CGMS

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MAINTENANCE AND UPGRADE OF SATELLITE INFORMATION IN THE WMO OBSERVING SYSTEMS CAPABILITY ANALYSIS AND REVIEW TOOL (OSCAR)

In September 2016 version 2 of the WMO space based Observing System Capability Analysis and Review tool (OSCAR/Space v2) was released. CGMS Members and Observers are asked to support the WMO effort to maintain and update OSCAR/Space v2. It is challenging to sustain the information at its current level due to the increasing range of satellite programmes of CGMS interest (e.g., Disaster monitoring and Space weather).

For facilitating the provision of information on programmes, satellites and instruments templates have been created and will be made available to satellite operators by WMO to streamline the provision of input to the WMO Space Programme. This will help the OSCAR/Space project team to properly inject new and updated information into the OSCAR architecture. The task of keeping OSCAR/Space up to date can only be achieved with the network of experts from space agencies.

Action/Recommendation proposed:

- CGMS Members and Observers to continue providing information on their satellite programmes to be recorded in OSCAR/Space, according to the recommended procedure.
- CGMS members to nominate experts for membership in the newly established OSCAR/Space Support Team.
- CGMS to invite the International Science Working Group (ITWG, IWWG, IPWG, IROWG, ICWG) to nominate experts for participation in the OSCAR/Space Science and Technical Advisory Team.

Appendices:

- Concept for OSCAR/Space maintenance and support
- Terms of reference for the OSCAR/Space Support Team and the OSCAR/Space Science and Technical Advisory Team
- Examples of templates for capturing information on programmes, satellites and instruments.

MAINTENANCE OF SATELLITE INFORMATION IN THE WMO OBSERVING SYSTEMS CAPABILITY ANALYSIS AND REVIEW TOOL (OSCAR)

1 Introduction

Since 2012 the WMO *Observing System Capability Analysis and Review* tool (OSCAR) has been developed as a database to replace the previous *Dossier on the Space-based Global Observing System*, which was annually published from 2004 to 2012. In September 2016, an enhanced version 2 of OSCAR/Space was released. It offers now factual information on satellites and instruments, but also the possibility to assess instruments by mapping them to measured variables. This enables the "gap analysis" by type of missions and/or by measured variables.

As compared with other major databases, such as:

- the ESA-sponsored *EO portal* (https://directory.eoportal.org/web/eoportal/satellite-missions), providing detailed descriptions of both Earth observation and Space weather satellites;
- the CEOS *Mission, Instruments and Measurements* (MIM) (http://database.eohandbook.com/), briefly describing all EO (not Space weather) programmes declared by the CEOS members;

the WMO database *OSCAR* (https://www.wmo-sat.info/oscar) includes estimates of the geophysical variables potentially retrievable from the various instruments, including rating of the achievable performances and the indication of possible operational limitations. In addition, on request of CGMS, the frequency plans of meteorological and some associated satellites are included as well.

This WP addresses the problem of OSCAR's sustainability and appeals to CGMS members for support through dedicated procedures.

2 The challenge of sustainability

The update process of OSCAR/Space faces the following challenges:

- the lack of clear user requirements for information collection in OSCAR/Space;
- the inclusion of additional areas of interest, which have been taken on board because of the recent establishment of the WMO *Disaster Risk Reduction Programme* (DRR) and the *Interprogramme Coordination Team on Space Weather* (ICTSW);
- the tendency in CGMS to reduce explicit reporting on the status of current and future satellite systems; this stems from the fact of replacing detailed working papers by power point presentations;
- the lack of dedicated reports by CGMS members and observers on satellite programmes of associated or related national entities managing satellites of interest to the CGMS community at large.

To keep OSCAR/Space updated with information of sufficiently high quality, WMO would like to strengthen the cooperation with CGMS members and observers from other agencies.

WMO proposes to act as the coordinating agency for the update and enhancement activities. To achieve an optimum update process, the following basic activities are necessary:

(1) Addition and - if needed - correction of factual information on satellites, instruments and programmes for ensuring the reliability of OSCAR space information.

(2) Occasional scientific reviews of the instrument and mission variables which are contained in the OSCAR space expert system. This implies the checking and validation of the various rules which underline the expert system.

To achieve a sufficient maintenance and support for OSCAR/Space the WMO Space Programme office will coordinate the activities through its OSCAR/Space project board. The project board will closely work together with two new support groups:

(a) Points of contact for (1); forming the OSCAR/Space Support Team (O/SST) (mainly composed of operational satellite agencies).

(b) Points of contact for (2); involvement of the various science teams (especially through chairs of the international CGMS science working groups) forming the OSCAR/Space Science and Technical Advisory team (O/SSAT).

(c) A streamlined procedure to ensure provision of satellite information into OSCAR. The procedure is based on the use of templates to indicate which information is needed, and to simplify the work for its provision. Examples of such templates are given in Annexes 3 to 6.

The terms of reference for the above two groups (O/SST and O/SSAT) are provided in Annex 2.

It is important that CGMS members and observers, especially national space agencies, accept some responsibility to also report about programmes managed by collaborating national entities.

3 Conclusion

CGMS members and observers are invited to endorse the proposal for establishing and supporting the new OSCAR/Space teams, O/SST and O/SSAT, to ensure the sustainability of OSCAR/Space in the years to come. This will lay the foundation of cooperation with WMO for sustaining the OSCAR/Space updating process through provision of information on their satellite programmes by making use of the provided templates.

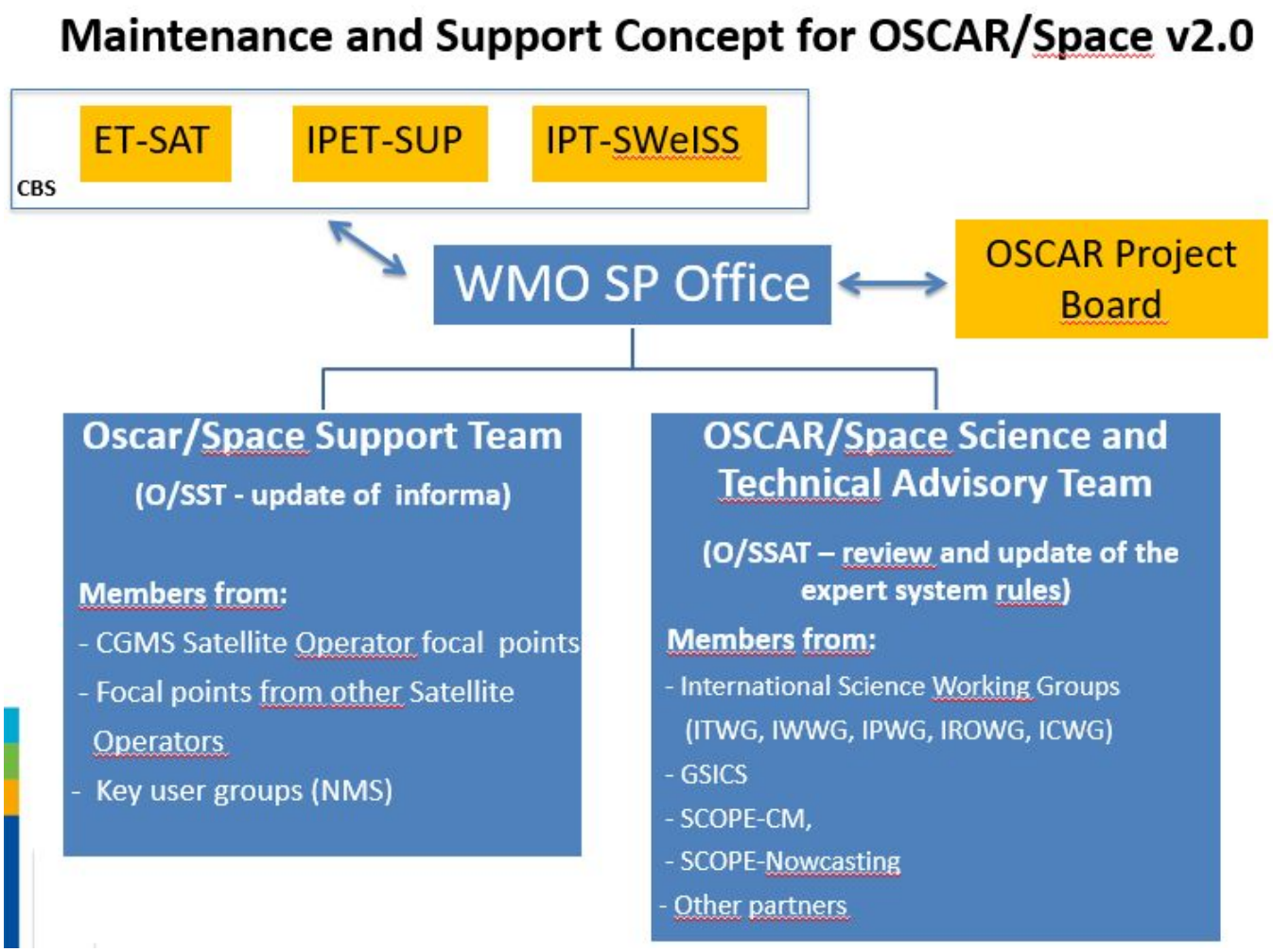
The templates will be provided by the WMO Space Programme office for collecting information on programmes of CGMS operators. Relevant information from collaborating national entities should also be conveyed as much as possible.

The requested update procedure covers information on:

- planned satellites;
- the status of satellites and instruments currently being flown.

As all current and most of the planned satellites are already recorded in OSCAR/Space, it is suggested to start the updating exercise by checking the existing information at https://www.wmo-sat.info/oscar.

Annex 1


Maintenance and Support Concept for OSCAR/Space v2.0
CBS
ET-SAT
IPET-SUP
IPT-SWeISS
WMO SP Office
OSCAR Project Board
Oscar/Space Support Team
(O/SST - update of informa)
Members from:
- CGMS Satellite Operator focal points
- Focal points from other Satellite Operators
- Key user groups (NMS)
OSCAR/Space Science and Technical Advisory Team
(O/SSAT – review and update of the expert system rules)
Members from:
- International Science Working Groups (ITWG, IWWG, IPWG, IROWG, ICWG)
- GSICS
- SCOPE-CM,
- SCOPE-Nowcasting
- Other partners

Annex 2

a. Terms of Reference for OSCAR/Space Support Team (O/SST)

The O/SST is composed of nominated experts from CGMS operators and observers from other satellite operators. Representatives nominated by ET-SAT and IPET-SUP (e.g. from NMS) can also be members of this group.

The ideal candidates would come from the relevant user service and information sections of these agencies.

The tasks of the members include:

1. To regularly (half-yearly) confirm that the factual satellite and instrument information contained in OSCAR/Space concerning their own satellites and instruments is up to date.
2. On the occasion of newly launched satellites, to provide the initial program and mission information to WMO Space Programme office, making use of the WMO provided templates.
3. On the occasion of satellite/instrument anomalies to report updated information to the WMO Space program OSCAR administrator as soon as possible.
4. To elect a chair person from the O/SST who is helping the WMO Space Programme office to timely resolve administrative enhancement and correction activities for the OSCAR/Space database.

b. Terms of Reference for the OSCAR/Space Science and Technical Advisory Team (O/SSAT)

The O/SSAT will be mainly composed by nominated members of the CGMS science groups (ITWG, IWWG, IPWG, IROWG, ICWG) and other relevant scientific satellite groups (GSICS, Scope-CM, Scope-Nowcasting). The members will be nominated by the relevant science groups and endorsed by CGMS.

The tasks of the members include:

1. To help the WMO Space Programme office to review the scientific content of the OSCAR/Space expert system by analysing the underlying rules for missions and instruments.
2. To elect a chair person from the O/SSAT who is helping the WMO Space Programme office to define and organise the review process for the OSCAR/Space expert system.
3. To analyse the results of the review process and to consolidate the outcome of the review.
4. To approve the enhancement of the OSCAR/Space science content. This is done through the chair person in conjunction with the WMO Space Programme office.
5. Assist in the definition and organisation of workshops for discussing issues of enhancement of OSCAR/Space functionalities and content.

Annex 3 - Template to provide information on a satellite Program

Annex 4 - Template to provide information on a Satellite

Annex 5 - Template for an Instrument (e.g. Moderate-resolution optical imager)

Annex 6 - Template for Frequencies

How to use the templates:

- The row recording an information candidate to be provided, is emphasised by " □ ";
- If the instrument can provide that information, please check the row [e.g., change "□" to "■"];
- If the requested information implies some figure or text, please fill the box ……

Annex 3 - Template to provide information on a satellite <u>Programme</u> [<u>more details are welcome</u>]

Name	Acronym: …….. Full name: ……..
Nature	□ Single satellite programme □ Satellite series (in temporal sequence) □ System of satellites in coordinated orbits (operated simultaneously) □ Satellite cluster (launched at once or at short intervals) □ Series of satellite clusters
Responsible	Nation: …….. International organisation: …… Entity with overall programme responsibility: ……..(acronym and full name)……. Co-responsible entity (role to be explained): .....(acronym and full name)……. Responsible of space segment development: …….. (acronym and full name)…… Responsible of ground segment development: ……..(acronym and full name)…….. Responsible of operations: ……..……(acronym and full name)…….… Other (role to be explained): ……..(acronym and full name)…….
Platform	□ 3-axis stabilised □ spin-stabilised Design lifetime: …….. y
Replacement policy	□ N/A (single satellite programme) □ launches planned at fixed intervals □ launch arranged shortly before the expected failure of a satellite of a series □ launch following the actual failure of a satellite of a series □ stand-by satellite common to a system of satellites in coordinated orbits □ graceful degradation of the number of satellites in a constellation or a cluster
Orbit type	□ geostationary - Nominal position(s): …… □ geosynchronous - Nominal position: …….. - Nominal inclination: …….. □ sunsynchronous - Nominal height: …… km - Nominal Equatorial Crossing Time(s) ….. h □ drifting - Nominal inclination: …… □ Highly-elliptical Earth Orbit (HEO) - Nominal perigee: …. km - Nominal apogee …. km □ Molniya orbit □ Tundra orbit □ Three-Apogee orbit □ Lagrange libration point L1 □ Lagrange libration points L4 and/or L5 □ Solar orbit □ Moon orbit □ Co-rotating with the Earth in the ecliptic plain

	□ Travelling across the magnetosphere
Reference	For detailed information, see the site http//www.....
Data circulation	Name and location of the main raw data acquisition and control station(s): …… Name and location of the operations control centre: …… □ science data stored onboard and downloaded on command □ science data broadcast in real time □ science data distributed after pre-processing, in Near-Real-Time (NRT) Names of the full-resolution real-time or NRT data acquisition service: ….. and station: …. Names of the low-resolution real-time or NRT data acquisition service: …. and station: …. □ NRT and other data distributed by EUMETCast □ NRT and other data distributed by CMACast □ NRT and other data distributed by GEONETCast-America □ NRT and other data distributed by Internet □ NRT and other data distributed by commercial satellites Name and location of the centre(s) responsible of archived data distribution: …… □ DCS to collect data from DCP's at fixed times. Name of service: …… □ DCS to collect data from DCP's upon interrogation. Name of service: …… □ DCS to collect data and localise the DCP. Name of service: …… □ Data Collection System able to re-configure the DCP. Name of service: …… □ Participation to the COSPAS/SARSAT system. Name of the service: …… □ Dissemination of processed data. Name of the service: ……

Annex 4 - Template to provide information on a Satellite [more details are welcome]

General	Acronym: …….. Full name: …… Programme (acronym): …… □ Single satellite in the programme If part of a series, progressive number: …….
Mission	Operational meteorology: □ Main mission - □ Substantial contribution - □ Significant contribution Research meteorology: □ Main mission - □ Substantial contribution - □ Significant contribution Climate monitoring: □ Main mission - □ Substantial contribution - □ Significant contribution Climate research: □ Main mission - □ Substantial contribution - □ Significant contribution Atmospheric chemistry: □ Main mission - □ Substantial contribution - □ Significant contribution Oceanography: □ Main mission - □ Substantial contribution - □ Significant contribution Sea ice monitoring: □ Main mission - □ Substantial contribution - □ Significant contribution Land observation: □ Main mission - □ Substantial contribution - □ Significant contribution Disaster monitoring: □ Main mission - □ Substantial contribution - □ Significant contribution Space weather: □ Main mission - □ Substantial contribution - □ Significant contribution Other (to specify): □ Main mission - □ Substantial contribution - □ Significant contribution
Sizing	Mass at launch (i.e., including fluel): ……. kg Dry mass: ……. kg Power: …… W
Data link	Web site where the information on data access is available: ……
Data access info	Instrument 1: □ direct high-re. - □ direct low-re. - □ NRT - □ land line - □ from archive …… Instrument n: □ direct high-re. - □ direct low-re. - □ NRT - □ land line - □ from archive
Orbit type	□ geostationary - position: …… □ geosynchronous - position; …… - inclination: …… □ sunsynchronous - height: …… km - Equatorial Crossing Time: …… h □ drifting - inclination: …… □ Highly-elliptical Earth Orbit (HEO) - perigee: …. km – apogee: …. km □ Molniya orbit □ Tundra orbit □ Three-Apogee orbit □ Lagrange libration point L1 □ Lagrange libration points L4 and/or L5 □ Solar orbit □ Moon orbit □ Co-rotating with the Earth in the ecliptic plain □ Travelling across the magnetosphere

Status	□ mission concept □ considered (design defined, implementation submitted to approval) □ planned (design consolidated, implementation approved) □ lost at launch □ commissioning (successfully launched, gradually testing and activating the instruments) □ operational □ warning (expected EOL reached or exceeded) □ stand-by (waiting fo become operational or to be re-activated for emergency) □ inactive
Status details	Free text to annotate, for currently flown satellites (with the date of occurrence): • anomalies or failure of major satellite subsystems • degradation or failure of instruments
Launch	Actual date of the occurred launch: day …… / month ……./ year ……. Scheduled launch window: month ……. / year ……. Planned launch (not before than): year ≥ …….
End-Of-Life	Actual date of the satellite end of service: day …… / month ……./ year ……. Expected End-Of-Life: year ≥ …….
Instrument status	For each instrument of a currently flown satellite, specify the following: Start of service: dd/mm/yyyy End-of-service: □ actual (dd/mm/yyyy) - □ expected (≥yyyy) Status: □ active - □ commissioning - □ degraded - □ inactive - comment: info on degradation

Annex 5 - Template for an Instrument (e.g. Moderate-resolution optical imager) [more details are welcome]

General	Acronym: …….. Full name: ……
Purpose	Free text highlighting which type of measurements are primarily addressed by the instrument
Short description	□ Radiometer - number of channels: …… □ Spectroradiometer - number of channels: …… Exploited spectral range(s): □ UV - □ VIS - □ NIR - □ SWIR - □ MWIR - □ TIR - □ FIR □ No. of UV channels: …… □ No. of VIS channels: …… □ No. of VIS channels with bandwidth ≤10 nm: …… □ No. of VIS channels with bandwidth ≤ 20 nm: …… □ No. of NIR channels: …… □ No. of channels in the NIR range 700-800 nm: …… □ No. of channels in the NIR range 900-1000 nm: …… □ No. of SWIR channels: …… □ No. of channels in the MWIR range 3.5-4.0 μm: …… □ No. of channels in the MWIR range 4-5 μm: …… □ No. of channels in the TIR range 6-8 μm: …… □ O3 channel(s) included □ No. of channels in the TIR range 10-13 μm: …… □ No. of channels in the TIR range 13-15 μm: …… □ IFOVmax at s.s.p.: …… (km) □ No. of different viewing angles: …… □ It has polarimetric capability □ It is scanning across the track Free text to highlight further features of interest: …… □ DETAILED CHARACTERISTICS IN THE TABLE BELOW
Background	□ New development □ Consolidated technology □ Replacing/improving a previous instrument - indicate the feature improved: ……..…… □ Complementary to, or supporting, another instrument on the same satellite: ……..
Scanning technique	□ Cross-track mechanical scanning from LEO - swath: …… km - pixel/line: …….. □ Push-broom scanning from LEO - swath: …… km - pixel/line: …….. □ Whisk-broom scanning from LEO - swath: …… km - pixel/line: …….. □ Spinning GEO: E/W or W/E pixel/line: …….. - N/S or S/N number of lines: …….. □ 3-axis stabilised GEO: E/W or W/E pixel/line: …….. - N/S or S/N number of lines: …….. □ 3-axis stabilised GEO: limited area of ……. km · ……. km

	□ Other to be described ……
Resolution	□ for channel groups to be specified ……..: IFOV: …… km at s.s.p. - pixel: ……. km at s,s.p.
Coverage / cycle	□ for high-inclination LEO: global in …….. days □ for low- and medium-inclination LEO: …….. days limited to latitudes ± …….. degrees □ GEO: full-disk every …….. min, Limited areas in correspondingly shorter time intervals □ GEO limited area of ……. km · ……. km every ……... min □ L1 Lagrange libration point: full Earth's disk every …….. min
Sizing	Mass: ……. kg Power: ……. W Data rate: ……. kbps
Details	TO BE PROVIDED AS TABLE - SEVERAL OPTIONS - EXAMPLES SHOWN BELOW

Central wavelength	**Spectral interval**	**SNR** or **NEΔT** @ specified input
…….. nm	……. - ……. nm	… @ ….. % albedo
…….. µm	……. - ……. µm	…. K @ ……. K

Central wavelength	**Bandwidth**	**SNR** or **NEΔT** at specified input spectral radiance	**IFOV** at s.s.p.
…….. nm	……. nm	…….. @ …….. W m^{-2} sr^{-1} μm^{-1}	……. km
…….. µm	……. µm	….. K @ …….. W m^{-2} sr^{-1} μm^{-1}	……. km

Central wavelength	**Bandwidth**	**SNR** or **NEΔT** @ specified input		**IFOV** at s.s.p.
		Low gain	High gain	
…….. nm	……. nm	… @ ….. % albedo	… @ ….. % albedo	……. km
…….. µm	……. µm	…. K @ ……. K	…. K @ ……. K	……. km

Annex 6 - Frequencies [reminder of a template already agreed in CGMS]

Note A	Note B	Note C	Note D	Note E	Note F	Note G	Note H	Note I
Service	Direction or sensing mode	Frequency (MHz)	Emission designator	Bandwidth (kHz)	Polarisation	D/A	Data rate (kbps) or Baseband (kHz)	Comments

- Note A: Service - Acronym of the addressed service: e.g. for raw data transmission to the central facility, for full-resolution scientific data transmission to a high-rate receiving station, for selected scientific data to a low-rate receiving station, for data collection system, telemetry, control, ranging, S & R, etc..
- Note I: Comments - It provides a short description of the Service in plain language. It might include some complementary information that did not have a place in a previous heading. In general, it should help understanding which instrument data are carried by the specified telecommunication service.
- Note B: Direction or sensing mode - Indicates whether the transmission is from Space to Earth (S-E) or from an Earth station to the satellite (E-S), or from Satellite to Satellite (S-S); or whether it is the channel of a passive MW radiometer.
- Note C: Frequency and Note E: Bandwidth - Two cases:
  - C1 / D1 - The central frequency C1 of a transmitter emitting over a bandwidth D1
  - C2 / D2 - The range of frequency subdivided in a certain number of channels, each one of bandwidth D2 [typical example: the Data Collection System that allocates narrow bandwidths to a number of channels; the number of available channels may be indicated under Note I, Comments, making distinction between International and domestic Data Collection Platforms].
- Note D: Emission designator - A compact code summarising features of use for ITT frequency administration.
- Note F: Polarisation - To specify Linear polarisation, or Circular (RHCP or LHCP) for transmitters, or V / H / P / M / L / R for passive MW radiometers.
- Note G: D/A and Note H: Data rate or Baseband - For digital transmission (D) the Data rate should be specified. For analog transmission (A), the Baseband