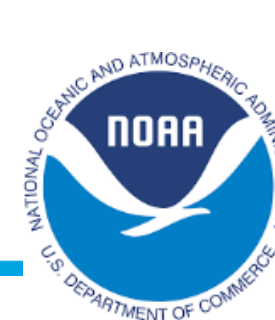


# NOAA Spectrum Management Report

Presented to CGMS-54 Working Group I session, agenda item 2.2

**Coordination Group for  
Meteorological Satellites**



## Executive summary of the WP

NOAA NESDIS is currently navigating a period of profound architectural transformation, transitioning from legacy polar systems to agile, disaggregated constellations such as NEON and GeoXO. This shift occurs within a hyper-congested radiometric environment in 2026, where the explosive growth of 5G mmWave, satellite Direct-to-Device (D2D) services, and NGSO mega-constellations—highlighted by SpaceX’s million-satellite proposal—presents a critical challenge to environmental intelligence. The interference landscape has evolved from discrete sources into a persistent “aggregate noise floor” problem that risks blinding sensitive passive radiometers globally. Empirical evidence, including the 2026 Denver ATMS study, confirms that this interference corrupts the atmospheric moisture profiles essential for local precipitation forecasts and public safety.

NOAA is emphasizing advanced RFI detection through studies like the DMiPS project and potential transition to cloud-based ground segments via the NESDIS Common Cloud Framework (NCCF). The strategic efforts at WRC-27 and within the CGMS are vital, as the accuracy of weather forecasts remains the primary priority for protecting millions of lives.

# The Core Challenge: Environmental Intelligence Under Threat

## Defining the Radiometric Imperative



### A New Era

Spectrum management has evolved from simple frequency assignments to a mission-critical exercise in “environmental defense”.



### Policy Conflict

The balance between commercial expansion and scientific integrity directly impacts the accuracy of weather forecasts.



### The Global Stakes

NOAA relies on international partnerships like CGMS and the ITU to ensure spectrum management isn't conducted in domestic isolation.

# NOAA's Architecture in Transition

## Moving from Legacy Systems to Agile Constellations



### Legacy Sunset

The POES constellation (NOAA-15, 18, 19) has officially been decommissioned following the 2025 NOAA-18 transmitter anomaly.



### The Shift

Operational burden has moved to JPSS and the Near Earth Orbit Network (NEON), utilizing smaller, proliferated satellites and commercial data-as-a-service.



### Future Vision









GeoXO (launching 2032) will introduce hyperspectral infrared sounding, requiring even wider bandwidths for data downlinks.



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# Programmatic Spectrum Priorities (2026–2045)

## Critical Focus Areas by Mission

| Program  | Lifecycle   | Primary Spectrum Focus                              |
|--|---|---|
|  GOES-R Series       | 2016 – 2035<br>   | Protecting L-band downlinks; managing X-band growth |
|  GeoXO               | 2032 – 2055<br>   | Coordinating hyperspectral infrared                 |
|  JPSS/NEON           | 2017 – 2040<br>   | 5G RFI in 24 GHz, S- and L-band transitions         |
|  Space Weather Next | 2025 – 2045<br> | Protecting coronagraph and plasma sensor links      |



# International Regulatory Strategy: WRC-27

## Defending Passive Sensing on the Global Stage



### AI 1.1 (Q/V-Band)

Protecting the 50.2–50.4 GHz EESS band from the aggregate emissions of thousands of airborne and maritime transmitters.



### AI 1.3 (NGSO Gateways)

Managing high-power FSS uplinks (51.4–52.4 GHz) that threaten critical sounding bands.



### AI 1.17 (Space Weather)

Formalizing protection for receive-only space weather sensors in bands like 73.0–74.6 MHz.



**CGMS**

# The “New Space” Expansion Crisis

## V/W-Band Congestion and Mega-Constellations



### The Players:

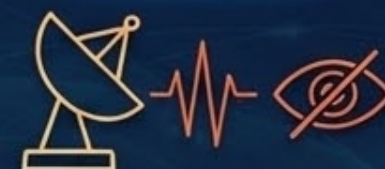
Companies like SpaceX, AST SpaceMobile, and Amazon’s Leo are migrating to the V-band (50 GHz) and W-band (80 GHz).



70x↑

### The Scale:

Proposals for “Orbital Data Centers” involving one million satellites represent a 70x increase in active assets.



### The Risk:

Cumulative RF leakage from such constellations could globally “blind” sensitive radiometers.

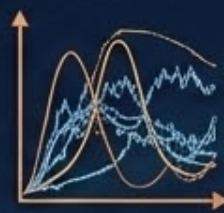
# Aggregate Interference Mechanics

## Beyond Discrete Source Problems



### The "Constant Hum":

Proliferated NGSO constellations create a persistent, elevated noise floor rather than discrete, transient bursts.



### The Estimation Gap:

Dynamic Monte Carlo simulations often underestimate this "hum" by missing the aggregate contribution of thousands of non-peak satellites.



### Side-Lobe Integration:

Unwanted signal pickup from thousands of devices leads to cumulative data corruption.



### Massive Scale:

SpaceX's 2026 filing for a one-million satellite constellation could increase active satellite numbers by 70x, potentially blinding radiometers worldwide.

# Regulatory Pitfalls: The Danger of “Light Licensing”

## Why Automated Databases Fail Passive Sensors



**Policy Flaw:** “Light Licensing” (automated, database-driven) is designed to prevent active-on-active jamming, not active-on-passive noise integration.



**The Tragedy of the RF Commons:** Unregulated, self-interested transmissions raise the noise floor, depleting the shared spectrum resource for everyone.



**Speed vs. Integrity:** Current frameworks prioritize deployment speed over the long-term integrity of the global sensing environment.

# Empirical Evidence: 5G RFI and Forecast Impact

## Quantifying the Risk to Public Safety



**The Denver Study (Jan 2026):** Statistical bias analysis showed clear indicators of RFI in ATMS channels from dense urban 5G deployments.



**Hurricane Sandy Scenario:** Re-running history without microwave data resulted in the forecast **missing New York/New Jersey** and **making landfall in Maine.**



**Economic Value:** Global forecasting provides a **\$160B/year benefit;** losing lead-time directly correlates to **loss of life.**

# Interagency Synergy: NOAA & USSF

## Scope and Objectives for RFI Mitigation



**Mission:** Transitioning interagency efforts from simply characterizing RFI to active implementation of cooperative resolutions.



### Technical Scope:

- **Mitigation Standards:** Advancing standards (e.g., IEEE P4006) to define protection criteria and acceptable interference levels.
- **System Hardening:** Defining joint requirements for the next generation of robust passive sensors resilient to spectral crowding.



**Unified Strategy:** Presenting a common set of requirements to industry and regulators to ensure coexistence rather than just observation..

# Technical Innovation: The DMiPS Project

## Building Resilience into the Next-Generation Fleet



**Mission:** “Detection, Characterizing, and Mitigation of Passive Sensor Data Corrupting Emissions”.



**Pathways:** Developing advanced digital backends and on-board “blinking” techniques to filter out insidious contamination before it reaches the ground.



**Collaborators:** NOAA is partnering with JPL and the private sector, BEST, to deliver these study results by September 2026.

# Modernizing the Ground Segment

## Cloud-Based Distribution and Commercial Partnerships



**NCCF Transition:** Moving data processing to the NESDIS Common Cloud Framework to decouple data generation from specific, vulnerable RF downlink locations.



**Commercial Data Program (CDP):** NOAA is expanding its “partnership-first” strategy, buying environmental data-as-a-service from commercial vendors for GNSS-RO and Ocean Surface Winds.



**Resilience:** These shifts reduce reliance on proprietary L-band systems and shift the burden of hardware maintenance and licensing.

# Future Strategy: The Five Pillars of SPICE

## A Comprehensive Approach to Spectrum Management



**1. Study:** Continuous evaluation of the economic and scientific value of spectrum allocations.



**2. Protection:** Active participation in ITU/FCC processes to defend **RS.2017 thresholds** (-166 dBW).



**3. Innovation:** Investing in DMiPS and next-generation sensor design.



**4. Coordination:** Working with NASA, ESA, and the commercial sector for shared coexistence solutions.



**5. Education:** Proactively communicating the value of environmental intelligence to policy makers.

# Conclusion

## Prioritizing Scientific Integrity for Global Safety



### Physics Cannot Be Negotiated:

If sensors are blinded by commercial noise, global safety infrastructure degrades.



### Final Priority:

In the balance of scientific integrity versus commercial expansion, the accuracy of the weather forecast—and the millions of lives it protects—must remain the primary priority.

## Key issues of relevance to CGMS:

- **Global Baseline Harmonization and RFI Mapping:** Weather is a global phenomenon; NOAA emphasizes that spectrum management cannot be achieved in domestic isolation.
- **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:** The shift from “discrete source” interference to an “aggregate noise floor” problem is a critical concern for global sensing. The scale of new proposals—such as SpaceX’s million-satellite filing—threatens to globally blind sensitive radiometers through cumulative RF leakage, requiring a unified international response to update aging regulatory limits (like EPFD).
- **Reference to HLPP 2.2**

## To be considered by CGMS:

- For information