The Importance of Spectrum
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September 20th, 2011
Overview

• What is Spectrum?
• Why is Spectrum Important to NASA?
• Key Players (NASA, National, International)
• Spectrum Management Process
• Pressures on Spectrum Access
• Summary
What is Spectrum?

The term “electromagnetic spectrum” describes the entire range of radiated energy from low frequency radio waves through visible light radiation and further to gamma and cosmic rays.

- **Radiofrequency spectrum** is the portion of the Electromagnetic Spectrum most commonly used for radio communications.
Virtually every mission undertaken by NASA requires radio spectrum.

- Earth Science
- Space Science
- Space Exploration
- Aeronautical Research

Missions may be:
- Near Earth/Deep Space
- Human/Robotic
- Long Term/Short Term
NASA Space Communications and Navigation Network
NASA Uses in UHF

- Search & Rescue
- ISS / Shuttle EVA

NASA Uses in 1 GHz

- Shuttle Navigation
- GPS
- Aero-telelemetry
- Meteorological Satellites

NASA Uses in 2 GHz

- TDRS / ISS / Shuttle
- Deep Space
- Earth Science
- Planetary Radar

NASA Uses in 3 GHz

- Proposed SRS Uplink
- Earth Science
- Space Science

Representative NASA Spectrum Use (300 MHz – 30 GHz)
(NASA spectrum use extends to greater than 300 GHz)
Overview: Spectrum Management

Domestic ↔ International

Creating the Rules ↔ Implementing the Rules
How Is Spectrum Managed? (International)

United Nations

ITU Member Administrations

Treaty Status

World Radiocommunication Conference (WRC-12)

Non-Government

Government

US Department of State

ITU

FCC

NTIA

NASA
Each nation has sovereignty over the use of its spectrum.
WRC-12

Preparation Process

- CPM-11
- ITU-R Study Groups, Working Parties & Task Groups
- U.S. Preparatory SGs, WPs, TGs

Report

Negotiation of final technical input to the WRC

Adoption of technical study results

Regional

Proposals

Optional

International

U.S. Domestic

State Department

- NTIA
- FCC

U.S. View and Proposal Preparation

U.S. preparation of technical inputs

Preparation of technical inputs

Preparatory SGs, WPs, TGs
LightSquared Issue

Source: Chris Hegarty, MITRE
• NASA is:

  • Continuing collaboration with space faring nations
  • Educating and conducting outreach regarding NASA spectrum use
  • Continue activities to ensure long term spectrum use for science
Backup slides
Backup Slides
Spectrum Policy “Ecosystem”
Radio Band Designations

- **UHF Band**: 300 – 1000 MHz
  - Used for Search and Rescue, ISS/ Shuttle EVA
  - Applications: Deep Space; Earth Science; Planetary radar
- **L Band**: 1 – 2 GHz
  - Used for Shuttle Navigation, GPS, Telemetry
- **S Band**: 2 GHz – 4 GHz
  - Used for TDRS; Deep Space; Planetary Radar
- **C Band**: 4 – 8 GHz
- **X Band**: 8 – 12 GHz
- **Ku Band**: 12 – 18 GHz
- **K Band**: 18 – 27 GHz
- **Ka Band**: 27 – 40 GHz

MHz
1000 MHz = 1 GHz

- **Earth Science; TDRS; Space Science**
The Global Positioning System

- Baseline 24 satellite constellation in medium earth orbit
- Global coverage, 24 hours a day, all weather conditions
- Satellites broadcast precise time and orbit information on L-band radio frequencies
- Two types of services:
  - Standard (free of direct user fees)
  - Precise (U.S. and Allied military)
- Three segments:
  - Space
  - Ground control
  - User equipment
The Players (International)

LEGEND

- Supporting Technical Information/Studies
- Conference Proposals re Radio Regulations
- Both Technical and Conference Related

Conference Proposals re Radio Regulations via U.S. DELEGATIONS

Private Industry

Direct Technical Inputs from Administrations

FCC - AC/IWGs

DoS

IRAC/RCS

SFCG

NATIONAL COMMITTEE

U.S. STUDY GROUPS

+ other Federal Agencies

NASA
Policy Development: International

- Coordinate Policy within International Science Community
- Develop U.S. Foreign Policy Views, Positions and Proposals
- Gather Regional Support within the Americas
- Negotiate Treaty Level Text on Behalf of U.S.
  - Serve on U.S. Delegation in support of the U.S. State Department at World Radiocommunications Conferences
  - Serve as Spokespersons on behalf of U.S. and/or Regional coalitions of Nations in the Americas
How Is Spectrum Managed? (National)

- **Executive Branch**
  - National Telecommunications and Information Administration (NTIA)
  - NTIA Chairs IRAC and The Subcommittees

- **Legislative Branch**
  - Federal Communications Commission (FCC)
  - Private Industry
  - State and Local Governments

**COORDINATION**

**INTERDEPARTMENT RADIO ADVISORY COMMITTEE** (IRAC)

**COMMUNICATIONS ACT OF 1934** (Telecom Act of 1996)