

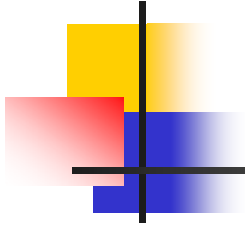
# Spectrum Management Challenges To Implement Advanced Sharing



Julius Knapp, Chief  
Office of Engineering and Technology

National Spectrum  
Management Association  
May 13, 2014

Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission



# The Demand: Explosive Growth of Mobile

# Demand for Mobile Continues to Grow



24/7



24X



120X

## Data-Hungry Devices

As of 2nd Qtr 2013, 64% of U.S. mobile subscribers owned smartphones, up from 41% in July 2011

It is predicted that by 2019, almost all handsets in North America will be smartphones and that total smartphone traffic over mobile networks will increase 10 times between 2013 and 2019

As of June 2013, 34 % of American adults owned a tablet computer, up from 18% in September 2010

All of these trends are resulting in more demand for network capacity and for capital to invest in the infrastructure, technology, and spectrum to support this capacity

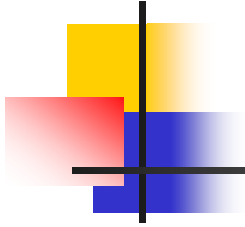
The demand for spectrum, moreover, is expected to continue to increase.

# The Internet of Things (M2M) is In Its Infancy

- Today's wireless networks are used for more than cell phones
- 1.9 billion devices today & 9 billion by 2018 [See: http://www.businessinsider.com/growth-in-the-internet-of-things-2013-10#ixzz2mHMe89oN](http://www.businessinsider.com/growth-in-the-internet-of-things-2013-10#ixzz2mHMe89oN)
- LTE connected vehicles in 2014
- Smart grid
- Appliance control via Internet
- Health care
- Connected advertising
- Remote access to devices
- Possibilities are limitless



Operate your garage door opener or view baby monitor on you smart phone or pad



# Key Milestones in Spectrum Policy

# National Broadband Plan

- National Broadband Plan (NBP) – Published in March 2010
- Comprehensive plan to facilitate broadband deployment in the USA
- Spectrum:
  - Make 500 megahertz of new spectrum available
  - Enable incentives and mechanisms to repurpose spectrum
  - Ensure greater transparency
  - Expand opportunities for innovative spectrum access models
- FCC has implemented most recommendations

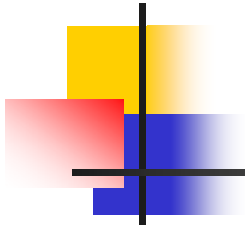




# Jobs Act (AKA Spectrum Act)

---

- Middle Class Tax Relief and Job Creation Act of 2012 – Enacted Feb. 2012 (Public Law 112 – 96)
- Provides for additional spectrum:
  - Authorizes voluntary incentive auctions in TV spectrum
  - Requires auction of certain spectrum bands
  - Unlicensed in TV white space & Studies @ 5 GHz
- Public safety:
  - Nationwide interoperable broadband network
  - Reallocates “D-Block” – Combined with existing public safety allocation provides 20 megahertz of contiguous spectrum
  - Establishes First Responder Network Authority - FirstNet
  - FirstNet is independent entity within the NTIA
  - Funding from auctions proceeds



# Presidential Memo of 2010

---

- Presidential Memo issued on June 28, 2010 on unleashing the wireless broadband revolution
- NTIA to collaborate with the FCC to make available a total of 500 MHz of Federal and nonfederal spectrum over the next 10 years:
  - Suitable for both mobile and fixed wireless broadband use
  - Available to be licensed by the FCC for exclusive use or made available for shared access by commercial and Government users in order to enable licensed or unlicensed wireless broadband technologies to be deployed





# Presidential Memo 2013

---

- President's Council Of Advisors on Science and Technology (PCAST) Issued Report in August 2012: *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*
  - Recommended building upon the TV white space model for access to federal spectrum, particularly in the band 2700 – 3700 MHz
  - Can apply model for both licensed services and unlicensed devices
- Presidential Memo issued June 14, 2013:
  - Encompasses many PCAST recommendations
  - Establishes Spectrum Policy Team
  - Agencies must document efficient use of spectrum
  - NTIA & NIST to develop policies and best practices to promote and facilitate greater collaboration among agencies, the private sector, and academia with respect to research, development, testing, and evaluation of spectrum-sharing technologies - Announced \$100 million in upcoming and proposed Federal investments in public-private research and development of spectrum sharing and other advanced communications technologies.
  - See memo for details at <http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovatio>



# FCC Chairman Tom Wheeler Brookings Speech

---

- FCC Chairman Tom Wheeler spoke at The Brookings Institution on March 24, 2014

## “Wireless Spectrum and the Future of Technology Innovation”

- Next Generation Spectrum Policies:
  - Incentive Auctions
  - Sharing

**PREPARED REMARKS OF FCC CHAIRMAN  
TOM WHEELER  
“WIRELESS SPECTRUM AND THE FUTURE OF  
TECHNOLOGY INNOVATION” FORUM  
THE BROOKINGS INSTITUTION  
WASHINGTON, D.C.  
MARCH 24, 2014**

Thank you, Roger Altman, for that introduction.

Thank you to Brookings for hosting this forum and inviting me to participate. Thanks in particular for limiting your forum to two hours. Giving an afternoon keynote to close a conference is much less daunting when the audience has only been here since lunch.

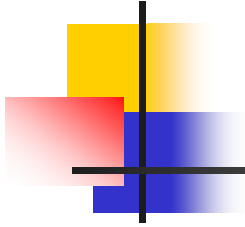
Thank you, Secretary Rubin, for your leadership of the Hamilton Project and identifying spectrum as an area of the Project’s focus.

More important, I want to commend Secretary Rubin and Brookings for having the good sense to commission Phil Weiser and Pierre de Vries to craft your new policy proposal to improve the allocation and adjudication of spectrum.

You’ve just heard a spirited discussion of Phil and Pierre’s paper, and some of the things we *should* be doing to update spectrum policy to meet today’s realities and seize tomorrow’s opportunities.

Now, it’s my job to close this forum by previewing some of the things we *will* be doing to update spectrum policy. In particular, I want share some thoughts about two next-generation spectrum policies – incentive auctions and sharing – that together hold the promise to completely revolutionize the way we manage our airwaves – and in so doing to provide the underpinning for economic growth.

(continues . . .)



# The Search for Spectrum

**Initial Band Candidates that NTIA and the National Broadband Plan  
Identified**

NTIA Plan and Timetable to  
Make Available 500  
Megahertz of Spectrum for  
Wireless Broadband

List of frequency bands for  
study/action

Many bands involve radar,  
aeronautical or satellite  
systems

See:

[http://www.ntia.doc.gov/files/ntia/publications/spectrumfactsheet\\_11152010.pdf](http://www.ntia.doc.gov/files/ntia/publications/spectrumfactsheet_11152010.pdf)

Frequency Band (MHz)	Amount (Megahertz)	Current Allocation/Usage (Federal, Non-Federal, Shared)
(Broadcast TV)** VHF/UHF Frequencies	120	Non-Federal
406.1-420	13.9	Federal
(D-Block)** 758-763 788-793	10	Non-Federal
1300-1390 (MSS)**	90	Federal
1525-1559 1626.5-1660.5 (MSS)**	40	Non-Federal
1610-1626.5 2483.5-2500	10	Non-Federal
1675-1710*	35	Federal/non-Federal Shared
1755-1780*	25	Federal
1780-1850	70	Federal
(AWS 2/3)** 1915-1920 1995-2000 (MSS)**	10	Non-Federal
2000-2020 2180-2200 (AWS 2/3)**	40	Non-Federal
2020-2025 (AWS 2/3)**	5	Non-Federal
2155-2180 2200-2290***	25	Non-Federal
(WCS)**	90	Federal
2305-2320 2345-2360	30	Non-Federal
2700-2900	200	Federal
2900-3100	200	Federal/non-Federal Shared
3100-3500	400	Federal/non-Federal Shared
3500-3650*	150	Federal
3700-4200	500	Non-Federal
4200-4400 [4200-4220 & 4380-4400]*	200	Federal/non-Federal Shared
<b>Total</b>	<b>2263.9</b>	<b>Federal/non-Federal Shared</b>

\* Bands selected for Fast-Track evaluation

\*\* Identified in the National Broadband Plan, Recommendation 5.8, page 86 (using nomenclature contained in Exhibit 5-E)

\*\*\* NTIA notes the ITU-R SA.1154 Recommendation

## Radars Operate in Much of the Spectrum

U.S. Radar Operating Bands, Radio Services, and Allocation Status

Frequency Band (MHz)	Radiolocation	Radionavigation	Aeronautical Radionavigation	Maritime Radionavigation	Meteorological Aids	Earth Exploration-Satellite
216–225 <sup>1</sup>	Sec					
420–450	Pri					
890–902	NIB					
902–928	Pri					
928–942	NIB					
1215–1240 <sup>2</sup>	Pri					Pri Pri
1240–1300 <sup>2</sup>	Pri		Pri Pri			Pri Pri
1300–1350	Sec					
1350–1370	Pri		Pri Pri			
1370–1390	Pri					
2310–2320	Sec	Pri				
2320–2345	Pri	Pri				
2345–2360	Sec	Pri				
2360–2390 <sup>3</sup>	Pri					
2390–2417	NIB					
2417–2450	Sec					
2450–2483.5	Sec	Sec				
2483.5–2500	Sec					
2700–2900	Sec		Pri Pri		Pri	
2900–3000	Sec			Pri Pri	Pri	
3000–3100	Sec			Pri Pri		
3100–3300 <sup>2</sup>	Pri	Sec				Sec Sec
3300–3500	Pri	Sec				
3500–3650 <sup>4</sup>	Pri	Sec	Pri			
4200–4400			Pri Pri			
5250–5350 <sup>2</sup>	Pri	Sec				Pri Pri
5350–5460 <sup>2</sup>	Pri	Sec	Pri Pri			Pri Pri
5460–5470	Sec	Sec	Pri Pri			
5470–5600	Sec	Sec		Pri Pri		
5600–5650	Sec	Sec		Pri Pri	Pri Pri	
5650–5925	Pri					
8500–8550	Pri	Sec				
8550–8650 <sup>2</sup>	Pri	Sec				Pri Pri
8650–8750	Pri	Sec				
8750–8850	Pri	Sec	Sec Sec			
8850–9000	Pri	Sec				
9000–9200	Sec	Sec	Pri Pri			

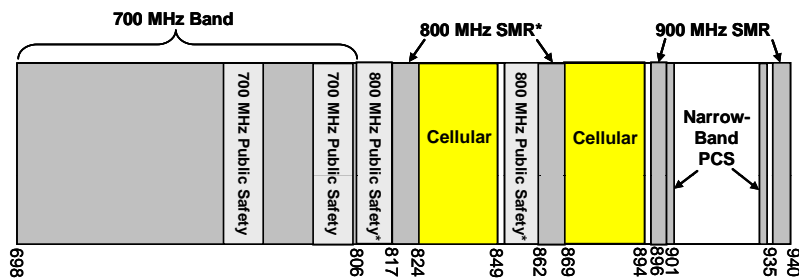
U.S. Radar Operating Bands, Radio Services, and Allocation Status

Frequency Band (MHz)	Radiolocation	Radionavigation	Aeronautical Radionavigation	Maritime Radionavigation	Meteorological Aids	Earth Exploration-Satellite
9200–9300	Sec	Sec		Pri Pri		
9300–9500	Sec	Sec	Pri Pri		Sec Sec	
9500–9800 <sup>2</sup>	Pri	Sec				Pri Pri
9800–9975	Pri	Sec				
9975–10025	Pri	Sec				Sec Sec
10025–10500	Pri	Sec				
10500–10550	Pri	Pri				
13250–13400 <sup>2</sup>			Pri Pri			Pri Pri
13400–13750 <sup>2</sup>	Pri	Sec				Pri Pri
13750–14000	Pri	Sec				
14000–14200			Pri Pri			
15400–15700			Pri Pri			
15700–17200	Pri	Sec				
17200–17300 <sup>3</sup>	Pri	Sec				Pri Pri
17300–17700	Sec					
24050–24250	Pri	Sec				Sec Sec
24250–24450			Pri			
24450–24650			Pri Pri			
24750–25050			Pri Pri			
25050–25250			Pri			
31800–33400			Pri Pri			
33400–35500	Pri	Sec				
35500–36000 <sup>2</sup>	Pri	Sec				Pri Pri
59000–64000	Pri	Pri				
66000–71000			Pri Pri			
76000–77000	Pri	Pri				
77000–78000	Pri	Pri				
78000–79000	Pri	Pri				Pri Pri
79000–81000	Pri	Pri				
92000–94000	Pri	Pri				
94000–94100 <sup>2</sup>	Pri	Pri				Pri Pri
94100–95000	Pri	Pri				
95000–100000	Sec		Pri Pri			
126000–134000	Pri	Pri				
134000–142000	Sec	Sec	Pri Pri			
144000–149000	Pri	Pri				
190000–200000			Pri Pri			

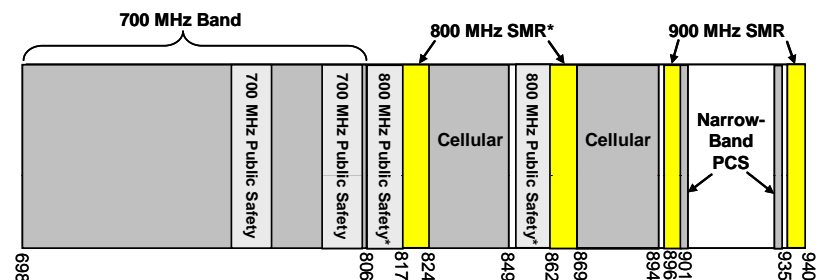
Source: *Department of Commerce Report May 2000 - Federal Radar Spectrum Requirements*

# Existing Major Commercial Spectrum Bands in the USA

698-940 MHz: Cellular Spectrum

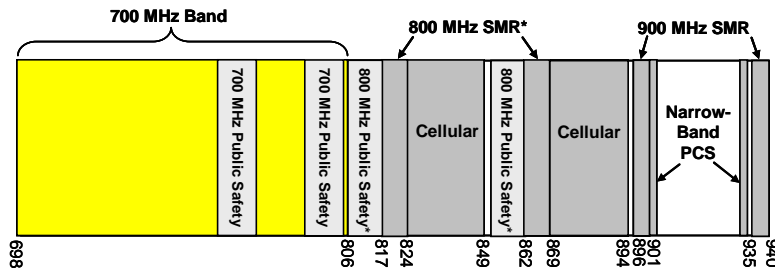


698-940 MHz: SMR Spectrum

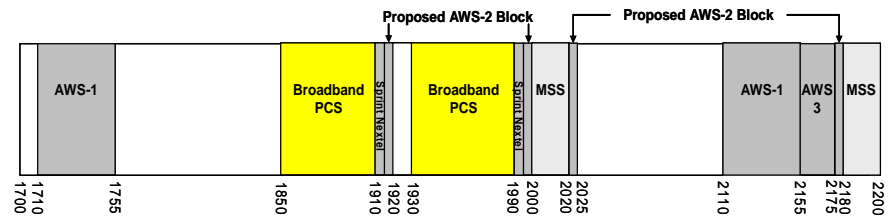


\* Post-800 MHz Band Reconfiguration

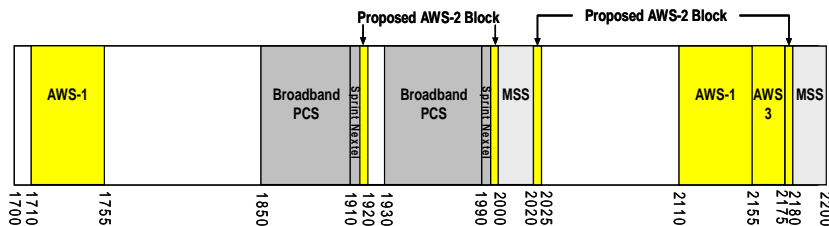
698-940 MHz: 700 MHz Band Spectrum



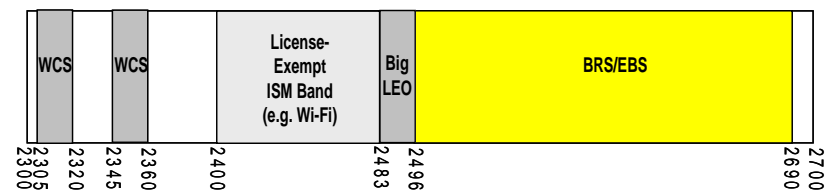
1700-2200 MHz: Broadband PCS Spectrum



1700-2200 MHz: Advanced Wireless Services Spectrum



2300-2700 MHz: BRS/EBS Spectrum



# USA-International Comparison

*Licensed Spectrum Summary –  
USA and Selected Countries*

Country		Current	Pipeline	Current + Pipeline
USA		608	55+	663+
Australia		478	230	708
Brazil		554	0	554
China		227	360	587
France		555	50	605
Germany		615	0	615
Italy		540	20	560
Japan		500	10	510
Spain		540	60	600
U.K.		353	265	618

*Unlicensed Spectrum Summary –  
USA and Europe*

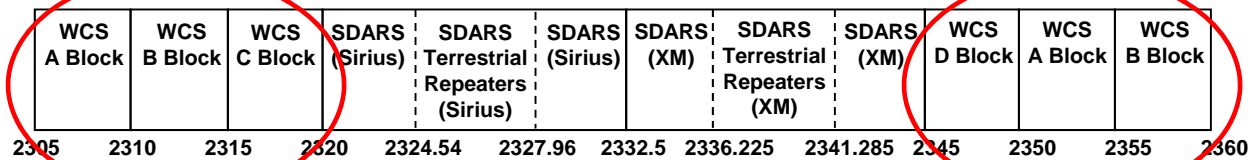
					
Band		Current	Pipeline	Current	Pipeline (Unknown)
TV White Spaces <sup>Unl1</sup>		0 - 150	+	-	
863-870 MHz		-	-	7 <sup>Unl2</sup>	
902-928 MHz		26 <sup>Unl3</sup>	-	-	
1880-1930 MHz		10 <sup>Unl4</sup>	-	20 <sup>Unl5</sup>	
2400-2483.5 MHz <sup>Unl6</sup>		83.5	-	83.5	
3550-3700 MHz		50 <sup>Unl7</sup>	100 <sup>Unl8</sup>	-	
5150-5350 & 5470-5825 MHz <sup>Unl9</sup>		555	-	555	
5350-5470 & 5850-5925 MHz		-	195 <sup>Unl10</sup>	-	
		724.5 - 874.5	295+	665.5	

Source: FCC White Paper

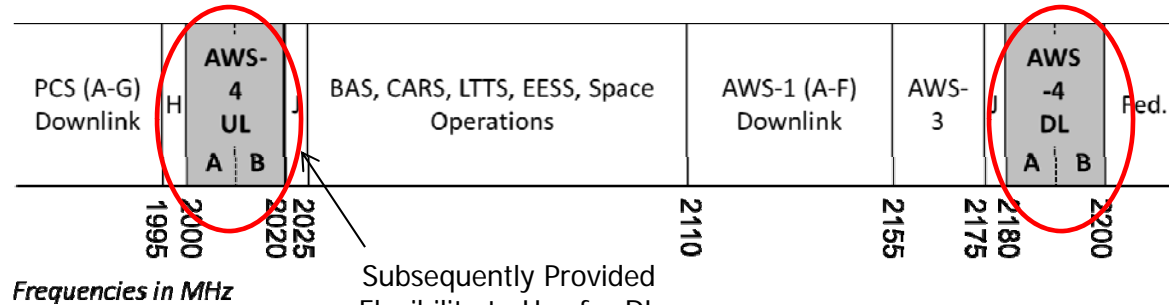
The Mobile Broadband Spectrum Challenge: International Comparisons  
Available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-318485A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-318485A1.pdf)

# Spectrum Added Recently

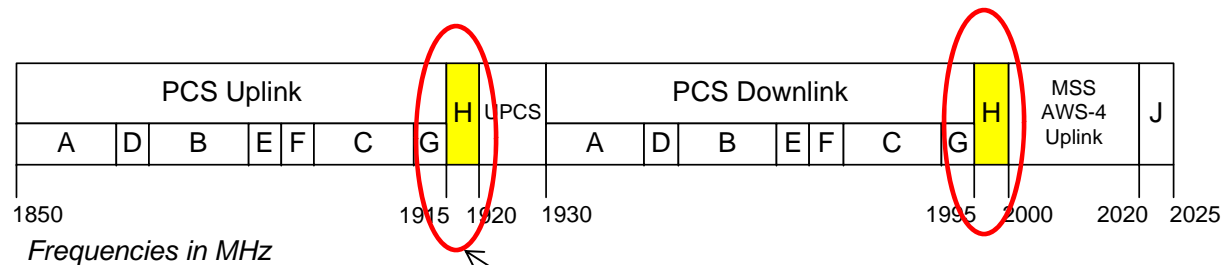
## ■ WCS:



## ■ AWS-4

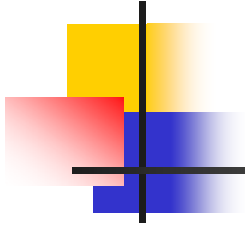


## ■ H-block



Auctioned For  
\$1.564 billion





# AWS-3



# AWS-3 et al / 1755 – 1850 MHz

- Spectrum Act calls for FCC to issue licenses for various spectrum bands by Feb. 2015
- 2155 – 2180 MHz band pairs ideally paired with 1755- 1780 MHz federal spectrum
- NTIA released report on potential for reallocation of federal spectrum at 1755 – 1850 MHz for wireless broadband
  - Challenges - - cost, complexity, time
  - Strong support for increased sharing
- NTIA convened work groups under Commerce Spectrum Management Advisory Committee (CSMAC):
- Department of Defense submitted proposal to share 1755 – 1780 MHz

## Jobs Act - Section 6401 - Auction:

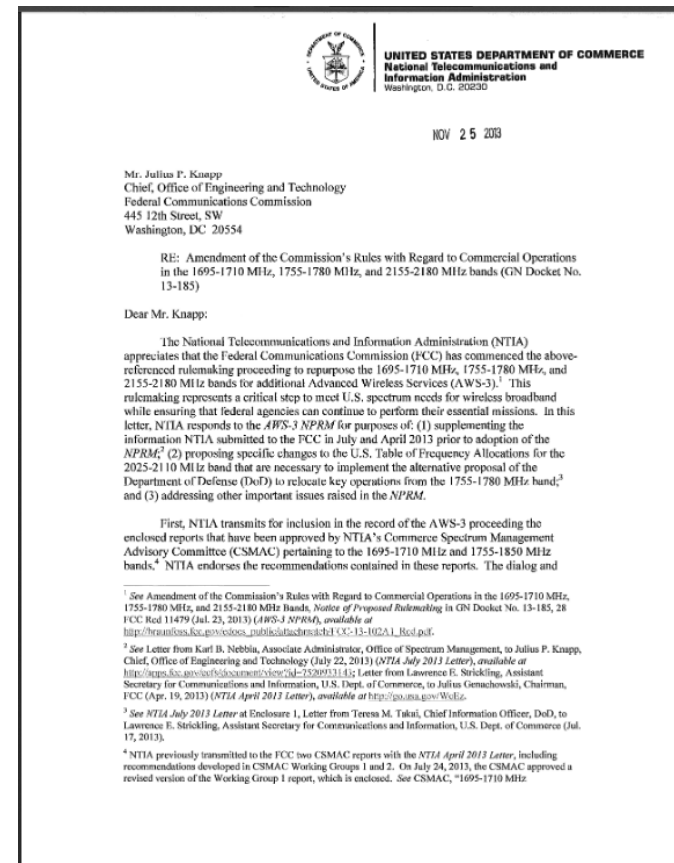
1915- 1920 MHz; 1995 – 2000 MHz;  
15 MHz between 1675 & 1710 MHz;  
2155 – 2180 MHz; 15 MHz to be  
identified by the Commission

## Federal Incumbent Systems:

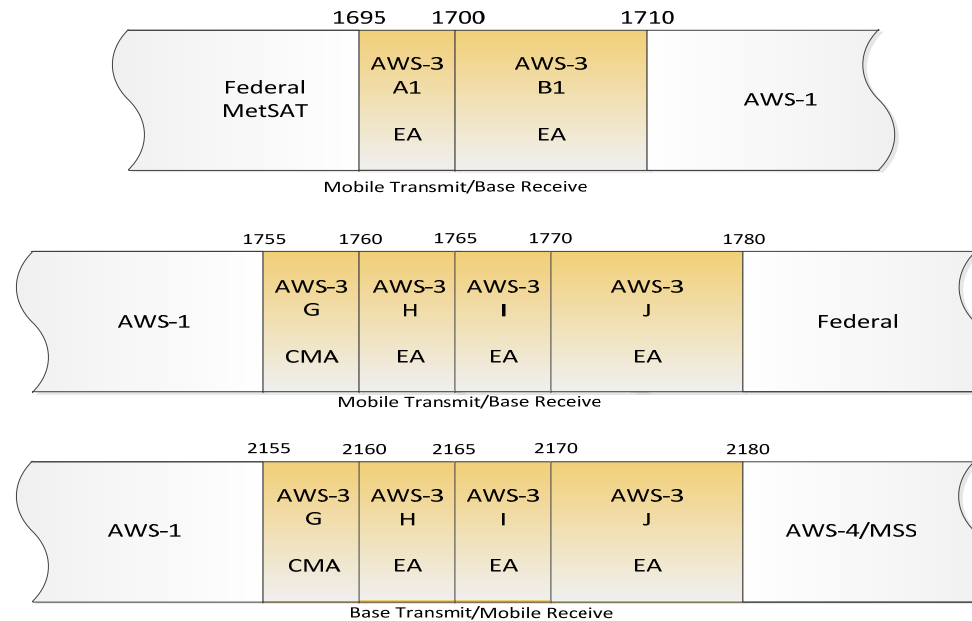
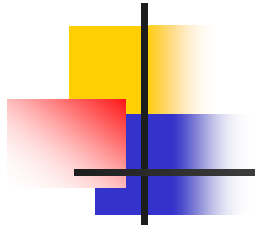
- Fixed Point-to Point Microwave
- Military Tactical Radio relay
- Air Combat Training System
- Precision Guided Munitions
- Tracking, Telemetry & Commanding
- Aeronautical Mobile Telemetry
- Video Surveillance
- Unmanned Aerial Systems
- Other Systems

# Progress on AWS-3

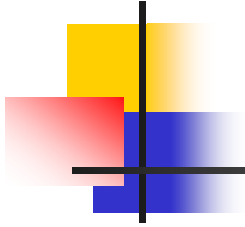
- NTIA Nov. 25, 2013 letter supports DoD proposal
- Relocate most federal operations from 1755-1780 MHz
- DoD will maintain capabilities by sharing with broadcast auxiliary at 2025 – 2110 MHz
- FCC Adopted Report and Order 3/31/2014 (Gen Docket 13-185)
- Transition plans completed



# AWS-3 Report and Order



<u>Block</u>	<u>Frequencies</u>	<u>Pairing</u>	<u>Bandwidth</u>	<u>Area</u>	<u>Licenses</u>
G	1755-1760 and 2155-2160 MHz	2 x 5 MHz	10 MHz	CMA	734
H	1760-1765 and 2160-2165 MHz	2 x 5 MHz	10 MHz	EA	176
I	1765-1770 and 2165-2170 MHz	2 x 5 MHz	10 MHz	EA	176
J	1770-1780 and 2170-2180 MHz	2 x 10 MHz	20 MHz	EA	176
A1	1695-1700 MHz	1 x 5 MHz	5 MHz	EA	176
B1	1700-1710 MHz	1 x 10 MHz	10 MHz	EA	176



# Small Cells & 3.5 GHz

# 3.5 GHz Proposal (GN Docket No. 12-354)

December 2012

Federal



Navy Ship  
Radars



Non-Federal  
Satellite ES

FSS

3550

3650

3700

Analysis based on  
full power ubiquitous  
LTE network

Large exclusion zones  
Along the U.S. coasts



Figure 4-8. Terrain Dependent Exclusion Zone Distances for Shipborne Radar - 1

**Federal fast-track spectrum  
at 3550 – 3650 MHz**



APPENDIX F: Protection Zones For Class-Band FSS And Federal Government Use  
Protection Zones: 3650 to 3700 MHz

**Formerly Federal Transfer Band  
at 3650 – 3700 MHz**

Nationwide  
non-exclusive  
Licensing - -  
fixed broadband

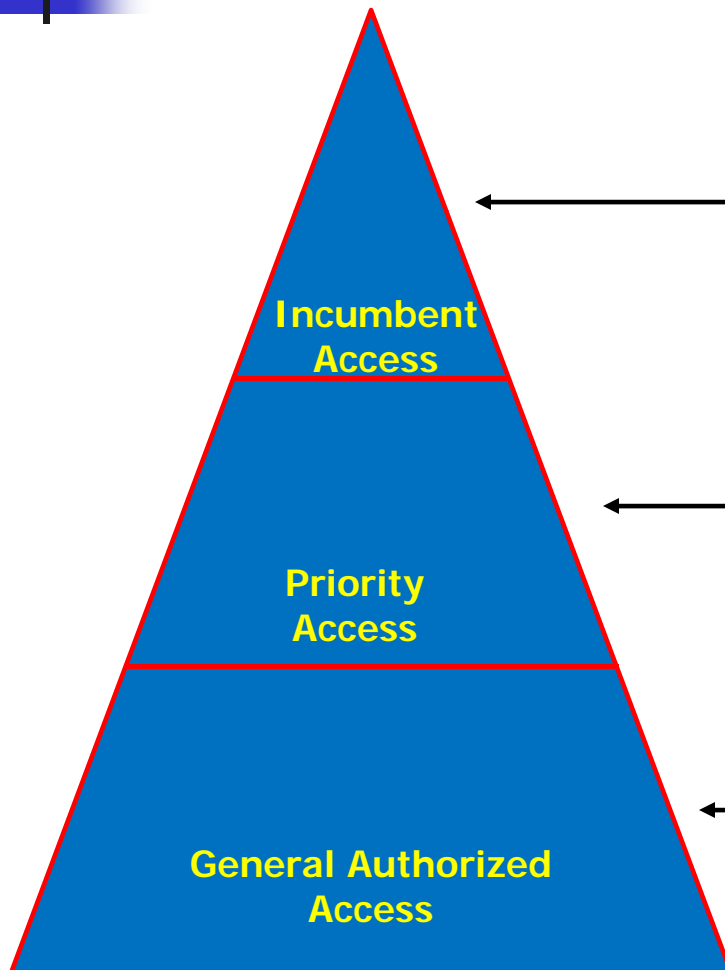
Satellite Protection  
Zones

- FCC NPRM would provide for small cells and other uses through data base access / dynamic spectrum access - - reduce exclusion zones
- A small cell is a low power access point that operates in licensed spectrum
- A spectrum access system, incorporating a geo-location enabled dynamic database, would govern access to the 3.5 GHz Band
- Proposal considers including 3650 – 3700 MHz



# 3.5 GHz Spectrum Access Tiers

---



← **Incumbent Access:** Includes authorized federal and grandfathered Fixed Satellite Service (FSS) users currently operating in the 3.5 GHz Band.

← **Priority Access:** Authorize certain users to operate with some interference protection in portions of the 3.5 GHz Band at specific locations

← **General Authorized Access:** Users would be authorized to use the 3.5 GHz Band opportunistically within designated geographic areas. GAA users would be required to accept interference from Incumbent and Priority Access tier users.

# Spectrum Access System

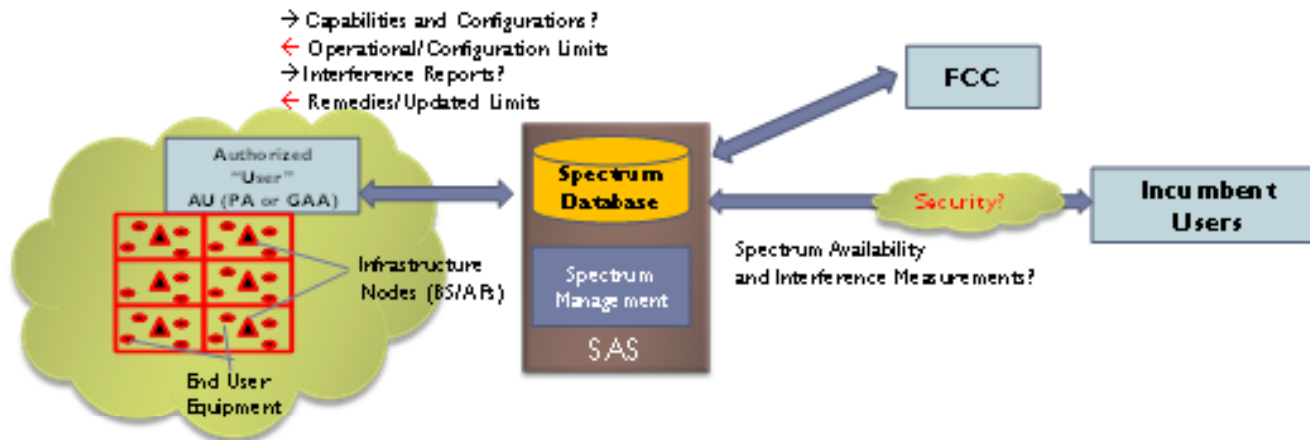


Figure 1: Spectrum Access System

## PUBLIC NOTICE

Federal Communications Commission  
 445 12<sup>th</sup> St., S.W.  
 Washington, D.C. 20554

How this is available and how to get it  
 Public Notice 13-254

DA 13-254  
 November 18, 2013

### WIRELESS TELECOMMUNICATIONS BUREAU AND OFFICE OF ENGINEERING AND TECHNOLOGY CALL FOR PAPERS ON THE PROPOSED SPECTRUM ACCESS SYSTEM (SAS) FOR THE 3.5 GHz BAND

GN Docket No. 13-254

As announced previously, the Wireless Telecommunications Bureau (WTB) and Office of Engineering and Technology (OET) (the Bureau) will host a workshop on Tuesday, January 14, 2014 from 9:00 a.m. to 12:00 p.m. (Workshop) to further explore the technical requirements, architecture, and operational parameters of the proposed Spectrum Access System (SAS) for the 3.5 GHz Band. The primary goal of the Workshop is to seek public input on a minimum set of high-level system requirements and functional parameters for the SAS. With this Public Notice, the Bureau is seeking that interested parties submit papers describing technical aspects of the SAS in advance of the workshop.

In December 2012, the Commission adopted a Notice of Proposed Rulemaking that proposed to make available at least 100 megahertz of spectrum in the 3.5 GHz Band for shared commercial use, including small cell service.<sup>1</sup> The 3.5 GHz NRPB proposes to share the spectrum to allow additional spectrum that would include up to 100 MHz of spectrum for shared commercial use of the 3.5 GHz Band.<sup>2</sup> Under the proposed system, access to the 3.5 GHz Band would be governed by a dynamic SAS, building on the TV White Space database concept.

The 3.5 GHz NRPB proposes that the SAS would manage three service tiers: (1) Incumbent Access, (2) Priority Access (PA), and (3) General Authorized Access (GAA). Incumbent Access users would include authorized

<sup>1</sup> See Wireless Telecommunications Bureau and Office of Engineering and Technology, *Report on the Proposed Spectrum Access System for the 3.5 GHz Band*, GN Docket No. 12-254, Radio Show, DA 12-254 (December 10, 2012) (Report), available at <http://www.fcc.gov/omh/et/2012/12/10/12-254-report>; and *Report on the Proposed Spectrum Access System for the 3.5 GHz Band*, GN Docket No. 12-254, Radio Show, DA 12-254 (December 10, 2012) (Report), available at <http://www.fcc.gov/omh/et/2012/12/10/12-254-report>.

<sup>2</sup> See *Report on the Commission's Study With Regard to Commercial Operation in the 3.5 GHz Band*, GN Docket No. 12-254, *Report on the Commission's Study With Regard to Commercial Operation in the 3.5 GHz Band*, DA 12-254 (December 10, 2012) (Report), available at <http://www.fcc.gov/omh/et/2012/12/10/12-254-report>.

## Public Notice Nov. 18, 2013: Call for Papers - Focus Areas:

- General Responsibilities and Composition of SAS
- Key SAS Functional Requirements
- SAS Monitoring and Management of Spectrum Use
- Issues Related to Initial Launch and Evolution of SAS and Band Planning

FCC Workshop was held on January 14, 2014



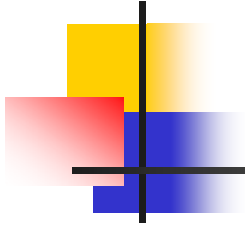


# Further NPRM

April 23, 2014

---

- Proposed text of rules
- Citizens Broadband Radio Service – Part 96
- Specific proposals:
  - Implement the three tier model
  - Exclusion Zones for incumbent federal operations
  - Create an open eligibility authorization system
  - Establish rights for the Priority Access tier
  - Set a defined “floor” for GAA spectrum availability,
  - Provisions for “Contained Access” Users
  - Baseline technical rules for fixed or nomadic base stations
  - Guidelines for operation and certification of SASs



Unlicensed @ 5 GHz



# Proposal for Additional Spectrum for Unlicensed at 5 GHz (ET Docket 13-49)

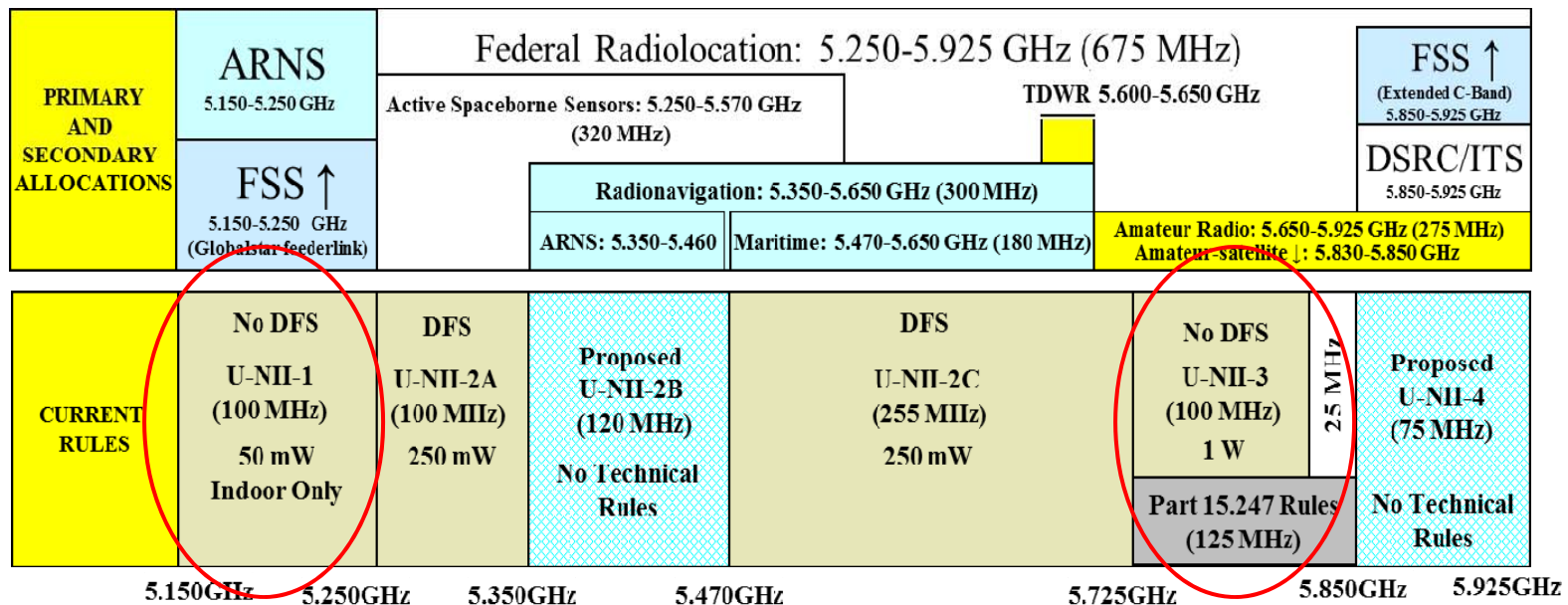
---

- Existing Part 15 rules provide access to 555 MHz of spectrum for unlicensed use in the 5 GHz region
- U-NII-2A and U-NII-2C sharing with federal radars based on Dynamic Frequency Selection (DFS)
- Devices “listen” and perform processing to detect radars
- Jobs Act called for NTIA studies of access to add'l 195 MHz without interference to federal systems. First report Jan. 2013
- FCC issued proposal on 2/20/13 proposing to add 195 MHz of spectrum predicated on outcome of studies

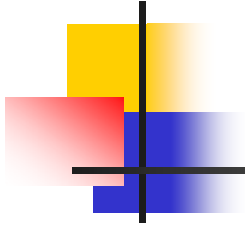
# First Report & Order

Adopted 3/31/2014 ET Docket No. 13-49

## Previous Rules



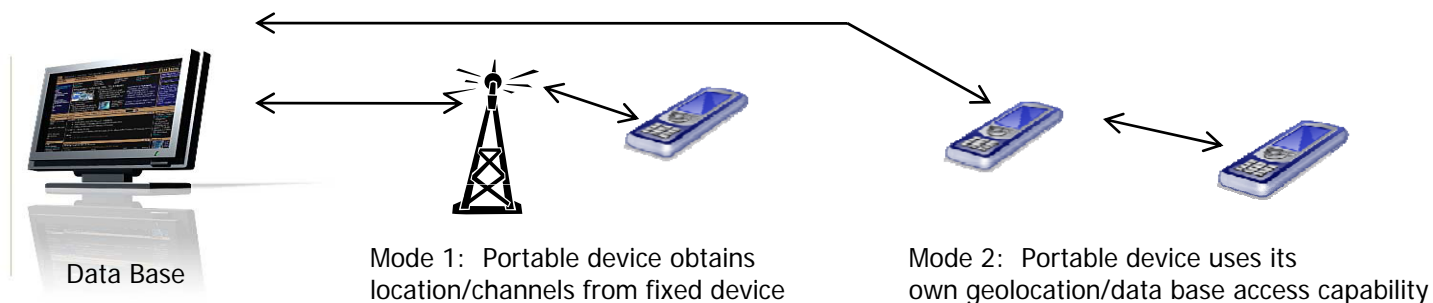
- For U-NII-1: Removed indoor-only restriction and increased permitted power: Increases utility of spectrum and accommodates next generation of Wi-Fi technology.
- Extended upper edge of the 5.725-5.825 GHz band to 5.85 GHz and consolidated
- Required all U-NII device software be secured to prevent its modification
- Modified rules to protect Terminal Doppler Weather Radar (TDWR) systems and other radars



# TV White Space

# White Space Access Method

- Device determines its location
- Communicates with data base of protected services
- Data base replies with permissible frequencies at that location
- Device automatically operates on permissible frequencies



# Progress on White Space in the TV Bands (Unlicensed)

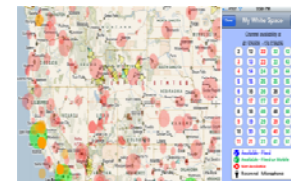
- Adopted final rules in 2012
- Nine devices approved:
  - Adaptrum, Koos Technical Services, Meld, Carlson, Redline and 6harmonix
  - All fixed devices, designed for professional installation - location entered manually
  - All are generic boxes with an input for a digital signal (voice, video, data).
  - About 450 devices deployed
- Data bases approved:
  - Spectrum Bridge, iconectiv (formerly Telcordia), Google and Key Bridge Global
- IEEE developing "af" standard
- Strong international interest



Meld

Carlson

Adaptrum



Spectrum  
Bridge



iconectiv



Wireless Cameras Cover Park  
in Wilmington NC

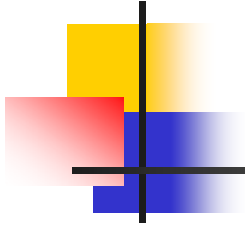
# Data Base Administrator Approval Process

- File application
- Workshops
- Submit data base
- FCC Review
- Public beta test
- Final report
- Public comment
- Final approval
- Maintenance: Q&A's

White Space Database Administrators

Administrator Name	Contact Information	Approval Status
Airity, Inc. (formerly WSdb LLC)		Pending
Comsearch	H. Mark Gibson, 19700 Janelia Farm Boulevard, Ashburn, VA 20147 <a href="mailto:mgibson@comsearch.com">mgibson@comsearch.com</a>	Pending
Frequency Finder, Inc.	Peter Moncure, 8910 Dick's Hill Parkway, Toccoa, GA 30557 <a href="mailto:pmoncure@radiosoft.com">pmoncure@radiosoft.com</a>	Pending
Google Inc.	Alan.Norman, 1600 Amphitheatre Parkway, Mountain View, CA 94043 <a href="mailto:alannorman@google.com">alannorman@google.com</a>	Approved
KB Enterprises LLC and LS Telcom	Dr. Georg Schöne, Im Gewerbegebiet 31-33, D-77839 Lichtenau, Deutschland <a href="mailto:GSchoene@LStelcom.com">GSchoene@LStelcom.com</a>	Pending
Key Bridge Global LLC	Jesse Caulfield, 1600 Tysons Blvd., Suite 1100, McLean, VA 22102 <a href="mailto:jesse.caulfield@keybridgeglobal.com">jesse.caulfield@keybridgeglobal.com</a>	Approved
NeuStar, Inc.	Brian Rosen, 1775 Pennsylvania Ave., NW, Washington, DC 20006 <a href="mailto:brian.rosen@neustar.biz">brian.rosen@neustar.biz</a>	Pending
Spectrum Bridge, Inc.	Peter Stanforth, 1064 Greenwood Blvd, Lake Mary, FL 32746 <a href="mailto:peter@spectrumbridge.com">peter@spectrumbridge.com</a>	Approved
iconectiv	John P. Malyar, 1 Telcordia Dr., Piscataway, NJ 08854 <a href="mailto:jmalyar@iconectiv.com">jmalyar@iconectiv.com</a>	Approved
Microsoft Corporation	Ian Ferrell, One Microsoft Way, Redmond, WA 98052, <a href="mailto:ianf@microsoft.com">ianf@microsoft.com</a>	Pending





# Commercial Space Launches

http://www.washingtonpost.com/wp-srv/special/national/nasa-newspace/

The Washington Post PostTV Politics Opinions Local Sports National World Business Tech Lifestyle Entertainment Jobs More

# NATIONAL

In the News Paul Walker Afghanistan The Guardian Auburn football Pacman and Peso

Advertisement

Quality is our style  
Summit Crossing Luxury Garage Townhomes  
in Gaithersburg, MD

CRAFTSTAR HOMES

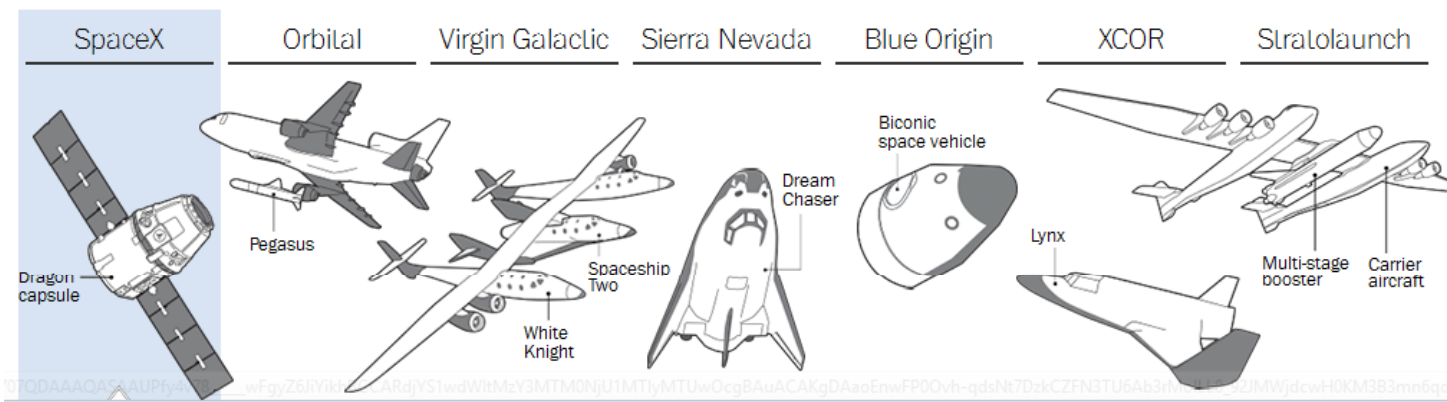
## New players in the space race

By Alberto Cuadra and Katie Park, Published: Nov. 22, 2013

Until recently, sending cargo or people into Earth's orbit was a task reserved for a handful of government agencies and contractors, but a new breed of entrepreneurs wants to make getting into space a much easier proposition. Some of these new companies are not only engaged in making space tourism a viable business but are also setting ambitious, long-term objectives, such as going to Mars. [Read related article.](#)

These are the companies working toward space travel.

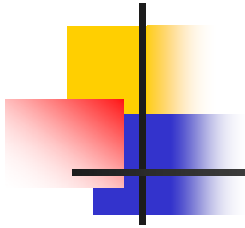
See what the companies have built ▶



# Proposal To Accommodate Commercial Space Launches & Federal Earth Stations

- NPRM Adopted 5/9/13
- Proposes to make non-Federal allocations in 3 bands to support commercial space launches:
  - 420-430 MHz - self-destruct signals for launches
  - 2200-2290 MHz – telemetry during launches
  - 5650-5925 MHz– radar tracking during launches
- Co-Primary Allocation of Fixed Satellite Service (FSS) for Federal Use: Federal earth stations can communicate with commercial satellites with interference protection
- Federal Use of Co-Primary Mobile Satellite Service (MSS) Allocation: Federal agencies can operate MSS satellites in a small (150 kHz) shared Federal/non-Federal band





# Why Spectrum Sharing?



# Why Spectrum Sharing?

---

- Will continue to seek potential reallocations
- Relocations increasingly complex, time consuming & costly:
  - PCS – Relatively easy
  - AWS-1 – Complex federal relocations
  - AWS-3 – Much more complex
  - Broadcast auxiliary spectrum reduction took 15 years!
  - TV Incentive Auction – Many stakeholders
- Many systems can't be moved (satellites, radars)
- Technology is enabling new sharing techniques

**Nearly all of the issues discussed earlier  
involve some form of sharing**

# "Garage Door Opener" Issue

- Myth: Military forced to stop deployment of mobile radios
- Reality: Consumer outreach & coordination of roll-out with garage door industry
- Fear: Consumer Complaints will trump spectrum rights
- Remedy: Robust technology



Ix  
↓  
Reduced range  
or stopped  
functioning





# Robust Technology

---

## Traditional Paradigm

- Device receives interference
- Little ability to cope – one trick pony
- Performance seriously degrades
- Or worse, totally unusable

## New Paradigm

- Device receives “interference”
- Strong ability to cope – big bag of tricks
- Performance degrades gradually
- Shifts to alternative spectrum resources

## Examples

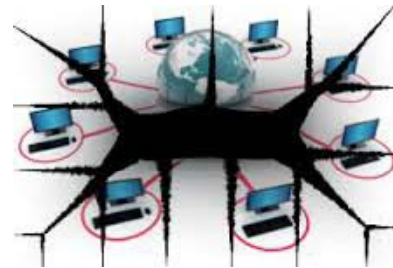
- LTE
- Wi-Fi
- Certain Medical

## “Show Me”

- Dialogue
- Tests

# Security of Data Bases & Devices

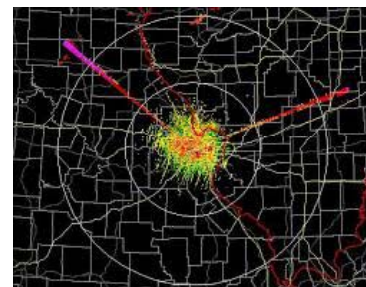
- Need to prevent:
  - Outages via cyber attacks
  - Disclosure of classified or sensitive information
  - Modification of equipment
- Remedies:
  - Establish security provisions
  - Evaluate risks
  - Establish fallbacks
  - Enforce the rules



What occurs if data base is attacked?



How do we prevent changes?



How do we enforce to prevent interference?



# Spectrum Rights & Controlling Interference

- Spectrum rights:
  - In the past, had your own lane
  - Now, lanes are shared



- Controlling interference
  - How to define harm?
  - Different expectations
  - Difficult when everything is flexible
  - Matters what you turn on

Turning on  
this . . .



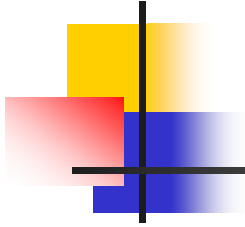
or this?



# Tackling the Issues

---

- Ongoing collaboration with NTIA, federal agencies & industry
- Working on specific items: AWS-3, 3.5 GHz, 5 GHz
- Technological Advisory Council
  - Interference harms claims threshold
  - Probability in interference analyses
  - Sharing principles
  - Enforcement in dynamic sharing

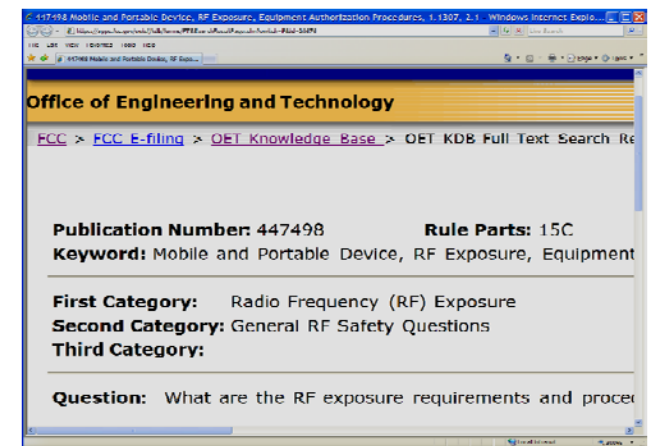


# Equipment Authorization

# TCB Program

- Telecommunications Certification Bodies (TCBs) certify most radios
- 35 TCBs world-wide under Mutual Recognition Agreements
- TCBs can often certify products in a matter of days
- Success of the program depends on consistent application processing:
  - FCC conducts regular workshops – require mandatory TCB attendance
  - Provides Knowledge Data Base guidance

TCB Workshop



Lab KDBs



# Streamlining the FCC Equipment Authorization Program (ET Docket 13-44)

---

- Rule making initiated 2/12/13 focusing on Telecommunications Certification Body Obligations:
  - Refine & codify Permit but Ask (PBA) procedure
  - Clarify TCB obligations for post-grant checks
  - Require accreditation for all test labs
  - Recognize latest industry testing standards
  
- 2nd NPRM – Administrative Procedures & Various Technical Matters:  
*Consider:*
  - Electronic labelling [Draft KDB released May 9, 2014]
  - Merging different self-approval procedures
  - Modifying permissive change and Software Defined Radio (SDR) rules
  - Certifying modular transmitters for licensed services



# Other OET Projects

---

- TV Incentive Auctions
- Technological Advisory Council
- Technology Transition Task Force
- Receivers – Interference Harms Threshold
- Broadband speed measurement project
- RF Exposure Proceeding
- Air-ground at 14 GHz
- mHealth – Mbans reconsideration
- Streamlining experimental licensing
- And many projects with other bureaus/offices



# Conclusion

---

Questions?