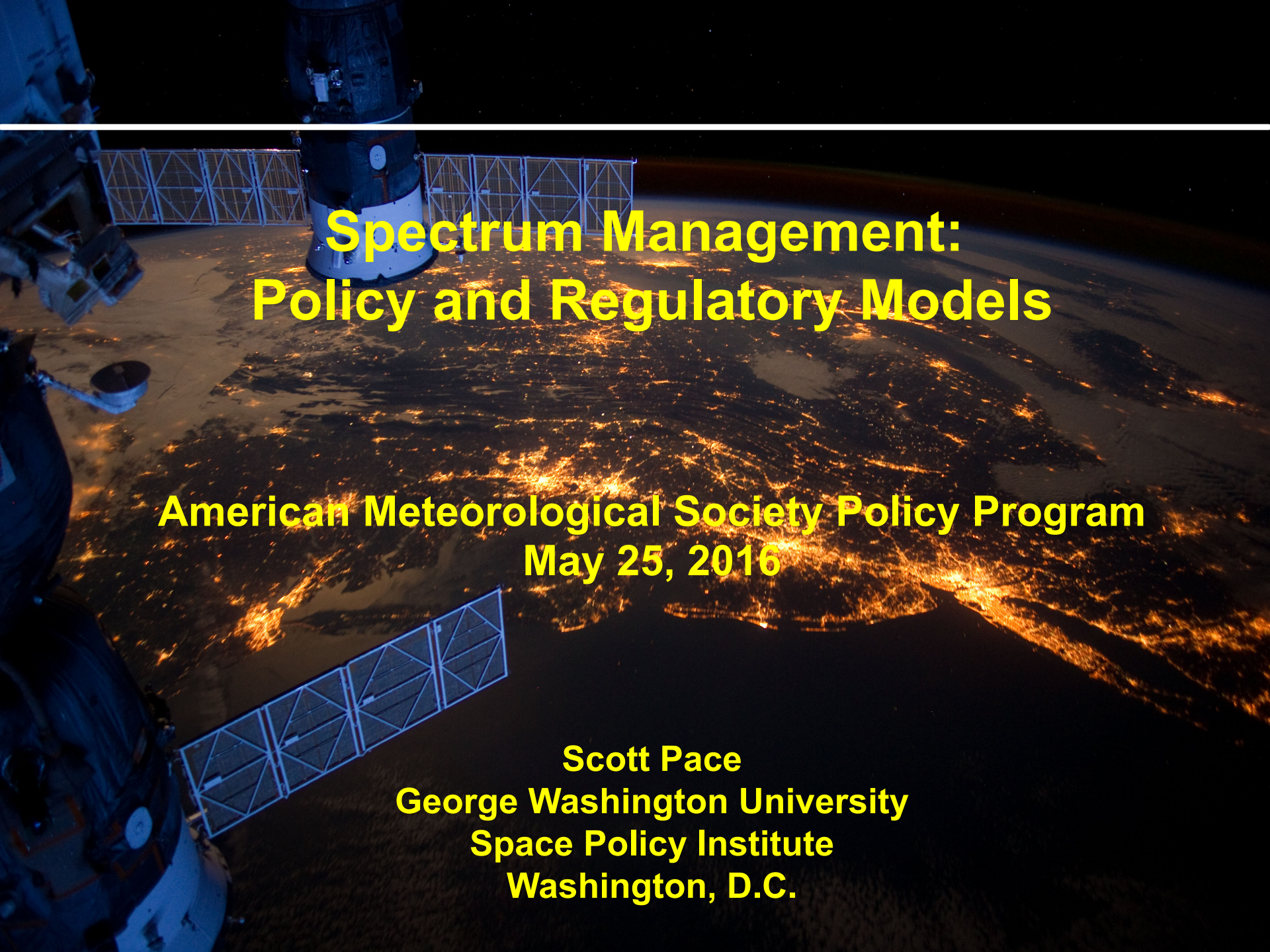


Spectrum Management: Policy and Regulatory Models

American Meteorological Society Policy Program
May 25, 2016

Scott Pace
George Washington University
Space Policy Institute
Washington, D.C.

GPS enables a diverse array of applications



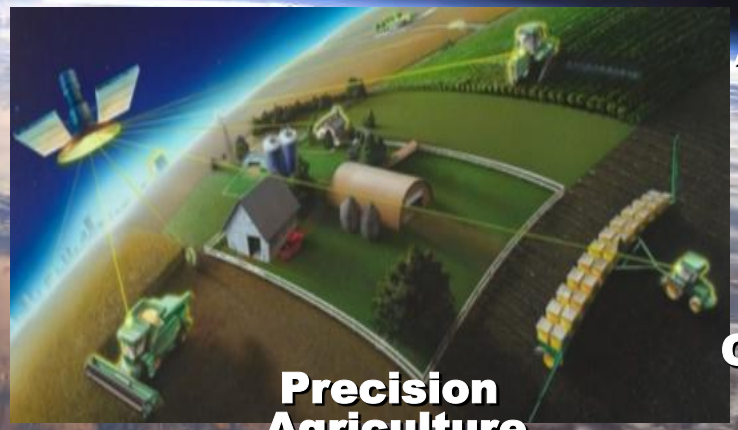
Space Application



Surveying & Mapping



Power Grids



Precision Agriculture



Transit Operations



NextGen



Disease Control



Intelligent Vehicles



TeleComm



Trucking & Shipping

Personal Navigation







Oil Exploration



Fishing & Boating

Aviation Severe Weather Warnings from GOES Direct Broadcast

Severe weather warnings to aviation indicating en route weather phenomena which may affect the safety of aircraft operations are issued by NWS.

These Significant Meteorological Information (SIGMET) warnings are developed from GOES/GOES-R satellite imagery as received via direct broadcast in 1675-1695 MHz.

Pink overlay shows actual flight routes for the time this image was applicable for forecast purposes.

Note that severe areas highlighted in Red are weather and convective SIGMET areas issued on that date, especially in western U.S. and over the Great Lakes region of U.S. Flights are actually routed around those areas of warning.

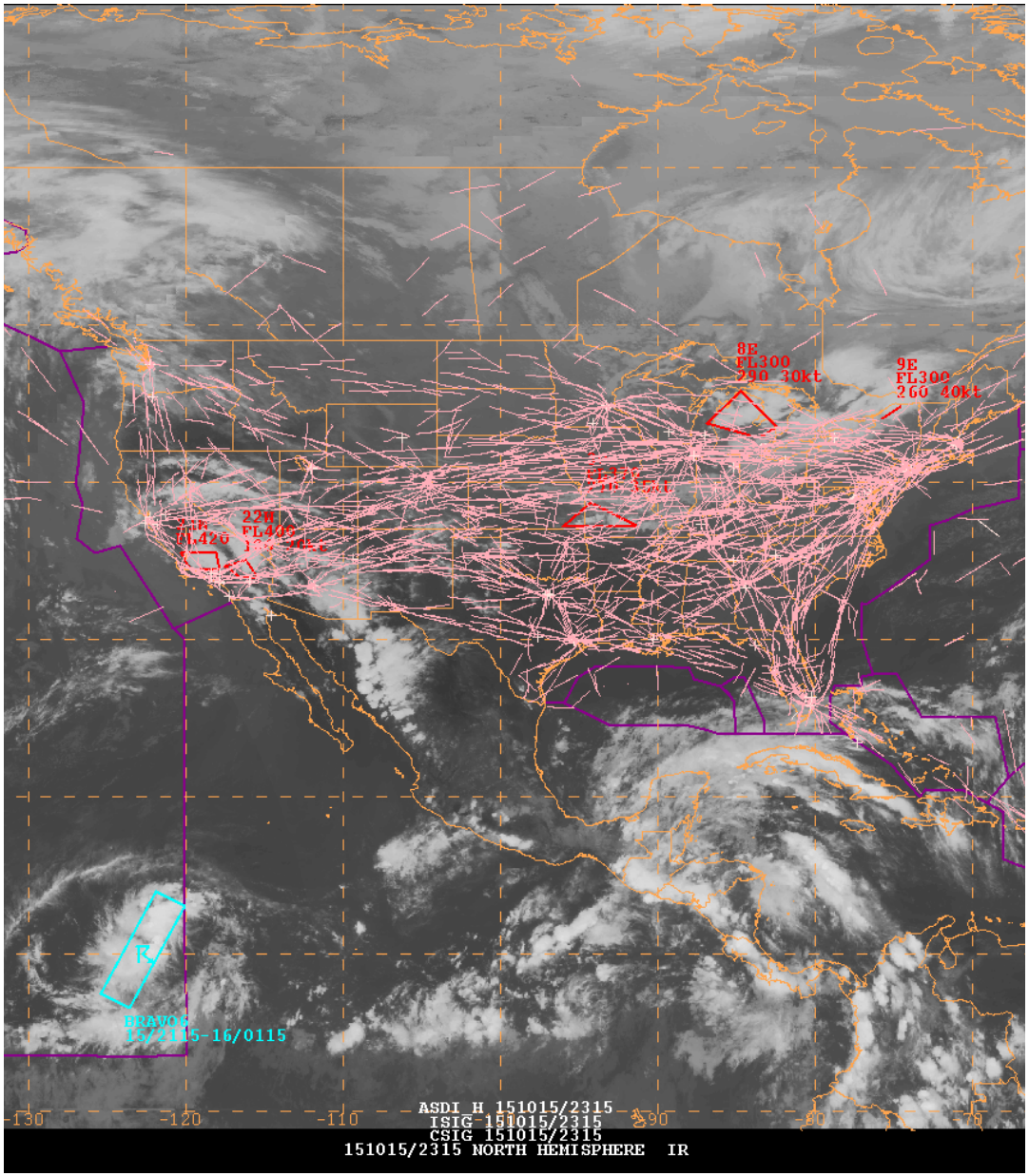
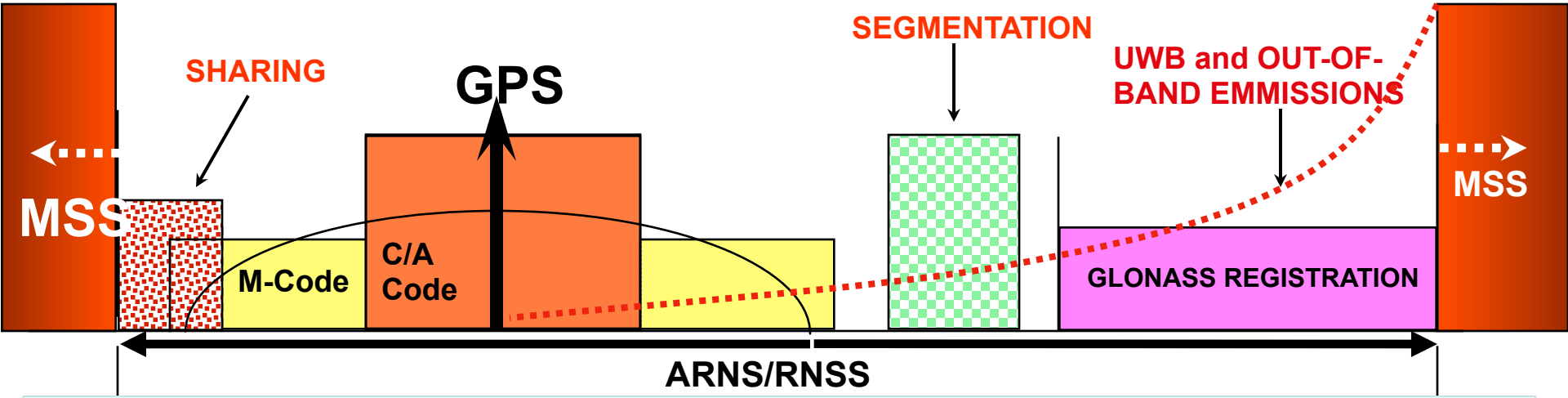


Illustration Source: NOAA / Aviation Weather Center
http://Aviationweather.gov

GPS Spectrum can be Harmed Several Ways



The ARNS/RNSS spectrum is a unique resource

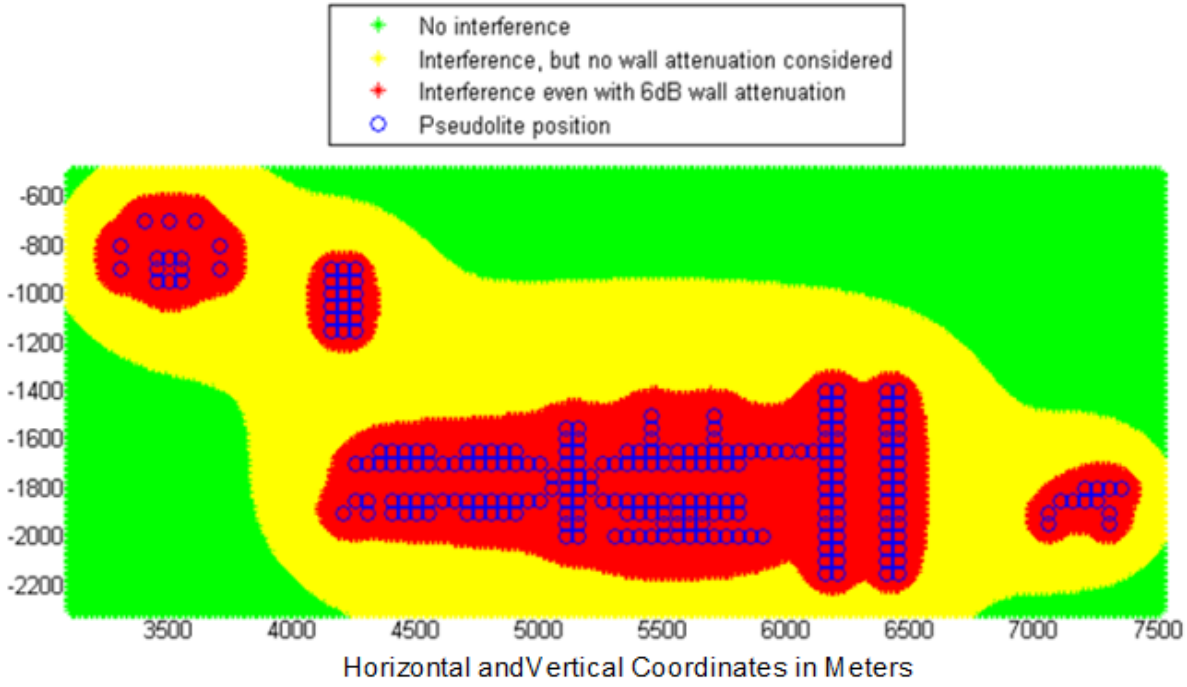
- Sharing with higher power services jams weaker signals
- Out-of-band and ultra wide-band emissions raise the noise floor
- Segmentation prevents future evolution
- Very high power in adjacent bands causes receiver overload

Spread spectrum GPS signals are unlike communication signals

- 10^{-16} W received power, one-way
- Any filter can be overwhelmed if exposed to enough power

Impact on Outdoor GNSS Uses From In-Band Pseudolite Network Operations Inside the Airport

- **ECC Report 183, Exec Summary, pg. 2**
  - **"Outdoor GNSS PLs should not be allowed in airports or other areas for aeronautical operations"**
- **ECC Recommendation (11)08 Framework authorization regime of indoor pseudolites, Recommends 4**
  - **"Indoor GNSS pseudolites should be installed in airport areas, or in the vicinity of them, only after case by case studies with the objective to avoid any potential interference to GNSS receivers in these areas"**



Spectrum Management "Models"

- **Command-and-Control (Licensing Regime)**
  - Allocations, Allotments, & Assignments
  - Not a bad thing for many applications
  - Ensures compatible "zoning" decisions
  - Can fail if regulations are not technically competent

- **Share with Permission – "check before talking"**
  - Cognitive Radio, Software-defined Radio
  - Technically challenging, immature, may shift risk

- **Commons Approach**
  - Unlicensed approach good for some, not all
  - Allows defined areas of innovation and experimentation
  - "You'll never notice I'm here." – but interference is determined by victim, not the emitter

Advantages/Disadvantages of Selected Private Sector–Initiated Options

	Petition for Rulemaking	Request for Rule Waiver	Congressional Legislation	White Paper/Ex Parte
Securing A Speedy Final Decision	-	+	- *	-
Framing Issues	+	+	-	+
Building Stakeholder Coalitions	+	-	+	+
Developing A Comprehensive Public Record	+	+ **	-	- ***

* Although the legislative process usually takes longer to complete than an FCC proceeding, it is sometimes advisable to seek legislative relief, especially where the FCC appears hesitant to rule in your favor.

** FCC has discretion whether to seek public comment on waiver applications. If no public comment is sought, a comprehensive public record will, of course, not be developed.

*** A more comprehensive public record can be developed if the FCC puts the White Paper/Ex Parte out for public comment before developing a response or NPRM proposal.

Source: Wireless Innovation Forum, Ari Fitzgerald, Partner, *Hogan Lovells* and Peter Tenhula, VP/General Counsel, *Shared Spectrum Co.* 28 April, 2011

Conflicting Public-Private Sector Interests

- **Strong interest in weakening international protections for space services in and near bands coveted by terrestrial mobile broadband**
  - **FCC Chairman's speech to the Satellite Industry Association, March 7, 2016**
  - **Spectrum reforms that may work for communications may not work for non-communications functions like navigation and remote sensing.**

- **Concerns not limited to space users but include commercial license holders. A major AWS-3 licensee ex parte stated:**
  - **"...it will be difficult, if not impossible, to reconcile the interference experienced by Federal Users' systems between AWS-3 operations and proposed operations in the 1670 – 1680 MHz band. When there are two potential interfering operators from two different spectrum bands, specifically mobile operations from 1695 – 1710 MHz as one operator, and 1675 – 1680 MHz base station operations as a second operator, identifying the offending party will be difficult, if not impossible, because the interference will be due to the combined operations of two different wireless providers."**

Policy and Politics are Important, but Electrons and Radio Waves Don't Care

- In advocacy for receiver standards, harm claim thresholds, and opposition to noise floor protection criteria, the blurring of accountability is an intrinsic feature.
- As the noise floor rises, it will be hard to hold a particular emitter culpable. This shifts the burden for resolving interference impacts from transmitters to receivers. This is a particular problem for RNSS, EESS, and other space services.

