



C-Band – Moving Forward

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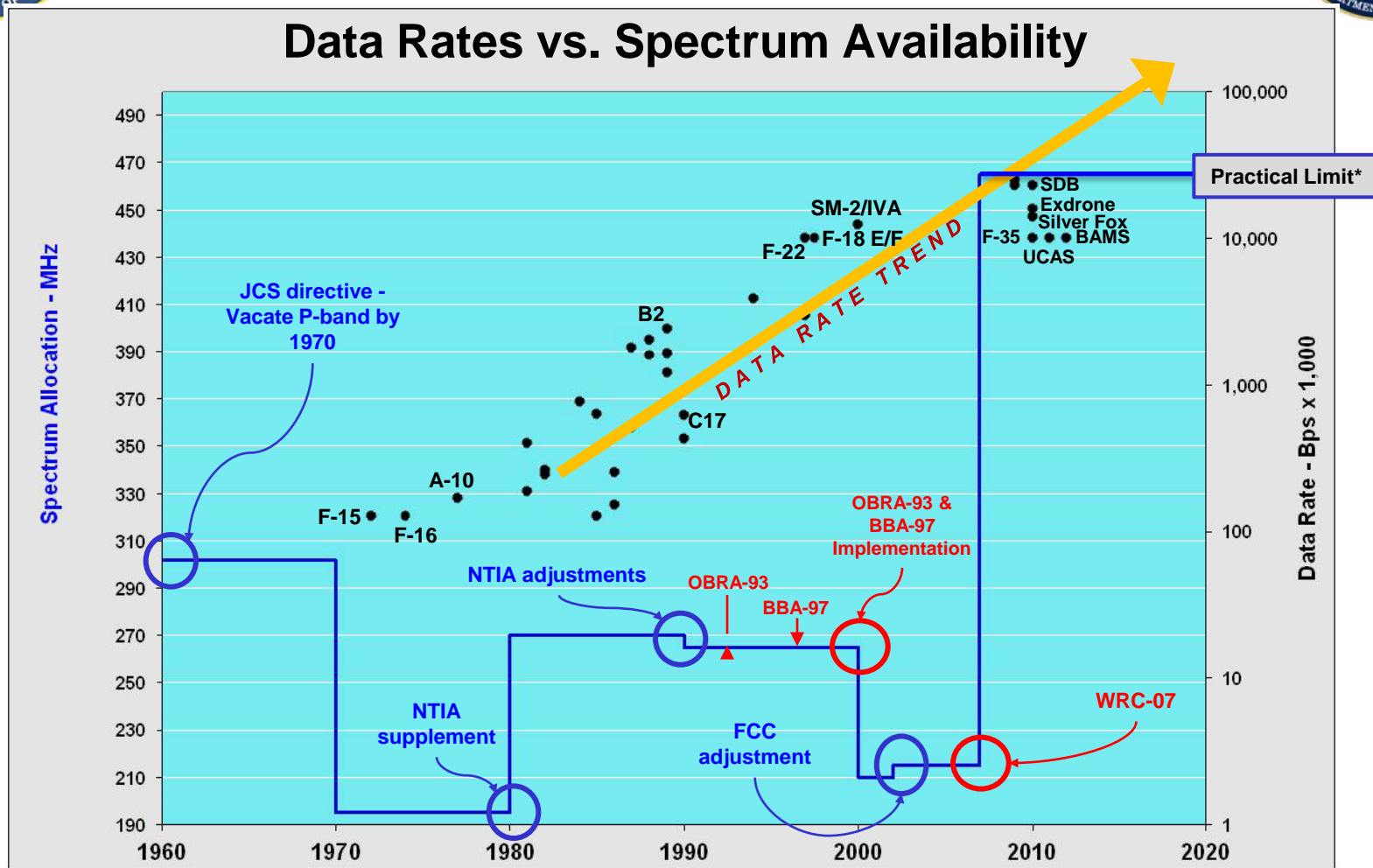
Outline



- Background – Why we need C-band
- Current spectrum environment
 - National Broadband Plan
 - Domestic threats
- What is coming
- Current efforts
- C-Band regulatory status
- Summary



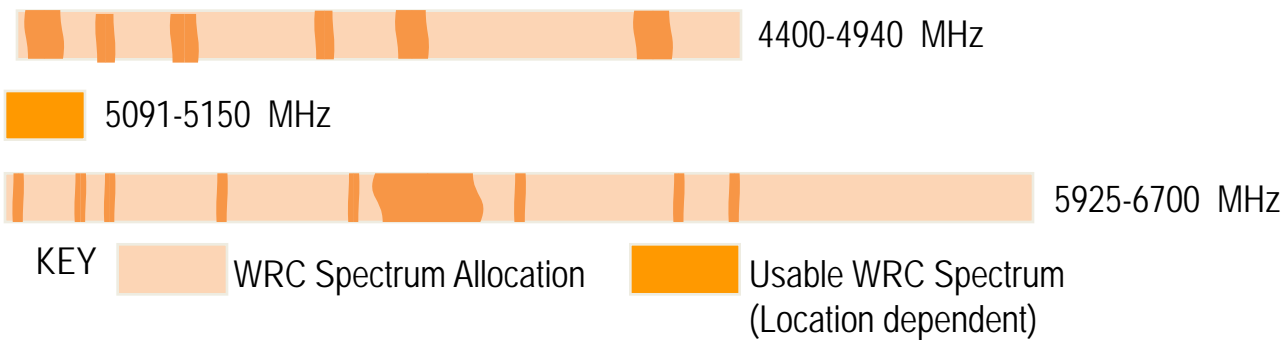
The Original Drivers



* Although the Ranges obtained access to over 1.3 GHz of spectrum at WRC-2007, only about 200-250 MHz of this is available at any given range because of other users. Technology research may increase the amount of available spectrum by a factor of 2 to 3 (to 500-750 MHz).



T&E Telemetry Spectrum After 2007 World Radio Conference



TOTAL ACCESSABLE

~ 100 MHz
 59 MHz
 ~90 MHz

} ~250 MHz
 WRC bands
 or
 C-Band

- NOTES**
1. 4 gig band is a DoD workhorse band. Shared with troposcatter, TDL, UAV, LAMPS, training systems, tactical comms, others
 3. 5 gig band has almost no users, civil or Federal.
 4. 6 gig band is all civil. Many thousands of VSATs and microwave systems. Every 7-11, utility, transportation system etc. Sharing is difficult and piecemeal.

Despite gaining access to 1.3 GHz of spectrum, only ~250 MHz is usable



National Broadband Plan



“Repurpose” 500 MHz for broadband wireless services over ten years

- Process

- Identify candidate bands – FCC & NTIA
 - Federal agencies work to President’s Ten Year Plan (TYP)
- Assess candidate bands listed in TYP over next 3 years
 - NTIA sets assessment schedule
- In DoD, MILDEPS assess, integrate at DOD CIO level, provide to NTIA
- Ranges report up-channel through their command structure
- NTIA and FCC coordinate on final band decisions

- Status

- 1st band decision “Pending”, all complete by mid-2014
- No decisions yet on when systems must vacate

THIS WILL AFFECT C-BAND!



National Broadband Plan: Potentially Adverse Impacts to T&E



- Outright loss of bandwidth
- Forced to share bandwidth
 - Increased crowding if other “losers” moved into existing T&E bands
 - Increased interference from wireless systems
 - In-band
 - Out-of-band (adjacent bands)

The goal of NBP is for wireless and incumbents to share bands to greatest extent possible. . . however . . . it is extremely difficult for wireless radio and T&E to share bandwidth.



Other Domestic Threats

- MBANS (medical telemetry) operating in 2360-2395 MHz
 - Coordination agreement near completion
- Broadband wireless (WCS) operating in 2345-2360 MHz
 - Working to minimize OOB interference into 2360-2395 MHz band
- LightSquared wireless operating in 1525-1559 MHz band
 - Analyzing potential for OOB interference into 1435-1525 MHz band
 - Could also affect range systems using GPS
- Dish Network wireless operating in 2180-2200 MHz band
 - New threat. Trying to obtain data to analyze potential for OOB interference into 2200-2290 MHz band
- 1755-1850 MHz band Reallocation



1755-1850 MHz Reallocation

- The Plan: Reallocate 1755-1850 MHz band for wireless broadband
 - 1755-1780 sub-band vacated in 3-5 years (approx. 2016)
 - 1780-1850 sub-band vacated in 5-7 years (approx. 2021)
- Ten categories of DOD systems affected
 - Approx. 14 test ranges
- Proposed alternative band for telemetry is 5150-5250 MHz
- Detailed plans & refined cost estimates for each range due approx. late-2012
- Auctions probably mid- to late-2013
- IMPLICATIONS:

Ranges may have to have C-band implementation plans by next year



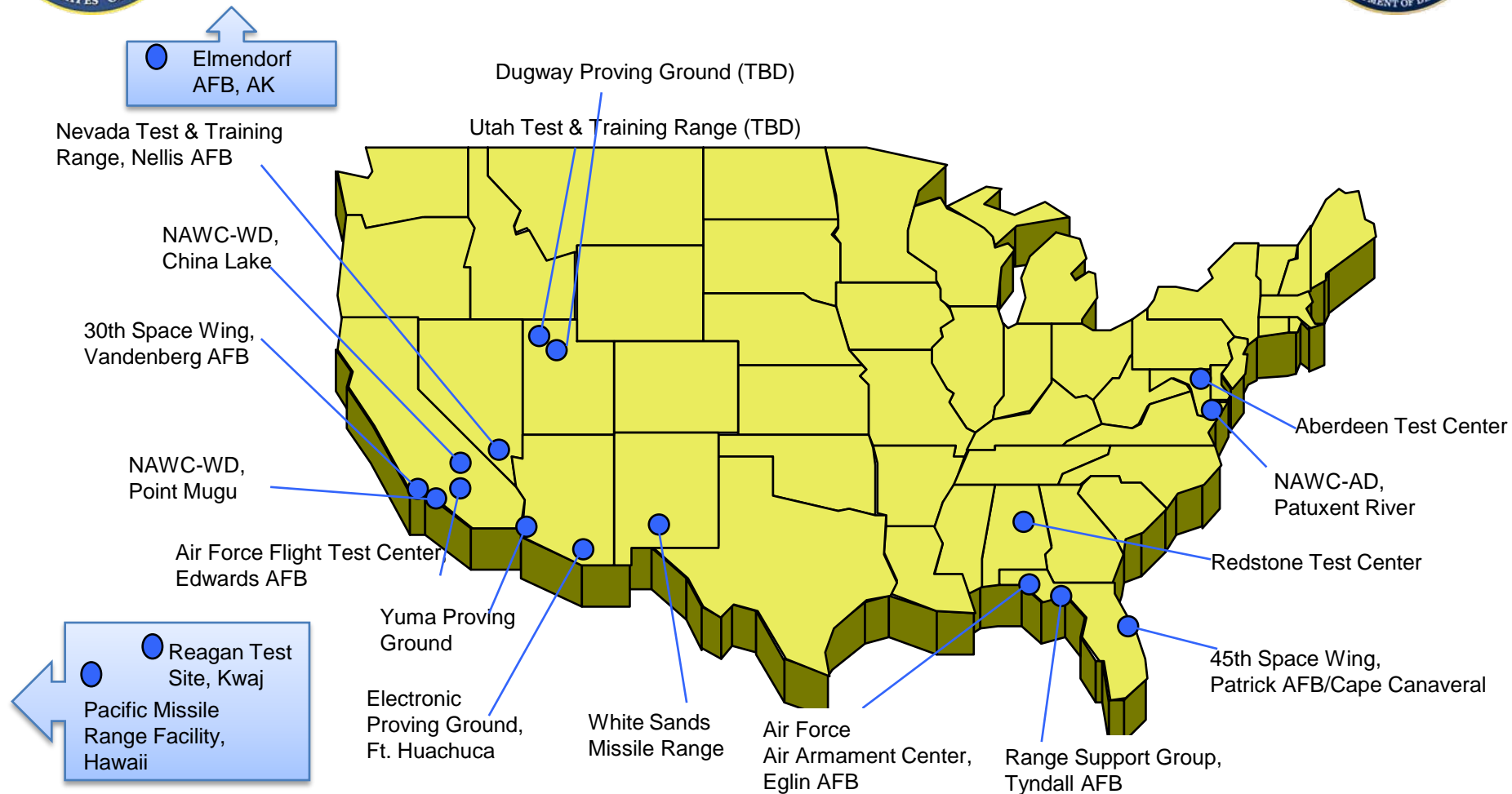
C-Band Regulatory Status

- **US Table of Allocations must be updated to show 4400-4940, 5091-5150 and 5925-6700 authorized for telemetry**
 - Table is considered updated when published in Federal Register
 - FCC publishes all updates to Fed Register
 - Text for Federal bands provided to FCC by NTIA
- **FCC has sent proposed regulatory language to IRAC for approval**
 - FCC recommends no change to 5925-6700 – too difficult to share
- **IRAC considering FCC proposal**
 - DOD evaluating FCC proposal on 5925-6700 band

STAND BY!



Candidates for C-Band Implementation



Spectrum Stewardship Senior Steering Group (S4G) oversees implementation
C-band working group comprising ranges provides technical integration



Summary



- The T&E community has experienced an exponential growth in data throughput requirements due to increased system complexity, and this trend continues.
- The T&E community has experienced significant encroachment from the wireless communications industry, and this encroachment continues.
- We have experienced some success in mitigating the impact to T&E spectrum, but we still have a lot of work to do

Implementing a robust C-Band telemetry capability is key to offsetting encroachment issues



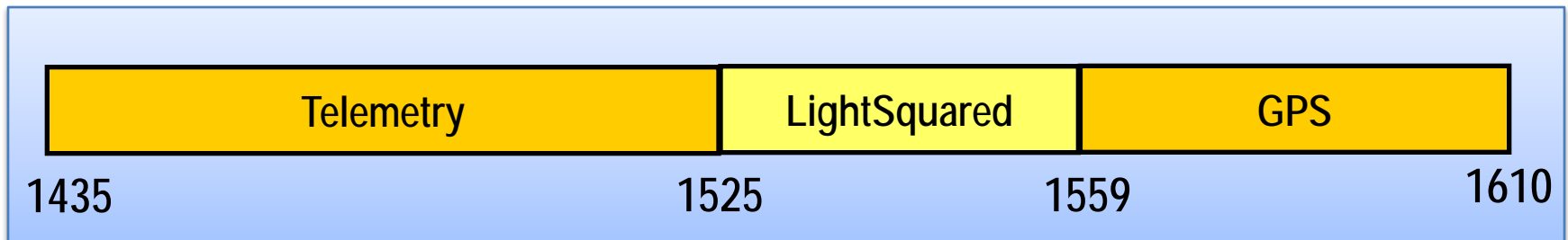
QUESTIONS?



Other Challenges We Are Watching: Other Systems in T&E Bands



- **DoD and commercial systems that already possess, or are in the process of obtaining, frequency assignments in key DoD T&E bands**
 - LightSquared (4G terrestrial infrastructure) has gained approval to operate in a band adjacent to the GPS band and lower L telemetry bands. As proposed, this will interfere with GPS and telemetry operations.
 - Additionally, some (DoD) tactical systems are currently assigned to T&E bands. We are looking for ways to mitigate the potential impact to the DoD T&E community.





Other Challenges We Are Watching: Medical Telemetry



Conflict with Telemetry Band

- GE Healthcare, Phillips, others seeking to operate thousands of low power devices in the 2360-2395 MHz telemetry band
 - Test show devices could interfere
- AFTRCC, DOD, GE, Phillips developed sharing methodology and coordination criteria

Proposed Technical Solution

- Inside building, devices can transmit on any frequency; outside bldg., devices cannot operate, or can be switched by device control center to frequency above 2395 MHz
- Medical facilities within LOS of a range must register with range
 - Awaiting final FCC rulemaking approving agreement

***DoD in Partnership with Industry:
A Model for Future Sharing Agreements***



National Broadband Plan



- Candidate bands for the Broadband Initiative are:

Frequency / Bands	Amount (MHz)	Current Allocation	T&E Usage
(Broadcast TV) VHF /UHF Frequencies	120	Non-Federal	
406.1-420	13.9	Federal	Yes
758-763 788-793	10	Non-Federal	
1300-1390	90	Federal	Yes
1525-1559 1626.5-1660.5	40	Non-Federal	
1610-1626.5 2483.5-2500	10	Non-Federal	
1675-1710	35	Shared	Yes
1755-1780	25	Federal	Yes
1780-1850	70	Federal	Yes
1915-1920 1995-2000	10	Non-Federal	
2000-2020 2180-2200	40	Non-Federal	
2020-2025	5	Non-Federal	
2155-2180	25	Non-Federal	
2200-2900	90	Federal	Yes
2305-2320 2345-2360	30	Non-Federal	
2700-2900	200	Federal	Yes
2900-3100	200	Shared	
3100-3500	400	Shared	Yes
3500-3650	150	Federal	
3700-4200	500	Non-Federal	
4200-4400 4200-4220 4380-4400	200	Shared	Yes
TOTAL	2263.9		

- Extensive impact and sharing studies underway by Ranges
 - Very costly
 - Lead times for research & development is years if bands are lost
- Wireless industry wants these specific bands because of cost and performance:
 - 1755-1850 MHz band matches the spectrum they got from us in 1990s (1710-1755)
 - 2200-2290 MHz band pairs well with 1710-1850 because industry can use same antennas & radios

Band critical for missile and missile defense T&E

Band critical for all unmanned vehicle testing, including missile and missile defense T&E. All DoD satellite C2.

Bands in yellow are used for various T&E purposes



Other Challenges We Are Watching: WRC-12 Agenda Items



- **AI 1.3 – C2 for UAS flying in civil airspace**
 - U.S. proposing 5030-5091 MHz; Some countries still thinking about 5091-5150 MHz
- **AI 1.4 – Airport ground network for ground aircraft safety**
 - Designated co-primary with telemetry in 5091-5150 MHz at WRC-07
 - WRC-12 considering additional spectrum; U.S. proposes 5000-5010 MHz add
- **AI 1.5 – Electronic news gathering (ENG)**
 - ENG scattered across many bands; WRC trying to bring order to chaos
 - ENG often requests operations in telemetry bands
- **AI 1.25 – Expansion of mobile satellite services (MSS) into new bands, including 5150-5250 MHz**
 - U.S. study shows MSS OOB would cause severe interference in 5091-5150 MHz band; U.S. accordingly opposes MSS proposal
- **AI 8.2 – Additional broadband wireless allocations in 400-4400 MHz**
 - NTIA has proposed this as an agenda item for WRC-15
 - Not yet reconciled with FCC for U.S. proposal



Background: T&E Spectrum Losses 1993-2003

