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THE AIR FORCE TEST CENTER TECHNICAL CHALLENGES

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AIR FORCE TEST CENTER
EDWARDS AFB, CA

APRIL 2018

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EDWARDS AIR FORCE BASE, CALIFORNIA
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UNITED STATES AIR FORCE

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Air Force Test Center



The Air Force Test Center Technical Challenges

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Integrity ★ Service ★ Excellence



OUTLINE

- **Air Force Test Center overview**
- **Center Challenges**
- **Relationship with AFRL**
- **Technical areas**
- **Examples of gaps and resolution**
- **Conclusions**



BLUF

- **Big challenges and technical gaps**
- **Aging infrastructures**
- **Emerging technologies**
- **Hard to predict the future**
- **Fiscal constraints**

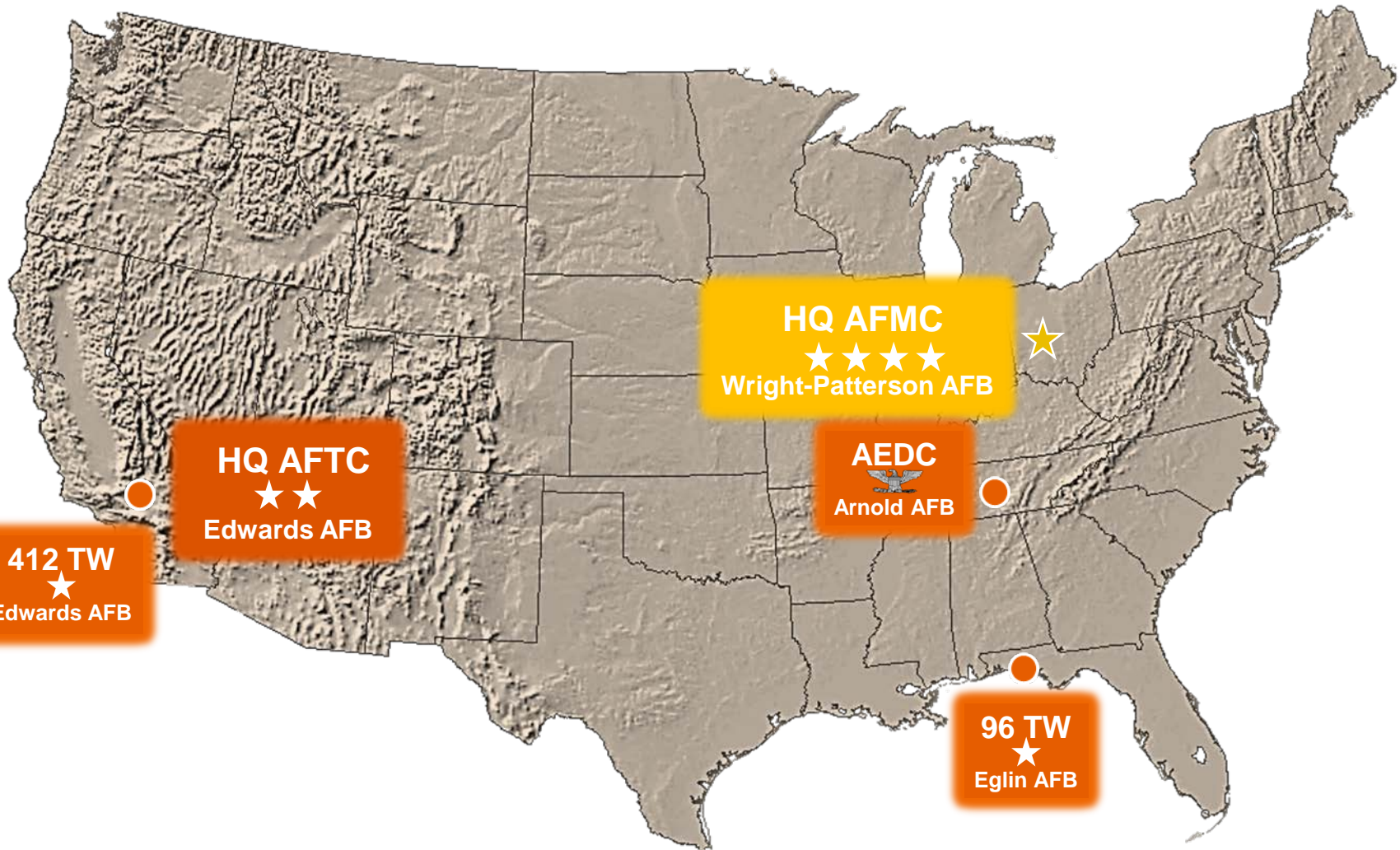


SIX AFMC Centers





Span of Operations



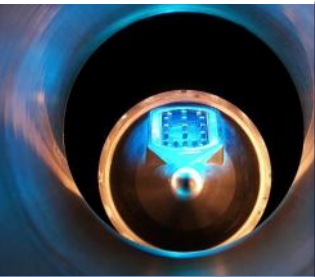


Our Mission and Our Vision

Conduct Developmental Test and Evaluation of air, space, & cyber systems to provide timely, objective, and accurate information to decision makers



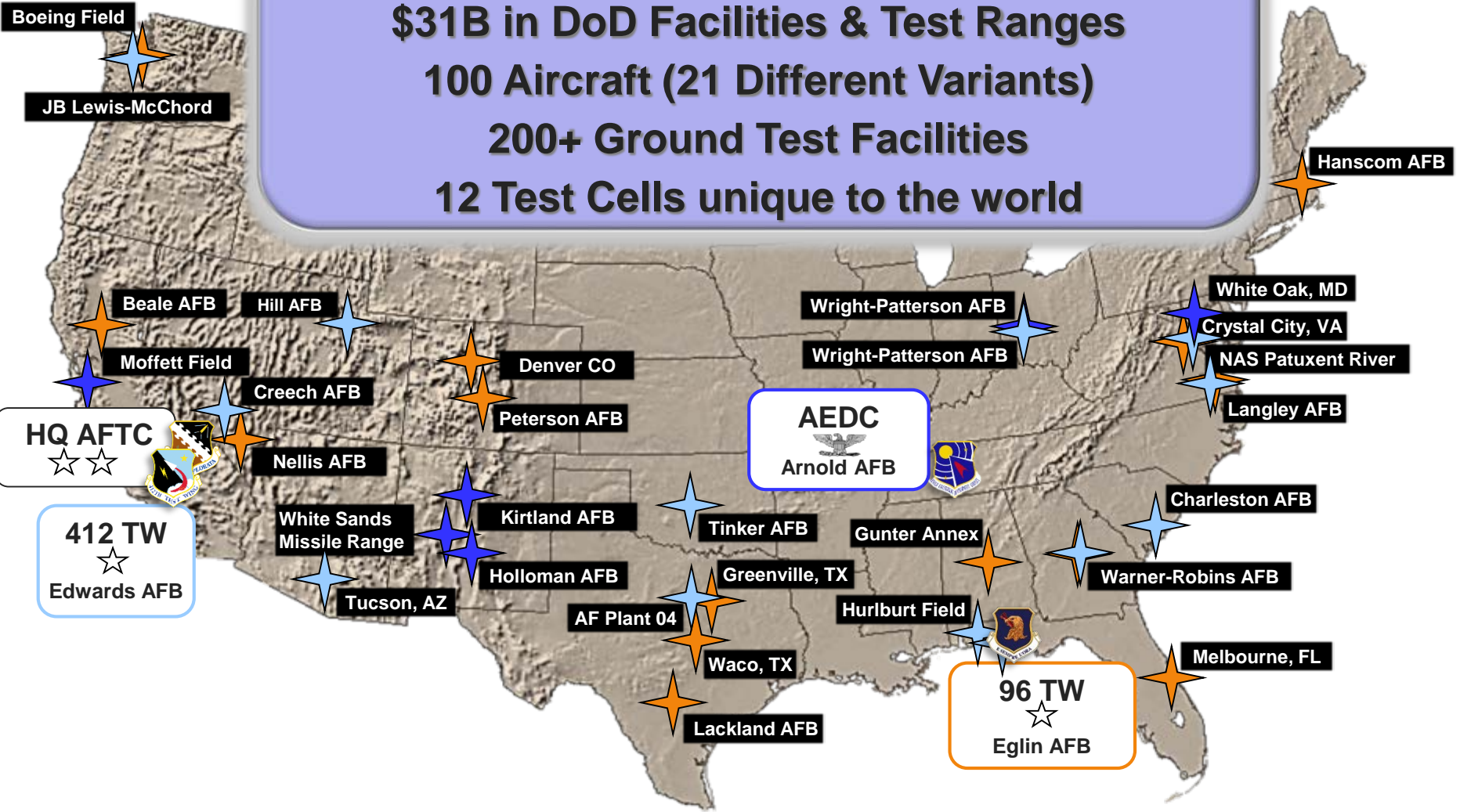
Tester of Choice... Today and Tomorrow





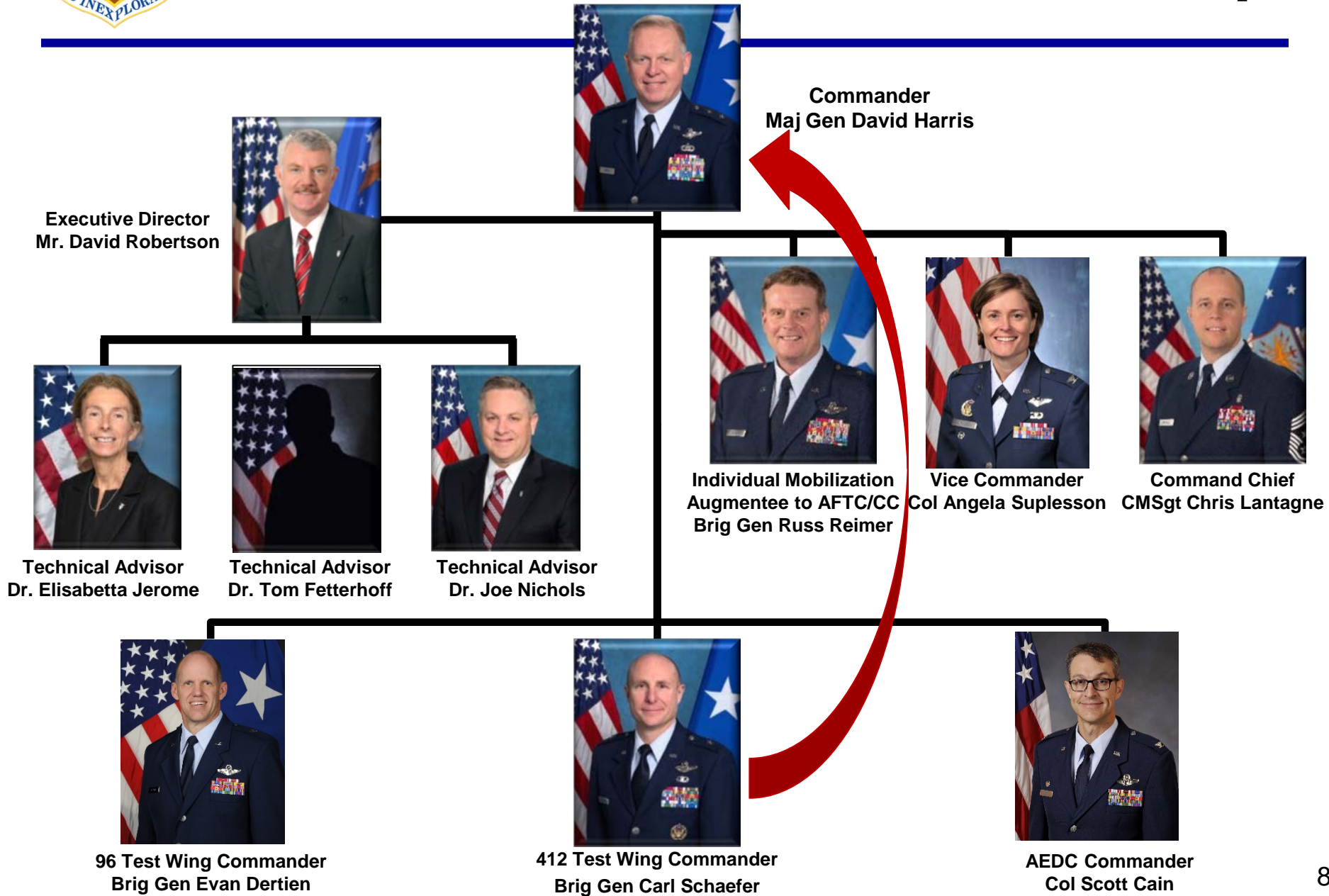
Span of Operations

32 Locations Total
\$2B Annual Budget, BOS at 3 Major Installations
\$31B in DoD Facilities & Test Ranges
100 Aircraft (21 Different Variants)
200+ Ground Test Facilities
12 Test Cells unique to the world





AFTC Leadership





Why Testing is important

"The mission of the test center is a sacred trust. If we fail, we must face the widows, widowers and the children left fatherless or motherless because of the system's fail. We are the safety net; we are the warrior's best friend," Maj. Gen. David Harris, Commander, Air Force Test Center



Why Testing is needed

- **“A defective ignition system is seldom found on a drafting board, night visibility cannot be discovered on a blueprint, and endurance cannot be calculated with a soft pencil and a pad of paper. These are things that can be determined by only one method – thorough testing. (GM Pamphlet – “Putting Progress Through Its Paces”)**



Big Picture

- **The Air Force Test Center conducts Developmental Tests for the Air Force**
- **To test emerging technology we need new instrumentation, new equipment, bigger and safer ranges,...**
- **The challenge is to know *what* we will need and *when***



AFTC Priorities

- **Agile** – Must be able to rapidly respond in all phases of our mission
- **Ready** – Must be proactive and forward thinking to position us for success in the future
- **Right** – Must be correct in our answers to decision makers



One Enterprise providing world-class test



AFTC and AFRL

- **AFTC technical leadership needs to be aware of ongoing research efforts within AFRL**
 - AFTC must be ready to test new things
 - AFTC can identify applicable technologies
- **AFRL scientists and engineers need to be aware of AFTC capabilities**
- **AFRL technical leadership needs to be aware of AFTC S&T gaps**
 - Relevance of research
 - Research vectoring



Background / History

- **AFMC/CC direction for a better relationship between AFRL and AFTC**
- **AFRL-AFTC Summit in January 2016**
- **AFRL-AFTC CS-SL first meeting in April 2016**



Mission Area Panels

Technical Advisor
Dr. Elisabetta Jerome

Technical Advisor
Dr. Joe Nichols

- Air Combat
- C4ISR, Networks & Cyber
- Test Environments
- Space Combat
- S&T
- Armament and Munitions
- Common Range
Instrumentation and
Target Systems
- Electronic Combat



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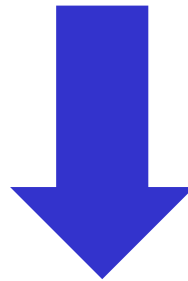
Strategic planning through the Mission Area Panels

- **The Mission Area Panels (MAPs) are the AFTC T&E technical Capabilities**
- **The MAPs main objectives are:**
 - **Help plan the AFTC investments in a strategic and Enterprise level way.**
 - **Produce roadmaps, strategic guidance and a cohesive look and prioritization of all the T&E Needs**
- **MAPs also provide recommendations, guidance, and advise on potential science and technology (S&T) projects for the advancement of T&E**



AFTC Strategic Guidance

- **Assess “guiding stars”**
- **Interact/cooperate with AFRL (S&T)**
- **Interact with customers (i.e. AFLCM/EB, AFNWC)**
- **Participate in National level panels (i.e. S4G, cyber)**



- **Mission Area Panels products:**
 - AFTC Strategic Guidance
 - 2023 priority list



“Translated” 2017 Guiding Stars for the AFTC (big rocks)

- **F-35, KC-46, Long Range Strike Bomber and Long Range Standoff Weapon, and the next generation ISR platform**
- **3rd Offset priorities: autonomy, human-machine interaction, cooperation, hypersonics and Directed Energy**
- **Testing in an A2/AD, GPS-denied environment with evolving and improving red threat systems will be important (speed, cooperation, swarming, ...)**
- **Electromagnetic spectrum available for test will continue to shrink. We must be able operate in new restricted environment**
- **Cyber testing and Cyber threats will continue to grow and become more sophisticated**



Key Challenges

- **Interconnectivity/Interoperability**
- **Emerging technologies: directed energy, next gen advanced turbine engines, hypersonic weapons**
- **Autonomy**
 - machine learning, artificial intelligence, big data analytics, and software intensive systems
- **Simulation Environments – M&S**
- **Order of magnitude increase in cyber T&E workload coming FY18-FY22 and related development of new test tools and techniques**
- **Manpower issues**
- **Modernization needs**



Examples

- **Realistically sized targets**
- **Telemetry for hypersonics weapons**
- **Spectrum loss**



Realistically sized and designed targets?





Gantry Crane Hard Target Test Capability Holloman High Speed Test Track (HHSTT)





UAV – Global Hawk Application Flight Technology Demonstration

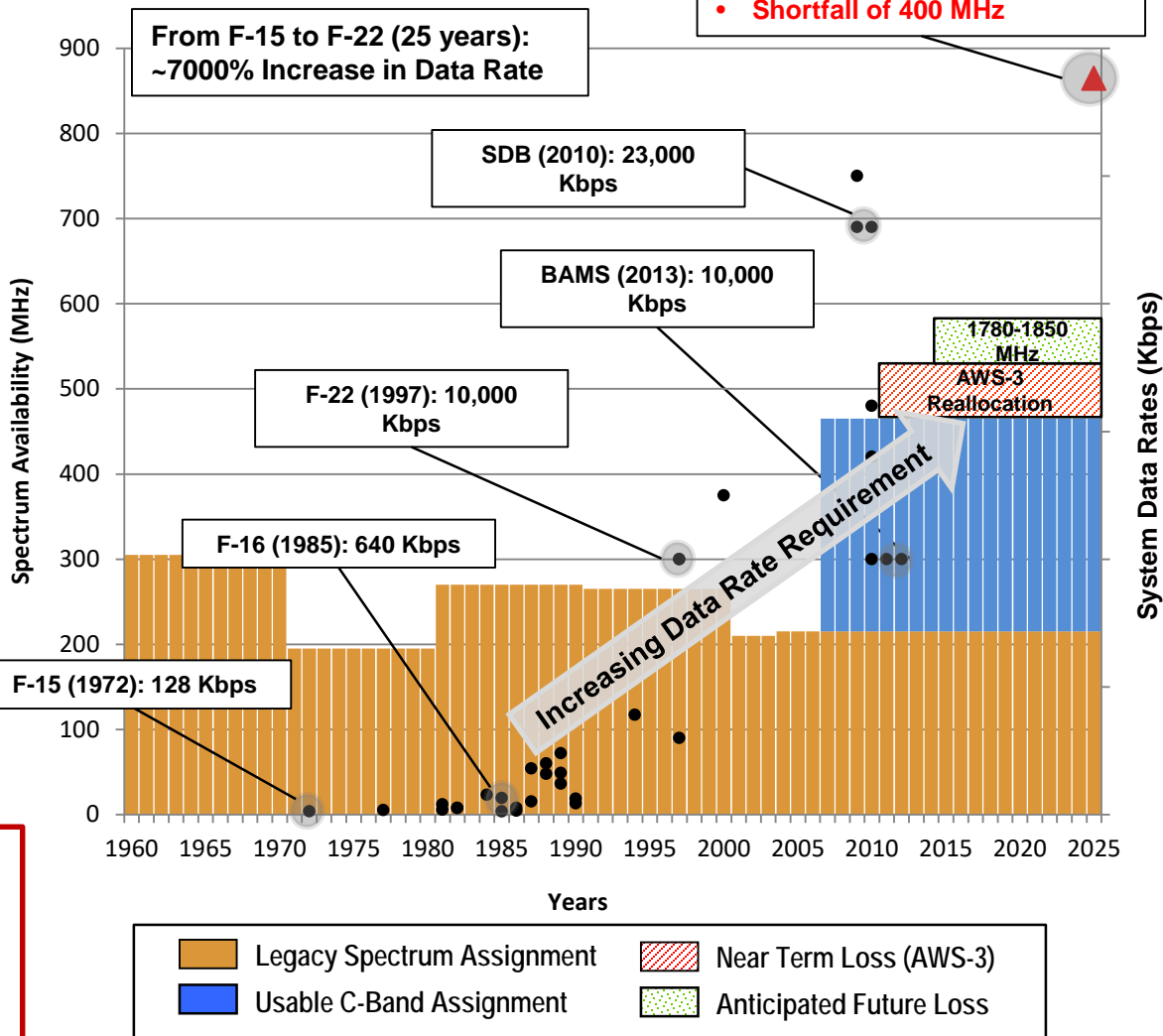




Encroachment to DoD Testing Spectrum Availability

- DoD Requirement of 865 MHz by 2025
- 465 MHz Currently Available
- **Shortfall of 400 MHz**

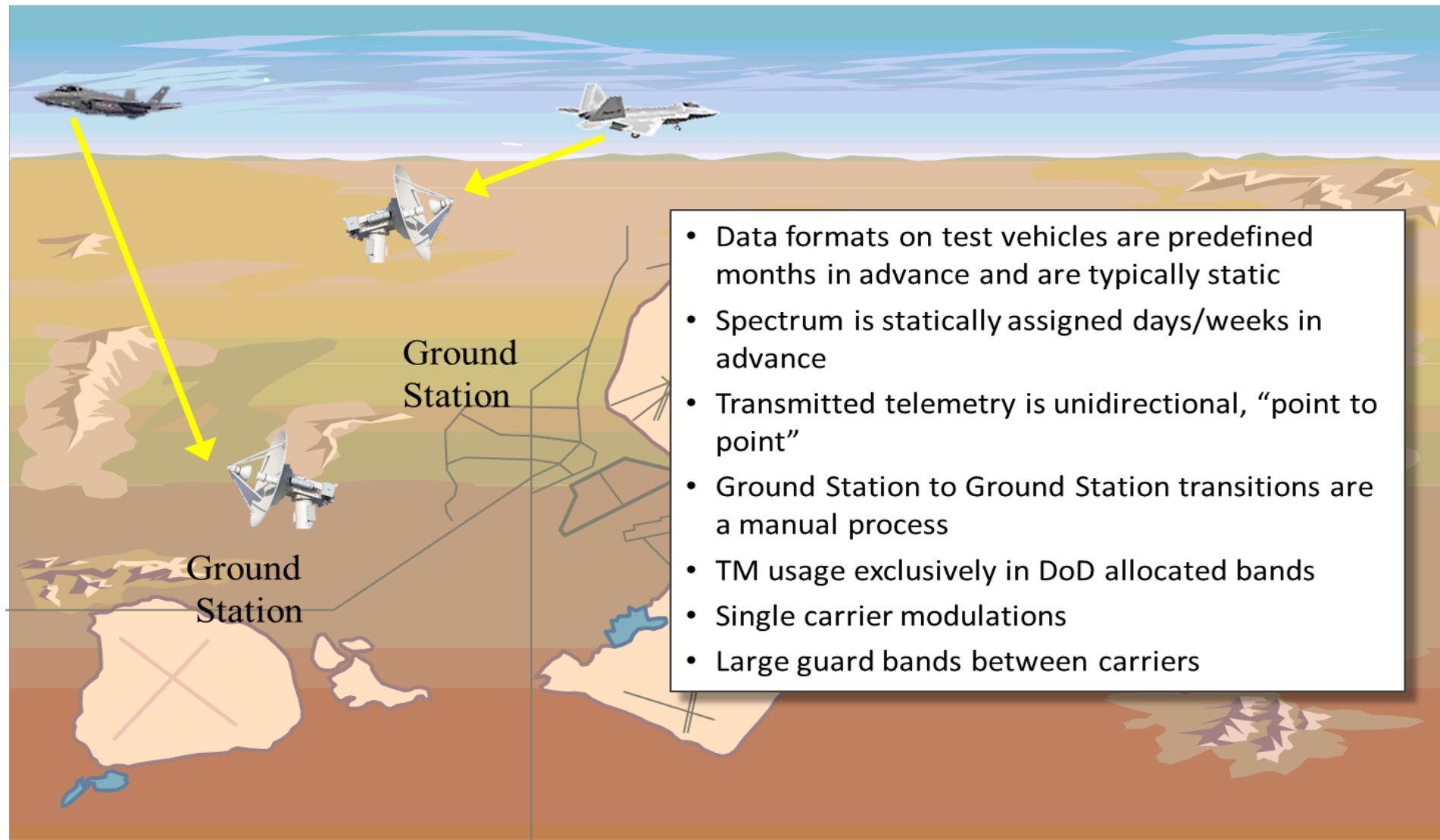
- **Increased complexity of weapon systems coupled with decreased availability of telemetry spectrum limits testing at national ranges (complexity of tests, data downlinks)**
 - Available spectrum will be further reduced by potential loss of 1780-1850 MHz and sharing spectrum with commercial users
- **Large amounts of data collected onboard system and analyzed post-test**
- **Continued investment in advanced RF and network technologies can partially mitigate the loss of spectrum**
 - Advanced modulation schemes
 - Networked telemetry
 - Non-traditional portions of the RF spectrum (e.g. C-band, Ka/Ku-Band)



Increased Weapon System Complexity and Reductions in Available RF Spectrum Limit the Amount and Types of T&E Missions a Range Can Support



Current AMT Paradigm at Test Ranges





CONCLUSIONS

- Big challenges and technical gaps
- Aging infrastructures
- Emerging technologies
- Hard to predict the future
- Fiscal constraints



QUESTIONS?



Tester of Choice... Today and Tomorrow



Major Investment Activity

- **Hypersonics ~ \$350M**
- **Cyber ~ \$100M**
- **Spectrum Relocation ~ \$400M over 10 yrs**
- **Joint Simulation Environment (JSE) ~ \$400M**
- **SLEP FSRM ~ \$340M over 5 yrs**
- **CTEIP ~ \$600M**



Roadmap Example

Title *	Prior	FY16	FY17	FY18	POM Center FY19	FY20	FY21	FY22	5th Gen Objective Year Center 5th Gen Threshold Year Center FY23	FY24	FY25	FY26	FY27	FY28	Emerging 6th Gen Center FY29
Effort #1		28,000						3,400	2,000						
Effort #2		800	800	4,300	4,500	3,000									
Effort #3		10,000				(T&E S&T)									
Effort #4		26,000													
Effort #5			40,000												
Effort #6			40,000												
Effort #7						TIPP									
Effort #8											TIPP				