Welcome from IUCAF at the ripe old age of 60

Harvey Liszt , Chair

SM2020 Stellenbosch March 2-6 2020

Thanks for coming

- ~50 registered attendees from ~17 countries
- The fifth and by far largest in a series stretching back ~20 years
  - Green Bank, USA 2002
  - San Pietro Terme, Italy 2005
  - Mitaka, Japan 2010
  - Santiago, Chile 2014
  - Stellenbosch, SA 2020
  - Asia-Pacific 2025?

Why are we here? Why do this again again again … ?

- Radio astronomy doesn't happen without spectrum access
- It doesn't suffice to sit back, watch other users decide our access

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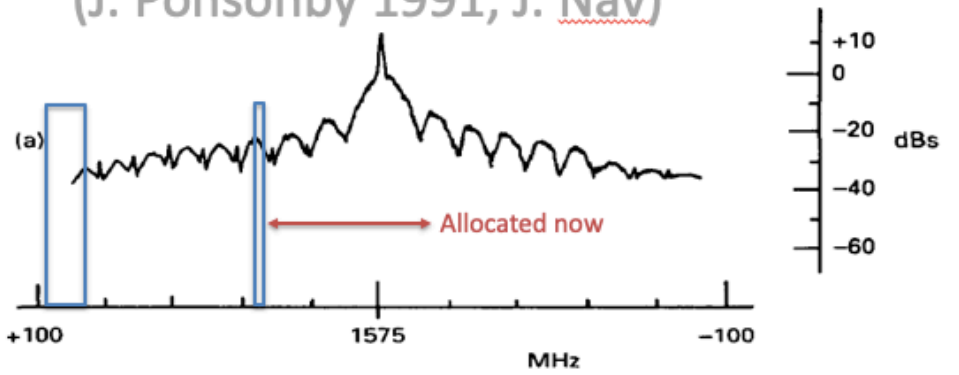
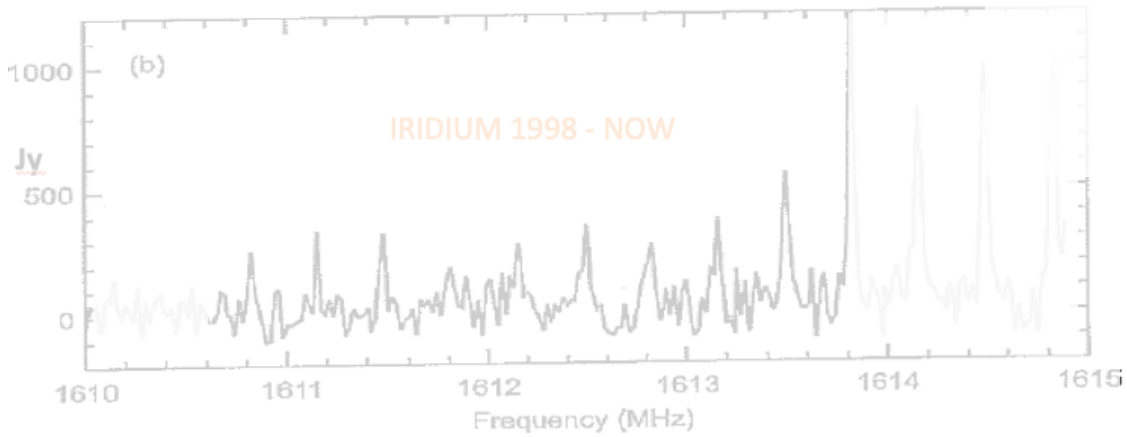
GPS Block I

(J. Ponsonby 1991, J. Nav)



RNSS-GLONASS



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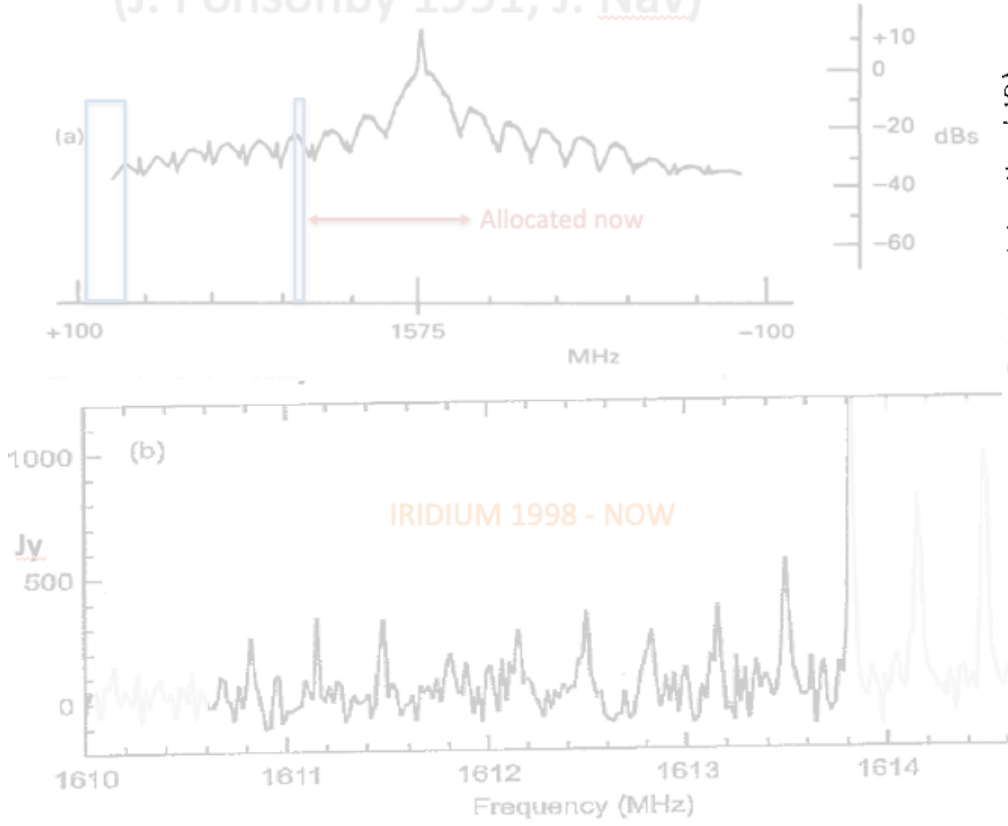
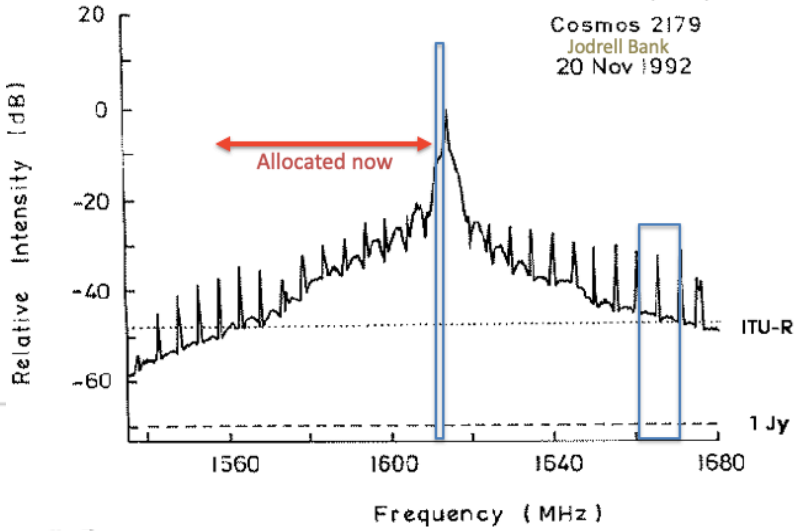


RNSS-GLONASS

- Unlike GPS, each GLONASS satellite uses a different frequency channel



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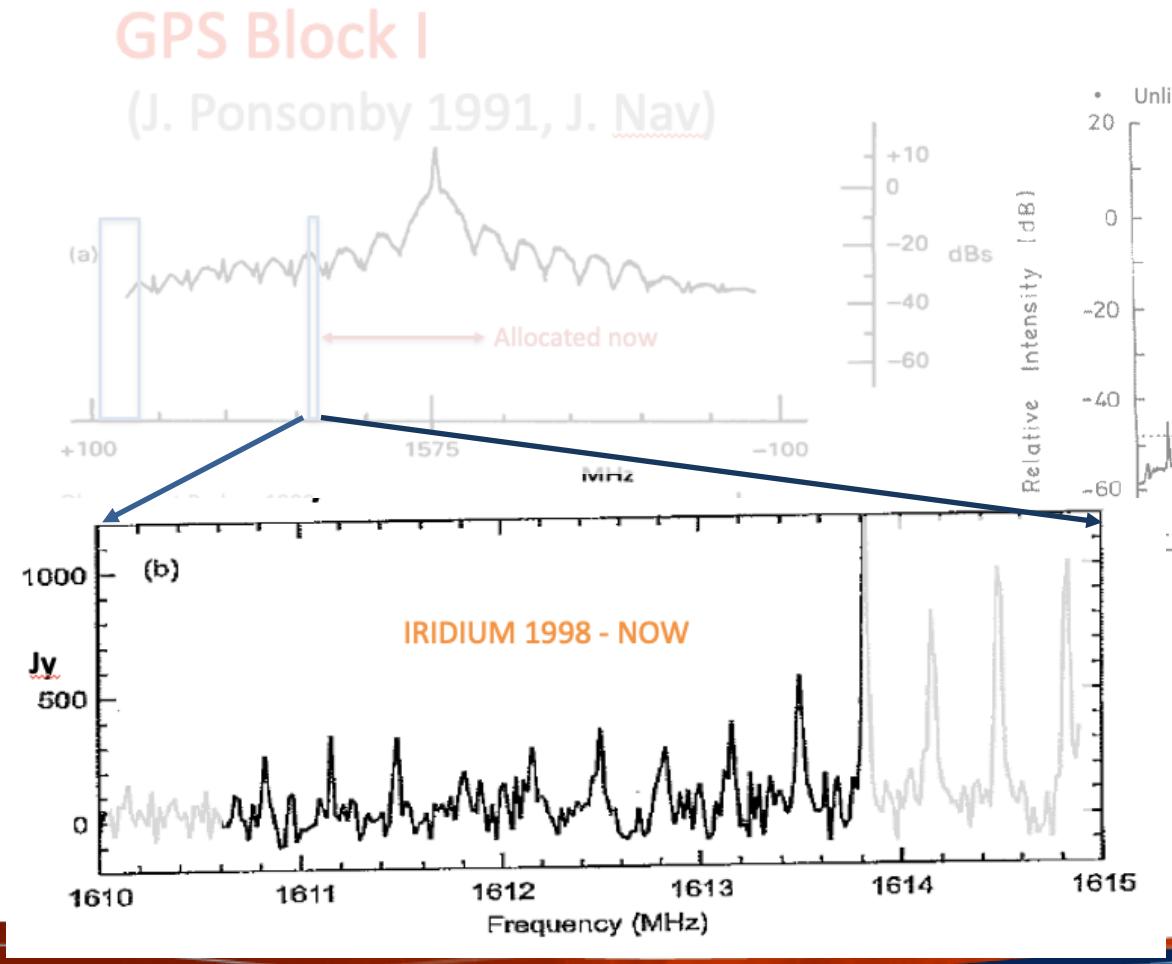

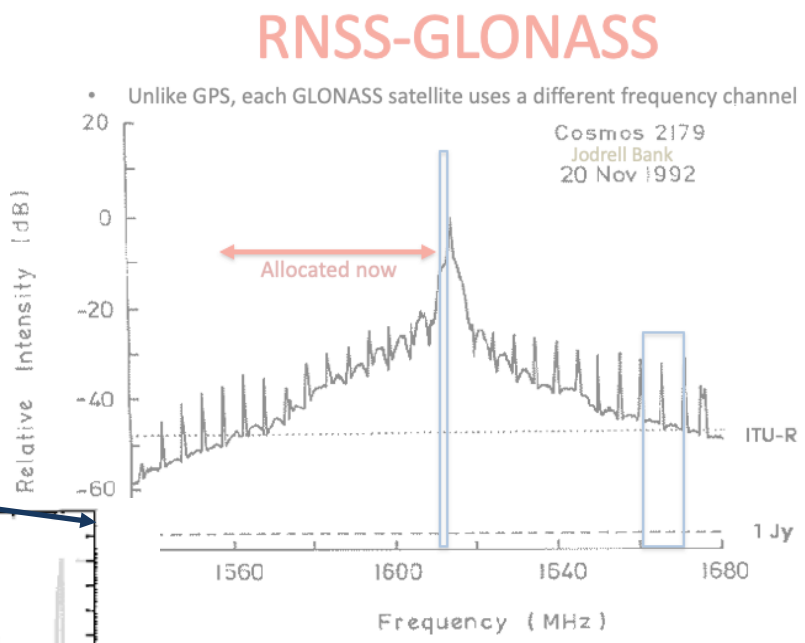

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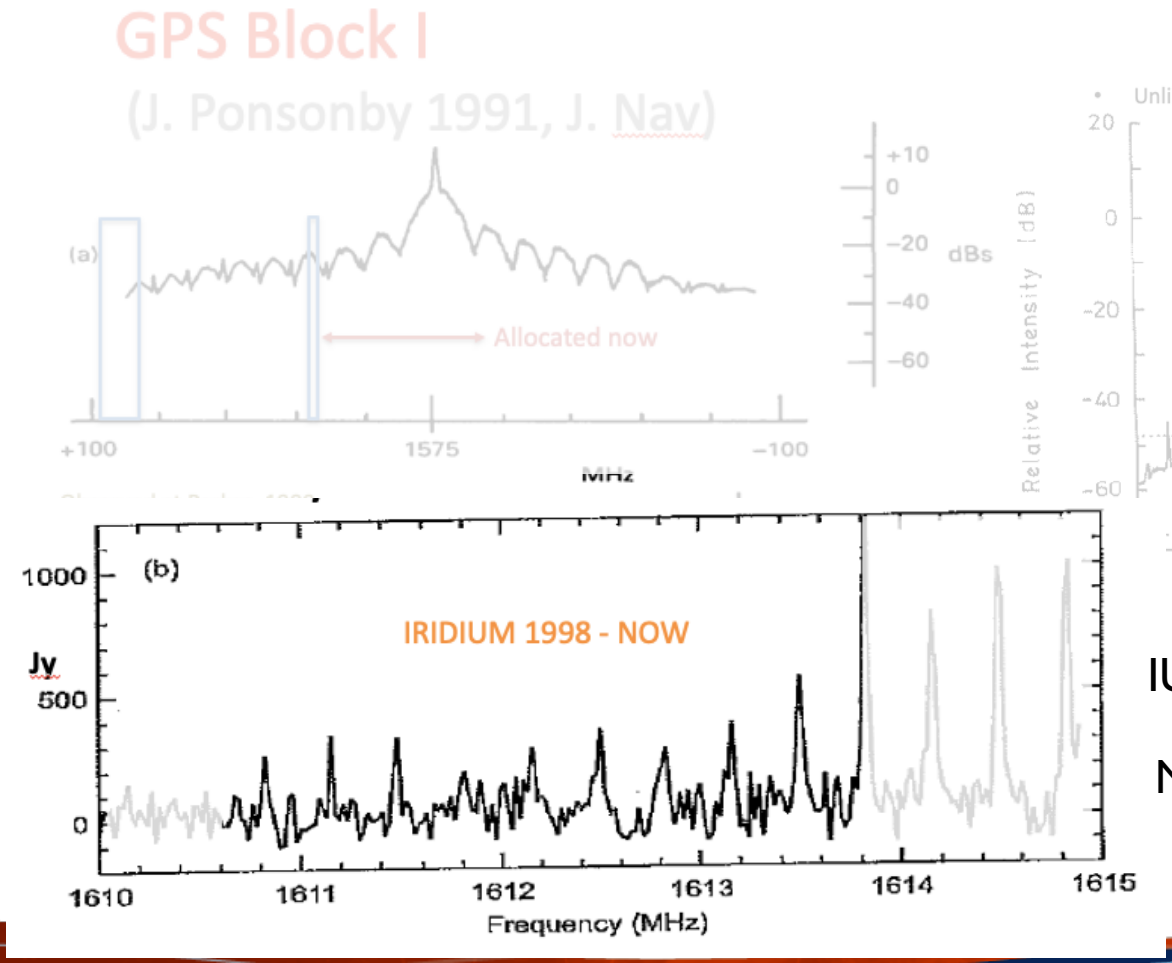

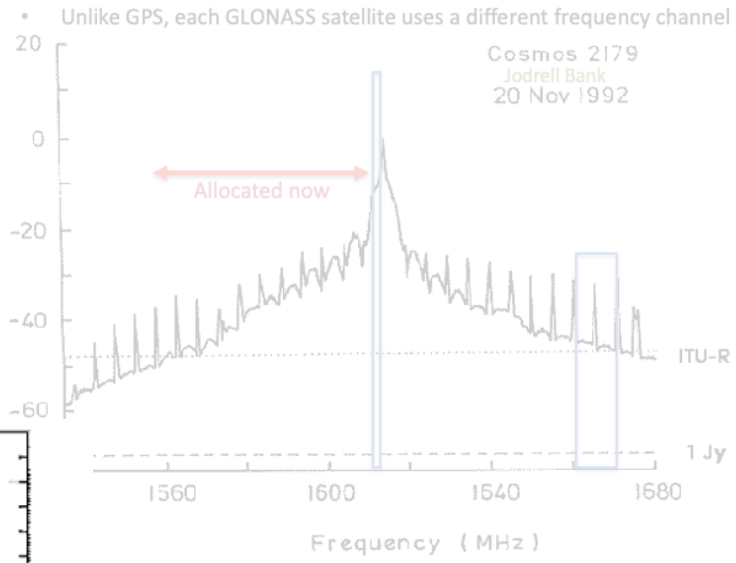

IUCAF dealt successfully with RNSS

Nobody gets anywhere with Iridium

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- It doesn't suffice to sit back, watch other users decide our access
  - Which they prefer to do whenever there is that chance
    - Protecting radio astronomy is hard & inconvenient for other users
      - Forces other users to think about all the dirty bits of their operations
  - Other radio services argue that discretion over radio astronomy's access to spectrum is granted to them by the ITU-R rules
  - We fought this battle on several fronts at WRC-19
    - Revising Article 4.6, motivated by Japan
    - Agenda Item 1.8 granting Iridium new privileges at the expense of radio astronomy observing OH at 1610.6 - 1613.8 MHz was decided almost entirely without radio astronomy participation

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  - Active radio services argue that discretion over radio astronomy's access to spectrum is granted to them by the ITU-R rules
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    - Iridium was granted new privileges and abandoned radio astronomy protection as soon as WRC-19 was over - never forget!

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  - New active systems are prodigious spectrum users

ECC Report 271

Table 19: Frequency Bands Used by the SpaceX System

Type of Link and Transmission Direction	Frequency Ranges	RAS band affected
User Downlink Satellite-to-User Terminal	10.7–12.7 GHz	10.6–10.7 GHz (10.68-10.7 passive)
Gateway Downlink Satellite to Gateway	17.8–18.6 GHz 18.8–19.3 GHz	
User Uplink User Terminal to Satellite	14.0–14.5 GHz	14.47–14.5 GHz
Gateway Uplink Gateway to Satellite	27.5–29.1 GHz 29.5–30.0 GHz	
TT&C Downlink	12.15–12.25 GHz 18.55–18.60 GHz	
TT&C Uplink	13.85–14.00 GHz	

SpaceX, OneWeb

HAPS

Report ITU-R F.2439-0
(11/2018)

Deployment and technical characteristics of broadband high altitude platform stations in the fixed service in the frequency bands 6 440-6 520 MHz, 21.4-22.0 GHz, 24.25-27.5 GHz, 27.9-28.2 GHz, 31.0-31.3 GHz, 38.0-39.5 GHz, 47.2-47.5 GHz and 47.9-48.2 GHz used in sharing and compatibility studies

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- *5G at WRC-15*
  - ***450-470,1427-1452,1492-1518,1710-1885,1885-2025,2110-2200, 300-2400,2500-2690,3400-3600 MHz***

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WRC-23:

1.2 to consider identification of the frequency bands
- **3 600-3 800 MHz and 3 300-3 400 MHz** (Region 2);
- **3 300-3 400 MHz** (amend footnote in Region 1);
- **7 025-7 125 MHz** (globally);
- **6 425-7 025 MHz** (Region 1);
- **10 000-10 500 MHz** (Region 2),

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  - Prime example was AI 1.13 at WRC-19, setting allowable levels for unwanted 5G emissions into the passive band 23.6 - 24 GHz
    - WMO wanted -55 dBW/200 MHz to protect remote sensing
    - US advocated -20 dBW/200 MHz
    - WRC-19 "compromise" at -28 dBW/200 MHz
      - 6 dB stricter post-2027, grandfathering all old IMT base stations
    - Issue is a subject of contention inside the US

DECEMBER 10, 2019

CHAIRWOMAN JOHNSON AND RANKING MEMBER LUCAS REQUEST GAO EVALUATION ON SPECTRUM INTERFERENCE ISSUES

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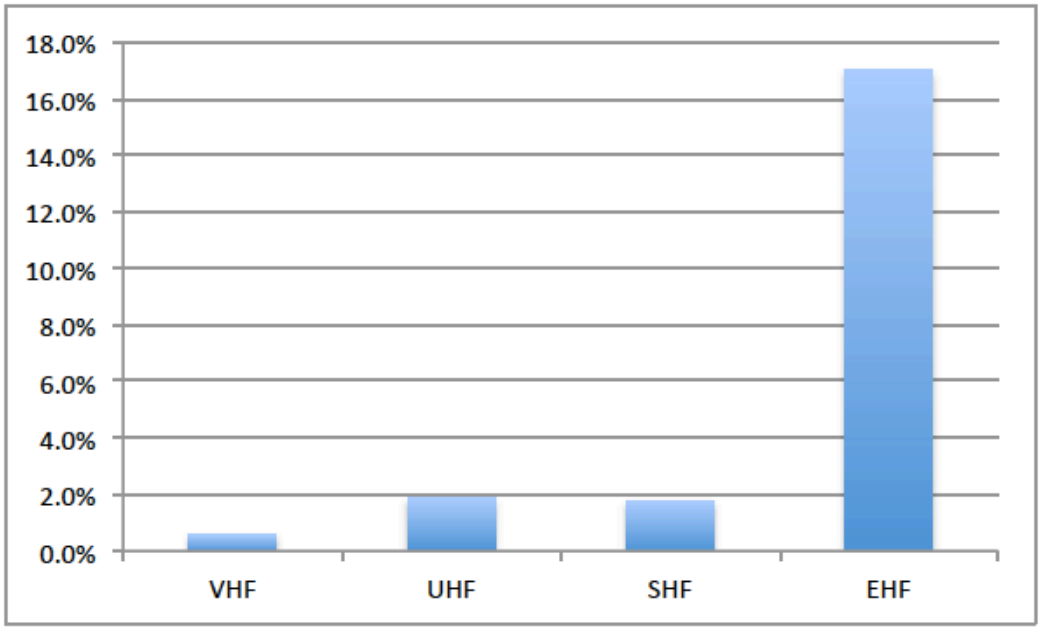

Figure 1: Fraction of band where transmitters are banned by terms of US246

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  - The passive bands dedicated to science are especially coveted
    - FCC order (ET Docket No. 18-21) created 10 yr special experimental licenses **in passive bands above 95 GHz**
      - **Allowing sale and marketing of experimental devices**

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  - **Less unoccupied spectrum**
  - **More unwanted emissions**
  - **Weakening of spectrum protections in passive bands**
  - **Increasing blurring, mixed use**
    - **Earth stations (FS, FSS, MSS) in motion, airborne (+UAV)**
    - **Inter-satellite links, cubesat downlinks in MSS spectrum**
    - **HIBS - 5G base stations on HAPS (WRC-23 AI 1.4)**

Why are we here?

- Spectrum management is the base level of spectrum access
- Spectrum management is where threats to the viability of radio astronomy first appear for discussion and characterization

“RFI is what happens when spectrum management fails”

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- Yeah, but this also happens when spectrum management fails

"RFI is what happens when spectrum management fails"

- And this *also* happens when spectrum management fails:

Tacoma, WA, Dec 2017
3 dead

Harper's Ferry, WVa Dec 2019
Appalachian trail closed

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- Spectrum management is necessary
- Let's use this week to help ourselves figure it out