



World Meteorological Organization

Infrastructure Commission

Standing Committee on Earth Observing Systems and Monitoring

Networks

**Virtual First Meeting of the Joint Expert Team on Aircraft-Based
Observing Systems (JET-ABO)**

8 – 10 December 2020, Geneva, Switzerland

Final Report

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Agenda

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General Summary

1. Opening of Meeting

The first meeting of the WMO Infrastructure Commission Joint Expert Team on Aircraft-Based Observing Systems (JET-ABO) was conducted virtually in three sessions over 8 – 10 December 2020.

The three sessions were:

1200 to 1430 UTC, 8 December, 2020

1200 to 1430 UTC, 9 December, 2020

2100 to 2330 UTC, 10 December, 2020

The meeting was opened by the Chair of the JET-ABO, Mr Curtis Marshall who welcomed the members of the team to its inaugural meeting. The meeting provisional agenda was presented and agreed as above. The team was addressed by Ms Estelle Grueter, Chair of the Standing Committee on Earth Observing Systems and Monitoring Networks (SC-ON) who provided a brief introduction to the INFCOM structure and the role of the SC within the commission. As a Joint Expert Team, the JET-ABO is jointly managed by the SC-ON and the Standing Committee on Measurements Traceability and Instrumentation (SC-MINT), while also having a connection with a number of other teams within both SCs.

Presentations from the meeting are [available here](#).

The attendance record of team members is provided in [Annex I](#).

2. Team Role and Activities

Terms of Reference

Mr Marshall briefly described the Terms of Reference of the team and their relationship with the key deliverables, activities and priorities which are summarized below. These in turn are linked with several of the priority activities and deliverables of the INFCOM and the two SCs.

Key deliverables, activities and priorities

Priority Items	Activities/Tasks & Deliverables
WICAP	<ul style="list-style-type: none">• Establishment of sub-group under JET (Members: Region Leads, IATA – post-EC, Oct 2020)• Finalisation of key documents: <i>Working Arrangement (Oct 2020)</i> <i>Data Policy (EC 2021 or Cg-2021)</i> <i>ToR – Est. of Governing Board (Jan 2021)</i>• WICAP promotional and technical materials (Consultancy, Q1/2021)• Develop a strategy on funding mechanisms and data sharing under WICAP• Coordination of est. regional programs (ongoing)
Regulatory Materials	<ul style="list-style-type: none">• Update WIGOS Report 2014-1, Benefits of ABO (underway, end 2020)• Review and update of WMO No. 8, Part II, Chap III) (end 2021)• Review & updated WMO No. 1200 Guide to ABO (end 2021)

Other ABO Data Sources	<ul style="list-style-type: none"> • Collaboration with ICAO on delivery of ADS-C data (underway, 2021) • Integration of Mode S data (ongoing 2022-23) • Access to AMDAR and AFIRS data (underway, 2020-21)
UAV ABO	<ul style="list-style-type: none"> • Development of whitepaper/BAMS publication on future use of UAVs in operational met. (underway, end 2020) • Development of global demonstration project (2022-23) • Crowd-source data provision project (2023)
ABO Data Management	<ul style="list-style-type: none"> • Finalisation of establishment of Global Data Centre & revised functionality for WICAP (underway, end 2021) • Development of WDQMS-ABO, NOAA/NCAP (end 2021) • Metadata development (end 2022)

Team information and coordination

Team members were advised regarding the location of key team information and tools as below.

- [Team details via WMO Contacts online](#) (login required) & [Community Platform](#)
- [Team Trello Board](#)
- WMO Community Platform [ABOP](#), [AMDAR](#), [WICAP](#) sites
 - News
 - [Resources](#)
 - [Newsletters](#)
 - [Yammer](#)

An email group has not yet been established as this functionality in general has not yet been made as part of the new WMO IT platform. It is expected to be available in early 2021.

The team agreed that, in addition to the Coordination Group on WICAP, the team might most effectively work in subgroups aligned with the team Terms of Reference and the actions of the work plan. See item 4 for details.

3. Report on ABOP Priority Activities

Status & expected recovery of aviation sector

[Presentation by Mr Brian Pearce](#), IATA Chief Economist

Summary of key points:

- In large part, the aviation sector has survived because governments have stepped up to support the industry - otherwise more airlines would have folded or been close to doing so.
- However, airlines are building financial debt.
- Cargo traffic has recovered well, whereas passenger sector is very deflated.
- Vaccine distribution is the key to recovery of the industry.
- Europe 2nd wave and USA 3rd wave have dampened or completely hampered the recovery.
- South America has put in measures to allow some increase in passenger travel.
- Chinese domestic market has fully recovered.

- Despite the situation in Australia with COVID under control, the passenger market has not recovered.
- Recovery to 2019 levels not expected until 2024.
- 120B USD in losses expected from 2020; 40B USD in losses forecast for 2021
- A real problem is the burndown in cash holding of airlines - not expected to become positive until next year.
- Median size airlines have only around 9 more months of cash burndown that they can support.
- While a process of virus testing has worked in South America to encourage passenger travel, the cost and difficulties to undertake such testing has resulted in less implementation and impact in Europe.

Status of WICAP and regional programs

Ms Minna Huuskonen and Mr Fernando Rodriguez provided the meeting with a [summary of progress made in the establishment of WICAP](#) following the related WMO Congress decision of Cg-18, 2019. This is summarized by the following points:

- At EC-72 (September, 2020):
 - adopted in principle the Data Policy for the WICAP, but requested that the policy should be further reviewed by INFCOM in Nov 2020. If then agreed by IATA, a final approval will be requested by EC-73, expected to take place in April or May 2021.
 - Approved Terms of Reference for the WICAP Governing Board.
 - Dissolved TT-IWCA and requested INFCOM to take responsibility of WICAP Implementation, with this responsibility to now lie with the JET-ABO.
- When the approval process in both WMO and IATA are complete the ToR and Data Policy will be signed and then appended to the Working Arrangement (WA).
- At the INFCOM Session I, Part II, the INFCOM recommended to EC to approve the WICAP Data Policy and a procedure for establishing the WMO membership of the WICAP Governing Board.
- WMO and IATA signed the WICAP Working Arrangement on WICAP in October 2020. The WA updates the previous version established in 2017 and defines responsibilities and joint efforts under an Initial 3-year framework to establish the WICAP.
- The WICAP Implementation Plan (IP) has been revised. While there are no major changes in terms of activities, with timelines updated so as to make adjustments according to outcomes of EC-72 and for INFCOM-1, Part II, which acted to delay the approval and establishment of the Data Policy. The IP still aims at implementing the full governance and regional operational structures of WICAP by end 2023.
- The inaugural meeting of the WICAP Governing Board is expected to take place in January 2021 where a key outcome will be the adoption of the high level strategy for WICAP and a work plan for 2021.
- Other achievements and ongoing activities include:
 - Completion of the Re-establishment of the [WICAP website](#) on the WMO Community Platform.
 - Introduction sessions to WICAP WMO Region Offices were held during October 2020. RAs will be encouraged to form working groups on ABO to coordinate development of WICAP in each region.

The following important key activities are planned for WICAP development in 2021:

1. Establishment of the Governing Board (GB) and first meeting (January 2021).
2. WICAP Promotional Activities:

- a. Communication Strategy and Plan to be updated based on the current industry situation
- b. Continued development of WICAP promotional videos (already under development)
3. Continued collaboration and development of regional IPs with RAs and within WMO & IATA
4. Establishment of regional working groups & regional governance within Regional Associations and IATA Regional Offices.
5. Development of global approach to WICAP budget and planning
6. Development of WICAP Manual for Airline Participation, providing a manual for airline's decision makers with clear definition of involved costs, benefits and potential cost sharing opportunities.
7. Development and finalisation of the WICAP Operator/Airline template agreement.
8. Investigate potential new technical solutions for onboard applications for AMDAR and turbulence reporting.
9. Agreement on strategy for data and cost sharing under WICAP.
10. Development of strategies for cost savings related to data communications and installation costs.
11. Development of strategy and plans for harmonization of AMDAR & turbulence reporting.
12. Review of regional target airlines to develop overall costing estimations for AMDAR operations (incl. Installation, retrofits and data communication costs).
13. Explore external funding possibilities.
14. Advocate with industry stakeholders for the provision of improved and more readily available solutions for reporting weather information from the aircraft platform, both from factory floor and for retrofit.

The JET-ABO Region Leads were requested to provide a response to a questionnaire on the status of WICAP development and the key regional issues impacting their respective programmes. The responses are summarized and tabled in the [presentation document here](#). This information will be analysed by the CG-WICAP in formulating plans in collaboration with regional work groups.

The following points were highlighted by the CG-WICAP Chair, Mr Steve Stringer:

- Funding of programs is a critical issue, particularly for Regions I and III.
- There is concern regarding the viability of several existing programs, including Mexico and LATAM.
- It appears as if expectations for introducing new airlines have been tempered by COVID, with 13 airlines nominated as high priority and 7 additional as also possible. Of these prospective airlines, no initial approach has been made, apart from Collins Aerospace having conducted initial discussions with COPA. NOAA has also been approached regarding assistance with development of the Ethiopia AMDAR programme.
- In relation to financing:
 - Highlighted a requirement for people/staff resources to be considered in addition to developmental and operational program costs.
 - There is a requirement for a standardised agreement/contract for airline participation.
- WICAP must consider how the program might handle the involvement of aircraft that are under lease by the partner airlines.
- In terms of WICAP implementation strategies:
 - Building on existing programs is critical, for example, E-AMDAR started out as individual program & came together as a regional program.
 - A centralized, global, funding mechanism should be considered.
 - Engaging with IATA to help with airline contacts and efficient implementation processes will be very important.
 - Development of an airline business case is critical.

- Development of WVSS and turbulence requires IATA input and engagement with the wider industry.

Status of national programs

Status of Kenya program development

The Secretariat provided a [brief outline](#) of the status and issues with the development of the Kenya AMDAR Programme.

The programme commenced as a [DFID, WISER Project](#) in 2017. The project is due to be completed in June 2021. The key project objectives and work packages were:

- Equipping Kenya Airways B737 (12) and E190 (15) fleets
- Development of Kenya AMDAR Data Processing System (contracted to Synthesys)
- Improvement to existing forecast processes
- Development of new forecast processes

The project contributors and stakeholders are: DFID, Met Office, KMD, Kenya Airways

The project has met with a number of major issues that have prevented successful completion of all component of the project. It is expected that only 5 aircraft will be able to be equipped as an outcome of the project, due to the project failing to be able to raise purchase orders with suppliers to upgrade aircraft avionics platforms and applications. As a result of this and also delays to organizing activities due to the COVID-19 crisis, the forecast improvements activities will be only partially completed. A major success of the project is the completion and implementation of the data processing system, which has been developed to later become a regional hub for AMDAR data processing in support of the RA I AMDAR Programme.

It is critical that the JET-ABO works with KMD to ensure that the program can continue to operate and develop after the completion of the project in June 2021.

Status of USA & LATAM

Mr Curtis Marshall provided a brief [presentation on the USA ABO programme](#), summarized by the following:

- The US ABO programme conducted a contract renewal process in 2020. This includes the contract for provision of “MDCRS” (AMDAR) data with most major commercial US airlines. It also includes:
 - A contract for continued provision of WVSS data from equipped aircraft
 - Provisions for ADS-C and data outside the continental US (CONUS) area, such as that provided by the LATAM group of airlines.
- USA has also established contracting arrangements with FLYHT for global provision of TAMDAR and AFIRS data through September 2021. This feed will need to be harmonized with the current feeds via Met Office, that was established as a temporary measure during the COVID-19 crisis.
- Beyond September 2021, there exists some uncertainty for future participation of LATAM in AMDAR because of COVID-19 impacts on the airline’s financial viability, however the US will continue to support this programme as funding allows and according to the willingness of the airline to participate.
- The US also supports the ABOP through the maintenance of the Global Data Centre and the Lead Centre for ABO – see item below on global data management issues.

Saudi Arabia programme development

Mr Stewart Taylor briefly discussed recent interactions with experts from Saudi Arabia regarding assistance required in development of their national AMDAR programme. Following are the key points:

- Over 2004-2008, Saudi Arabia had developed a small AMDAR programme that provided around 300 observations daily, with the E-AMDAR program providing a data monitoring and quality evaluation role in support. It is not clear why the programme ceased.
- At the AMDAR Panel meeting in December 2009, discussions took place regarding a co-operation with the General Authority of Meteorology and Environmental Protection (GAMEP) in Saudi Arabia – including AMDAR development.
- In December 2018, GAMEP held discussions with local company JamJoom and Saudi Arabian Airlines regarding a Joint Venture (JV) for AMDAR development, which does not seem to have progressed.
- In July 2019, Saudi Arabia Presidency of Meteorology and Environment (PME), contacted EUMETNET regarding the possible establishment of consultancy services with local company Nudhum to support AMDAR development, however this is not within the remit of EUMETNET.
- In November 2020, the Met Office was again contacted regarding AMDAR development, with the enquiry passed to WMO and RA II Focal Points with the idea that this initiative might be advanced under the RA II regional programme. In parallel, the ABOP was informed that MeteoFrance International (MFI) were in discussion with GAMEP and MFI also asked Met Office for assistance with this possible development.

Action: This initiative should be supported by the ABOP under the CG-WICAP.

COVID impacts on data output

Mr Taylor also reported that, since the downturn in aviation associated with the COVID-19 crisis early in 2020, the ABOP has maintained a close watch on the impact on the ABO output and resulting impacts on forecast systems. The E-ABO, WMO and other programs and data centres have routinely provided updates on the status and impact.

The article “COVID-19 Pandemic Imperils Weather Forecast” (Chen) – funded by NERC - was published in Geophysical Research Letters (GRL) COVID-19 Pandemic Imperils Weather Forecast – see: [Chen - 2020 - Geophysical Research Letters - Wiley Online Library](#). It was believed that this article contained a number of inaccurate assertions and assumptions that were addressed by a group of scientists from ECMWF, UKMO, BoM and NCEP. The resulting draft response was provided to Chen for comment and an amicable dialogue resulted. After several iterations, the response article was accepted by GRL to be published Dec 2020 under the title, "The Impact of COVID-19 on weather forecasts: a balanced view".

Some other relevant articles and sources of information on this subject include the following:

- ECMWF – Newsletter 164 [Coordinated response mitigates loss of ABO weather data](#)
- ECMWF – AMS article (Jan 2021) “COVID-19, ECMWF Changes to the use of Aircraft Data” [101st American Meteorological Society Annual Meeting \(confex.com\)](#)
- WMO – Bulletin 69 [Impacts of COVID-19 Restrictions on Observations and Monitoring | World Meteorological Organization \(wmo.int\)](#)
- E-ABO – weekly summary of impacts to European AMDAR and other associated information
- Aviation Industry – EUROCONTROL, ICAO, IATA etc.

Strategies for recovery, development & resourcing

The Meeting discussed a range of aspects of the development of WICAP focusing on possible means for funding and resourcing AMDAR development under WICAP taking into account development of both water vapour and turbulence measurement.

Some summary key points and aspects from the meteorological side were [presented by the Secretariat](#) as summarized in [Annex II](#).

A number of key questions relating to funding and resourcing WICAP were considered in discussion.

The Secretariat also provided a possible high-level approach to the resourcing of WICAP as described in [Annex II](#).

Mr Steve Stringer made the following points in relation to the availability of “third party” data via FLYHT.

- Under arrangements with FLYHT earlier in 2020 in which AFIRS and TAMDAR Data are made available to WMO and its Members free of charge, data had been routed to the GTS by the Met Office via the E-ABO data processing system in a relatively simple process as the data was provided by FLYHT in AMDAR BUFR format.
- It was noted also that these data would continue to be made available on the GTS until at least September 2021 under the terms of a contract between NOAA and FLHT.
- In relation to sharing of EDR data from the IATA Turbulence Aware program:
 - This could be more problematic as it will need to be processed by the E-ADAS and converted into BUFR, for which a requirements specification would need to be developed. Development (& potentially operational) costs for this would need to be covered by the ABOP or WICAP.
 - E-ABO preferred that the data licensing required by IATA should be between WMO and IATA.
- More generally, it was clear that third party data providers generally are not often willing to consider a ‘pay once, distribute to all’ arrangement, and, if they do, we could expect costs to be significantly higher.
- In addition to wanting to remain sustainable, providers also have a fear of losing control of IPR over data when allowing wider and less controlled access to data.

Mr Stringer made the following points in relation to water vapour measurement and the strategy and plans being developed as part of the A-SIP (see agenda item 4):

- A convincing Business Case for an airline to participate in WVM must be expressed in terms of the bottom line of airline savings or the mitigation of safety risks.
- An affordable funding model must cover high costs of installation (and continued operation).
- Strategies would include both an approach to OEMs for line-fit and also for retro-fit to existing AMDAR programs.
- WVM as part of both the AMDAR/WVSS-II and via access to TAMDAR data would be taken into consideration.
- Other possible methods and proxies should be considered, such as ADS-C arrival angle differences.
- In addition to the approach under ABOP and WICAP, the UK Met Office and DWD, Germany were considering plans with national carriers to implement WVSS-II as a component of AMDAR.

Ms Katya Vashchankova provided a [presentation on IATA progress with development of the IATA Turbulence Aware Platform](#).

In relation to turbulence, the following issues were raised:

- How do NMHS intend to use EDR data and for what products?
- How can we protect unauthorized distribution of the raw EDR data?
- Is wind and temperature data downlinked within EDR reports useful in the absence of AMDAR reports?

Action: The team agreed that the CG-WICAP should focus following activities on continuing development of strategy for developing and resourcing the WICAP, including the development of a plan of key actions for 2021. This should be presented at the first Governing Board meeting, expected to take place in January 2021.

Global data management issues

Mr Marshall provided a [presentation on progress on the implementation and development of the functionality of the ABO Global Data Centre and the Lead Centre for ABO](#).

Lead Centre for ABO

Background

Quality monitoring and evaluation (QM/E) of ABO data at NCEP/EMC has traditionally taken the form of monthly reporting according to monitoring standards defined in the WMO Manual on Global Data-Processing and Forecasting Systems (GDPFS), first published in 1992.

Recent progress:

With the increased sophistication of NWP systems and increased quantities of data assimilated, the more timely identification and resolution of long-term errors to assimilated data beyond monthly reporting has become ever more necessary to:

- Reduce system burden of preliminary, near-real time error scans intended for short-term or random errors.
- Ensure that the most complete set of data is satisfactory for assimilation and for point-of-reference user analysis.
- Improve the accuracy and generation time of NWP analyses and forecasts.

WMO-No. 1200, Guide to Aircraft-Based Observations outlining recommendations of QM/E procedures to be enacted at the Regional, Global, and Lead Centre levels, summarized below.

USA has provided an in-kind contribution to the WMO AMDAR Trust Fund to upgrade this monitoring to more frequent and higher fidelity reports.

Expected functions of the Lead Centre to be developed are:

Global/Regional Centre procedures

- Daily Availability Report
- Daily 10-day-moving Report
- Monthly Report
- Minimal Quality Monitoring/Evaluation procedures
- ABO Guide Annex I procedures

- Receive/use Lead Centre reports
- Receive/use Global/Regional Centre reports
- Production/scrutiny of national reports
- Analysis of monitoring outputs and reports
- Minimal incident management procedures
- System & practice improvements

Lead Centre specific procedures

- Receive, process, archive, analyze Global/Regional reports
- Reports to, and request action from WMO Focal Points
- Incident Management System (maintenance)
- Technical advice to JET-ABO Members
- Online facility per Attachment III of ABO Guide Annex II
- Annual report to CBS/OPAG-IO5

Global Data Centre for ABO

Terms of Reference for the GDC are provided in [Annex 3](#).

The role has been designated to NOAA with the [functions to be provided by the MADIS System](#).

WMO established a process to provide feedback to NOAA/GSL (“bug fixes”, etc.) as it stands up the GDC and moves from JAVA to ESRI display (the MADIS Aircraft Data Display System). Current progress for MADIS development are on temporary hold due to funding constraints, however most “bugs” have been submitted to MADIS and have been addressed. It is hoped to resume progress by Summer 2021.

Metadata Management

Mr Dean Lockett, Secretariat, made a [presentation on the status of the development of the OSCAR/Surface/ABOS metadata repository](#).

Background

Development of a specification for ABOS metadata development commenced in 2016, based on a specification of metadata integrated into WMO 1200 Guide to ABO, Appendix D. The functional specification of metadata for OSCAR Surface includes the following key components:

1. Repository for all required metadata
2. Additional requirements for determining capabilities
3. User interface for OSCAR/Surface
4. XML API for machine-machine transfer

Progress

Initially ABOP had expected a cost of around 80K CHF to implement the ABOS metadata repository. Finally received in 2019, an estimated cost of around 200K, for development in OSCAR/Surface coordinated by Meteo-Swiss, OSCAR/Surface became operational in 2020, meaning a different development paradigm.

Since then, the Secretariat has been assessing options:

1. Development by Meteo-Swiss/European dynamics

2. Development by WMO contracted developer, WMO operation
3. Development by WMO contracted developer, operated by WMO Member
4. Development and operation by WMO Member

Currently expenditure of funds in WMO is suspended due to contribution shortfalls but development process is expected to resume in 2021.

Next Steps

1. Develop a tender specification
2. Implement based on an AGILE working arrangement
3. Phased development aimed at meeting requirement for central metadata repository
4. Expected cost 100K plus?
5. Expected (possible) timeline:
 - a. Tender complete Q1 2021
 - b. Development to end-2021
 - c. Testing Q4 2021
 - d. Operation Q1 2022

Requirements for input from ABOP:

1. Assistance with metadata input testing
2. Each program to undertake operational implementation
3. Work with WIS (INFCOMM/IT) on WIGOS Station Identifier implementation in data exchange

Work Plan Actions related to ABO data management to be addressed in the work plan are:

1. Resolve the formalization of agreement between NOAA and WMO to correctly establish the Lead Centre and Global Data Centre functions under INFCOM.
2. Continue functional development of the Lead Centre.
3. Continue functional development of the GDC.
4. Continued to coordinated development of ABO metadata repository.

Uncrewed Aerial Systems

James Pinto provided an update on an article that was submitted to the Bulletin of the American Meteorological Society (BAMS) in early Dec 2020 that summarizes the current status and future outlook for implementation of small Uncrewed Aerial Systems (UAS) to support operational meteorology. The article is based on information collected during the 2019 Workshop on UAS in operational meteorology and includes key contributions from a number of workshop participants.

Also discussed were plans to develop a white paper and implementation plan to support a demonstration project in the 2022-23 timeframe. Note that the LAPSE-RATE field project could serve as a model for such a demonstration project. Sponsored by the International Society for Atmospheric Research using Remotely piloted Aircraft (ISARRA), a number of papers in various stages of publication describing outcomes of this project are becoming available (see LAPSE-RATE special issue in the Journal of Earth System Science Data (ESSD)). In addition, all the observations datasets collected during this week-long project as well as special high resolution model data uses to support UAS flight operations are posted at zenodo.org.

5. Review and update of team work plan

Update of ABO Strategy & Implementation Plan (A-SIP)

The Secretariat, the JET-ABO leadership group, the Region Leads and several team members have developed an updated [draft \(2020\) of the Aircraft-Based Observing System Strategy and Implementation Plan \(A-SIP\)](#), aimed at harmonizing the WICAP as an element of the wider plans for coordinating the development of the ABOS under the WMO Aircraft-Based Observations Programme. This update also includes a revision of the two annexes which describe development of turbulence and water vapour measurement under the ABOS and as a component of the AMDAR observing system.

Further work on the strategy relating to WICAP development is required to be undertaken by the CG-WICAP and the WICAP Governing Board.

Action: It was agreed that the A-SIP would be finalized by the Secretariat and then provided to the JET members and the SC-ON leadership group to review.

Revised template for ABOP Regional Implementation Plan (A-RIP)

The A-SIP will provide the basis and strategy for the work program of the JET-ABO over the coming inter-sessional period and to 2026, including the WMO regional plans for development that will be formulated within the ABOS Regional Implementation Plans (A-RIP).

Review and adoption of the work plan

The team reviewed the JET-ABO draft work plan and then revised a list of proposed subgroups to undertake the various activities and tasks. Team members were asked to nominate themselves for particular groups with this process to be ongoing until the work plan is finalized for submission to SC-ON along with the budget for 2021-2022.

The current version of the [draft JET-ABO Work Plan](#) is here. The Sub-Group list is below the work plan.

Actions:

1. Team members to continue to nominate themselves for a role in the work plan.
2. Secretariat and leadership group to finalise the work plan and develop the proposed budget by end-January 2021.

Schedule of meetings and activities

The team agreed that:

1. The team should meet virtually once per quarter – i.e. 4 times per year. Such meetings would be aimed at reviewing progress on activities.
2. The Secretariat would schedule meetings of subgroups on a regular and routine basis aimed at each subgroup meeting at least monthly and as required.
3. The Leadership Group would continue to meet on a fortnightly basis.
4. A face to face meeting of the team might be expected late in 2021 or early in 2022.

6. Input to INFCOM, inc. SC-ON, SC-MINT and JET-EOSDE

The JET-ABO is currently represented to other INFCOM teams:

- SC-ON – Stewart Taylor
- SC-MINT – Nicolas Rivaben

- SC-ON/JET-EOSDE – Curtis Marshall

The Leadership Group and the team in the future need to consider:

1. Plan for likely milestone activities that require a decision of INFCOM and/or other constituent bodies.
2. Submission of requirements for decisions relating to:
 - a. The UAV demonstration project.
 - b. Designation of ABO centres under INFCOM.

7. Any other business

No other business was discussed.

8. Closure of the meeting

The meeting closed around 2300 UTC, 10 December 2020.

Annex I – Meeting Attendance

Member		8 December	9 December	10 December
Brent	KING	Y	Y	Y
Stuart	FOX	Y	Y	Y
Carmen	EMMEL	Y	Y	Y
Curtis	MARSHALL	Y	Y	Y
Debbie	O'SULLIVAN	Y	Y	Y
Douglas	BODY	Y	Y	Y
Gregory	MEYMARIS	Y	Y	Y
Yiu-fai	LEE	Y	Y	Y
Nicolas	RIVABEN	Y	Y	Y
Bruno	PIGUET	Y	Y	Y
Bryce	FORD	Y	Y	Y
Ercument	AVSAR	Y	Y	
Fernando	RODRIGUEZ	Y	Y	
Frédéric	LENORMAND	Y	Y	Y
Francis	MOSETLHO	Y	Y	Y
Jan	SONDIJ	Y	Y	
Shigeharu	NISHIKAWA	Y	Y	Y
Raul	ROMERO			
Steve	STRINGER	Y	Y	Y
Stewart	TAYLOR	Y	Y	Y
Suengpil	JUNG	Y	Y	
Tammy	FLOWE	Y	Y	
Jeannine	HENDRICKS	y	y	y
Jie	LIAO	Y	Y	
Katya	VASHCHANKOVA	Y	Y	Y
Meredith	BELL	Y	Y	
James	PINTO	Y	Y	Y

Annex 2 – Key Aspects of Strategy & Resourcing Related to WICAP Development

Key Points Summarising WMO Member View of WICAP Resourcing

- Most WMO members tend to have an arrangement with ICAO Civil Aviation Authorities (CAA) in which the costs of met. services to support aviation are financed/paid by CAAs and recovered from airlines and possibly others - as established at and under the ICAO Chicago Convention.
- Also under the ICAO convention (and usually paid under the same mechanism), aviation supports the costs of the provision of Basic Data required as inputs for met. services - this was "notionally" set (I believe) at around 10% of total national met. service costs of such operation and provision of data. ICAO does not classify AMDAR data as Basic Data.
- When it comes to AMDAR and WICAP we should avoid that this cost recovery mechanism should not become a "vicious circle" in negotiating and sharing costs for WICAP development and operation. That is, there should not be a continuous process of aviation and NMHSs increasingly charging each other more and more to recoup the costs associated with AMDAR operation.
- Under the ICAO Air Navigation Plan (ANP) and its Annex III (which is also established as part of WMO Technical Regulations), ICAO member states are required to provide Aircraft Reports in support of the ANP and also the operations of the ICAO World Area Forecast Centres. Aircraft Reports include weather information and are expected to be provided by aircraft at 30s intervals on ascent (first 10 minutes) and every 15 minutes afterwards. Such reporting of AIREPs has never been fully implemented although a lot of ADS-C data is available to WMO members under arrangements agreed with ICAO.
- Generally, AMDAR implementation and operation at the national level has been implemented either on a "cost-recovery to the airline" basis (majority) or the airline has borne the costs (sometimes).
- While met. services are generally able to justify ongoing costs such as data comms, meeting the costs of paying for private entity purchases or upgrade of assets can present difficulties.
- Met. services still consider AMDAR data supplementary (although considered Essential under Resolution 40) and it is always difficult to find such funds outside of the larger and more advanced met. services.
- AMDAR comms costs have proven to be prohibitive for small met. services, particularly when they do not directly run their own computer modelling systems - where the chief benefit is derived.
- Met. services will be concerned about paying for redundant or excessive data that they cannot use.
- While turbulence data will likely be a highly desirable data for met. services to source both for forecast validation and for current and future forecast assimilation, met. services are likely to see these data as primarily a requirement by and for aviation. Their availability would certainly result in an improved level of services and products in support of aviation.
- WMO AMDAR has always had a requirement for the provision of turbulence data and this is part of the standards specification for AMDAR onboard software.
- The WMO AMDAR community is definitely open to the idea of harmonised AMDAR and turbulence reporting and cost sharing, however, a decision on this and resulting policy would have to come from and be approved by the wider WMO membership.

Proposal for Approach to WMO & IATA Contribution to WICAP Resourcing

Proposed approach	Issues	Justification
<p>NMHSs take a global (GBON) approach to funding WICAP data</p> <ul style="list-style-type: none"> Requirements for turbulence and WVM are built-in 	<ul style="list-style-type: none"> Need a global plan How to agree on requirements? How to meet national/regional variation in requirements Turbulence seen as an aviation requirement by MET 	<ul style="list-style-type: none"> Parts of the world will not be able to fund comms (let alone equipping) GBON has great support Biggest data users and those with highest priority for data pay MET needs to determine requirements
<p>Aviation/airlines take responsibility for funding of equipping aircraft</p> <ul style="list-style-type: none"> Includes software, hardware (WVM) 	<ul style="list-style-type: none"> How to convince Airlines? WICAP must have visibility Business case is critical Special approach required for WVM – how to make fair for airlines? Retrofit difficult – must make factory floor fit a BIG priority How do we reach agreement between AVI/MET? 	<ul style="list-style-type: none"> Difficult for gov. MET agencies to justify expenditure on airline assets This is AVI contribution to meeting requirements for Wx information Sends a message: airlines need this – industry will provide

Proposed approach	Possible Activities	Justification
Process for global approach to funding AMDAR data	<ul style="list-style-type: none"> • Develop a concept paper for funding WICAP • Develop global plan with costs – have to “optionalise” WVM. • Decision process to be taken through INFCOM to Exec Council & Congress • Activate grant funding 	<ul style="list-style-type: none"> • Need WMO Infrastructure Commission support • Need WMO constituent body support • WVM not going to happen without a global approach
Process for AVI commitment to Wx & funding infrastructure	<ul style="list-style-type: none"> • Need to hold an AVI conference/summit – 2021? • Develop a strong business case • Develop requirements for OEMs and avionics providers (want option of delivery of a “weather package”) • IATA to coordinate “message” to Industry. • Canvas ICAO support • Leverage impact of AVI on environment, climate • Leverage positive perceptions and promotional aspects for airlines & industry partners 	<ul style="list-style-type: none"> • Require a strong and unified message to industry (OEMs, Avionics) • Must ensure future factory floor fit of weather options • How is this made most efficient for airlines? • Add to the Build Back Better approach.

Annex 3 – Global Data Centre ABO, Terms of Reference

The WMO Global Data Centre for Aircraft-Based Observations (GDC-ABO) shall:

1. Liaise as necessary and come to agreement with designated CBS expert teams on the detailed operation and functions of the GDC-ABO;
 2. Receive, quality control and maintain a database archive of all aircraft-based observations (ABO) transmitted on the WMO Information System (WIS), along with the required metadata;
 3. Make provision of archived ABO data and metadata to WMO Members and approved and registered data users in accordance with the data policy of data providers;
 4. Develop and maintain a record of data quality issues associated with ABO data, taking into account quality monitoring and quality assessment reports from designated WMO monitoring and lead centres;
 5. To the extent possible, retrieve and backfill the GDC-ABO database with available historical global ABO data; and
 6. Report to CBS on an annual basis on actions taken, progress achieved, concerns and recommendations.
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