

Report and recommendations from WGI

Presented to CGMS-54 plenary session, agenda item 5

Executive Summary

CGMS-54 WGI meeting on 13 April 2026.

All Task Groups presented the progress of their activities since CGMS-53.

WGI Outcomes

Key recommendations to Plenary:

- RFI best practices in the area of Data Collection Services (DCS) **for endorsement**
- Proposed update to the Manual on the WIGOS **for endorsement**
- Frequency management reports **for information**
- Progress on all Task Group activities **for information**, including:
 - Status of format standards for compatibility with AI and ML
 - Progress of Space Environment Sustainability (SES) Best Practices preparation
 - Progress on Enhanced Data Collection Platform (EDCP) standard implementation
 - Task Group Chair changes

Recalling WGI Scope

Aim of WGI on 'Satellite Systems and Operations': to keep CGMS aligned with the latest technological solutions that will operationally support the meteorological user community.

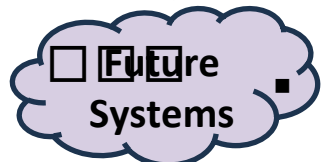
Objectives of CGMS WGI:



Provide a regular forum for CGMS agencies to address topics of interest in areas related to **global coordination of satellite systems and telecommunication**;



Allow agencies to **share experiences, lessons learnt**, to develop **best practices** and detailed technical standards where appropriate related to global/common aspects of satellite systems and operations;



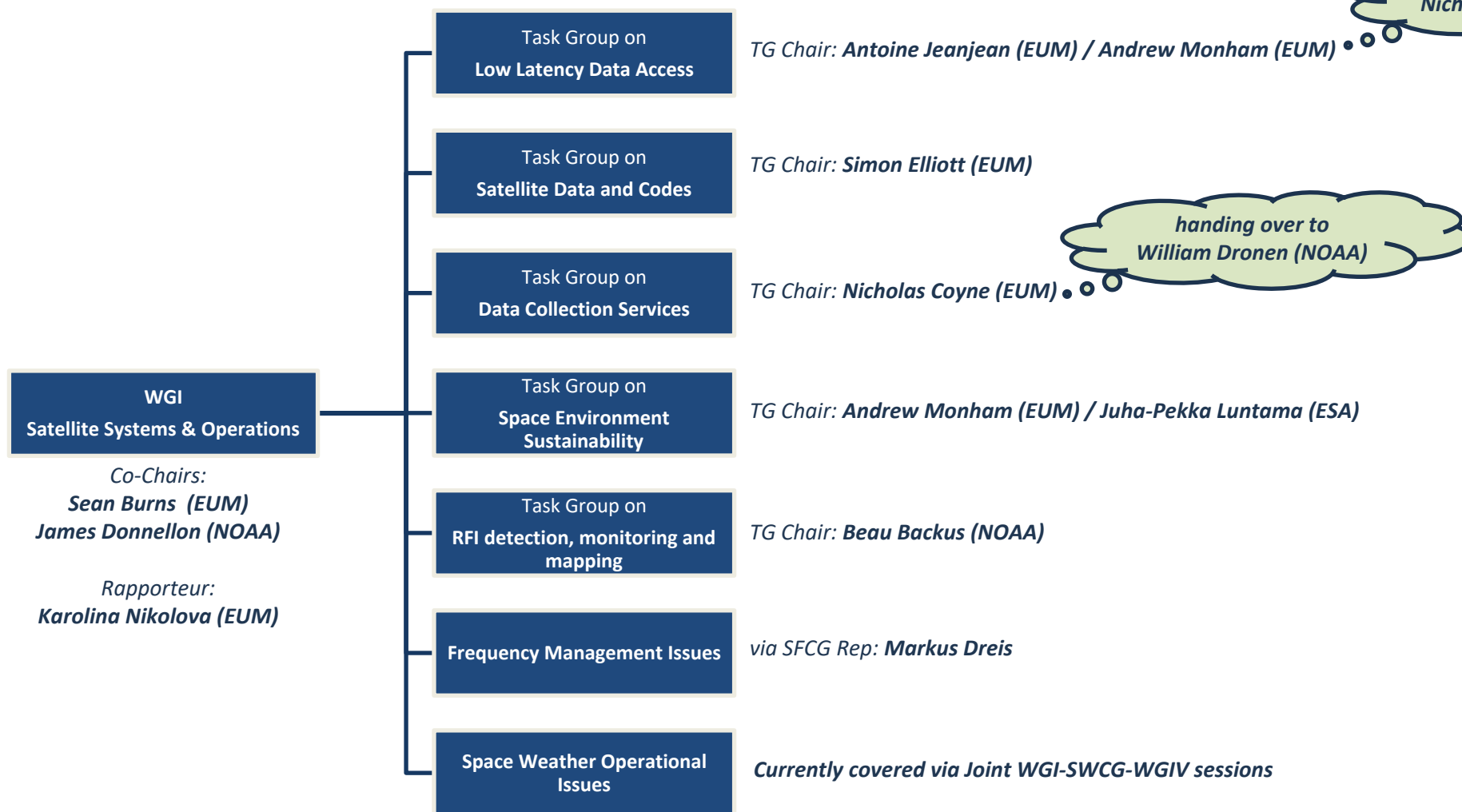
Support CGMS **in preparation of future generations** of meteorological satellite systems;



Contribute to consolidation and updates of **interoperability and standardisation** imposed by technological evolution.

Objectives of WGI achieved via Task Groups: specific areas investigated in detail, with the aim of producing best practices and standards for current and future architectures and systems.

Current WGI Structure

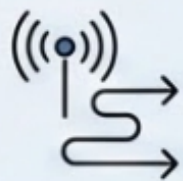


RFI detection, monitoring and mapping

- The key activity of the Task Group on RFI since CGMS-53 has been the development of “**RFI best practices in the area of Data Collection Services (DCS)**” [CGMS-54-WGI-WP-20]*, aiming to define a framework for managing RFI throughout the DCS lifecycle. **WGI seeks CGMS Plenary endorsement of the developed best practices in the area of DCS.**
- The best practices encompass the end-to-end lifecycle in five key stages and emphasise proactive design, informal engagement strategies for RFI resolution, and the establishment of robust communication channels between users and operators:
 - 1) **Planning for RFI** in System Design
 - 2) **Monitoring** System Operations
 - 3) **Characterising RFI** and communicating impact
 - 4) **Mitigation** Strategies
 - 5) **Removing RFI** & Organisational relationships
- Central to these best practices are:
 - Requirements for **flexible hardware**, such as reprogrammable transmitters and transparent transponders
 - Utilisation of AI/ML for advanced performance monitoring
- The report concludes that **the successful removal of RFI depends on both technical signal characterisation and the cultivation of strong organisational relationships to influence change in RFI source operations.**

**Report highlights on next slides + full report for offline information/ analysis*

Planning for RFI in System Design



Communication Modeling:
Utilizing modified Shannon-Weaver models to identify RFI-vulnerable components.



The Design Window:
Satellite hardware and spectrum architecture must be finalized early; modifications post-launch are nearly impossible.



Proactive Acquisition:
DCS operators must be active in satellite acquisition to ensure RFI is factored into spectrum filing.

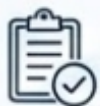


Recursive Effort:
Once a variable is addressed in one part of the chain, the impact on others must be assessed.

Technical Design Considerations



Transmitter Requirements:



Must adhere to industry standards (spurious emissions, filtering).



Flexibility: Designed for remote commanding (backhaul) and firmware updates to adapt to new RFI avoidance techniques without hardware changes.



Satellite & Receiver Resilience:



Selectivity: Satellite receivers should maximize desired signals and exclude undesired ones.



Transparency: Use transparent transponders so uplink signals can be analyzed via the downlink.



Metadata: Ground stations should process signal strength, timing, and variability metadata for each message.

Highlights of RFI best practices in the area of Data Collection Services (DCS)

Monitoring System Operations

Categories of Monitoring:



1. Supporting Infrastructure performance.



2. Data flow integrity (identifying loss or corruption).



3. Spectrum monitoring (uplink/downlink) to confirm non-DCS RF energy.

Key Capabilities:



• **Automated dashboards** for real-time status.



• **Extended storage** for historical trend analysis.



• **Advanced Analytics:** Leveraging AI/ML to merge performance metrics with In-Phase Quadrature (IQ) spectrum data.

Characterizing RFI and Communicating Impact



Characterization Data: Aligning with ITU Satellite Interference Reporting and Resolution System (SIRRS) requirements.



Required Documentation:

- Source details (location and measured signal characteristics).
- Frequency assignments and scan/geolocation plots.



The Regulatory Reality: Unreported RFI is viewed as “no RFI” by regulatory bodies; documenting the specific impact on user operations is critical for support.

Highlights of RFI best practices in the area of Data Collection Services (DCS)

Mitigation Strategies

- **Mitigation vs. Removal:** Focused on limiting data loss while the RFI source is still active.



Operational Adjustments:

- Employing alternative broadcast times, redundant transmissions, or different channels.
- Repointing antennas or updating to modern, more robust DCP models.



Technological Improvements:

Improving digital signal processing and using error correction or robust modulation.

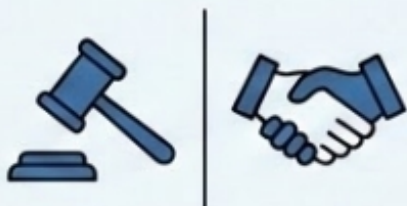


Data Path Redundancy:

Using multiple satellites or commercial services to avoid single points of failure.

Removing RFI & Organizational Relationships

Formal vs. Informal Approaches



RFI removal via regulatory enforcement or collaborative engagement.

The “Collaborative Approach”



International sources often unaware of interference.

Effective Strategies



Radio-operator engagement is fastest. Emphasize “Safety of Life & Property” impact.

Prerequisites for Removal



Clearly characterized signal & high certainty of operator identity.

Conclusion – A Strategic Imperative



Shift in Posture:

Move from reactive response to proactive, lifecycle-based management.



Cost-Efficiency:

Embedding monitoring and flexibility during the design phase is the most cost-effective RFI strategy.



Core Takeaway:

Reliable data integrity in a congested spectrum depends on robust technical design coupled with strong organizational relationships.

RFI detection, monitoring and mapping - informational

In addition to the RFI best practices in the area of DCS, the Task Group noted the following key RFI-related issues of relevance to CGMS:

The Mega-Constellation Crunch:

Rapid deployment of large-scale LEO satellite constellations presents an unprecedented risk of aggregate interference and out-of-band emissions

Standardising Commercial Data Buys:

Critical need to ensure commercial datasets meet the same rigorous spectral protection and RFI-flagging standards as member-owned assets

Operational necessity of integrating AI/ML:

Traditional RFI detection methods are effectively being "blinded" by modern 5G signals that mimic natural Gaussian noise.

As part of next steps towards CGMS-55, the Task Group on RFI will work towards a:

- Report on mitigation strategies for LEO mega-constellations
- Report on RFI considerations for commercial data buys

CGMS Agencies are invited to:

Take note of key RFI detection, monitoring and mapping issues of relevance to CGMS and next steps towards CGMS-55

Frequency Management - informational

The following reports highlighted the importance of strategic efforts in frequency management and protection in the context of ITU World Radiocommunication Conference 2027 (WRC-27) and CGMS:

- “Report on frequency management related topics” [CGMS-54-WGI-WP-20] – *dedicated presentation to plenary follows.*
Discussion highlighted challenges related to:
 - Administrations faced with licensing requests for mega-constellations. They need guidance from the satellite operators operating passive sensors needing protection.
 - Regulations of ground-based systems, e.g. ground-based telescopes. In this case, global regulations may not be sufficient, and require local regulations to protect the sites.
 - An abstract on Frequency Management related issues has been submitted to WMO Technical Conference (TECO-2026).
- “NOAA Spectrum Management Report” [CGMS-54-NOAA-WP-19] highlighted:

Global Baseline Harmonisation and RFI Mapping:

Weather is a global phenomenon, spectrum management cannot be achieved in domestic isolation

Advanced RFI detection studies:

Ongoing through “Detection, Characterizing, and Mitigation of Passive Sensor Data Corrupting Emissions” (DMiPS) project

The Transition to Cloud-Based Ground Segments:

NOAA is moving toward the NESDIS Common Cloud Framework (NCCF) to decouple data generation from specific RF downlink locations

Aggregate Interference from Mega-Constellations:

Shift from “discrete source” interference to an “aggregate noise floor” problem is a critical concern for global sensing, requiring a unified international response to update aging regulatory limits

CGMS Agencies are invited to:

Take note of the frequency management reports and the key issues highlighted in the area of RFI detection, mitigation and spectrum protection of relevance to CGMS and preparation for WRC-27

Satellite Data and Codes (SDC)

- The Task Group on SDC has continued to support **successful development new BUFR encoding sequences and Common Code Table entries**.
- **OSCAR/Space now includes references to WMO Common Code Table satellite identifiers (C-5)** as the last field of the the WIGOS Station Identifier for many satellites. The Group will continue to encourage the inclusion of instrument identifiers from C-8.
- **Format standards for compatibility with AI and ML:**

At CGMS-53, discussion of response of CGMS to AI challenges resulted in **endorsement of four key AI/ML areas to enhance meteorological and space weather data utilisation**. The first one of these topics was **“Data curation standards”**

As a result, WGI TG on SDC was tasked with **creating draft standards for Earth observation data**, including formats like Zarr and metadata per CF conventions, **to ensure compatibility with AI and ML**

- **Efforts to secure expert input on this topic failed** to solicit the requisite level of response.
- **Task Group will again be invited to address this important topic.**

Proposed updates to the WMO Manual on WIGOS

The **existing WMO regulatory framework** requires that “core” satellite data must be exchanged using the WIS in a format specified by the WMO Manual on Codes.

Satellite operators commonly make use of community standard formats such as netCDF for data representation

It is **proposed to work with WMO to update the Manual on the WIGOS** such that “core” satellite data can be exchanged using the WIS in either the standard formats specified by the WMO Manual on Codes or in other standard formats endorsed by CGMS for satellite data.

- **WGI seeks CGMS Plenary endorsement for the update to the Manual on the WIGOS.**
- Given the endorsement of CGMS Plenary, the CGMS Secretariat and the WMO Secretariat would work together to **prepare a paper for INFCOM-4 addressing the proposed update of the Manual on the WIGOS.**

CGMS Agencies are invited to:

Endorse the proposed update to the Manual on the WIGOS

Space Environment Sustainability (SES) - informational

- The WGI Task Group on SES continues progressing activities supporting safe and sustainable space operations across CGMS member missions:

SES Best Practices preparation is progressing well towards presentation at CGMS-55

Looking at **space weather observation requirements** for improved Space Traffic Coordination services and space sustainability and **reviewing current usage of space weather data for spacecraft operations** and goals for improvement

Work ongoing towards producing a report on **modelling of thermospheric density impacts**

- Sufficient Task Group Membership to allow a meaningful exchange to take place, but **would still benefit from participation of currently unrepresented agencies**, particularly in the domain of space safety and situational awareness

CGMS Agencies are invited to:

Take note of the Task Group on SES progress and activities

Contribute operational expertise and inputs to SES Task Group activities through expanded membership from further organisations

Low Latency Data Access (LLDA) – informational (1/2)

- The WGI Task Group on LLDA continues activities supporting improved low latency access to LEO meteorological satellite data from both global and regional perspective.

LLDA Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis now maintained

Living document supporting yearly assessment of technology developments

Premature to establish a Best Practice for LLDA

Technologies (e.g. inter-satellite data relay, phased array antennas, cloud data processing and dissemination) investigated, but **not yet operational**

Operational partnerships for coordination of phased orbits and sharing of additional ground infrastructure **only done to limited extent**

- In the lead up to CGMS-55, the Task Group will work towards:

Assessing value of existing global data acquisition partnerships

Estimating projected value of wider cooperations

Identifying future satellite programme opportunities for coordination of LEO orbits

Comparing synchronised phasing and value compared to uncoordinated systems

- WGI endorsed Nicholas Coyne (EUM) as new Task Group Co-Chair, taking over from Andrew Monham (EUM).

CGMS Agencies are invited to:

Take note of the Task Group on LLDA progress and activities, as well Co-Chair changes

Low Latency Data Access (LLDA) – informational (2/2)

- In WGI, Liam Gumley, Chair of the WMO DBNet Coordination Group, CIMSS/SSEC/UW-Madison, gave a virtual presentation on the [Status of the Direct Broadcast Network \(DBNet\) for global real-time acquisition, processing, and delivery of satellite direct readout data](#), coordinated by WMO.

DBNet ensures the global availability of near real-time LEO data received by a collection of Direct Broadcast stations distributed around the world

Global consistency is ensured by common software (i.e. AAPP, CSPP, FY3PP) consistent with global processors, standardized coding and file naming, and quality monitoring

DBNet is coordinated by WMO Space Programme and supported by CGMS

- WGI agreed that an important takeaway message is to **encourage all satellite operators to continue to develop and maintain valuable software packages such as AAPP, CSPP, FY3PP.**

CGMS Agencies are invited to:

Take note of the value of the continued development and maintenance of processing software packages such as AAPP, CSPP, FY3PP.

Data Collection Services (DCS) – informational (1/2)

- The WGI Task Group on Data Collection Services continues progressing the [Enhanced Data Collection Platform \(EDCP\)](#) implementation as primary activity:

NOAA has incorporated the EDCP standard into ongoing communication protocol efforts

Microcom has updated software for GOES DCS-based ground infrastructure and demonstrated its capabilities with successful in-ground tests

EUMESAT is investigating how they may incorporate similar updates to their system for the same purpose

EDCP transmitters have been built by Microcom to be launched on TechEdSat Small Sat missions

While initial analysis suggested a potential need to reduce rates to 350/750 bps, the group has confirmed that EDCP implementation with 400/800 bps is feasible

- According to current schedule, EDCP is still foreseen to be declared operational in 2027.

Data Collection Services (DCS) – informational (2/2)

- The Task Group on DCS also:

Continues to investigate Ionospheric Scintillation and its potential use with DCS transmissions

Has worked extensively on the topic of RFI in relation to DCS and pending endorsement by plenary will start reporting against the RFI Best Practices in the area of DCS from CGMS-55 onwards

Has maintained an RFI Register documenting existing RFI issues being experienced by CGMS DCS Operators
[CGMS-54-WGI-WP-102]

NOAA has coordinated removal of two interference sources since CGMS-53

- WGI endorsed William Dronen (NOAA) as new Task Group Chair, taking over the role from Nicholas Coyne (EUM).

CGMS Agencies are invited to:

Take note of the Task Group on DCS progress and activities, as well Chair change

Key WGI Task Group activities in the lead up to CGMS-55

Task Group on RFI

- Report on mitigation strategies for LEO mega-constellations
- Report on RFI considerations for commercial data buys

Task Group on SDC

- Develop new BUFR encoding sequences and Common Code Table entries
- Continue to encourage the inclusion of WIGOS instrument identifiers from C-8
- Further work to secure expert input on format standards for compatibility with AI/ML

Task Group on SES

- Prepare SES Best Practices
- Work on Space weather observation requirements
- Review current usage of space weather data for spacecraft operations
- Report on modelling of thermospheric density impacts

Task Group on LLDA

- Assess value of existing global data acquisition partnerships
- Estimate projected value of wider cooperations
 - Identify future satellite programme opportunities for coordination of LEO orbits

Task Group on DCS

- Further work on EDCP Standard implementation
- Continue to investigate Ionospheric Scintillation and its potential use with DCS transmissions
- Continue to maintain an RFI Register
- Start reporting against newly endorsed RFI Best Practices in the area of DCS

To be considered by CGMS:

- CGMS is invited to take note of the WGI Task Group activities and progress since last plenary, including:
 - Status of format standards for compatibility with AI and ML
 - Progress of Space Environment Sustainability (SES) Best Practices preparation and the request for participation of further CGMS agency experts
 - Progress on Enhanced Data Collection Platform (EDCP) standard implementation
 - Task Group Chair changes
- CMGS Agencies are invited to:
 - **Endorse** the RFI best practices in the area of Data Collection Services (DCS)
 - **Endorse** the proposed update to the Manual on the WIGOS