

WORLD METEOROLOGICAL ORGANIZATION

INSTRUMENTS AND OBSERVING METHODS

REPORT No. 4

METEOROLOGICAL SATELLITE
GROUND-BASED RECEIVING EQUIPMENT

WMO EQUIPMENT SURVEY

METEOROLOGICAL SATELLITE
GROUND-BASED RECEIVING EQUIPMENT

November, 1980



Secretariat of the World Meteorological Organization - Geneva, Switzerland

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INTRODUCTION

As requested by the seventh session of the Commission on Instruments and Methods of Observation (Res. 13 (CIMO-VII)), Mr. Harold Yates (USA), the Rapporteur on Satellite Instrumentation for Meteorology requested information from the approximately 35 known vendors of satellite direct broadcast receiving equipment or components thereof. This catalogue represents the information provided by the 15 vendors who responded with information which would be useful to Members of the World Meteorological Organization.

The information contained in the body of the catalogue is substantially that provided by the vendor, and unless otherwise noted, the prices are given in the vendor's local currency.

It is hoped that this information is of use to Members of the World Meteorological Organization in making plans for the use of such equipment. However, one should also be aware that prices may be increased a little if the power requirements of the equipment, and other such factors differ from the standards prevailing in the country of origin.

Other major manufacturers of such equipment include P & P Industries and Harris Corporation in the US, Nippon Electric Company in Japan, Hell-Fax in the Federal Republic of Germany, Vaisala Oy in Finland and Technavia in Switzerland. Unfortunately none of these companies supplied information to the rapporteur.

CANADA

Company name and address: Muirhead Systems Ltd. Muirhead Inc.
50 Galaxy Blvd Unit #4 1101 Bristol Road
Rexdale, Ontario Mountainside, NJ 070092
Canada M9W 4Y5 U.S.A.

Telephone number: (416) 675-7450
Telex: 06-989264

MUIRHEAD SYSTEMS (A)

1. Equipment type: Complete ground receiving station
2. Station use: APT(VHF), WEFAX
3. Equipment trade name/model: Muirhead MS556 weather satellite ground station.
4. Equipment description: Fully integrated system to automatically receive and process TIROS-N APT, WEFAX, or other comparable weather satellite signals, ultra high fidelity hard copy photographic 16 step grey scale reproduction with enhancement capabilities.
5. Special features: MS145 processor provides all control functions-recorder and signal conditioning as to operator instruction-10c for WEFAX set-selectable and adjustable 10c for two other satellites-doppler correction image enhancement-built-in test generator-full resolution of signal information.
6. Price information: See Attachment
7. Delivery: 4 months ARO
8. Comments: Different recorder options available (See below)

MUIRHEAD SYSTEMS (B)

1. Equipment type: K560-MS3 photo image recorder, K560-MS4 photo image recorder, M300-MS4 dry silver recorder, M300-MS5 dry silver recorder
2. Station use: APT WEFAX
3. Equipment trade name/model: K560-MS4, APT & WEFAX; M300RH (dry silver), APT & WEFAX; K560-MS3, WEFAX only; M300RF (dry silver), WEFAX only.
4. Equipment description: K560-MS4 high resolution-photo stabilization processing; M300--dry silver thermal processing.

5. Special features: High resolution imagery, 16 step grey scale, full tonal -- useable for APT, WEFAX HRPT, or suitably processed stretched VISSR.
6. Price information: See attachment
7. Delivery: No response
8. Comments: K550 electro-chemical mufax recorder; M136J electro- static recorder also available for lower resolution and cost options.

Company name and address: MacDonald, Dettwiler & Associates Ltd.
3751 Shell Road
Richmond, B.C.,
V6X 2Z9
Canada

Telephone number: (604) 278-3411
Telex: 04-355599

MACDONALD, DETTWILER (A)

1. Equipment type: TIROS-N HRPT Format Synchronizer and Test Pattern Generator
2. Station use: TIROS-N HRPT
3. Equipment trade name/model: AVHRR Format Synchronizer and Test Generator, MDA Model 882.
4. Equipment description: Preprocessor for TIROS-N AVHRR and TIP data. AVHRR output data format is suitable for input to a computer or digital image processing systems such as the MDA Model 880A and Model 900 Weather Image Processing Systems. TIP data format is suitable for interface to a computer or recorder. Includes HRPT signal simulator and test pattern generator.
5. Special features: Error-tolerant synchronization detection. Video data compression using three selectable sets of built-in 5-band look-up tables. Four selectable test generator video data patterns.
6. Price information: \$25,000.
7. Delivery: 90-180 days.
8. Comments: Optional programmable look-up table for use with MDA Model 900 or computer-based systems. Similar equipment available for Meteosat VISSR, Meteosat PDUS, and GOES VISSR.

MACDONALD DETTWILER (B)

1. Equipment type: GMS HRFX Digitizer and Test Pattern Generator
2. Station use: GMS HRFX

CANADA (Cont.)

3. Equipment trade name/model: GMS/HRFAX Digitizer and Test Pattern Generator, MDA Model 881B.
4. Equipment description: Preprocessor for GMS HRFAX data. HRFAX digital output data format is suitable for input to a computer or digital image processing system such as the MDA Model 880A and Model 900 Weather image Processing Systems. Includes HRFAX signal simulator and test pattern generator.
5. Special features: Noise-tolerant phase-locked synchronization detection. Two selectable test generator video data patterns.
6. Price information: \$30,000.
7. Delivery: 90-180 days.
8. Comments: None

MACDONALD, DETTWILER (C)

1. Equipment type: Image Processor
2. Station use: TIROS-N/NOAA A-G AVHRR, GMS HRFAX, Meteosat PDUS
3. Equipment trade name/model: Weather Image Processing System I (WIPS-I), Model 880A processor.
4. Equipment description: A digital image processor with an operator's CRT/keyboard terminal, digital tape drive, automatic image recorder/processor, and optional video display system. Output is provided for 120 lines/min. remote facsimile stations.
5. Special features: Full image data can be imaged in real-time or playback modes, including text and grey scale annotation. Radiometric enhancement using programmable correction tables. Geometric correction of TIROS-N AVHRR data. Image enlargement in playback mode.
6. Price information: \$175,000 - \$350,000 depending on specific satellites. Spares, special test equipment, consumables, training and installation are offered as options.
7. Delivery: 8-14 months.
8. Comments: Forms the basis of a complete ground station for data reception and image processing with the addition of antenna, receiving and format synchronization equipment. Capable of multiple satellite processing.

MACDONALD, DETTWILER (D)

1. Equipment type: Complete ground receiving station
2. Station use: TIROS-N AVHRR, GMS HRFAX, Meteosat PDUS
3. Equipment trade name/model: Weather Image Processing System I (WIPS-I)
4. Equipment description: A complete data reception and image processing facility for polar orbiting and/or geostationary satellites based on the MDA Model 880A image processor. Data are preprocessed and stored on digital computer-compatible tape. Real-time hard copy and video image generation.
5. Special features: Sequential reception from multiple satellites. Sequential production of multiple images. Real-time or tape playback imaging. 120 lines/minute wirephoto link to remote locations. Radiometric enhancement, geometric correction, and enlargement of image data. Text and grey scale annotation of hard copy images.
6. Price information: Price information: \$300,000 - \$1,000,000 depending on specific satellites. Spares, special test equipment, consumables, training and installation are offered as options.
7. Delivery: 8-14 months.
8. Comments: The WIPS-I system is in daily use at installations throughout the world. Options include multiple satellite capability and video display unit with colour, animation, and real-time imaging capability. Digital data are compatible with the MDA METDAS system. Upgradable to WIPS-II.

MACDONALD, DETTWILER (E)

1. Equipment type: Complete ground receiving station
2. Station use: TIROS-N HRPT, GMS HRFAX, Meteosat PDUS, GOES VISSR
3. Equipment trade name/model: Weather Image Processing System II (WIPS-II)
4. Equipment description: An advanced data reception and image processing facility for polar orbiting and/or geostationary satellites based on the MDA Model 900 image processor. Capable of exceptionally high data throughput. Data are stored on disk for rapid random access.
5. Special features: Simultaneous reception from multiple satellites. Simultaneous production of multiple images. Multiple 120 or 240 lines/min. wirephoto links to remote locations. Image enlargement, radiometric

enhancement, text and grey scale annotation, geometric correction of AVHRR data, and geographical basemap overlay. 24-hour operations scheduling.

6. Price information: \$500,000 - \$1,400,000 depending on specific satellites. Spares, special test equipment, consumables, training and installation are offered as options.
7. Delivery: 12-24 months.
8. Comments: Options include video display unit with colour and animation capability, data archiving on computer compatible tape, and program development facilities. Communication with MDA METDAS system through high-speed interactive port and shared disk access.

MACDONALD, DETTWILER (F)

1. Equipment type: Image Analysis System.
2. Station use: TIROS-N HRPT, GMS HRFAX, Meteosat PDUS, GOES VISSR
3. Equipment trade name/model: Meteorological Data Analysis System (METDAS)
4. Equipment description: A state-of-the-art computer-based system for the interactive display, manipulation, and analysis of meteorological satellite data and conventional weather data. Operates as a stand-alone system or linked with the MDA WIPS-I or WIPS-II system.
5. Special features: Interactive video display and image animation system. Overlay of meteorological fields and satellite imagery. Precision basemap generation and overlay. Image input from WIPS-II disk or digital tape. Operational scheduling. Precision image rectification. Archiving of corrected data. Input ports for meteorological data.
6. Price information: \$1,000,000 and up depending on specific satellites and features. Spares, consumables, training and installation are offered as options.
7. Delivery: 12-24 months.
8. Comments: Allows on-line program development. Multiple video display work stations allowing simultaneous operation by more than one user. Designed compatibility with MDA WIPS-II and WIPS-I systems. Options include retrieval, display and storage of temperature and humidity profiles from TIROS Operational Vertical Sounder data, calculation of sea surface temperature, cloud-top temperature, wind vectors and other numerical data.

FEDERAL REPUBLIC OF GERMANY

Company name and address: Dornier System GmbH
Attn. Mr. H. Kappel
P.O. Box 1360
D-7990 Friedrichshafen
Federal Republic of Germany

Telephone number: 07545-81
Telex 07-34359

DORNIER SYSTEM GMBH (A)

1. Equipment type: Complete Ground Receiving Station
2. Station use: HRPT
3. Equipment trade name/model: TIROS-N HRPT Receiving Station
4. Equipment description: Receiving station for the HRPT format from TIROS-N/NOAA A-G including the data from the sensors AVHRR, TOVS, SEM and DCLS. The station comprises: 3.0-3.3m parabolic antenna, LNA and downconverter, X-Y antenna pedestal, programmed tracking with overlaid step tracking, receiver, bit and format synchronizer, decommutator, realtime image processor, laser beam recorder, magnetic tape recorder, minicomputer of the PDP 11 series for data processing, data storage, and station control.
5. Special features: Realtime image processor performs for realtime image recording: Calibration of IR data, scaling and sectorizing 1:4, 1:2, 1:1, 2:1, 4:1, enhancement by 8 selectable graylevel transfer functions, graylevel reduction to 256, 128, 64, 32, 16, 8 and 4 graylevel, generation of 8 different isothermal contour lines, generation of constant gray zones between 7 different temperature levels, grid of latitude and longitude.
6. Price information: The price for a complete station ranges between 700.000,-Deutsch Marks (DM) and 1.300.000,-DM FOB Friedrichshafen depending on the requirements.
7. Delivery: 9 - 12 months
8. Comments: The station is modular in design and can be adapted to the requirements of the user.

DORNIER SYSTEM GMBH (B)

1. Equipment type: Complete ground receiving station
2. Station use: HRPT
3. Equipment trade name/model: METEOSAT HRPT Station

FEDERAL REPUBLIC OF GERMANY (Cont.)

4. Equipment description: Receiving station for the HRPT format from METEOSAT. The station comprises 2.4 - 3.6, parabolic antenna, LNA and downconverter, receiver, bit and format synchronizer, decommutator, laser beam recorder, magnetic tape recorder, minicomputer of the PDP 11 series for data processing and data storage.
5. Special features: The receiving equipment can be interfaced to an image handling system.
6. Price information: The price for a complete station ranges between 500.000,-DM and 900.000,-DM FOB Friedrichshafen depending on the requirements of the user.
7. Delivery: 9 - 12 months
8. Comments: None

DORNIER SYSTEM GMBH (C)

1. Equipment type: Image Handling System
2. Station use: HRPT
3. Equipment trade name/model: Image Handling System
4. Equipment description: The Image Handling System comprises: A minicomputer (PDP 11/23, 34, 44, 70 depending on amount of required computer activities), high speed mass storage, and a COMTAL colour display unit. It serves for receiving and storing of HRPT data in real time as well as for sophisticated image presentation and analysis.
5. Special features: Image presentation in black/white true-colour or pseudo-colour, contrast enhancement, zoom and roaming, overlay of coloured graphics (e.g. grids, coastlines, annotation), arithmetic image combine, calculation of intensity profiles and histograms, movie loops.
6. Price information: Budgetary price for a typical system using the minicomputer PDP 11/34 with 256 KB memory, 67 MB disc, 45 ips, 1600 bpi tape, hardcopy terminal, interface to frontend, RSX- 11/M operating system, image handling software, 750.000,-DM FOB Friedrichshafen.
7. Delivery: No response
8. Comments: None

DORNIER SYSTEM GMBH (D)

1. Equipment type: Complete ground receiving station.
2. Station use: APT and/or WEFAX
3. Equipment trade name: APT/WEFAX - Station
4. Equipment description: Receiving station for single or combined reception of APT (VHF) or WEFAX (S-band) including: Fixed helix VHF-antenna, 2m parabolic S-band antenna, VHF filter and preamplifier, synthesized receiver, digitizer and synchronizer, microprocessor for image processing and station control, realtime clock, tape recorder, image recorder HELL TM 4006 (or other types if required).
5. Special features: Automatic operation of the station; all functions are pre-programmable over a period of 24 hours. Automatic overlay of a grid (circle of longitude and latitude, selected coastlines) in realtime for APT reception and replay from tape. Image enhancement by 8 fixed (PROM stored), user defined functions and by two variable (RAM stored), operator defined functions.
6. Price information: Price for a complete station for: APT reception: 120,000,-DM to 140,000,-DM APT/WEFAX reception: 150,000,-DM to 190,000,ODM FOB, Friedrichshafen.
7. Delivery: 6 weeks to 6 months depending on stock holding.
8. Comments: None

FEDERAL REPUBLIC OF GERMANY (Cont.)

UKW-TECHNIK

Company name and address: UKW-Technik
Jahnstr. 14
D-8523 Baiersdorf
Federal Republic of Germany

Telephone: 09133-855/856
Cable Telex: 629 887 ukwdo d

1. Equipment type: Complete SDUS for GOES/GMS/Meteosat as well as complete APT-systems for TIROS/NOAA/METEOR Satellites.
2. Station use: APT(VHF), WEFAX
3. Equipment trade name/model: UKW-Technik, Satellite Receiving Systems
4. Equipment description: Antennas, Preamplifiers, Converters for SHF and VHF, as well as VHF-Receivers and Video Processors for WEFAX and APT. All modules are available individually.
5. Special features: Compact and inexpensive systems suitable for fixed, portable and mobile operation and applications.
6. Price information: Systems available from approximately \$12,000 complete at factory.
7. Delivery: Existing stock to six months according to required module.
8. Comments: Equipment very compact and easy to operate. Especially designed for the small airport or harbor.

FRANCE

Company name and address: CIT ALCATEL - Dpt Transmissions/EAN
Route de Perros-Guirec - B.P. 344
France 22304 Lannion

Telephone: 16.96/37.46.33

Telex: 730719 CITCOM

CIT ALCATEL (A)

1. Equipment type: AHQ 137 antenna, WEFAX W02 system, rack 42 units including VHF receiver-TR 455, magnetic tape recorder-REVOX B 77, control panel-PCAW and clock, satellite picture reproducing and processing system-STRI 2000. Optional: MG 102 management and gridding device.
2. Station use: APT, WEFAX
3. Equipment trade name/model: CIT Alcatel APT/WEFAX station
4. & 5. Equipment description and special feature: Automatic APT/WEFAX station including VHF omnidirectional antenna with high sensitivity receiver. Laser facsimile: analog to digital signal converter. Selection of picture format dynamical processing of digital APT/WEFAX signals. 16 grey levels. Optional: MG 102 management and gridding device allowing selection of 24 hours of desired pictures, parallels and meridians on APT pictures, annotations of pictures, alpha numeric inscriptions.
6. Price information: (Budgetary, basic equipment) Basic APT/WEFAX CIT Alcatel station (ex works): 345,000 FF (\$69,000 US).
7. Delivery: From 3 to 7 months ARO (depending on our planning charge).
8. Comments: Depending upon the purchaser's requirements, we can also provide other complementary equipment and services: Software for processing of pictures, test equipment, maintenance sets, transmission of pictures by telephonic line

CIT ALCATEL (B)

1. Equipment type: METEOSAT antenna ARP-34, Pedestal-T14, Command and control-ASS 703, TC 561 receiver, SRB 111 bit synchronizer, SFT 111 frame synchronizer, STRI 2000 laser facsimile display. Data processor-PDP 11/34 CPU 32 Kwords. Optional: Enlargement of sectorized pictures. DCP METEOSAT CRT display.
2. Station use: METEOSAT (High resolution image dissemination)

FRANCE (Cont.)

3. Equipment trade name/model: CIT Alcatel PDUS station (Primary data user station).
4. & 5. Equipment description and special feature: Primary data user station made for the European Space Agency (METEOSAT 1). Documentation available in Darmstadt (F.R.G.) Optional possibilities: adaptation for GOES & GMS reception.
6. Price information: (budgetary, basic equipment) 1981: 1,905,000 FF = (\$381,000 US)
7. Delivery: 10 months ARO
8. Comments: None

CIT ALCATEL (C)

1. Equipment type: ARP 32 parabolic antenna, T28 pedestal, ASS 702 slaving system, CD 601 controller antenna, PM 500 tracking subsystem, 601 C tape reader, HDA 002 digital clock, TC 562 down converter, TR 562 HRPT receiver, SRB 110 HRPT bit synchronizer, SFT 112 frame synchronizer, IDH 123 demultiplexer, STRI 2000 laser facsimile, HDDR recorder, data processor-PDP 11/34 CPU 32 Kwords. Integration in two racks 42 units. Exploitation unit CSD 120 Software: TIROS N programmed tracking. Optional software geographical gridding, enlargement of sectorized pictures, annotation of pictures, contour lines of IR temperatures. Also an optional CRT.
2. Station use: HRPT
3. Equipment trade name/model: CIT Alcatel HRPT station
4. & 5. Equipment description and special feature: Three selectable antenna positioning modes (computer track, tape reader track, manual track). Real time demultiplexing of AVHRR data, automatic orbit prediction, one TIROS N HRPT channel selected among the five AVHRR channels.
6. Price information (budgetary, basic equipment) 1981: 1,840,400 FF = (\$368,080 US)
7. Delivery: 10 months ARO
8. Comments: None

Company Name and Address: Spembly Limited
Technical Services Division
5 Vicarage Hill, Alton, Hampshire
England

Telephone Number: ALTON (0420) 88683

SPEMBLY LIMITED (A)

1. Equipment Type: Meteorological Satellite Ground Station.
2. Station Use: Reception of APT Data.
3. Equipment Trade Name/Model: Ground station type MSGS-01.
4. Equipment Description: Ground station for the reception of polar orbital APT data from the TIROS-N series and APT data from the METEOR-2 series.
5. Special Features: A low cost system with a number of options which can be tailored to customer requirements.
6. Price Information: The Price is dependant on the options required and is in the range \$4,200 to \$10,350, less the facsimile recorder.
7. Delivery: 180 Days.
8. Additional Comments: The ground stations available range from a simple system with an omni-directional antenna and VHF receiver only to the more complex systems which can include a Tape Recorder, System Control Unit, Time Mark Generator and Equipment Console.

The station is supplied without a facsimile recorder to enable the user to choose the one most suitable for his needs. Suitable recorders are Models 851 or 811 (See E and F below).
An additional option provides facilities for the reception and recording of W.M.O. Weather Charts.

SPEMBLY LIMITED (B)

1. Equipment Type: Meteorological Satellite Ground Station.
2. Station Use: Reception of WEFAX data.
3. Equipment Trade Name/Model: Ground Station type MSGS-02.
4. Equipment description: Ground station for the reception of LR-FAX or SDUS data from the geo-stationary series of weather satellites such as GOES, Meteosat, GMS and GOMS.

7. Delivery: 180 days.
8. Comments: Produces high quality images on photographic paper or transparent film.

SPEMBLY LIMITED (F)

1. Equipment type: Image Facsimile Recorder.
2. Station use: For use with APT and/or WEFAX Ground Stations.
3. Equipment trade name/model: Facsimile Recorder Models 811, 813 or 814.
4. Equipment description: These are modified Muirhead K649 18" wide electro-chemical recorders, with special Image Processors incorporated in the same cabinet.
5. Special features: Model 811 will provide recordings of TIROS-N APT data only. Model 813 will provide recordings of TIROS-N or WEFAX data. Model 814 will provide recordings of TIROS-N or METEOR-2 data.
6. Price information: From \$9,250.
7. Delivery: 180 days.
8. Comments: This recorder takes wide 18" electro-chemical paper and is ideal for the TIROS-N APT double image formats. When used for the recording of WEFAX data it is recommended that a Spembly Model 202 Image Converter is incorporated into the system. The Model 202 Image Converter produces recorded images with an improved scan density and thus an improved contrast ratio on the 18" wide paper.

SPEMBLY LIMITED (G)

1. Equipment type: HRPT Image Sectoriser.
2. Station use: for use with HRPT Ground Stations.
3. Equipment trade name/model: HRPT Image Sectoriser Model 204
4. Equipment description: Produces image sector enlargements from any part of the TIROS-N HRPT image data.
5. Special features: The image sector enlargements data are linearised prior to being fed out as 10 bit digital data or analogue data modulated on a sub-carrier.
6. Price information: From \$7,500.

7. Delivery: 180 days.
8. Comments: The equipment also incorporates header identification data which are printed out on the recorded image. The analogue data are in a format suitable for transmission over high quality telephone lines to drive remote facsimile image recorders, such as the Spembly Models 851 or 811.

If the full HRPT format is required, this can be recorded on a Spembly Model 853 Laserfax Image Recorder. A Frame format synchroniser and bit synchroniser are required between the output of the receiver and the Model 204 HRPT Image Sectoriser.

SPEMBLY LIMITED (H)

1. Equipment type: Satfax Data Simulator.
2. Station use: For use with APT and WEFAX Ground Stations.
3. Equipment trade name/model: Data Simulator Model 105.
4. Equipment description: APT and WEFAX data simulator.
5. Special features: Enables easy adjustment and maintenance of facsimile recorders and associated equipment.
6. Price information: \$1,450
7. Delivery: 120 days.
8. Comments: Other simulators are planned for HRPT and METEOR-2 image data.

SPEMBLY LIMITED (I)

1. Equipment type: Time Mark Generator.
2. Station use: For use with APT Gound Stations.
3. Equipment trade name/model: Time Mark Generator Model 701.
4. Equipment description: The equipment incorporates a digital clock and precision time epoch selector.
5. Special features: The equipment is designed to produce identification 'markers' on the recorded polar orbital image data at any pre-selected latitude.

UNITED KINGDOM (Cont.)

6. Price information: \$500.
7. Delivery: 120 days.
8. Comments: The latitude 'marker' position is calculated and inserted by the operator, from the satellite orbital data. (TBUS).

SPEMBLY LIMITED (J)

1. Equipment type: Antenna - VHF.
2. Station use: For use with APT Ground Stations.
3. Equipment trade name/model: VHF Antenna Model 302.
4. Equipment description: VHF Omni-directional Antenna.
5. Special features: This is a light weight antenna designed for use in very harsh environment. It is completely sealed for long life with very little maintenance.
6. Price information: \$2,200.
7. Delivery: 120 days.
8. Comments: The antenna incorporates a low noise pre-amplifier and bandpass filter.

SPEMBLY LIMITED (K)

1. Equipment type: VHF Satellite Receiver.
2. Station use: For use with APT Ground Stations.
3. Equipment trade name/model: VHF Satellite Receiver Model 603.
4. Equipment description: VHF/FM Receiver.
5. Special features: Designed for the reception of APT data from the TIROS-N and METEOR-2 series of Weather Satellites.
6. Price information: \$2,000.
7. Delivery: 120 days.
8. Comments: The receiver incorporates a power supply to drive the pre-amplifier in the Model 302 VHF Antenna.

SPEMBLY LIMITED (L)

1. Equipment type: VHF/L-Band Satellite Receiver.
2. Station use: For use with WEFAX and APT Ground Stations.
3. Equipment trade name/model: VHF/L-Band Satellite Receiver Model 602.
4. Equipment description: L-Band Down Convertor and VHF/FM combined Receiver.
5. Special features: Combined L-Band and VHF reception system incorporating a common FM Receiver. Designed for the reception of APT data from TIROS-N and METEOR-2 also WEFAX data from geostationary satellites.
6. Price information: \$6,900.
7. Delivery: 150 days.
8. Comments: A suitable VHF Antenna is the Spembly Model 302 and a suitable L-Band Antenna is the Spembly Model 305.

SPEMBLY LIMITED (M)

1. Equipment type: Antenna - L-Band.
2. Station use: for use with WEFAX Ground Stations.
3. Equipment trade name/model: L-Band Antenna Model 305 or 306.
4. Equipment description: Model 305 is an 8' (2.5m) antenna designed for stations within 2000 miles of the satellite sub-point. Model 306 is a 10' (3m) antenna designed for stations greater than 2000 miles from the satellite sub-point.
5. Special features: Both antenna incorporate a linear foam filled feed and simple to erect mounting frame.
6. Price information: From \$1,850.
7. Delivery: 120 days.
8. Comments: A heavy duty mount is available, to special order, for areas which may experience windspeeds up to 200 MPH.

SPEMBLY LIMITED (N)

1. Equipment type: Equipment Cabin.
2. Station use: All types of Meteorological Satellite Ground Stations.
3. Equipment trade name/model: Equipment Cabin Model 905.
4. Equipment description: to house receiving, processing and image recording equipment in remote areas where permanent buildings are not available.
5. Special features: The cabin is normally custom built to customer requirements. It is fully wired for lighting and power and is air-conditioned. It incorporates equipment benches, chairs and storage cupboards and it is fully insulated for most climatical conditions.
6. Price information: From \$5,500.
7. Delivery: 140 days.
8. Comments: The Model 905 cabin is a free standing unit. Other designs are available incorporating a two or four wheeled chassis for transportation purposes.

Company name and address: Alden Electronic & Impulse
Recording Equipment Co., Inc.
Alden Research Center
Westborough, MA 01581

Telephone: 617-366-8851
Telex: 94-8404

ALDEN ELECTRONIC & IMPULSE (A)

1. Equipment type: Weather Satellite Ground Receiving Station
2. Station use: APT
3. Equipment trade name/model: Alden APTS-3B
4. Equipment Description: Complete Weather Satellite Ground Receiving Station for automatic reception from TIROS-N/NOAA-6 satellites with options for GOES/WEFAX, METEOSAT/WEFAX or GMS/LR-FAX. also options for HF radiofacsimile reception.
5. Special features: Utilizes omni-directional antenna for unattended operation. Also available with steerable VHF antenna. System can operate as master receive station for distribution network. Such distribution to be via phone line or other voice grade channel to any number of receive locations.
6. Price information: Approximately \$30,000 and up depending upon station equipment, options, desired spares, training and installation.
7. Delivery: 90 to 120 days.
8. Comments: No response.

ALDEN ELECTRONIC & IMPULSE (B)

1. Equipment type: WEFAX Ground Receiving Station
2. Station use: WEFAX
3. Equipment trade name/model: Alden 1100
4. Equipment description: Complete WEFAX Ground Receiving including parabolic antenna, UHF/VHF Down converter, Telemetry Receiver, Alden recorder.
5. Special features: Utilizes triplexer for down conversion. Master oscillator is maintained at room temperature so as to eliminate retuning in presence of

UNITED STATES OF AMERICA (Cont.)

Company name and address: Aydin Monitor System
502 Office Center Drive
Fort Washington, PA. 19034
USA

Telephone number: (215) 646-8100
Telex: TLX 510-661-1520

1. Equipment type: Telemetry Ground Equipment
2. Station use: APT(VHF) HRPT
3. Equipment trade name/model:
4. Equipment description: See Short Form Catalog
5. Special features: None
6. Price information: See price list.
7. Delivery: 150 days.
8. Comments: None

ENTERPRISE ELECTRONICS CORP.

Company name and address: Enterprise Electronics Corporation
P.O. Box 1216
Enterprise, Alabama 36330
USA

Marketing Enterprise Electronics Corporation
5801 Lee Highway
Arlington, VA 22207

Telephone: Alabama (205) 347-3478
Virginia (703) 338-3150
Telex: 440152 EEC UI

1. Equipment type: Satellite Tracking, receiving and processing equipment
2. Station use: WEFAX
3. Equipment trade name/model: Meteorological Satellite Data Station - MSDS-80
4. Equipment description: 12 foot tracking antenna/radome-receiver with EEC interface to laserfax-NOVA 4X computer subsystem with 96 M Byte disk, line printer, keyboard CRT, analog recorder.
5. Special features: Computer derived picture with landmarks, gridding expansions, enhancements, 79VS printout, cloud top temperatures, and full picture printout backup.
6. Price information: Basic system with simple interface, analog recorder, laserfax - \$225,000.00 - Added computer system for added price of \$350,000.00
7. Delivery: 6 to 8 months
8. Comments: Systems have been delivered to Brussels, Tunis, India, Dores, and Singapore.

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3. Equipment trade name/model: GR-3 Receiving System
4. Equipment description: The GR-3 Receiving System is a complete GOES WEFAX receiving system consisting of two primary components - an S-band downconverter and a tunable IF receiver. The S-band downconverter is enclosed in a weatherproof housing designed for mounting on the antenna mast. The circuitry of the downconverter employs microstripline and interdigital circuit elements. System noise figure is below 3 dB (2.5 dB typical). The converter features two stages of low-noise RF preamplification, impedance-matched IF preamplification and a stable local oscillator chain. The converter is powered through the IF feedline from the station receiver so that additional power cables are not required.

The IF receiver is a double conversion FM design using MOSFET transistors in the two-stage RF preamplifier and linear integrated circuits in the 10.7 MHz and 455 KHz IF stages and the audio power amplifier. The receiver is tuned with a digital frequency synthesizer that provides coverage from 130.000 to 139.995MHz in 5 KHz steps. Sensitivity is peaked in the 136-138 MHz VHF satellite band. The downconverter converts the 1691 MHz GOES WEFAX frequency to a nominal 137.500 MHz for demodulation by the IF receiver. Stations desiring METEOSAT dual channel reception should so state at the time of order to permit the installation of the appropriate LO crystal in the downconverter so that both METEOSAT channels can be tuned by the IF receiver. A phase-locked FM detector is employed for excellent gray-scale response and a constant peak amplitude video output port is provided that is independent of the volume setting employed for the internal monitor speaker.

5. Special features: The weatherproof converter is easily mounted at the antenna with the convenience of feedline power capability. The IF receiver may be employed independently for reception of polar orbit APT signals if desired. The synthesizer tuning eliminates the need to acquire specific crystals for APT or WEFAX operating frequencies. The receiver employs an internal monitor speaker and volume control as well as a squelch control to silence the receiver when no signal is present. Standard domestic units are supplied with a grounded 3-wire AC power cord and are wired for 110-120V 60 Hz AC mains but 220-240V 50 Hz units are available at no extra charge. Either the 110 or 230V models will operate at supply frequencies up to 4400 Hz if required.
6. Price: \$2,000.00
7. Delivery: 30-90 days
8. Comments: No response

METSAT PRODUCTS, INC (C)

1. Equipment type: Facsimile recorder
2. Station use: WEFAX
3. Equipment trade name/model: FX-2EA Facsimile Recorder
4. Equipment description: The FX-2EA is a drum-type facsimile recorder designed to provide very high quality display of WEFAX imagery at low system and operating costs. The recorder prints black and white images in a 6.5 inch (16.5 cm) square format with gray scale rendition of photographic quality. The recorder consists of two assemblies - the electronics control unit and the picture printer. Video AGC is used so that multiple video sources or spacecraft may be monitored without attention of video levels. Start, phase, print, and stop operations are completely automatic (see Special features). Safety interlocking and limit switching are provided in the picture printer for operator safety and to prevent inadvertant damage to the printer if it is operated by untrained personnel. Input impedance is 10K, unbalanced, and input levels from 0.01 to 5V can be accommodated. The FX-2EA recorder interfaces directly with the GR-3 receiver with a single audio cable. Standard units are powered from 110-120V 60Hz mains (3-wire cord standard) but 220-240V 50Hz export versions are available at no extra cost.
5. Special features: (a) The recording paper is white, dry, non-light sensitive, and handles like ordinary office bond. The paper has unlimited storage life under normal office or laboratory conditions. Images are printed in true black and white tones, the pictures are off photographic quality, and the images will not fade or discolor under any conditions of display or storage compatable with standard paper products. The pictures are available immediately without any requirement for further processing or stabilization. (b) Operating costs range from \$0.10 per print, depending upon the quantity in which paper is purchased. The paper itself is available directly from Metsat or world-wide through alternate sources. (c) In addition to printing pictures directly from the receiver, the FX-2EA will also print high quality images from standard audio tape recordings of the spacecraft signal. A variety of tape formats may be used (reel-to-reel, 8-track, or cassette) and if the equipment is capable of quality music reproduction the imagery will be virtually indistinguishable from that printed directly from the receiver. This feature permits archiving of satellite data tapes or the printing of multiple copies of pictures of particular interest without the need to resort to photographic or other means of reproduction. (d) The recorder is actuated by the satellite subcarrier signal, resulting in extreme reliability in the event of operational errors in the satellite data flow. Isolated start tones or missing stop tones will not result in wasted paper while pictures will be properly printed even if the start tone is omitted from the data format. (e) The recorder mechanics and electronics circuits are extremely rugged. The system documentation and the layout of the units facilitates field

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service by virtually any electronics technician. Metsat maintains complete factory service facilities but will also provide parts to support field service activities. In addition, most of the electronic components are available world-wide, facilitating maintenance in less developed countries.

6. Price: \$3,000.00

7. Delivery: 30-90 days

8. (a) An extended version of the FX-2EA mechanics unit that will permit the printing of 2 WEFAX frames will be available after January 1, 1981. (b) An optional digital timer that permits unattended printing of any set of frames in the daily spacecraft schedule will be available in January of 1981. The timer is battery operated with a two-year lifetime when operated from a single C-cell (1.5V). The timer provides front panel display of either local or universal time (GMT) and switch selected display of the acquisition time of the desired image product. Since the timer is battery operated, it retains its timekeeping and program functions even when transported. The program timing can be reset in less than one minute so that unattended acquisition of many frames each day is quite practical. Using the timer, designated the GT-2, permits optimum economy of operation since you print only the frames required while not wasting paper on imagery of little interest. The price of the GT-2 timer is expected to be about \$250.00. (c) An APT version of the FX-2EA for TIROS/NOAA imagery will be available about March 1, 1981. The price is expected to be comparable with the WEFAX version.

MICROCOMM

Company name and address: Microcomm
14908 Sandy Lane
San Jose, CA 95124
USA

Telephone: Not available

1. Equipment type: Receive Downconverter for:
SMS METEOSAT VHRR
GOES TIROS-N AVHRR
GMS WEFAX VISSR
2. Station use: HRPT/WEFAX
3. Equipment trade name/model: Microcomm RX-1691
4. Equipment description: Meteorodyne Conversion Unit to enable VHF receivers to process S-band (1691 MHZ) signals. A single +12VDC supply.
5. Special features: 2.5dB typical noise figure; 30 dB conversion gain; 80dB dynamic range; high-reliability integral microstrip construction; 1091 MHZ in, 137.5 MHZ out.
6. Price information: \$795.00 FOB San Jose, CA. All orders must be prepaid, in full, in U.S. dollars.
7. Delivery: Stock to 6 weeks ARO
8. Comments: A detailed equipment manual is available postpaid for \$12.00 U.S. delivery (\$14.00 elsewhere). Purchase price of manual is credited against subsequent equipment purchase. Order the RX-1691 Instruction Manual.

MICRODYNE CORPORATION

Company name and address: Microdyne Corporation
627 Lofstrand Lane
Rockville, Md. 20850

Telephone number: (301) 762-8500
Panafax: (301) 762-3782
TWX: 710-828-0478
Cable: Microdyne, Rockville, Md. USA

1. Equipment type: The types of equipment supplied by Microdyne are modular receivers that can be specifically configured for all types of meteorological satellites.
2. Station use: All APT (VHF), HRPT and WEFAX ground stations can use these receivers.
3. Equipment trade name/model: The basic receiver involved is the Microdyne Model 1100-AR.
4. Equipment description: The Model 1100-AR base chassis requires an appropriate plug-in RF tuner, FM or PM demodulator, a second IF filter bandwidth, plus other pertinent modules and crystals that are compatible with the given satellite down link frequency and modulation format employed. These receivers have been extensively field proven under operational conditions throughout the world for many years and offer a Mean-Time-Between-Failure (MTBF) rate of approximately 9,000 hours, as reported by Vandenberg AFB, California.
5. Special features: Special features include the ability to receive and demodulate the various meteorological satellite data specified with only one receiver, if necessary, by plugging in the few extra modules that are unique to each satellite's format. Thus, one receiver can be used to receive all three satellites' data, provided that all data is not required at the same time. Also, when more than one receiver is employed, each receiver can serve as a back up to the other in case of failure. Other significant features are covered in Item 4 above.
6. Price information: Line item prices for the 1100-AR base chassis and each plug-in module required for each APT (VHF), HRPT, and WEFAX configuration are listed separately in enclosures B, C, and D respectively. Options are also listed separately in the event that satellite down links must be down converted to lower frequencies at the antenna before being fed to the receiver. Applicable specifications are included in Enclosure A.
7. Delivery: All times in each satellite receiver configuration will be ready for shipment 150 days ARO.
8. Comments: No additional comments appear to be indicated at this time except that a special section devoted to MET satellites, including DMSP, METEOSAT, LANDSAT and DATA COLLECTION PLATFORMS, as well as the configurations required for each satellite, will be found on pages 23, 24, and 25 on Enclosure A.

UNITED STATES OF AMERICA (Cont.)

Company name and address: United Press International
General Offices
News Building
220 East 42nd Street
New York, New York 10017
U.S.A.

Telephone: (212) 682-0400
147203 WU

U.P. INTERNATIONAL (A)

1. Equipment type: Facsimile Satellite Picture Recorder
2. Station use: WEFAX
3. Equipment trade name/model: Unifax II WEFAX
4. Equipment description: Unifax II is a high resolution receiver providing permanent high quality photographic copy on electrostatic paper. The machine provides up to 700-800 satellite pictures per roll of paper and operates automatically unattended. Pictures are delivered cut and stacked. The copy provides 64 gray shades from crisp white to jet black. Dimension stability is excellent, making the use of overlays accurate and easy. Tonal stability from copy to copy is also exceptional.
5. Special features: Has built-in gray scale generator and diagnostic test facilities. Checking for correct operation of the machine is therefore self-contained and can be accomplished without any external signal input.
6. Price information: Overseas: \$12,200 FOB Dallas, Texas. Supplies: 1 kit (8 rolls paper each 750' x 11") and 2 sets of chemical \$410.55 FOB New York.
7. Delivery: 90 days or less ARO.
8. Comments: Unifax II WEFAX can be used to receive Meteosat and GMS satellite pictures.

U.P. INTERNATIONAL (B)

1. Equipment type: Facsimile Satellite Picture Recorder
2. Station use: APT
3. Equipment trade name/model: Unifax II TIROS-N (APT)
4. Equipment description: See attached.
5. Special features: See attached

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6. Price: \$12,200. Supplies: \$410.55 as per WEFAX (above)
7. Delivery: 90 days or less ARO
8. Comments: The Unifax II TIROS-N/APT recorder is used with a suitable scan converter such as P&P Industries' P.O.1711 (or equivalent) to provide correct phasing pulses, frequency and levels to the recorder. The scan converter also allows IR/VIS side by side or full IR or full VIS by a switch.**

Special Note: United Press International will consider modification of the Unifax II picture recorders to meet specific satellite requirements if a special application arises. For information, contact Ian Smith, Director of Marketing/Facsimile Products, (212) 682-0400.

**Specifications attached to letter.