National Aeronautics and Space Administration

NASA Spectrum Management Issues
Presentation to CORF

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NASA Spectrum Management Update: Status of WRC-12 Issues and Current Domestic Concerns

CORF Spring 2010 Meeting

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WRC-12 Background

- 2012 World Radiocommunication Conference (WRC-12) to take place in Geneva, Switzerland 23-January-17-February 2012
- 192 International Telecommunication Union members will decide treaty-based modifications to the ITU Radio Regulations
- Technical preparatory work done in the ITU Radiocommunication Sector Study Groups
- Conference Preparatory Meeting (CPM) Report to contain approaches for satisfying each agenda item (basis upon which proposals are made from Member States)
- US Regulators oversee conference preparations by Federal Government (NTIA) and private sector (FCC)

WRC-12 Issues of Primary Interest to NASA

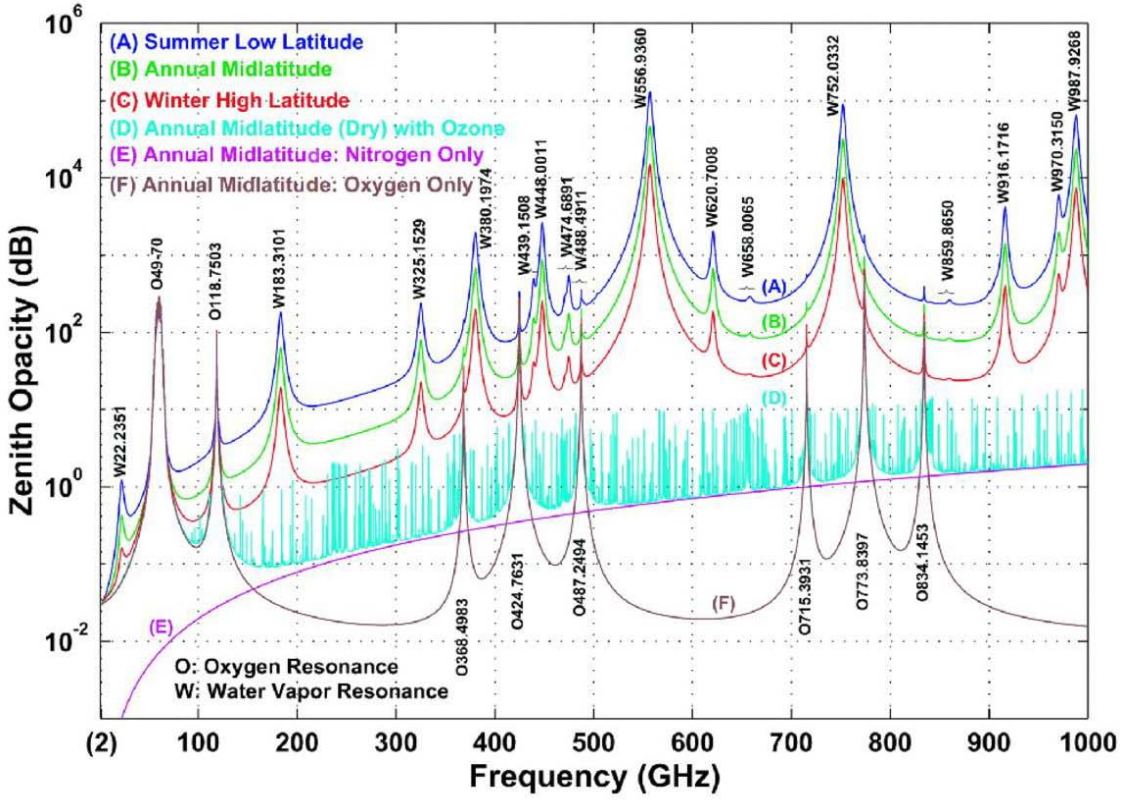
- **1.6 (Resolution 950)** deals with passive uses of the spectrum from 275-3000 GHz
- **1.11** considers a new primary allocation to the space research service (Earth-to-space) in the band 22.55-23.15 GHz
- **1.12** considers protection of primary services (including space research (space-to-Earth)) in the band 37-38 GHz from interference from aeronautical mobile service operations

WRC-12 Issues of Primary Interest to NASA (continued)

- **8.1.1 (Issue C)** deals with improving the recognition of the essential role and global importance of Earth observation radiocommunication applications and their societal benefits
- **8.2** considers future WRC agenda items for the 2015 WRC and beyond

AI 1.6: (Res 950) deals with passive uses of the spectrum from 275-3000 GHz

- While there are no allocations above 275 GHz, footnote 5.565 currently notes the bands used by the passive services (remote sensing and radio astronomy) between 275 and 1000 GHz. Due to scientific advances, more information is available on the bands between 275 and 3000 GHz that are or will be used by the passive services and the footnote should be updated.



AI 1.6 (Res 950): Continued

NASA Objectives:

- Protect future uses of 275-3000 GHz frequency range for remote sensing and radio astronomy applications
- Modify footnote 5.565 accordingly to continue protection of this spectral region

US Status:

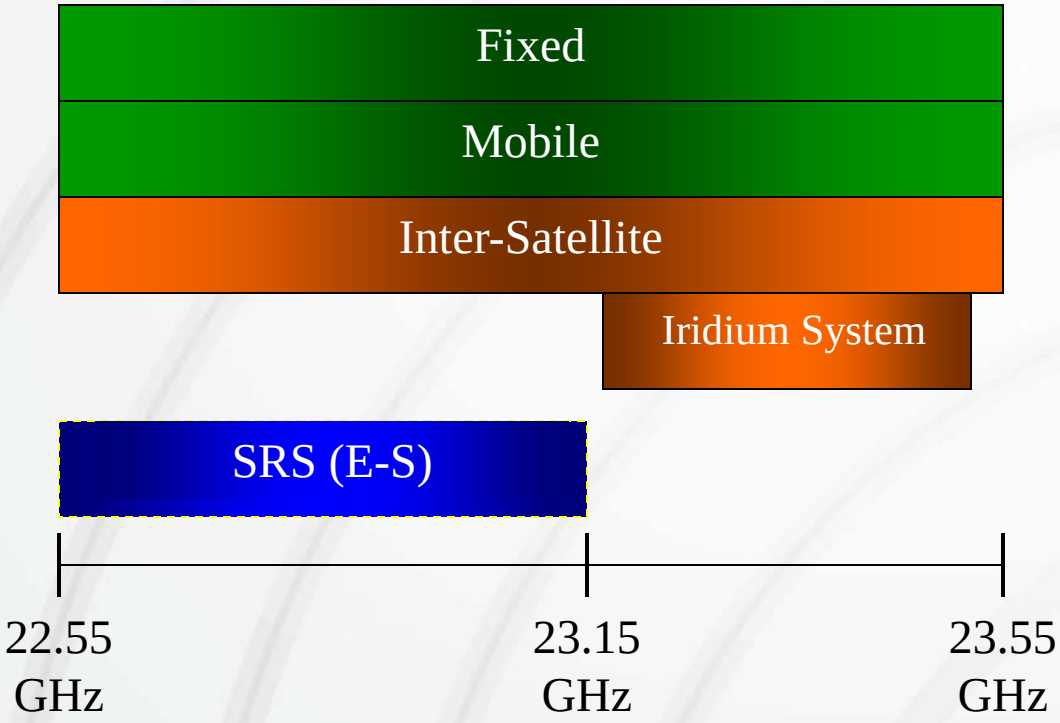
- Executive Branch proposal completed – awaiting FCC proposal and reconciliation process.
- US Proposal could go to CITEL meeting in September or November

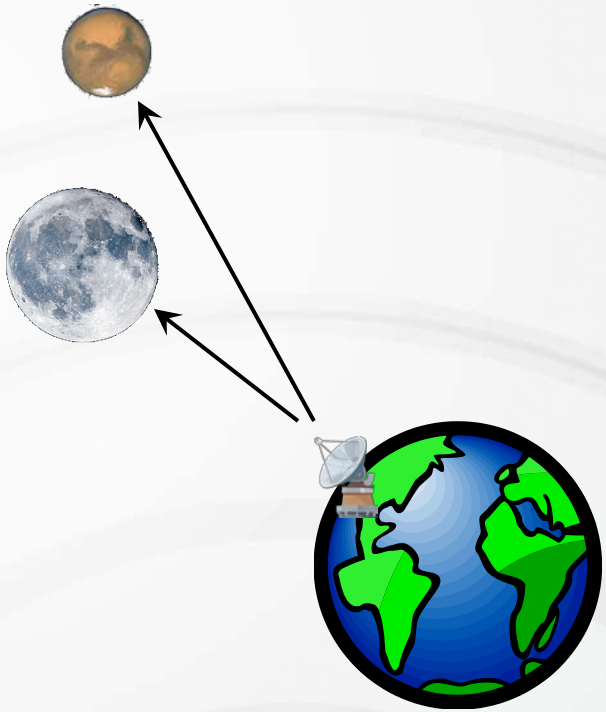
International Status:

- Studies on passive use to be finalized at WP 7C and 7D meetings in June.; draft CPM text is to be finalized as well
- CPM text contains two methods to satisfy the agenda item: one modifying footnote 5.565 to point to new WRC Resolutions that provide details on the passive use of the spectrum in this frequency range and the other updating bands of interest and noting possibilities for sharing

AI 1.11: Considers a new primary allocation for wideband space research uplinks in 22.55-23.15 GHz

- Required SRS uplink envisioned for future exploration missions to the Moon and Mars for communications





AI 1.11: Continued

NASA Objectives:

- Obtain primary allocation of at least 500 MHz within the 22.55-23.15 GHz band for the space research service (E-s) to support future exploration missions

US Status:

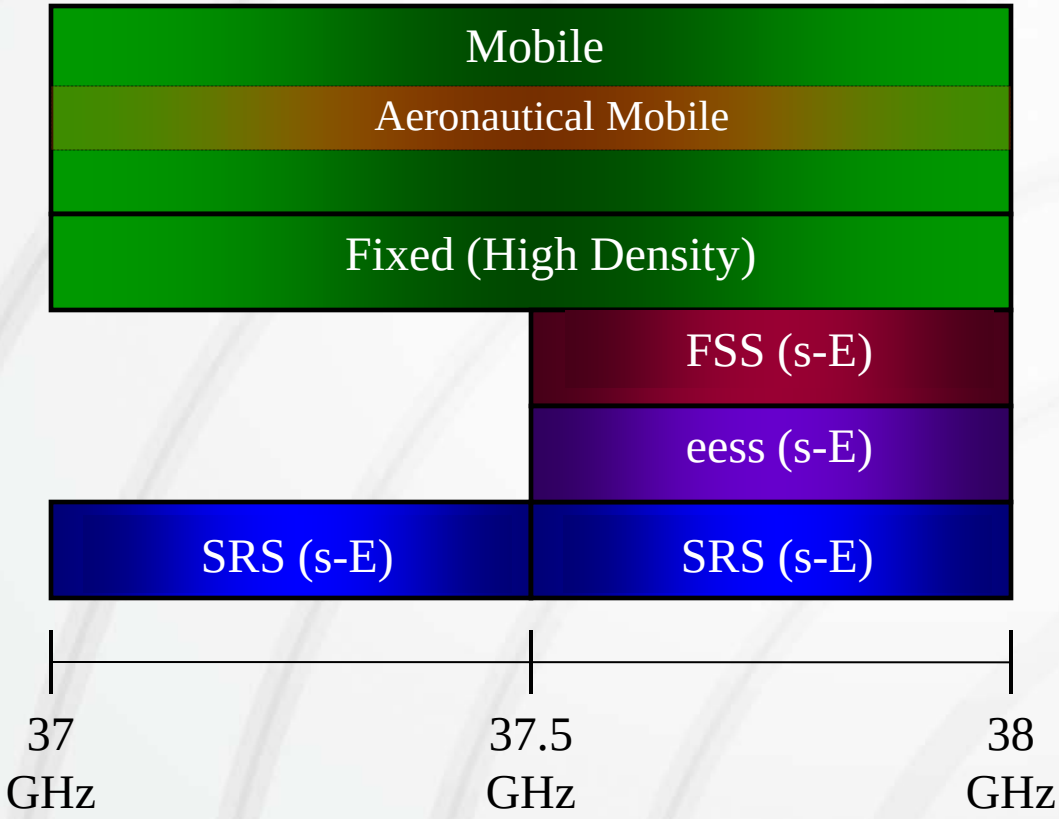
- Executive Branch proposal for 600 MHz allocation from 22.55-23.15 GHz for space research service uplinks without constraints
- WAC proposal by Iridium for 300 MHz allocation also without constraints in order to protect Iridium crosslinks

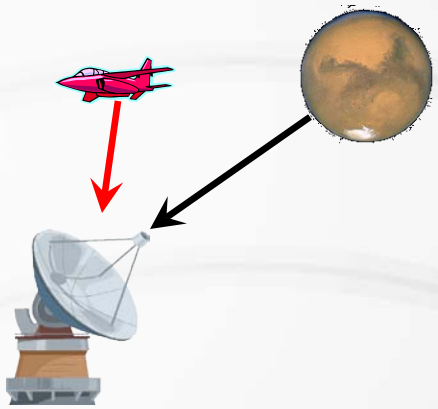
International Status:

- Studies in WP 7B indicate tens of dB of margin
- Iridium still adversarial seeking explicit out-of-band considerations "protection" for Iridium even though studies indicate compatibility
- NTIA opposes such protection as unnecessary and bad precedent

AI 1.12: Protection of services in 37-38 GHz from interference from aeronautical mobile applications

- Within the 37-38 GHz band, aeronautical mobile applications would cause interference to the space research service (s-E) uses of the band





Note: SFCG Rec 14-2R5 reflects agreements on the use of the 37-37.5 GHz band vis-à-vis the 37.5-38 GHz band

AI 1.12: Continued

NASA Objectives:

- Protection of the space research downlinks in the 37-38 GHz band

US Status:

- Executive Branch proposal for footnote in band to protect SRS downlinks reconciled with similar proposal from FCC (Boeing)
- Boeing would like to keep allocation available for communications within and in close proximity of the airframe for aircraft sensors
- US Proposal should be sent to September CITEL meeting

International Status:

- Studies to be completed at June WP 7B meeting; draft CPM text also to be completed at this meeting
- CEPT generally supportive of studies and of removal of aeronautical mobile from existing mobile allocation

AI 8.1.1 (Issue C): Essential role and importance of Earth observation systems and societal benefits

- Resolution 673 calls for studies to improve the recognition of the essential role and global importance of Earth observation radiocommunication applications and the knowledge and understanding of administrations regarding the utilization and benefits of these applications

Examples of Earth Observation Frequencies

438 MHz	6750 MHz	21.4 GHz	54-60 GHz
1260 MHz	9500 MHz	23.8 GHz	86-92 GHz
1413 MHz	10.65 GHz	31.5 GHz	118 GHz
3200 MHz	14.5 GHz	36.5 GHz	150 GHz
5350 MHz	18.7 GHz	50.3 GHz	183 GHz

AI 8.1.1 (Issue C): Continued

NASA Objectives:

- Increase the visibility of Earth observation radiocommunication applications
- Encourage protection of frequency bands for Earth observation applications, especially by developing countries

US Status:

- No Preliminary Views or proposals to date
- NASA may submit draft proposal modifying existing Resolution 673 to reflect completion of studies in ITU-R recognizing importance of Earth observation

International Status:

- Report within ITU-R on the essential role of Earth observation applications & other science apps nearing completion (June 2010)
- Recommendation ITU-R RS.1859, “Use of remote sensing systems for data collection to be used in the event of natural disasters and similar emergencies” approved January 2010
- US introduced draft new Recommendation on use of remote sensing in studying climate change (September 2009)
- US leading effort on drafting EESS Handbook in ITU-R which includes information on societal benefits (to be completed in 2010)

AI 8.2: Future Conference Agenda Items of Interest to NASA

Possible NASA sponsored agenda items for WRC-15:

- Possible need for wideband deep-space space research (space-to-Earth) allocation below 40 GHz
- Possible need for designated band in S-band for emergency communications for human spaceflight missions in future exploration missions

Status:

- Studies have been initiated in support of both requirements; preliminary studies nearing completion
- Next step is draft proposals from Government Agencies

WRC-12 Issues of Primary Concern to NASA

- **AI 1.2** deals with flexible regulatory framework
- **AI 1.5** deals with ENG Harmonization
- **AI 1.8** deals with fixed service use between 71 and 238 GHz
- **AI 1.19** deals with possible regulatory measures for Software Defined Radio (SDR) and Cognitive Radio Systems (CRS)
- **AI 1.22** deals with emissions from Short-Range Devices (SRD)
- **AI 1.25** deals with mobile-satellite service (MSS) in the ~4-16 GHz Range

AI 1.2 – Regulatory Framework

- *take appropriate action with a view to enhancing the international regulatory framework*

Concern:

- NASA is mainly concerned about changes to the regulatory framework that could adversely affect NASA operations
- FCC currently is pushing its "National Broadband Plan" and is making this agenda item part of its efforts in this area
- Main concern is the notion of convergence of services, especially fixed and mobile services which share bands with EESS and SRS operations

AI 1.5 – ENG Harmonization

- *to consider worldwide/regional harmonization of spectrum for electronic news gathering (ENG)*

Concern:

ENG frequency harmonization may impact NASA uses of the space research service in S-band (2 GHz)

AI 1.8 – Fixed Service Use 71-238 GHz

- *to consider the progress of ITU-R studies concerning the technical and regulatory issues relative to the fixed service in the bands between 71 GHz and 238 GHz*

Concern:

FS activities in this frequency range could impact passive remote sensing operations

- Passive bands: 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz, 114.25-122.25 GHz, 148.5-151.5 GHz, 164-167 GHz, 174.8-191.8 GHz, 200-209 GHz, 226-231.5 GHz, and 235-238 GHz

Current revision to Report F.2107 on characteristics of fixed systems above 57 GHz gives characteristics for systems in 110-130 GHz where there are only 2.75 GHz of bandwidth currently allocated for the fixed service and significant passive use

AI 1.19 – SDR and CRS

- *to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems*

Concern:

- ensure possible use of SDR and CRS technologies in science applications
- ensure protection of existing uses of the spectrum such as the space research service and passive remote sensing

AI 1.22 – Short-Range Devices

- *to examine the effect of emissions from short-range devices on radiocommunication services*

Concern:

- SRDs could affect sensitive NASA operations such as GPS, deep-space communications and passive remote sensing
- RFID devices are an example of such systems

AI 1.25 – MSS from 4 to 16 GHz

- *to consider possible additional allocations to the mobile-satellite service (with particular focus on the range 4 GHz to 16 GHz)*

Concern: new MSS allocations in this frequency range may impact NASA operations

  - List of bands for MSS narrowed down but contains 7145-7235 MHz deep space SRS band for downlinks and 8400-8500 MHz deep space SRS band for uplinks as well as 13.25-13.4 GHz active sensing band for downlinks

WRC-12 Issues of Secondary Concern to NASA

AI	Description	NASA Concern
1.3	Consider spectrum/regulations for safe operation of UAS	Protection of NASA operations and use of spectrum
1.4	Possible AM(R)S use of 960-1164 MHz and 5000-5030 MHz	Protection of NASA operations and use of spectrum
1.6 (Res 955)	Possible procedures for free-space optical links	Ensure NASA optical communications & sensors are not adversely affected
1.7	AM(R)S and MSS in 1 525-1559 MHz and 1626.5-1660.5 MHz	Protection of GPS L1 frequencies
1.20	HAPS in 5850-7075 MHz	Possible impact on passive sensing in 6700-7075 MHz
1.21	Allocation to radiolocation in 15.4-15.7 GHz	Protection of NASA operations and use of spectrum in nearby bands

U.S. Broadband Initiatives

- U.S. Broadband initiatives all seek to enhance the broadband (i.e., high-speed) access to the Internet
- All of these actions will require additional spectrum access for wireless broadband service providers in private sector, generally below 5-6 GHz (although eventually may go up to 10 GHz)
- White House Broadband Initiative
  - Administration driven initiative to help formulate and guide national Broadband Policy
- FCC Broadband Plan and associated Notices
  - Identified some commercial and some Federal spectrum for reallocation and methods to facilitate such reallocation
- House and Senate Spectrum Inventory Bills
  - To identify areas of spectrum to reallocate from Federal use
- House update of Commercial Spectrum Enhancement Act
  - To fund relocation of Federal Users due to spectrum reallocations

DOMESTIC ISSUES

NRC Spectrum Study

- NRC Study “Spectrum Management for Science in the 21st Century” jointly funded by NASA, NOAA and NSF
- Study describes challenges of spectrum management for passive use of the spectrum currently and into the foreseeable future for both Earth remote sensing under the Earth exploration-satellite service (EESS) and for radio astronomy under the radio astronomy service (RAS)
- Report describes many “findings” about passive use of the spectrum by these two radio services which support Committee’s conclusions
- Study conclusions are given in the form of sixteen (16) “recommendations”
- NASA Space Communications and Navigation (SCaN) Spectrum Policy and Planning currently reviewing Report and its recommendations and will work with Science Mission Directorate (SMD) to formulate an Action Plan responding to the Spectrum Study

Active Sensing Issues

- Three upcoming NASA remote sensing missions will use the 1215-1300 MHz band for active sensing applications
  - Aquarius, whose primary focus is on measuring ocean salinity, will use a scatterometer
  - SMAP, whose primary focus is on measuring soil moisture content, will use a somewhat different scatterometer
  - DesDynI, whose primary focus is measuring surface and ice sheet deformation, will us a synthetic aperture radar (SAR)
- FAA and AF operate important air surveillance radars in this band and these active sensing instruments could potentially cause harmful interference to these radars (recent tests in Oklahoma City currently being evaluated)
- GPS also operates in this frequency band and space-based radars need to protect operation of GPS receivers

Summary

- WRC-12 agenda items of interest to NASA are proceeding reasonably well, although AI 1.11 is still problematic
- WRC-12 agenda items of concern for NASA have generally proceeded well, but AI 1.2 (framework) and AI 1.25 (MSS) are currently hot items
- National Broadband efforts will likely impact NASA spectrum use within next 5-10 years in some manner
- NRC Spectrum Study has great value to NASA in that we now have on record the independent views of the users of the passive spectrum for science that can be referenced in various venues by the Agencies who try to manage this spectrum
- Future L-band active sensing missions require careful coordination with FAA and DoD to avoid interference to/from existing systems

QUESTIONS???