



Frequency Allocations in Remote Sensing Technical Committee

Bill Blackwell, MIT Lincoln Laboratory, Outgoing Chair
Ian Adams, Naval Research Laboratory, Outgoing Vice-Chair

IGARSS Evening Meeting

Melbourne, July 22, 2013





Agenda

- Overview of FARS technical committee
- Leadership transition
- FARS Technical Achievement Award to SMOS group
- CORF update (Jasmeet Judge)
- TGRS Special Issue update
- Recent/upcoming meetings

FARS website: <http://www.grss-ieee.org/community/technical-committees/frequency-allocations-in-remote-sensing/>





Frequency Allocation for Remote Sensing (FARS) Technical Committee

- **Objectives**

- ⇒ *Interface between GRSS and the frequency regulatory process*
 - Help to educate membership on frequency regulatory process
 - Gather and distribute information on current frequency management issues to membership
 - Organize GRSS efforts to impact regulatory process as appropriate
- ⇒ *Coordinate and advocate GRSS technical input to regulatory organizations and working parties*
 - Standardization of methods applied to analyses
 - ITU-R RS 577, 1166, 1028, 1029
 - Respond to requests for sensor and user information
 - Investigation of RF interference and mitigation





New Chairs

- **Sid Misra**
 - Jet Propulsion Laboratory

- **Paolo de Matthaeis**
 - NASA Goddard Space Flight Center



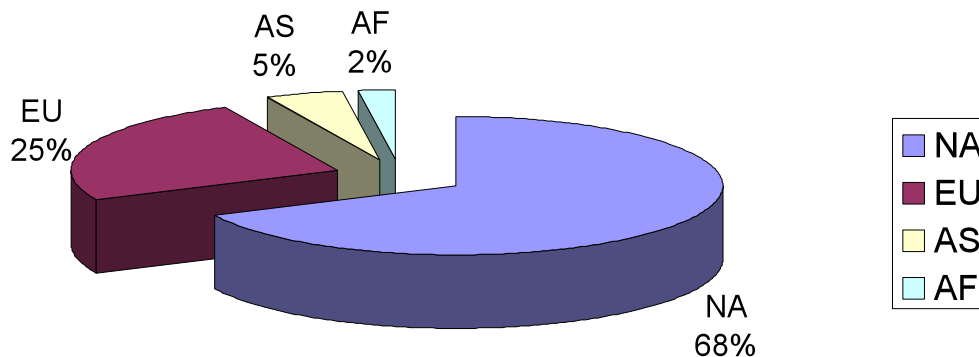


Membership

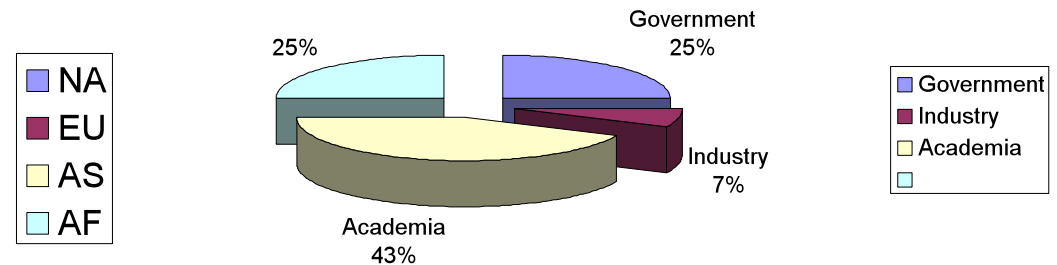
**New members are welcome, you are encouraged to recruit/spread the word!
Interested parties (must be GRSS members) contact WJB@LL.MIT.EDU**

- **June 2013**
 - **85 Members; 10 Countries**

FARS Membership by Continent



FARS Membership by Organization



Other: Non Profit, FFRDC (LL, JPL, Aero)





Various Updates

- **Recent and future meetings**

- Committee on Radio Frequencies (CORF), May 2013
- Space Frequency Control Group (SFCG-31), June 2013
- World Radiocommunication Conference (WRC-15), early 2015

- **Recent initiatives**

- Promotion of FARS causes
- Cross-fertilization with other groups/communities
- Recognition of impactful FARS work

- **Recent events**

- FARS technical session at IGARSS
- FARS article in GRSS Magazine



FARS featured in first GRSS Magazine issue

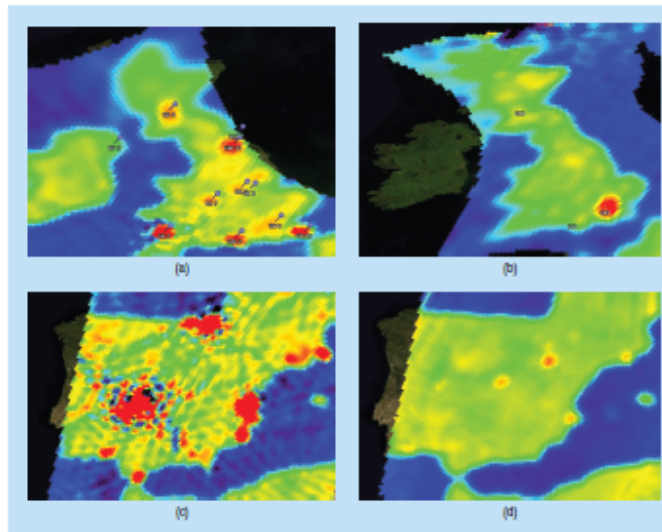


FIGURE 1. SMOS brightness temperatures observed over the U.K. [(a) and (b)] and Spain [(c) and (d)] early in the mission [(a) and (c)] and in April 2011 [(b) and (d)] after efforts to characterize and mitigate radio-frequency interference [1].

flexibility in handling RFI. Beyond the identification and mitigation of RFI, monitoring the radio-frequency environment informs scientific users of the spectrum of the expanding nature of RFI and shapes future policy. Understanding how contamination and mitigation affect measurements furthers data quality.

RFI IDENTIFICATION, MITIGATION, MONITORING, AND IMPACT ASSESSMENTS

The desire to measure an expanding list of features of the Earth and the universe results in an increasing need for high-precision measurements. Consequentially, the ability to discern radio-frequency contamination, particularly at low levels, is key to compiling long-term, consistent data records. Those who design sensors and data-processing software must work to ensure the quality of observations, while users must understand how RFI and its mitigation impact data. As society expands its use of the electromagnetic spectrum, a limited resource, the potential for interference in remote scientific observations increases.

Outside of spectrum management, which focuses on policy-level decisions informed by scientific and societal need, the subject of radio-frequency interference may be divided into four distinct, but interconnected, topics. Identification deals with the hardware and/or software methods of determining measurements that may be corrupted with RFI. While many instances of measurement contamination may result in obvious outliers in the data, low-level RFI is much more insidious. The inability to discern small amounts of contamination can skew environmental and climate data records. Mitigation allows for the use of contaminated measurements after the removal of RFI, and is an important and evolving aspect of operating in a congested radio-frequency environment. Informing those who work with remote sensing instruments and data, both from the engineering and usage areas, requires careful monitoring of RFI. In many instances monitoring RFI is reactive, as there may be no knowledge of an interferer until it begins to transmit. In some cases, monitoring the environment results in the removal of unannounced transmitters (see Figure 1, where SMOS



Committee on Radio Frequencies

- **CORF represents the interests of U.S. scientists who use radio frequencies for research**
 - Radio astronomers and remote sensing researchers
- **CORF deals with radio-frequency requirements and interference protection**
 - Primarily through filing comments under the aegis of the National Academy of Sciences in public proceedings of the Federal Communications Commission
- **CORF acts as a channel for representing the interests of U.S. scientists:**
 - Scientific Committee on Frequency Allocations For Radio Astronomy and Space Science (IUCAF) of the International Council for Science
 - Working groups of the Radiocommunication Sector of the International Telecommunication Union (ITU).





What is the Space Frequency Coordination Group?

The SFCG is an informal group comprised of the major civil space agencies and related national and international scientific organizations

Its main objectives are:

- To provide working level coordination of international RF spectrum usage among users of the science services
- To adopt agreements that optimise the use of the allocated bands
- To agree common policies and identify long-term targets related to potential changes to the international regulations (ITU-R, WRC, Regional Groups)





World Radiocommunication Conference

- **The World Radiocommunication Conference (WRC) is a gathering of official delegations from over 140 nations and organized by the International Telecommunication Union (ITU)**
- **National government officials come together every few years to negotiate proposals to changes in international spectrum regulations**
- **If approved, these changes would then be in-force internationally through the auspices of the ITU**





WRC-15 Proposals of Interest

- **Mobile Broadband spectrum requirements**
 - Study expected to concentrate below 6 GHz
 - » Includes GNSS allocations
- **Mobile-Satellite Service allocations**
 - 22–26 GHz
- **Additional proposals**
 - Eventual look at micro/nano/cubesats (WRC-18)
 - FSS and MMSS proposals
 - » Below 20 GHz





First FARS Technical Achievement Award

“Certificate of Recognition to **Elena Daganzo-Eusebio, Roger Oliva, Philippe Richaume, and Sara Nieto** of the SMOS mission for their successful efforts in working with national authorities to remove radio-frequency interference sources from the protected 1400-1427 MHz EESS band.”

To be presented at IGARSS banquet





CALL FOR PAPERS IEEE Transactions on Geoscience and Remote Sensing

Special Issue on “Radio Frequency Interference: Identification, Mitigation, and Impact Assessment”

Due to sharing of allocated bands, limitations in hardware, and transmissions outside of allocations, remote sensing observations experience radio-frequency interference (RFI). Corrupted measurements may be difficult to identify, especially at low levels of interference. As the need for high-precision measurements expands—principally for ocean and terrestrial sensing, but also for radio astronomy—investigators have developed new methods for sharing spectrum and for identifying and mitigating RFI. For heritage hardware, post-processing software methods have proven invaluable for identifying radio-frequency interference, with some measured success in mitigation. For future sensors, digital receivers offer flexibility in handling RFI. Beyond the identification and mitigation of RFI, monitoring the radio-frequency environment informs scientific users of the spectrum of the expanding nature of RFI and shapes future policy. Understanding how contamination and mitigation affect measurements furthers data quality.

To catalog the important work being performed to identify, monitor, and mitigate RFI, and to assess the impact of interference, the Frequency Allocations in Remote Sensing technical committee is coordinating a special issue of TGRS covering this subject. Submissions will cover a combination of software and hardware solutions to the RFI problem. Moreover, the special issue will detail the challenges in monitoring radio-frequency interference, and attempt to quantify the impact that interference has on measurements. By collecting a range of papers concerning RFI, the issue will serve as a central resource to sensor designers, algorithm developers, and data users.

List of topics

Contributions for this special issue are welcome from the research community. This special journal issue will focus on the utilization of various methods to identify, mitigate, and monitor RFI. A secondary objective is to inform data users of the impact of RFI on observations to promote awareness and consideration of this important issue. The guest editors invite submissions that explore topics including, but not limited to, RFI detection and mitigation algorithms, comparisons of recent RFI detection methods, and RFI analyses and results from recent and forthcoming missions/instruments including SMAP, SMOS, Aquarius, AMSR-E, and [WindSat](#).

Paper submission deadline: 30 August 2012





Future Initiatives

- **NASA request for “RFI Primer for PI’s” (terms of reference, players, etc.)**
- **Lots of good work at L band, but what about other bands?**
- **Build relationship with GEOSS Task AR-06-11**

- **Others?**