL MOBILE SERVICE COMMUNICATIONS

3.1 Content and format of meteorological messages

~~11.4.1~~3.1.1 The contents and format of reports, forecasts and SIGMET information transmitted to aircraft shall be consistent with the provisions of Chapters 4, 6 and 7 this Annex.

~~11.4.2~~3.1.2 ~~**Recommendation.—**~~The contents and format of air-reports transmitted by aircraft ~~should~~ shall be consistent with the provisions of Chapter 5 of this Annex and PANS-ATM (Doc 4444), Appendix 1.

3.2 Content and format of meteorological bulletins

~~11.4.3~~ The substance of a meteorological bulletin transmitted via the aeronautical mobile service shall remain unchanged from that contained in the bulletin as originated.

4. USE OF A AERONAUTICAL DATA LINK SERVICE — D-VOLMET

4.1 Detailed content of meteorological information available for D-VOLMET

~~11.5.2~~4.1.1 **Recommendation.—** *The aerodromes for which reports and forecasts are to be available for uplink to aircraft in flight should be determined by regional air navigation agreement.*

~~11.5.3~~4.1.2 **Recommendation.—** *The flight information regions for which SIGMET and AIRMET messages are to be available for uplink to aircraft in flight should be determined by regional air navigation agreement.*

4.2 Criteria related to information to be available for D-VOLMET

~~11.5.4~~4.2.1 **Recommendation.—** *The latest available ~~reports in the~~ METAR ~~and~~ , SPECI ~~code forms~~, ~~forecasts~~ TAF ~~and~~ , SIGMET ~~and~~ , AIRMET ~~messages~~ should be used for uplink to aircraft in flight.*

~~11.5.5~~4.2.2 **Recommendation.—** *~~Aerodrome forecasts~~ TAF included in the D-VOLMET should be amended as necessary to ensure that a forecast, when made available for uplink to aircraft in flight, reflects the latest opinion of the meteorological office concerned.*

~~11.5.6~~4.2.3 **Recommendation.—** *If no SIGMET message is available for a flight information region, an indication of "NIL SIGMET" should be included in the D-VOLMET.*

4.3 Format of information to be available for D-VOLMET

~~11.5.7~~ ~~**Recommendation.**~~**—**The content~~s~~ and format of reports, forecasts and SIGMET and AIRMET information included in D-VOLMET ~~should~~ shall be consistent with the provisions of Chapters 4, 6 and 7 of this Annex~~, as applicable to reports issued in the METAR/SPECI code forms~~.

5. USE OF AERONAUTICAL BROADCASTING SERVICE — VOLMET BROADCASTS

5.1 Detailed content of meteorological information to be included in VOLMET broadcasts

~~11.6.3~~5.1.1 **Recommendation.—** *The aerodromes for which reports and forecasts are to be included in VOLMET broadcasts, the sequence in which they are to be transmitted and the broadcast time should be determined by regional air navigation agreement.*

~~11.6.6~~5.1.2 **Recommendation.—** *The flight information regions for which SIGMET messages ~~should~~ are to be included in scheduled VOLMET broadcasts ~~if~~ should be determined by regional air navigation agreement. Where this is done, the SIGMET message or an indication of "NIL SIGMET" should be transmitted at the beginning of the broadcast or of a five-minute time block.*

5.2 Criteria related to information to be included in VOLMET broadcasts

~~11.6.4~~5.2.1 **Recommendation.—** *When a report has not arrived from an aerodrome in time for a broadcast, the latest available report should be included in the broadcast, together with the time of observation.*

~~11.6.5~~5.2.2 **Recommendation.—** *~~Aerodrome forecasts~~ TAF included in scheduled VOLMET broadcasts should have a period of validity of 9 hours; they should be issued every 3 hours and should, between these routine issues, be amended as necessary to ensure that a forecast, when transmitted, reflects the latest opinion of the meteorological office concerned.*

5.3 Format of information to be included in VOLMET broadcasts

~~11.6.7~~5.3.1 ~~**Recommendation**.—~~The content~~s~~ and format of reports, forecasts and SIGMET information included in VOLMET broadcasts ~~should~~ shall be consistent with the provisions of Chapters 4, 6 and 7 of this Annex~~, as applicable to bulletins disseminated beyond the aerodrome of origin~~.

~~11.6.8~~5.3.2 **Recommendation.—** *VOLMET broadcasts should use standard radiotelephony phraseologies.*

Note.— Guidance on the standard radiotelephony phraseologies to be used in VOLMET broadcasts is given in the Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services *(Doc 9377), Appendix A.*

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Editorial Note.— Delete in *toto*.

~~ATTACHMENT A. GUIDANCE ON AREA FORECASTS IN ABBREVIATED PLAIN LANGUAGE~~

~~(See 3.2.14, 3.2.15, 3.3.1 and of this Annex)~~

Secretariat

ATTACHMENT ~~B~~A. OPERATIONALLY DESIRABLE AND CURRENTLY ATTAINABLE ACCURACY OF MEASUREMENT OR OBSERVATION

Note.— The guidance contained in this table relates to Chapter 4 — Meteorological observations and reports, in particular to ~~4.1.13~~4.1.8.

Element to be observed	*Operationally desirable accuracy of measurement or observation**	*Attainable accuracy*** *of measurement or observation (1994)*
Mean surface wind	Direction: ± 10° Speed: ± 2 km/h (1 kt) up to 19 km/h (10 kt) ± 10% above 19 km/h (10 kt)	Direction: ± 5° Speed: ± 2 km/h (1 kt) up to 37 km/h (20 kt) ± 5% above 37 km/h (20 kt)
Variations from the mean surface wind	± 4 km/h (2 kt), in terms of longitudinal and lateral components	as above
Visibility	± 50 m up to 600 m ± 10% between 600 m and 1 500 m ± 20% above 1 500 m	± 50 m up to 500 m ± 10% between 500 m and 2 000 m ± 20% above 2 000 m up to 10 km
Runway visual range	± 10 m up to 400 m ± 25 m between 400 m and 800 m ± 10% above 800 m	± 25 m up to150 m ± 50 m between 150 m and 500 m ± 10% above 500 m up to 2 000 m
Cloud amount	± 1 okta	In daylight an observer can attain an accuracy of ±1okta at the point of observation. In darkness, and when atmospheric phenomena limit the viewing of low cloud, there will be difficulty in attaining that accuracy.
Cloud height	± 10 m (33 ft) up to 100 m (330 ft) ± 10% above 100 m (330 ft)	± 10 m (33 ft) up to 1 000 m (3 300 ft) ± 30 m (100 ft) above 1 000 m (3 300 ft) up to 3 000 m (10 000 ft)
Air temperature and dew point temperature	± 1°C	± 0.2 °C
Pressure value (QNH, QFE)	± 0.5 hPa	± 0.3 hPa

* The operationally desirable accuracy is not intended as an operational requirement; it is to be understood as a goal that has been expressed by the operators.

** The accuracy stated refers to assessment by instruments (except for cloud amount); it is not normally attainable in observations made without the aid of instruments.

ATTACHMENT ~~E~~B. OPERATIONALLY DESIRABLE ACCURACY OF FORECASTS

Note 1.— The guidance contained in this table relates to Chapter 6 — Forecasts, in particular to 6.1.1.

Note 2.— If the accuracy of the forecasts remains within the operationally desirable range shown in the second column, for the percentage of cases indicated in the third column, the effect of forecast errors is not considered serious in comparison with the effects of navigational errors and of other operational uncertainties.

Element to be forecast	*Operationally desirable accuracy of forecasts*	*Minimum percentage of cases within range*
	~~AERODROME FORECAST~~TAF	
Wind direction	± 30°	80% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	80% of cases
Visibility	± 200 m up to 700 m ± 30% between 700 m and 10 km	80% of cases
Precipitation	Occurrence or non-occurrence	80% of cases
Cloud amount	± 2 oktas	70% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	70% of cases
Air temperature	± 1°C	70% of cases
	~~LANDING~~ TREND FORECAST	
Wind direction	± 30°	90% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	90% of cases
Visibility	± 200 m up to 700 m ± 30% between 700 m and 10 km	90% of cases
Precipitation	Occurrence or non-occurrence	90% of cases
Cloud amount	± 2 oktas ± 30% between 700 m and 10 km	90% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	90% of cases
	FORECAST FOR TAKE-OFF	
Wind direction	± 30°	90% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	90% of cases

Element to be forecast	*Operationally desirable accuracy of forecasts*	*Minimum percentage of cases within range*
Air temperature	± 1°C	90% of cases
Pressure value (QNH)	± 1 hPa	90% of cases
	AREA, FLIGHT AND ROUTE FORECASTS	
Upper-air temperature	± 3°C (Mean for 900 km/500 NM)	90% of cases
Upper wind	± 28 km/h (15 kt) up to flight level 250 ± 37 km/h (20 kt) above flight level 250 (Modulus of vector difference for 900 km/500 NM)	90% of cases
Significant en-route weather phenomena and cloud	Occurrence or non-occurrence	80% of cases
	Location: ± 100 km/60 NM	70% of cases
	Vertical extent: ± 600 m/2 000 ft	70% of cases

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Insert new text as follows:

Editorial Note.— To be updated in coordination with WAFCs.

ATTACHMENT C . BACKUP PROCEDURES AT THE WORLD AREA FORECAST CENTRES
(See Chapter 3, 3.2.2 of this Annex)

1. INTRODUCTION

The object of the world area forecast system (WAFS) is to provide essential en-route meteorological information utilizing a comprehensive, integrated, global, and uniform system in a cost-effective manner. Two world area forecast centres (WAFCs) have agreed to provide these services by producing and distributing global wind, temperature, and tropopause height forecasts, and a suite of significant weather forecasts. To satisfy the recommendation in ICAO, Annex 3, a WAFC will provide any or all of the WAFS services in case of an interruption of the operation of the other. To accomplish this, the WAFCs London and Washington studied a number of potential service interruption and outage scenarios, reviewed the current communication links between to two WAFCs, and agreed to the appropriate responses to each failure.

2. NUMERICAL WEATHER PREDICTION (NWP) PRODUCTION INTERRUPTIONS

2.1 *WAFC London interruptions*. A global gridpoint atmospheric model runs as part of the Met Office operational suite in Exeter. The NWP output from this model forms the basis for the wind and temperature messages produced in Gridded Binary (GRIB) format. In addition, the model output is available to the WAFC London forecasters. Two, largely identical, supercomputers are housed in separate computer halls (called hall 1 and hall 2) at Exeter, allowing the global model to run on either machine. Therefore, routine or non-routine maintenance can be performed on one of the supercomputers without affecting the operational capability of WAFC London. In the event that the global model cannot be run on either supercomputer, two courses of action are possible. The first time a model run is delayed or not available, the WAFC will use the data from the previous model run. In the event that a second, consecutive run is unsuccessful, WAFC London would process the NWP data routinely received from WAFC Washington for the production of their products .

2.2 *WAFC Washington interruptions*. A global spectral model runs at the National Centres for Environmental Prediction (NCEP) to produce the WAFC Washington NWP, forming the basis for the GRIB wind and temperature messages. If the primary NCEP supercomputer should fail a second computer is available in the same facility. If the NWP is significantly delayed or missing, a decision is made to use the GRIB data routinely received from WAFC London to produce the WAFS GRIB messages.

3. NWP POST-PROCESSING INTERRUPTIONS

3.1 *WAFC London interruptions*. It is possible that the global model may run successfully, but the post-processing computer fails to produce the GRIB data, and diagnostic fields for the significant weather forecasters. When a post-processing run is delayed or cannot be produced, a decision can be made to use the most recent model run incremented by the appropriate number of forecast hours. If two consecutive model runs were missing, a decision would be made to use the WAFC Washington WAFS grids as a replacement for the WAFC London data.

3.2 *WAFC Washington interruptions*. GRIB data is normally created in the post-processing cycle of the supercomputer. When this cycle is interrupted or cannot be completed in a timely fashion on either supercomputer, the National Weather Service Telecommunications Gateway (NWSTG) is notified to use the WAFC London WAFS grids to create the GRIB messages.

4. SIGNIFICANT WEATHER PRODUCTION INTERRUPTIONS

4.1 *WAFC London interruptions*. In the event of a failure at the primary WAFS operational workstation, the forecaster would use one of the backup workstations located on the forecast floor. Paragraphs 2.1 and 2.2 address the procedures that would be used in the case of a failure of the NWP system. If Exeter is affected by a significant failure, paragraph 7 describes the action under "Total outage of a WAFC."

4.2 *WAFC Washington interruptions*. Similar to WAFC London, if the primary operational workstation fails, the forecaster would use a backup workstation located on the forecast floor. Paragraphs 2.1 and 2.2 address the procedures that would be used in the case of a failure of the Washington NWP system. If the Washington WAFC significant weather (SIGWX) production centre, located at the NWS Aviation Weather Centre, is out, WAFC London is called on to produce all of the Washington WAFS SIGWX forecasts. These forecasts are then switched back to the NWSTG with the routine London SIGWX forecasts for dissemination via the International Satellite Communication System (ISCS).

5. MESSAGE SWITCH INTERRUPTIONS

5.1 *WAFC London interruptions*. Two message switches exist at Exeter. The primary switch is located in computer hall 1, and a backup switch in located in hall 2. In the event of a failure at the primary switch, the backup switch would be used to send and receive data. The backup message switch can be immediately connected to the Washington and Toulouse GTS routes, and to SADIS in the event of failure of the primary switch. (See paragraph 7 on the: "Total outage of a WAFC.").

5.2 *WAFC Washington interruptions*. If the message switch at the NWSTG is out, WAFC London is notified to begin sending WAFS products on the integrated services digital network (ISDN) circuit from Exeter to the ISCS uplink site. The products are then broadcast normally by the ISCS satellites.

6. SATELLITE UPLINK AND SATELLITE SYSTEM INTERRUPTION

6.1 The operation of the communication satellites used for the SADIS and ISCS broadcasts is outside the control of the two WAFS. Thus, the reliability and availability of these services is guaranteed by the commercial providers, and not by the two WAFCs.

7. TOTAL OUTAGE OF A WAFC

7.1 *WAFC London outage*. It is considered extremely unlikely that WAFC London would ever be totally out. The new state of the art infrastructure in Exeter ensures that both computer halls can operate totally independently of each other. The two halls are supplied by separate primary and backup power supplies. The backup procedures carried out would depend on the nature of the outage, and have been largely detailed earlier in the document. In a worst case scenario when computer hall 1 becomes inoperable and the Washington – Exeter GTS link is out of action, the ISDN dial-up line maintained between Washington and computer hall 2 would be used to obtain data from Washington. This circuit is a physical backup to the link that is normally in place between Silver Spring and Exeter, and is used only when a major failure occurs in computer hall 1. It should be noted that failure of computer hall 1 would not affect the ability of WAFC London to populate the SADIS broadcast. However in the highly unlikely failure of the GTS route between computer hall 1 and Washington, WAFC London would promulgate their WAFS charts to Washington by way of the ISDN route to the ISCS uplink site. The products would then be broadcast normally by the ISCS satellites. In the event of the forecast office in Exeter becoming unserviceable, then WAFC Washington may be contacted to initiate backup production of all the SWH and SWM charts routinely produced by WAFC London. However it should be noted that a backup forecast office is provisioned at Exeter in a separate wing of the building, so it is considered highly unlikely that WAFC London would be totally unable to produce their WAFS charts. The backup products would still be available for SADIS uplink in such a scenario assuming that either computer hall in Exeter is available.

7.2 *WAFC Washington outage*. The WAFS product generation facilities are located at multiple sites. Thus, WAFC Washington would never be completely out. The backup procedures carried out would depend on the facility affected, and have been described above. Two independent data paths exist from the message switch. Thus, a cable cut would not disrupt communications. However, if the Washington message switch is out, the distribution of products to the United Kingdom and to the ISCS is also severed. A backup location for the message switch is planned, but not yet implemented. Thus, the UK Met Office would be called on to produce all of the Washington WAFS data and send it directly to the ISCS uplink site. The United States maintains a dial-up line between Exeter and the uplink site for this purpose.

8. ROUTINE AND BACKUP SIGNIFICANT WEATHER CHART INFORMATION

8.1 This following table summarizes the ICAO areas and associated WMO headers for both routine and backup high level significant weather charts. This information may be used to update WAFS workstation data management systems.

Table C-1. ICAO areas and associated WMO headers for both routine and backup high level significant weather forecasts

SWH Area	*Routine WAFC* *Backup WAFC*	*Routine WMO Header* *Backup WMO Header*
A	Washington London	PGEE07 KKCI PGEE07 EGRR
B	London Washington	PGS(D/E)06 EGRR PGIE07 KKCI
B1	Washington London	PGIE07 KKCI PGIE07 EGRR
C	London Washington	PGR(D/E)06 EGRR PGRE06 KKCI
D	London Washington	PGZ(D/E)06 EGRR PGZE06 KKCI
E	London Washington	PGG(D/E)06 EGRR PGGE06 KKCI
F	Washington London	PGGE07 KKCI PGGE07 EGRR
G	London Washington	PGC(D/E)06 EGRR PGCE06 KKCI
H	London Washington	PGA(D/E)06 EGRR PGAE07 KKCI
I	Washington London	PGBE07 KKCI PGBE07 EGRR
J	Washington London	PGJE07 KKCI PGJE07 EGRR
K	London Washington	PGK(D/E)06 EGRR PGKE06 KKCI
M	Washington London	PGDE30 KKCI PGDE30 EGRR

End of new text.

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ATTACHMENT ~~C~~D. SELECTED CRITERIA APPLICABLE TO AERODROME REPORTS

AMOSSG

(The guidance in this table relates to Chapter 4 ~~— Meteological observations and reports, 4.5 to 4.12 inclusive~~ and Appendix 3)

	Surface wind				Visibility (VIS)			RVR[1] A B C (OBS TIME) -10 -5 (Time, MIN)			Present weather	Cloud					Temperature	Pressure (QNH, QFE)		Supplementary information
												Amount				Type[2]				
Specifications	Directional variations[3]			Speed variations[3]	Directional variations[4]			Past tendency[5]		Variations[5]		Layers reported if coverage								
	$ 6 0° and < 180°		$ 180°			Special cases		⌐&5(AB) - &5(BC)⌐		⌐&1 - &10⌐ > MAX [50 m or 20% x &10]										
	Mean speed																			
	~~#~~< 6 km/h (3 kt)	~~>~~$ 6 km/h (3 kt)		Exceeding the mean speed by $ 20 km/h (10 kt)	General rule	VIS $ 1.5 x Minimum VIS in one or more directions	Minimum VIS < 1 500 m and VIS > 5 km in another direction	< 100 m	$ 100 m			Lowest layer	Next layer >	Next higher layer >	CB[6] or TCU	Identification		Parameters reported	Updated if changes > agreed magnitude	Parameter to be included
Local routine and special report	2 min [7] VRB + 2 extreme directions[11]	2 min mean + 2 extreme directions[11]	2 min VRB + 2 extreme directions[11]	2 min Minimum and maximum speed	1 min N/A	N/A	N/A	1 min N/A[8]	N/A	1 min N/A	No general criteria applicable to all the WX phenomena (for specific criteria see 4.8.4-4.8.7)	Always	2/8	4/8	Always	CB TCU	No criteria	QNH QFE[9]	Yes	All[10]
METAR/ SPECI	10 min VRB~~[11]~~ (no extremes)	10 min mean + 2 extreme directions ~~[11]~~	10 min VRB (no extremes)	10 min Maximum speed ~~[12]~~[11]	10 min Minimum VIS	Minimum VIS + direction	Minimum VIS + direction, and higher VIS + direction	10 min No tendency observed ("N") No tendency available, the tendency is to be omitted	Upward ("U") or downward ("D")	1 min Minimum and maximum (instead of 10 minute mean)		Always	2/8	4/8	Always	CB TCU		QNH	No	Recent WX of operational significance and wind shear~~[13]~~[12]
Relevant reporting scales for all messages	Direction in three figures rounded off to the nearest 10 degrees (degrees 1-4 down, degrees 5-9 up)			Speed in 1 km/h or 1 kt Speed < 2 km/h (1 kt) indicated as CALM	*If* / *Step applicable* VIS < 800 m : 50 m 800 m# VIS < 5 000 m : 100 m 5 000 m # VIS < 10 km : 1 km VIS $ 10 km : None, given as 10 km or covered under CAVOK			*If* / *Step applicable* RVR < 400 m : 25 m 400# RVR # 800 m : 50 m 800 < RVR <~~1 500~~2 000 m : 100 m~~[14]~~[13]			N/A	*If* / *Step applicable* Base # 3 000 m (10 000 ft) : 30 m (100 ft) Base > 3 000 m (10 000 ft) : 300 m (1 000 ft) (Reference level: Aerodrome elevation~~[15]~~[14] or mean sea level for off-shore structures)					Rounded off to whole degrees: up (down) for decimals 5-9 (1-4)	In whole hPa~~[16]~~[15] *rounding* down for decimals 1-9~~[17]~~[16]		N/A

Notes.—

1. Considered for the past 10 minutes (exception: if the 10-minute period includes a *marked discontinuity* (i.e. RVR changes or passes 150, 350, 600 or 800 m, lasting ≥ 2 minutes), only data after the discontinuity to be used). A simple diagrammatic convention is used to illustrate those parts of the 10-minute period prior to the observation relevant to RVR criteria, i.e. AB, BC and AC.
2. Layer composed of CB and TCU *with a common base* should be reported as "CB".
3. Considered for the past 10 minutes (exception: if the 10-minute period includes a *marked discontinuity* (i.e. the direction changes $30° with a speed $ 20 km/h *or* the speed changes $ 20 km/h lasting $ 2 minutes), only data after the discontinuity to be used).
4. If several directions, the most operationally significant direction used.
5. Let &1 = any 1-minute mean RVR-value during period AC, &10 = 10-minute mean RVR-value during period AC, &5(AB) = 5-minute mean RVR-value during period AB and &5(BC) = 5-minute mean RVR-value during period BC.
6. CB (cumulonimbus) and TCU (towering cumulus = cumulus congestus of great vertical extent) if not already indicated as one of the other layers.
7. Time averaging, if applicable, indicated in the upper left-hand corner.
8. N/A = not applicable.
9. QFE is to be included if required.
10. As listed in 4.12.1 to 4.12.4, and 4.12.7.
~~11. Also indicate as "VRB" where variations in wind direction are 180° or more or where when it is not possible to report a mean wind direction (e.g. a thunderstorm passing over the aerodrome).~~

~~12~~11. According to the WMO *Manual on Codes* (WMO-No. 306), Volume I.1, Part A — Alphanumeric Codes, paragraph 15.5.5, "it is recommended that the wind measuring systems should be such that peak gusts should represent a three-second average."

~~13~~12. Also sea-surface temperature and state of the sea from off-shore structures. Other information may only be inserted in accordance with regional air navigation agreement.

~~14~~13. Report if RVR and/or VIS < 1 500 m, limits for assessments 50 and 1 500 m.

~~15~~14. For landing at aerodromes with precision approach runways and with the threshold elevation ≥ 15 m below the aerodrome elevation, the *threshold elevation* to be used as a reference.

~~16~~15. Measured in 0.1 hPa.

~~17~~16. Reference elevation for QFE should be aerodrome elevation except for precision approach runways, and non-precision approach runways with threshold $2 m (7 ft) below aerodrome elevation, where the reference level should be the relevant threshold elevation.

ATTACHMENT ~~D~~E. CONVERSION OF INSTRUMENTED READINGS INTO RUNWAY VISUAL RANGE AND VISIBILITY

(See ~~4.7.10~~ Appendix 3, 4.3.4 of this Annex)

1. The conversion of instrumented readings into runway visual range and visibility is based on Koschmieder's Law or Allard's Law, depending on whether the pilot can be expected to obtain main visual guidance from the runway and its markings or from the runway lights. In the interest of standard-ization in runway visual range assessments, this Attachment provides guidance on the use and application of the main conversion factors to be used in these computations.

2. In Koschmieder's Law one of the factors to be taken into account is the pilot contrast threshold. The agreed constant to be used for this is 0.05 (dimensionless).

3. In Allard's Law the corresponding factor is the illumination threshold. This is not a constant, but a continuous function dependent on the background luminance. The agreed relationship to be used in instrumented systems with continuous adjustment of the illumination threshold by a background luminance sensor is shown by the curve in Figure ~~D-1~~E-1. The use of a continuous function which approximates the step function such as displayed in Figure ~~D-1~~E-1 is preferred, due to its higher accuracy, to the stepped relationship described in 4.

4. In instrumented systems without continuous adjustment of the illumination threshold, the use of four equally spaced illumination threshold values with agreed corresponding back-ground luminance ranges is convenient but will reduce accuracy. The four values are shown in Figure ~~D-1~~E-1 in the form of a step function; they are tabulated in Table ~~D-1~~E-1 for greater clarity.

Note 1.— Information and guidance material on the runway lights to be used for assessment of runway visual range are contained in the Manual of Runway Visual Range Observing and Reporting Practices *(Doc 9328).*

Note 2.— In accordance with the definition of visibility for aeronautical purposes, the intensity of lights to be used for the assessment of visibility is in the vicinity of 1 000 cd.

Editorial Note.— *Insert* Figure D-1 and *renumbered* E-1.

Table ~~D~~E-1. Illumination threshold steps

Condition	*Illumination threshold (lx)*	*Background luminance (cd/m2)*
Night	8 x 10^{-7}	#50
Intermediate	37385	51 - 999
Normal day	37355	1 000 - 12 000
Bright day (sunlit fog)	37324	> 12 000

APPENDIX C

DRAFT TERMS OF REFERENCE AND COMPOSITION OF THE PROPOSED WAFS OPERATIONS GROUP (WAFSOPSG)

1. Terms of reference

The WAFSOPSG should:

a) provide advice and guidance to the WAFC Provider States concerning the operation of the WAFS and its effectiveness in meeting current global and, where appropriate, regional operational requirements;

b) develop proposals for the development of the WAFS in order to ensure that it continues to meet evolving global and, where appropriate, regional operational requirements;

Note.— Such proposals for requirements should be made under ICAO procedures for the amendment of Annex 3.

c) monitor, assess and provide advice on technological developments relevant to the WAFS to ensure that full advantage may be taken of such technologies to maintain and, where possible, improve the cost-effectiveness of the WAFS, and develop appropriate proposals, as necessary, for the adoption of such technologies;

d) liaise with the MET advisory groups to the PIRGs regarding progress by States in their capability to receive/decode/process WAFS output products in the GRIB and BUFR code forms, and any other binary codes that may be used in the WAFS in the future. Based on information received, provide advice as necessary to ICAO, and through ICAO to WMO, regarding training and/or guidance material that may be required to ensure that all States have the opportunity to use WAFS output products regardless of the present or future mode of coding and/or transmission;

e) advise the WAFCs in the development and use of appropriate WAFS output performance indicators;

f) monitor the WAFS output to ensure that both the appearance of the output and location of systems in areas of overlap are harmonized;

g) liaise with the SADISOPSG and the MET advisory groups to the PIRGs regarding the global distribution of WAFS data and products by satellite broadcast; and

h) make regular progress reports to the Air Navigation Commission.

2. Composition

The WAFSOPSG should comprise representatives from the two WAFC Provider States, one of the ex-RAFC Provider States from each region, user States that provided members to the WAFSSG, a user State from each region, the International Air Transport Association (IATA), the International Council of Aircraft Owner and Pilot associations (IAOPA), the International Federation of Air Line Pilots' Associations (IFALPA) and the World Meteorological Organization (WMO).

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APPENDIX D

PROPOSED AMENDMENT TO

PROCEDURES FOR AIR NAVIGATION SERVICES

ICAO ABBREVIATIONS AND CODES (DOC 8400)

FIFTH EDITION — 1999

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT TO PANS-ABC

1. The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

~~Text to be deleted is shown with a line through it.~~	text to be deleted
New text to be inserted is highlighted with grey shading.	new text to be inserted
~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

2. The sources of the proposed amendments have been indicated as follows:

Source	Annotation
Aerodrome Meteorological Observing Systems Study Group (AMOSSG)	AMOSSG
Meteorological Information Data Link Study Group (METLINKSG)	METLINKSG

ABBREVIATIONS

DECODE

METLINKSG

A

. . .

ASPEEDG Airspeed gain
ASPEEDL Airspeed loss

. . .

C

. . .

CLIMB-OUT Climb-out area

AMOSSG

M

. . .

METAR ~~Aviation~~Aerodrome routine ~~weather~~meteorological report (in ~~aeronautical~~ meteorological code form).

. . .

S

. . .

SPECI ~~Aviation selected~~ Aerodrome special ~~weather~~meteorological report (in ~~aeronautical~~ meteorological code form).

. . .

T

. . .

TAF Aerodrome forecast (in meteorological code form).

. . .

Editorial Note.— Amend the encode section accordingly.

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APPENDIX E

PROPOSED AMENDMENT TO

PROCEDURES FOR AIR NAVIGATION SERVICES

AIR TRAFFIC MANAGEMENT (DOC 4444)

FOURTEENTH EDITION — 2001

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT TO PANS-ATM

1. The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

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New text to be inserted is highlighted with grey shading.	new text to be inserted
~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

2. The sources of the proposed amendments have been indicated as follows:

Source	Annotation
Aerodrome Meteorological Observing Systems Study Group (AMOSSG)	AMOSSG
Meteorological Information Data Link Study Group (METLINKSG)	METLINKSG

CHAPTER 1. DEFINITIONS

AMOSSG

. . .

Ground visibility. The visibility at an aerodrome as reported by an accredited observer or automated systems..

. . .

Editorial Note.— *Renumber* note after the definition of visibility as Note 1 and add the following Note 2:

Note 2. — The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.

. . .

CHAPTER 9. FLIGHT INFORMATION SERVICE AND ALERTING SERVICE

9.1 Flight information service

9.1.3 Transmission of information

METLINKSG

. . .

9.1.3.2 *Transmission of special air-reports, SIGMET and AIRMET information*

9.1.3.2.1 Appropriate SIGMET and AIRMET information, as well as special air-reports which have not been used for the preparation of a SIGMET, shall be disseminated to aircraft by one or more of the means specified in 9.1.3.1.1 above as determined on the basis of regional air navigation agreements. Special air-reports shall be disseminated to aircraft for a period of 60 minutes after their issuance.

. . .

CHAPTER 11. AIR TRAFFIC SERVICES MESSAGES

. . .

11.4.3 Flight information messages

. . .

AMOSSG

11.4.3.2.3.2.3 In ~~meteorological reports disseminated beyond the aerodrome~~ METAR and SPECI, the visibility shall be representative of the aerodrome and its ~~immediate~~ vicinity. In the case of significant directional variations in visibility:

a) the ~~lowest~~ prevailing visibility shall be reported; and

b) ~~additional values~~ the lowest visibility shall be ~~given~~ reported with an indication~~s~~ of the direction of observation.

. . .

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APPENDIX F

PROPOSED AMENDMENT TO

INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES

RULES OF THE AIR

ANNEX 2
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

NINTH EDITION — JULY 1990

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT TO ANNEX 2

1. The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

~~Text to be deleted is shown with a line through it.~~	text to be deleted
New text to be inserted is highlighted with grey shading.	new text to be inserted
~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

2. The sources of the proposed amendments have been indicated as follows:

Source	Annotation
Aerodrome Meteorological Observing Systems Study Group (AMOSSG)	AMOSSG

. . .

CHAPTER 1. DEFINITIONS

AMOSSG

. . .

Ground visibility. The visibility at an aerodrome as reported by an accredited observer or automated systems..

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Editorial Note.—	*Renumber* note after the definition of visibility as Note 1 and add the following Note 2:

Note 2. — The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.

. . .

— — — — — — — —

APPENDIX G

DRAFT CONTENT OF THE MANUAL ON AUTOMATIC METEOROLOGICAL OBSERVING SYSTEMS AT AERODROMES

Introduction

Definitions and explanation of terms

Automatic observations of

- surface wind
- visibility
- RVR
- present weather
- clouds
- air temperature and dew-point temperature
- atmospheric pressure
- supplementary information

Integrated automated observing systems

Maintenance and back-up procedures

Use of remote sensing as part of automatic observing systems

Reporting practices

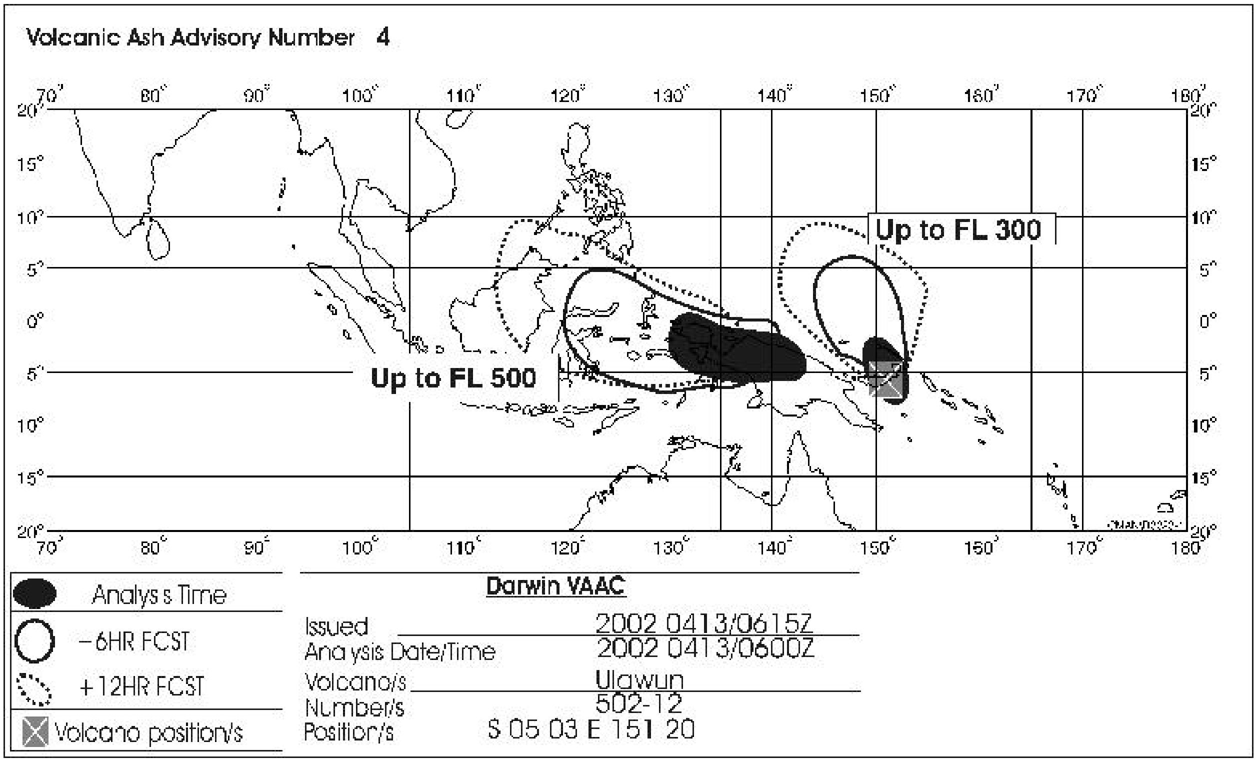
Influence of topography and climatological conditions

Quality assurance of automatic meteorological observations at aerodromes

— — — — — — — —

APPENDIX H

PROPOSAL FOR VOLCANIC ASH ADVISORY IN GRAPHICAL FORMAT



— — — — — — — — —

APPENDIX I

DRAFT TERMS OF REFERENCE AND COMPOSITION OF THE PROPOSED VAWSG OPERATIONS GROUP

1. Terms of reference:

The IAVWOPSG should:

a) provide advice and guidance to the secretariat concerning the operation of the IAVW and its effectiveness in meeting current operational requirements;

b) develop proposals for the development of the IAVW in order to ensure that it continues to meet evolving operational requirements;

Note.— Such proposals for requirements should be made under ICAO procedures for the amendment of Annex 3.

c) assist the Secretariat in the coordination of the arrangements between the various international organizations comprising the IAVW;

d) coordinate with the SADISOPSG and WAFSOPSG regarding the inclusion of volcanic ash advisories and SIGMETs on the ICAO satellite broadcasts;

e) assist the Secretariat in the development of appropriate guidance material both for operations with volcanic ash in the atmosphere and also operations with volcanic ash deposited on aerodromes;

f) develop specific proposals for the provision of warnings for aerodrome management for deposition of volcanic ash on aerodromes;

g) provide advice and guidance to the Secretariat and the VAACs regarding the future ICAO IAVW and existing VAAC Websites, respectively;

h) provide advice to the Secretariat regarding the development of international arrangements for the provision of warnings to aircraft of radioactive materials and toxic chemicals in the atmosphere (legacy task of the VAWSG); and

i) make regular progress reports to the Air Navigation Commission

2. Composition

The IAVWOPSG should comprise representatives from States providing the VAACs, other user States that provided members to the VAWSG, and representatives from International Atomic Energy Agency (IAEA), International Air Transport Association (IATA), International Federation of Air Line Pilots' Associations (IFALPA), International Union of Geodesy and Geophysics (IUGG) (covering the World Organization of Volcano Observatories), and World Meteorological Organization (WMO).

— END —