

NTIA



Spectrum Issues Related to Satellite Communications

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Program Manager

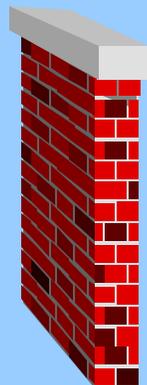
Satellite Coordination and Policy

Office of Spectrum Management

Introduction and Regulatory Environment

- Insufficient spectrum for proposed new uses
 - private sector requesting access to Govt.-exclusive spectrum either by reallocation or increased sharing
- International Telecommunication Union (ITU)
 - international spectrum allocations
 - advance publication/coordination/notification
 - filing fees, cost recovery, filing backlogs
- Domestic Spectrum Management
 - FCC: non-Govt. spectrum management
 - NTIA: Govt. spectrum management (IRAC)

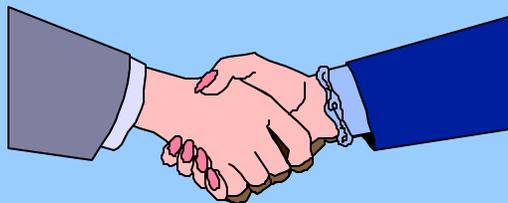
Non-Government



Government

**YOU WAREHOUSE SPECTRUM!
SPECTRUM IS CRUCIAL TO
NATIONAL ECONOMIC SECURITY!
YOU DON'T UNDERSTAND OUR
REQUIREMENTS!
WE DON'T KNOW HOW YOU USE
SPECTRUM!
YOU HIDE BEHIND SECURITY !**

**YOU WASTE SPECTRUM!
SPECTRUM IS CRUCIAL TO
NATIONAL DEFENSE SECURITY!
YOU DON'T UNDERSTAND OUR
REQUIREMENTS!
YOU ONLY WANT TO TAKE
GOVERNMENT SPECTRUM !
YOU INVOLVE CONGRESS OVER
MINOR ISSUES!**



***INCREASED COOPERATION BETWEEN THE GOVERNMENT AND
NON-GOVERNMENT SECTORS HELPS MEET NEW REQUIREMENTS
AND INCREASES OVERALL SPECTRUM EFFICIENCY***

International Satellite Regulation

- International Telecommunication Union
- Spectrum Regulation through ITU Radio Regulations
- ITU-R Recommendations of Technical Characteristics
- ITU World Radiocommunication Conference
 - new frequency allocations
 - regulations to facilitate sharing and prevent interference
 - regulations on procedures and requirements for country-to-country coordination
- New Issues:
 - competition for “good” orbital slots
 - Sharing between GSOs and NGSOs
 - due diligence to reduce “paper” satellite filings

U.S. Commercial Communications Satellite Industry



**Excerpt from
FCC 98-235
Federal Communications Commission
NOTICE OF PROPOSED RULEMAKING**

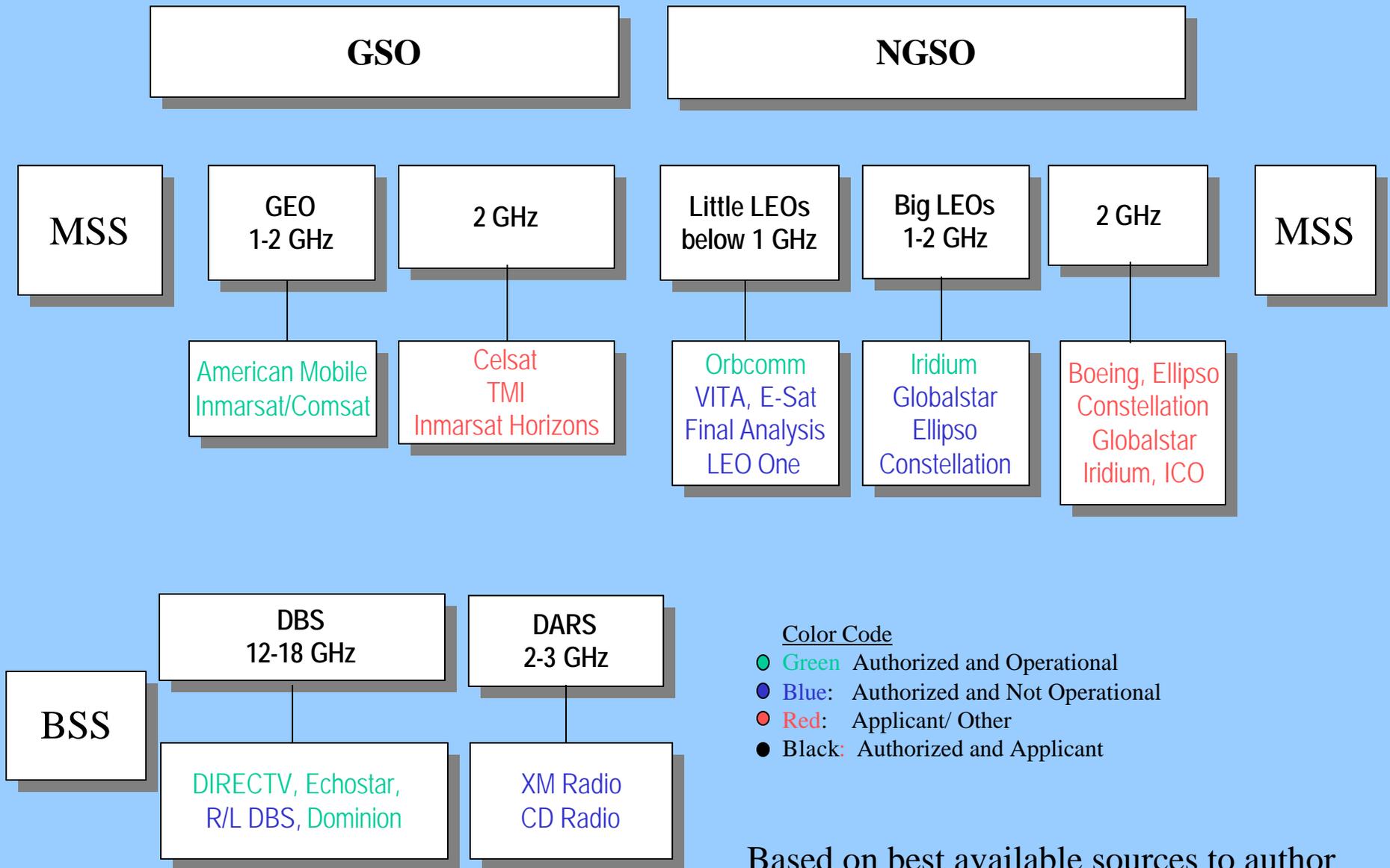
Uplink Band

| | | | | | |
|---------------------|----------------------|-----------------|----------------|----------------|------------------|
| LMDS | GSO/ FSS | NGSO/FSS | MSS/FL | MSS/FL | GSO/FSS |
| fss | ngso/ fss | gso/fss | and | and | ngso/fass |
| 850 MHz | 250 MHz | 500 MHz | 150 MHz | 250 MHz | 500 MHz |
| 27.5 | 28.35 | 28.6 | 29.1 | 29.25 | 29.5 |
| 30.0 GHz | | | | | |

Downlink Band

| | | | | | |
|---------------------------------|----------------------------|-------------------------------|---------------------------|------------------------------|-----------------|
| FS | GSO/FSS | GSO/FSS and FS | NGSO/FSS | MSS/FL and FS | GSO/FSS |
| gso/fss and ngso/fss | fs and ngso/fss | ngso/fss | fs and gso/fss | gso/fss | ngso/fss |
| 600 MHz | 250 MHz | 250 MHz | 500 MHz | 400 MHz | 500 MHz |
| 17.7 | 18.3 | 18.55 | 18.8 | 19.3 | 19.7 |
| 20.2 GHz | | | | | |

U.S. Commercial Communications Satellite Industry



Based on best available sources to author

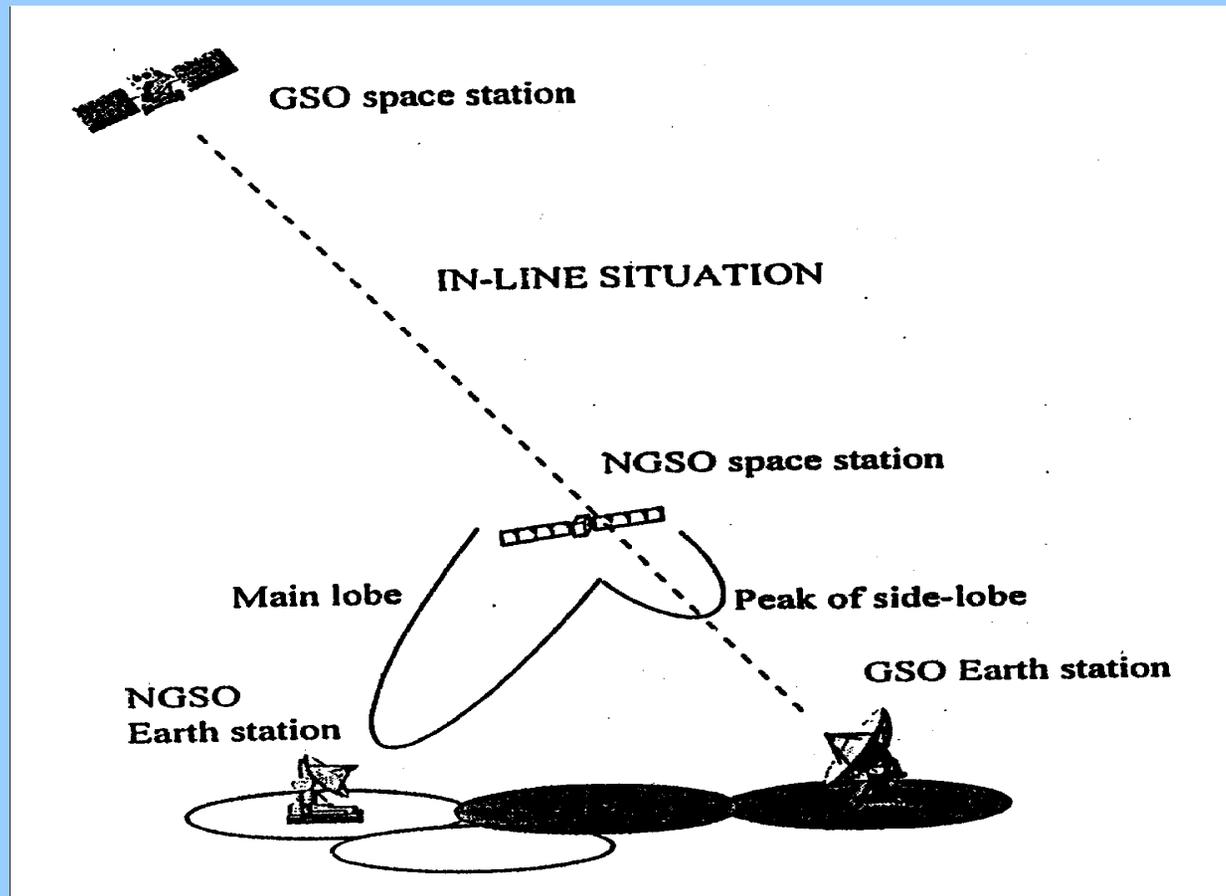
Current Spectrum Planning Issues

- WRC-2000 Issues:
 - NGSO FSS sharing with GSO FSS/BSS & terrestrial services
 - BSS-planned bands and feederlinks
 - Spectrum for satellite component of IMT-2000 (3G)
 - FS and FSS sharing in 36-51 GHz band
 - Spurious emissions (revision of Appendix S3)
 - IMT-2000/advanced mobile communications (terrestrial and satellite component)
 - High Altitude Platforms (HAPS) at 47-48 GHz
 - FSS C-band earth stations aboard vessels (ESV)
 - Coordination with terrestrial stations around satellite earth stations (Appendix S7)

Current Spectrum Planning Issues (continued)

- Spectrum Management Considerations for NGSO Satellites
 - number of satellites in view simultaneously
 - generally will not be able to use polarization discrimination due to antenna beam size and satellite motion
 - may be able to take advantage of time sharing of coverage areas in addition to other sharing techniques (Little LEOs and NOAA)
 - minimum look angle restrictions can be used to avoid interference to GSO and to enhance sharing between satellite earth terminals and the FS result is larger satellite constellation
- New Regulatory Mechanisms Necessary for NGSO Sharing
 - Resolutions 130 and 538 for NGSO FSS sharing with other services
 - Resolution 46 (S9.11A) for NGSO MSS sharing with other services

Interference From NGSO to GSO Systems



NGSO-GSO Interference

Spectrum Sharing Techniques

- Virtually all primary FSS allocations between 2.5-40 GHz share spectrum with other terrestrial or space services
- Common techniques to facilitate sharing include:
 - spatial isolation (e.g., GSO orbital slot separation)
 - geographical separation (satellite earth terminals)
 - time/frequency/code isolation (modulation)
 - frequency band segmentation or band planning
 - minimum look angle restrictions (sharing between earth terminals and the FS) and GSO arc avoidance (NGSO sharing with GSO FSS and BSS)
 - co-coverage avoidance schemes (e.g., NOAA and Little LEOs) satellite and ET power limitations

Space and Earth Station Spurious Emissions

- Impact on Sharing with Other Services
 - FCC and NTIA regulations limit most OOB emissions
 - Radars exhibit high levels of OOB emissions...can interfere with satellite receivers unless preventive measures are taken
- Protection of GPS from MSS Handset OOB Emissions
 - limits placed on MSS handset OOB emissions in ITU-R recommendations and domestic/European regulations
 - limits on terrestrial services being investigated
- Protection of Radio Astronomy Observations
 - emissions from space-based and aeronautical transmitters are particularly problematic for RAS protection

Conclusions

- **Spectrum management issues related to satellite communications have become more complex with the need to satisfy requirements of new applications and systems in the limited spectrum resource.**
- **Advances in satellite technology and new methods of sharing spectrum are being investigated to alleviate spectrum congestion and avoid interference to existing and planned space and terrestrial systems.**
- **Cooperation between countries, and between the government and non-government sectors, is essential to efficient spectrum management.**