Another two years of IUCAF

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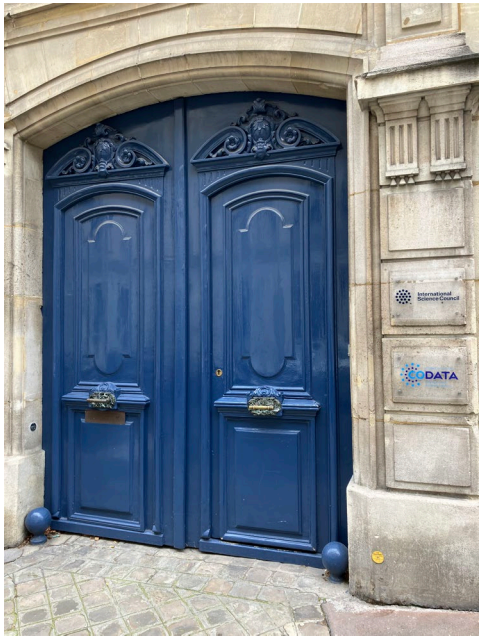
Topics from IUCAF http://www.iucaf.org/

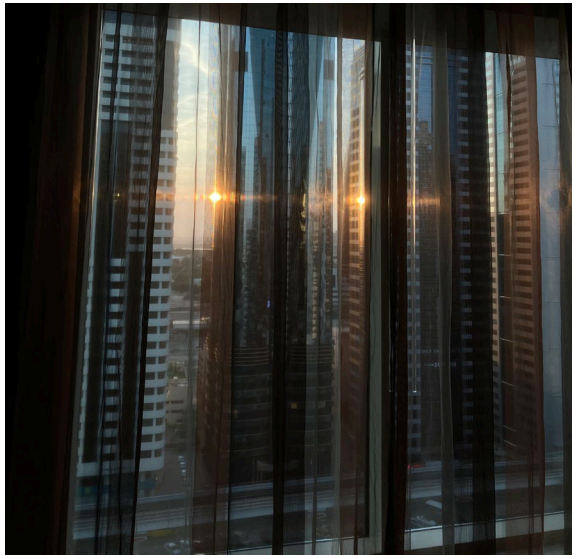
- IUCAF
  - For info on IUCAF see my 2022 presentation
  - Current state of affairs at IUCAF and elsewhere
- WRC-23 outcomes
  - www.cv.nrao.edu/~hliszt/RFI/IUCAF-WRC23-Post-Mortem.docx
- WRC-27 Agenda Items and ITU-R matters
  - www.cv.nrao.edu/~hliszt/RFI/IUCAF-WRC27-Pre-Mortem.docx
- Spectrum for lunar radio astronomy
- Spectrum management school in 2025

IUCAF http://www.iucaf.org/

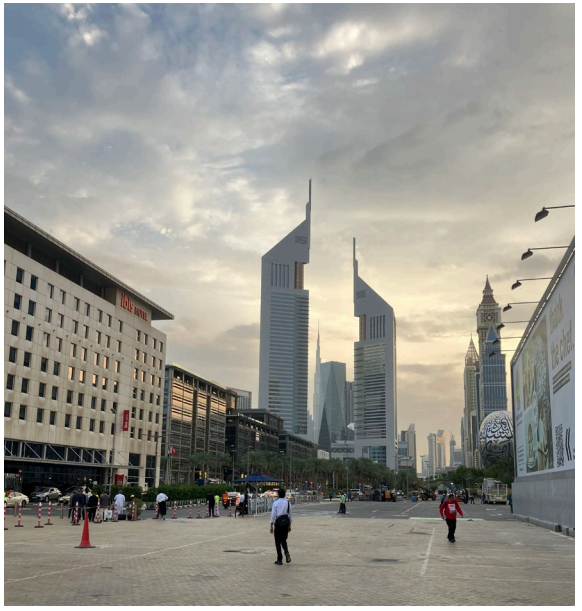


- IUCAF: an affiliated body of the ISC
  - Three recent retirements and one death
- CRAF: much invigorated since 2019
  - France, Germany especially active at ITU-R
- SKAO: At least 2 full time spectrum managers
- NAOJ: Created full time position ~3 years ago
- NRAO: Working on practical matters, spectrum monitoring, RFI measurement with SpaceX, real-time transmission observing information, NRQZ

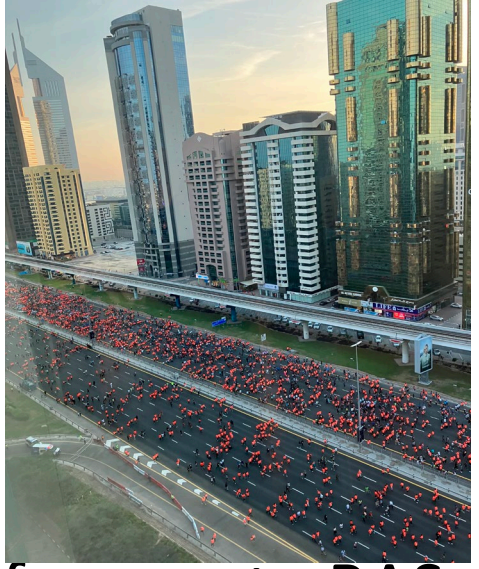
WRC-23 Outcomes - I



- AI 1.2 IMT 10-10.5 GHz in Region 2
  - Failed in US, Canada and Argentina
    - X-band SAR would be wiped out by IMT
  - US gratuitously removed RAS protection at last minute
- AI 1.4 HIBS succeeded with some RAS protections
  - Uplink if 2nd harmonic in RAS bands
  - Hard limit on pfd into 2 690 – 2 700
  - HIBS could appear in New Mexico
    - Sceye testing HAPS now



WRC-23 Outcomes - II



- AI 1.10 non-safety AMS 15, 22 GHz
  - AMS(OR)S got secondary status Region 1
  - Footnote attached that might allow interference to RAS
  - Similar to the 70/80/90 GHz airborne network in US
- AI 1.13 primary upgrade of space data relay system at 14.8-15.35 GHz
  - Blocked in US to protect future IMT
    - NASA was the main proponent !!
  - Badly written regulatory text
    - 3 separate 2% data loss allowances

WRC-23 Outcomes - III

- Rec. ITU-R RA.1513 failing badly
  - Recommends no more than 5% data loss from all systems and no more than 2% from one network in any band allocated to RAS on a primary basis
    - Very unfortunately it includes for the 5.340 bands
  - A dumping ground general solution lacking force
    - 15.35 – 15.4 GHz now subject to 5 - 6 uncoordinated 2% data loss allowances to RLS, AMS, SRS
      - AI 1.7 (WRC-27) will probably identify 14.8 – 15.35 GHz for IMT
      - WP 5B will recommend UAS Detect & Avoid radars at 15.4-15.7 GHz

WRC (27) - in Rwanda?

- Agenda is heavy, complex and topsy-turvy
  - Satellite services FSS WP4A (6 AI) & MSS 4C (4) taxed
  - Radar/aero/FS/IMT WP5B (2), 5C (1), WP 5D (1) relaxed
  - Science services 7B (1), 7C (2.5), 7D (1.5) w/ a full plate

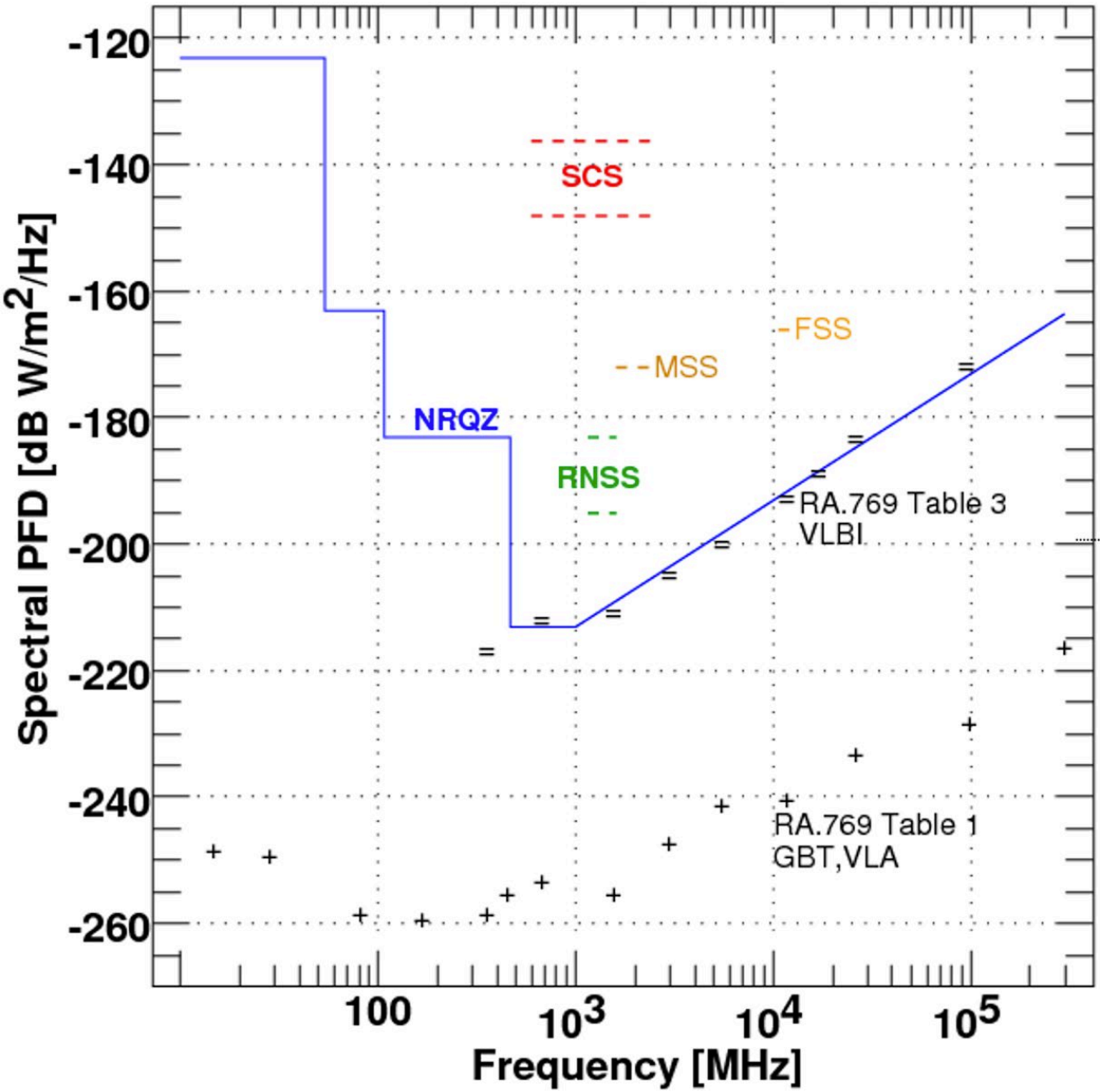
WP 4A (FSS)

- AI **1.1** 47.2-51.4 GHz ESIM (E-s)
  - *5.555 Additional allocation: the band 48.94-49.04 GHz is also allocated to the radio astronomy service on a primary basis. 5.340 from airborne platforms*
    - ALMA registered but can't do interferometry above 50.0 GHz
- AI **1.3** 51.4-52.4 GHz nGSO gateway (E-s)
- AI **1.6** Equitable access to LEO???
  - to consider technical and regulatory measures for FSS satellite networks/systems in the frequency bands 37.5-42.5 GHz (s-E), 42.5-43.5 GHz (E-s), 47.2-50.2 GHz (E-s) & 50.4-51.4 GHz (E-s) for equitable access to these bands
  - WP 4A is asking other WP how to proceed!

WP4C AI **1.12** & **1.13** Direct-cell, **1.14** more MSS
Little room at ITU-R for RAS to contribute

FCC Range	FCC SCS	AI 1.12, AI 1.14	AI 1.13
600 – 700	614 – 652, 663 – 700 not ITU-R		
			694/698 – 960
700 – 800	700 – 769, 775 – 799		
800 – 900	805 – 806, 824 – 849, 869 – 894		
		1 427 – 1 432 (s-E)	***1 427 – 1 518***
		1 645.5 – 1 646.5 (both)	
			1 805 – 2 025
1 850 – 2 000	1850 – 1920, 1930 – 2000		
		1 880 – 1 920 (both)	
		2 010 – 2 025 (both)	
		2 010-2 025 (E-s) 2 160-2 170 , 2 120-2 160 (s-E)	2 110 – 2 200
			2 300 – 2 400
			2 500 – 2 690

Direct-Cell pfd compared



WP 5B (aero, radar), 5C (fixed), 5D (IMT)

- 5B AI **1.8** radiolocation for mm/sub-mm imaging
  - New allocations 231 – 275 GHz
  - New ID 275 – 700 GHz
- 5C AI **1.10** pfd and eirp limits on FSS, MSS and BSS in Appendix 21 to protect FS and MS
- 5D AI **1.7** IMT 4.4 – 4.8, 7.125 – 8.4, 14.8 – 15.35 GHz
  - Reply liaison statements to 5D causing grief in 7B, C, D
    - 7D didn't succeed to reply, 7B has a correspondence group
    - IUCAF tried to inform 5D about pileup of 2% data loss exceptions at 15.35 – 15.4 GHz but was blocked

WP 7B, 7C

- 7B AI **1.15** new SRS (s-s) allocations for lunar coms
  - Industry version of this AI used 7B to create a parallel spectrum management regime outside ITU-R
  - Care needed to protect RAS in the SZM (see below)
- 7C AI **1.17** passive space weather apps
  - In RAS bands but space weather uses active sensors and wasn't a good fit in RAS
- 7C AI **1.18** Res.740 above 76 GHz (AI with 7D)
  - Sets hard limits to protect EESS(passive) from active services in adjacent bands

WP 7D

- AI **1.16,** *the* RAS item
  - Singles out RQZ around ALMA, SKAO-SA
  - Protection from satellite constellations
  - Getting unprecedented pushback from WP 4A, 4C

- AI **1.18** Res.739 above 76 GHz

Radio astronomy frequency band	Active satellite service frequency band	Active satellite service (space-to-Earth)
76-81 GHz	71-76 GHz	Fixed-satellite service (FSS), mobile-satellite service (MSS), broadcasting-satellite service (BSS)
130-134 GHz	123-130 GHz	FSS, MSS, radionavigation-satellite service (RNSS)
164-167 GHz	167-174.5 GHz	FSS
226-231.5 GHz	232-235 GHz	FSS

Off the WRC-27 books at ITU-R

- WP 5A revising Rec. M.2057 with ~130 - 148.5 GHz car radar (front, side and rear) following ECC work
- WP 5B Detect & Avoid aero (DAA) radar for UAV
  - Recommending 15.4-15.7 GHz
    - Doesn't need a new allocation, might not get studied
- WP 1A WPT
  - Revision of Rep. SM 2392 (has Solar Power Satellites)
  - Revision of Rep. SM.2505 to include 24 GHz WPT
    - Opposition was a hobby-horse of Liese's
    - IUCAF derailed it earlier but it's creeping back in

Lunar Coms and the SZM

- AI 1.15 at WP 7B is the tip of an iceberg of activity
  - Frequency use discussed in SFCG, CCSDS … ITU-R
  - Protecting RAS in the SZM requires that
    - Frequency use is limited to bands allocated to radio services that are mentioned for such purposes in the RR
    - Frequency use is minimal, compact and chosen to do the least harm, recognizing that uses like 40-50 MHz surface penetrating radar will be operated in bands wanted by RAS
    - Protection criteria appropriate to observing in the lunar environment are developed

AI 1.15 is the tip of an iceberg of systems engineering

Lunar Interoperability Forum

Overview

The Consultative Committee for Space Data Systems (CCSDS) & Interagency Operations Advisory Group (IOAG) hosted a **Lunar Interoperability Forum on May 7th, 2024 in Washington, DC.** with the aim of accelerating the development of all needed international space communication and navigation standards required to ensure multi-national and multi-system interoperability around the Moon. This forum brought implementing organizations and associated industries together with the developers of relevant standards to identify missing standards and methods for the participants to be collectively involved in their development. Applying wider expertise will lead to interoperable prototype and, ultimately, flight systems for the benefit of all space agencies and industrial partners.

For additional information, send inquiries to **Lunar-Interoperability-Forum@mailman.ccsds.org**.

6th SM School in 2025?

- Now 4 years since Stellenbosch
- Tentative discussions with DSA-2000 for Pasadena in 2025

Thanks for inviting me and let’s just hope we’re all in one piece next year