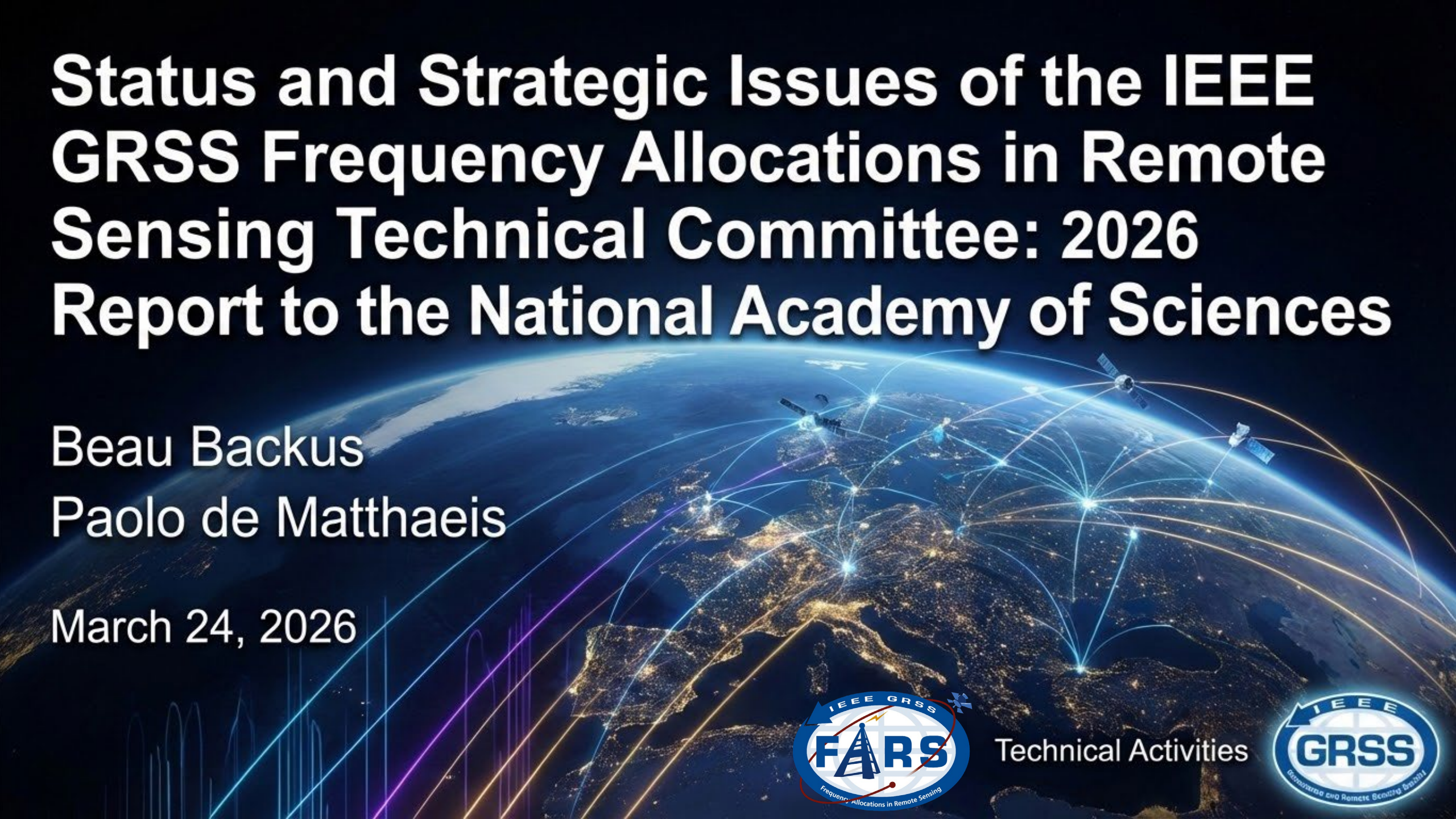
Status and Strategic Issues of the IEEE GRSS Frequency Allocations in Remote Sensing Technical Committee: 2026 Report to the National Academy of Sciences

Beau Backus
Paolo de Matthaeis

March 24, 2026



FARS TC Leadership

Past-Chair

Paolo de Matthaeis

NASA Goddard Space Flight Center

Chair

Beau Backus

Johns Hopkins
Applied Physics Lab

Chair-Elect

Raúl Díez García

Telespazio UK for ESA

Co-Chairs

Ming-Liang Tao

Xi'an Northwestern
Polytechnical University

TBD

- To be filled by
Sep 2026

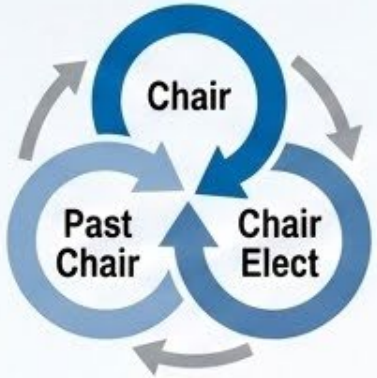
Secretary

Judit González Gutiérrez

ISDEFE - European Space
Agency

Organizational Governance

- The governance of the FARS TC has undergone a significant structural transformation in the past year, prompted by new rules implemented by the IEEE GRSS to ensure institutional continuity and professional management.
  - Starting in 2025, the Technical Committee transitioned to a leadership triumvirate model consisting of a Chair, a Past Chair, and a Chair Elect, with these roles rotating every two years.
  - This cycle ensures that institutional knowledge is preserved while allowing for fresh strategic direction.
- Administrative modernization has also been a priority.



Leadership Transformation

Starting in 2025, transitioned to a **leadership triumvirate**. Ensures institutional knowledge preservation and fresh strategic direction.

Administrative Modernization

Transitioned to official **IEEE-hosted Google features** for internal infrastructure. Facilitates better project support and professional oversight of digital assets like the RFI Signal Database.

FCC Regulatory Communications

The FARS TC has maintained an ongoing schedule of filings with the FCC

- Addressing the “New Space” expansion and the resulting threats to the electromagnetic environment required for passive sensing.

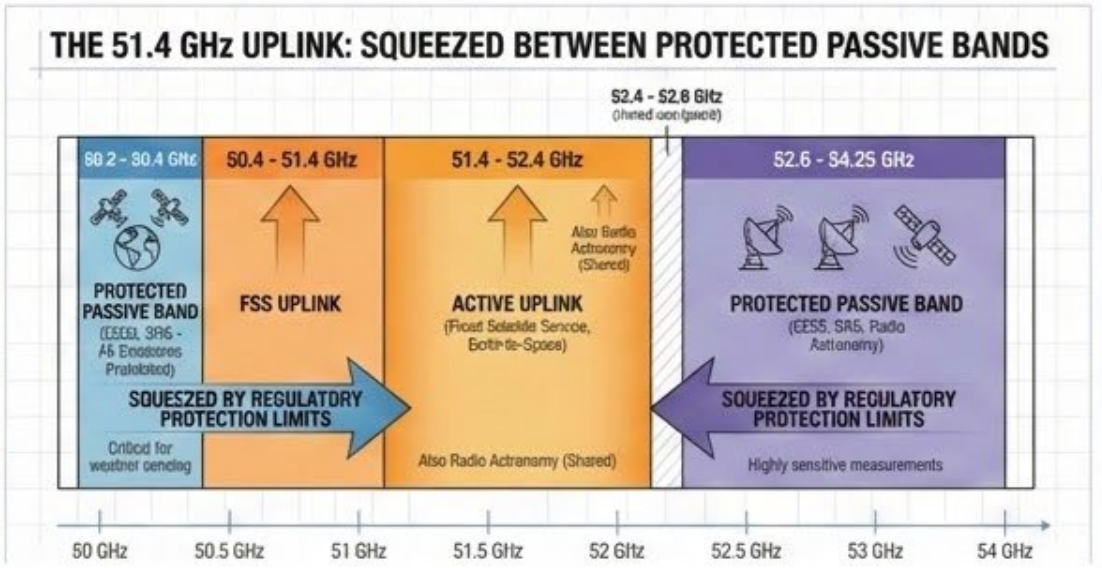
The core of the FARS TC rests on this principle

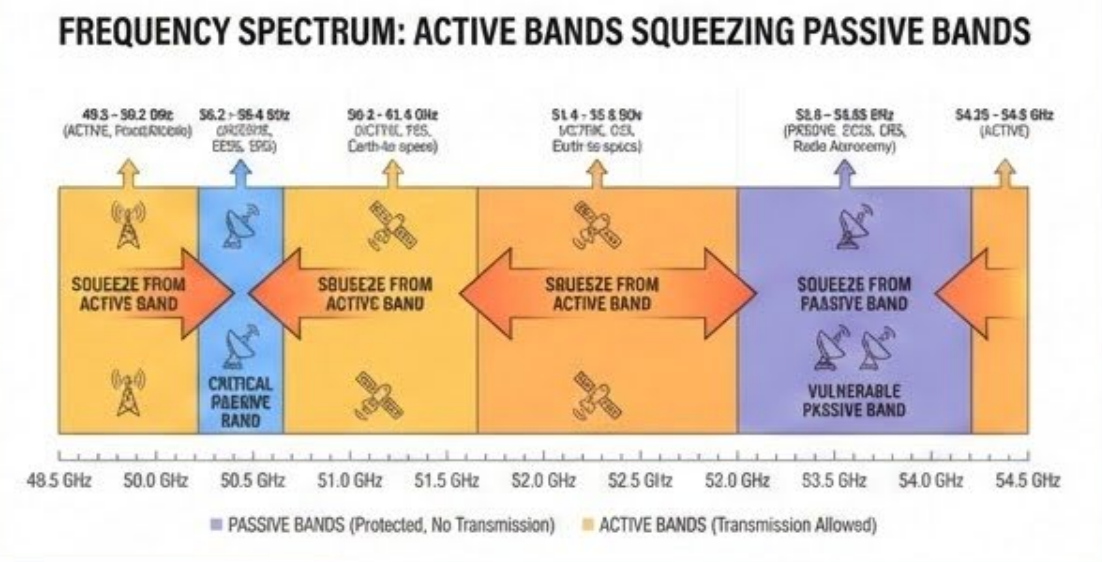
- That passive remote sensing is dictated by the **immutable laws of physics** and molecular resonance.
- ***Meaning that measurements cannot simply be “relocated” when interference occurs.***

Spectrum at the Edge: The Conflict Between Satellite Broadband and Weather Forecasting in the V/W-Bands

Analysis of Aggregate Interference and the Failure of Light Licensing

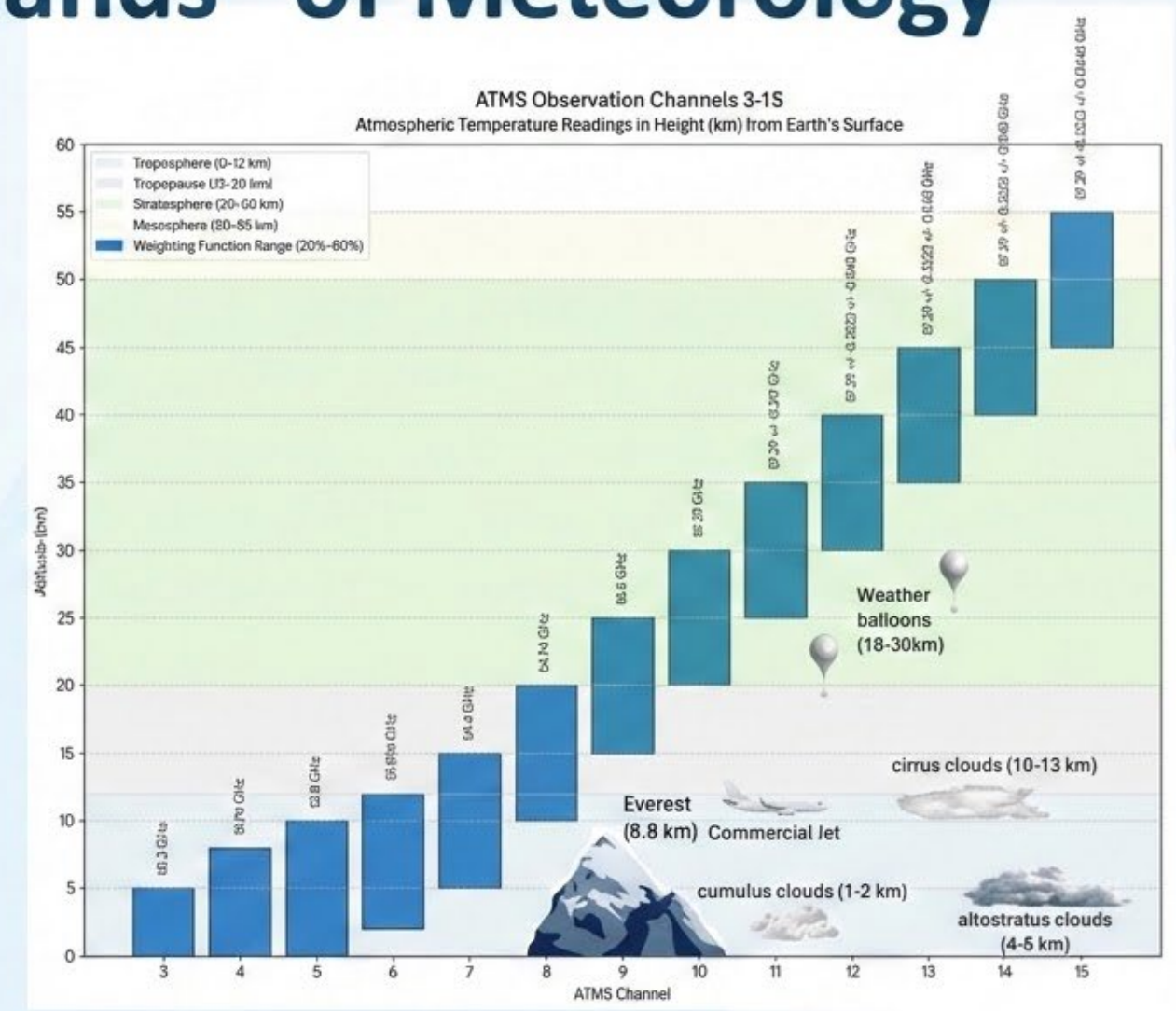
Two ways to view the spectrum needs of the rapidly and dramatically expanding Space Sector





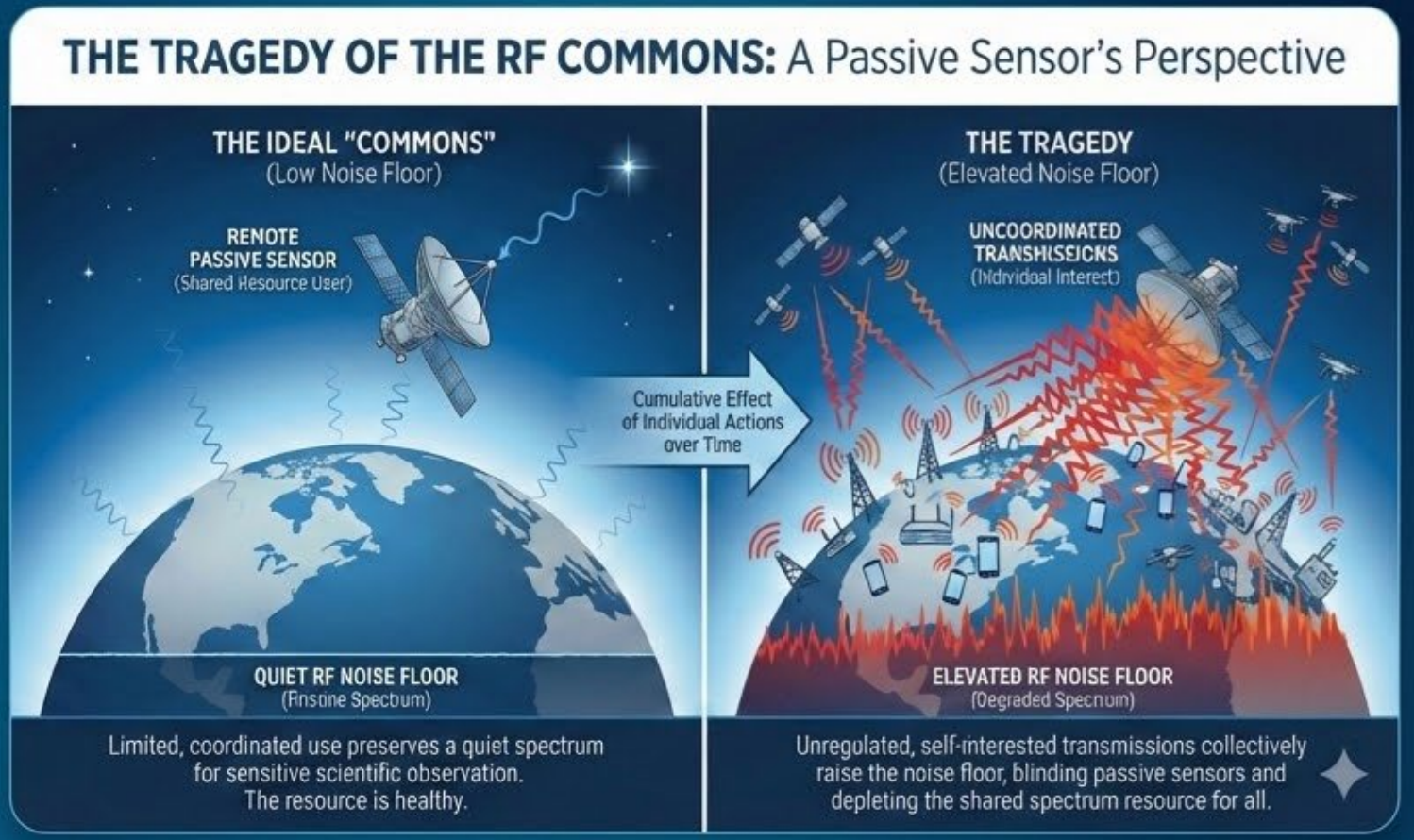
The “Golden Bands” of Meteorology

- **Physics:** The Oxygen (O_2) Absorption Complex (~50-60 GHz).
- **Concept:** “Slicing the Atmosphere” – How opacity varies with frequency to yield 3D temperature profiles.
- **Criticality:** Why 50 GHz is the only way to see inside hurricanes (cloud penetration).



The Regulatory Trap: “Light Licensing”

- **Definition:** Automated, database-driven licensing (Part 101 heritage).
- **The Flaw:** Designed for active-active protection (jamming). Fails for active-passive protection (noise floor integration).
- **Key Concept:** “The tragedy of the commons” applied to the noise floor.



Space Modernization and the Part 100 Transition

- **Transition to the Part 100 Framework** 
  - The FCC proposes moving from legacy Part 25 rules to a new "**Part 100**" framework to streamline satellite licensing.
  - The goal is to establish a "licensing assembly line" that significantly accelerates the deployment of new satellite constellations.
- **Technical Risks to Passive Sensing** 
  - FARS TC warns that expedited licensing may threaten the "thermal noise floor," which consists of **weak**, **naturally occurring** radiation.
  - Passive microwave instruments are highly sensitive; an error of just 1.0 Kelvin can **catastrophically degrade** the accuracy of Numerical Weather Prediction models.

Space Modernization and the Part 100 Transition

Proposed vs. Recommended Regulatory Timelines

- The FCC's plan for 7- to 15-day "fast-track" review cycles is viewed by FARS as mathematically and administratively insufficient for **complex interference modeling**.
- FARS recommends **extending public notice periods** to 30 days and requiring **mandatory technical reviews** prior to any grants for systems operating near EESS bands.

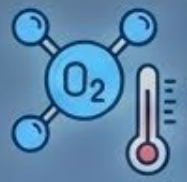
Coordination and Administrative Concerns

- Effective interference assessment requires **interagency coordination** between the FCC, NTIA, NOAA, and **NASA**, which cannot be realistically completed in compressed timeframes.
- The committee cited clerical errors in the proposal—such as "**Pile Town**" instead of "**Pie Town**"—as evidence that an **automated "assembly line" risks** overlooking critical site-specific protections.

Upper Microwave Flexible Use Service (UMFUS) and the 50 GHz Band

Opposition to "Light-Licensing" for FSS

The FARS TC argues against a simplified licensing approach for Fixed-Satellite Service (FSS) earth stations, citing a high risk of "insidious corruption" of scientific data.
Existing automated deconfliction databases are insufficient because they focus on co-channel interference, whereas passive sensors are primarily future primarily threatened by out-of-band emissions (OOBE).



Criticality of the 50–60 GHz Oxygen Band

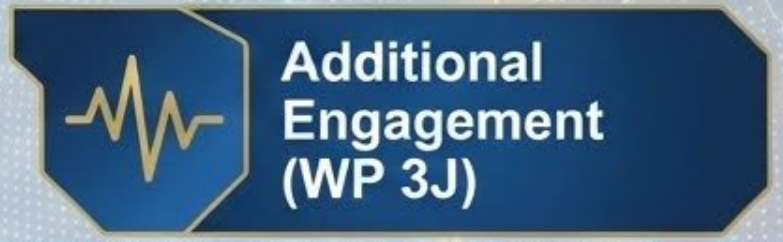
This specific frequency range is described as a "stable, intrinsic calibration reference" for all other passive satellite channels.
Most importantly, this band provides the unique ability to "see inside" hurricanes by penetrating heavy cloud cover, a capability essential for meteorological safety.

Threats to Key Meteorological Applications

Key bands for Water Vapor (24 GHz) and Atmospheric Temperature (50-60 GHz) are currently vulnerable due to their proximity to 5G and FSS window bands.
The committee demands mandatory technical studies to ensure the long-term integrity of sensors like NOAA's Advanced Technology Microwave Sounder (ATMS) and the upcoming SMBA.

International Spectrum Management and ITU-R Working Groups

- The FARS TC maintains a robust presence at the International Telecommunication Union Radiocommunication Sector (ITU-R),
- Particularly within Working Party 7C (WP 7C), which covers remote sensing systems.
  - Participation in these meetings is vital because it allows the scientific community to advocate for spectrum use
  - Limiting the pressure to compromise with commercial interests.
- FARS TC also attends Working Party 3J (WP 3J), which covers propagation fundamentals



Technical Reports and the 18 GHz Band

- At the September 2025 ITU-R WP 7C meeting in Geneva, the FARS TC successfully reached a consensus on the “Preliminary Draft New Report on RFI at 18 GHz”
  - This report documents the increasing levels of interference affecting the 18.6–18.8 GHz band, which is critical for measuring ocean surface emissivity and atmospheric water vapor.
  - The committee’s work with the ITU is also coordinated through the IEEE Standards Association (SA) to ensure that technical submissions carry the weight of an international professional organization.

Preparations for WRC-27

Agenda Item 1.19: SST Monitoring Remediation

- Strongly supports a primary allocation to the EESS (passive) in the 4,200–4,400 MHz and 8,400–8,500 MHz bands.
- This is a strategic remediation effort following the degradation of the traditional 6.9 GHz band, which was identified for IMT at WRC-23.

Agenda Item 1.7: Mid-Band Spectrum Protection

- Considers the identification of the 7.125–8.4 GHz range for IMT.
- FARS TC strongly supports “View B” (No Change) for the 7,400–8,400 MHz range.
- Primary band for the downlink of raw instrument data from meteorological satellites.
- Reallocating this spectrum would create an international regulatory mismatch and undermine billions of dollars in federal and commercial investment in satellite sensing.

Agenda Item 1.3: Oxygen Absorption Band Protection

- FARS TC supports modifying Resolution 750 to establish mandatory unwanted emission limits for non-GSO FSS gateways in the 51.4–52.4 GHz band.
- Goal is to protect the adjacent 52.6–54.25 GHz passive band, which is the most important data source for measuring the vertical temperature profile of the atmosphere.

Space Frequency Coordination Group (SFCG) Activities

FARS TC Participation & Role

- Actively participates in the SFCG
- Provides an informal forum for space agencies to coordinate spectrum use.
- IEEE GRSS holds observer status
- Allows FARS TC to bring scientific and engineering perspectives to the table.

44th SFCG (June 2025): X-band Alarm

150+

X-band EESS filings in 2023 alone

More than 2021 and 2022 combined.

Focused on alarming increase in EESS networks containing X-band allocations.

Upcoming 45th SFCG (June 2026): TASA & Beyond 5G

- Hosted by Taiwan Space Agency (TASA) in Taipei.
- Focus on continued update of WRC-27 objectives.
- TASA plans to launch six low-Earth orbit satellites starting in 2026 as part of ‘Beyond 5G’ (B5G) project.

SFCG Members and Observers

Region	Member Agency
Global/Multilateral	**ESA** (European Space Agency), **EUMETSAT** (European Organisation for the Exploitation of Meteorological Satellites)
Americas	**NASA** (USA), **NOAA** (USA), **CSA** (Canada), **CONAE** (Argentina), **INPE** (Brazil)
Europe	**CNES** (France), **DLR** (Germany), **ASI** (Italy), **UKSA** (United Kingdom), **INTA** (Spain), **NSO** (Netherlands), SSAU (Ukraine), **ALR** (Austria), **SSC** (Sweden)
Asia-Pacific	**JAXA** (Japan), **CNSA** (China), **CMA** (China), **NSSC** (China), **ISRO** (India), **KARI** (South Korea), **TASA** (Taiwan), **CSIRO** (Australia), **ASA** (Australia), **MYSA** (Malaysia)
Africa & Middle East	**MBRSC** (UAE), **SANSA** (South Africa), **NASRDA** (Nigeria), **EGSA** (Egypt)
Eurasia	**ROSCOSMOS** (Russia)
Non-Voting Members:	
ITU (International Telecommunication Union)	
WMO (World Meteorological Organization)	
IUCAF (Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science)	
IEEE GRSS (Geoscience and Remote Sensing Society)	
IOAG (Interagency Operations Advisory Group)	

Technical Standards: The P4006 Project

- One of the committee's most significant technical initiatives is the development of the IEEE P4006 standard,
  - Titled "Standard for Remote Sensing Frequency Band Radio Frequency Interference (RFI) Impact Assessment"
  - As of March 2026, the standard is officially in the review phase.
- The P4006 standard defines the quantitative assessment of man-made RFI in each frequency band.
  - It is designed to be used in RFI impact evaluations and the monitoring of frequency bands allocated to space-based remote sensing.
  - Historically, the scientific community lacked a standardized metric for "quality," making it difficult to demonstrate the severity of data corruption to regulators.
- P4006 provides a rigorous mathematical framework for characterizing RFI impact on the radiometric precision of sensors.

RFI Signal Database and Contest

GRSS TC continues to maintain the “GRSS FARS Database of RFI Observations,”

- Centralized repository of interference events observed in Earth remote sensing data.
- Provides empirical evidence of the real-world impact of unauthorized or non-compliant emissions on remote sensing systems

FARS TC organized an RFI Signal Database Contest aimed at collecting real-world and simulated RFI signals in I/Q format.

- The winners had been selected, and an announcement was planned for the near future.
- These winning contributions will help build a comprehensive database to support the development of new detection and mitigation techniques.

Conferences and Workshops

URSI AP-RASC 2025 (Sydney)

Co-organized three sessions on RFI and Spectrum Management.

Delivered an overview lecture on radio-wave propagation.

IGARSS 2026 (Washington, D.C.)

Organized “Community-Contributed Theme”: Radio Frequency Interference and Spectrum Management Issues in Microwave Remote Sensing.

Significant paper submissions exploring this theme.

XXXVIth URSI General Assembly (Aug 2026)

FARS TC will be attending this upcoming symposium.

Publications and Knowledge Dissemination

- FARS TC utilizes the “IEEE Geoscience and Remote Sensing Magazine” (GRSM) as a vehicle for keeping the society membership informed.
  - A FARS TC Column was published in the December 2025 issue, detailing the “silent crisis” of spectrum coexistence.
  - These columns are designed to provide both technical depth and policy context, making them suitable for the diverse membership of the GRSS.
- FARS TC continues to publish its own newsletter at 4-month intervals.
- In January 2026, FARS TC delivered a presentation titled “Silent Crisis: Spectrum Coexistence” at the American Meteorological Society (AMS) 106th Annual Meeting,
  - Continuing to expand FARS TC’s presence in the meteorological community.

Technical Synthesis and the Future of Scientific Spectrum

FUNDAMENTAL DIFFERENCE

Remote sensing spectrum management is distinct from telecommunications. Passive sensing is tied to immutable molecular absorption lines (physics), while active services can often adapt.

THE AGGREGATE CHALLENGE

Moving from ‘single-entry’ to ‘aggregate’ interference protection.

Passive sensors integrate energy from millions of devices globally.

FARS TC advocates for mandatory aggregate interference studies for new active services (full-constellation scenarios).

BRIDGING PHYSICS & POLICY

FARS TC is committed to providing the technical expertise needed to bridge complex physics with regulatory policies, ensuring a sustainable future for Earth observation.