



412th Test Wing



War-Winning Capabilities ... On Time, On Cost



SRF Program for the SW AF Ranges

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U.S. AIR FORCE

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Integrity - Service - Excellence



Outline



- Requirements & Upgrades for Flight Test Operations
 - Spectrum Monitoring
 - Airborne Segment
 - Ground Segment



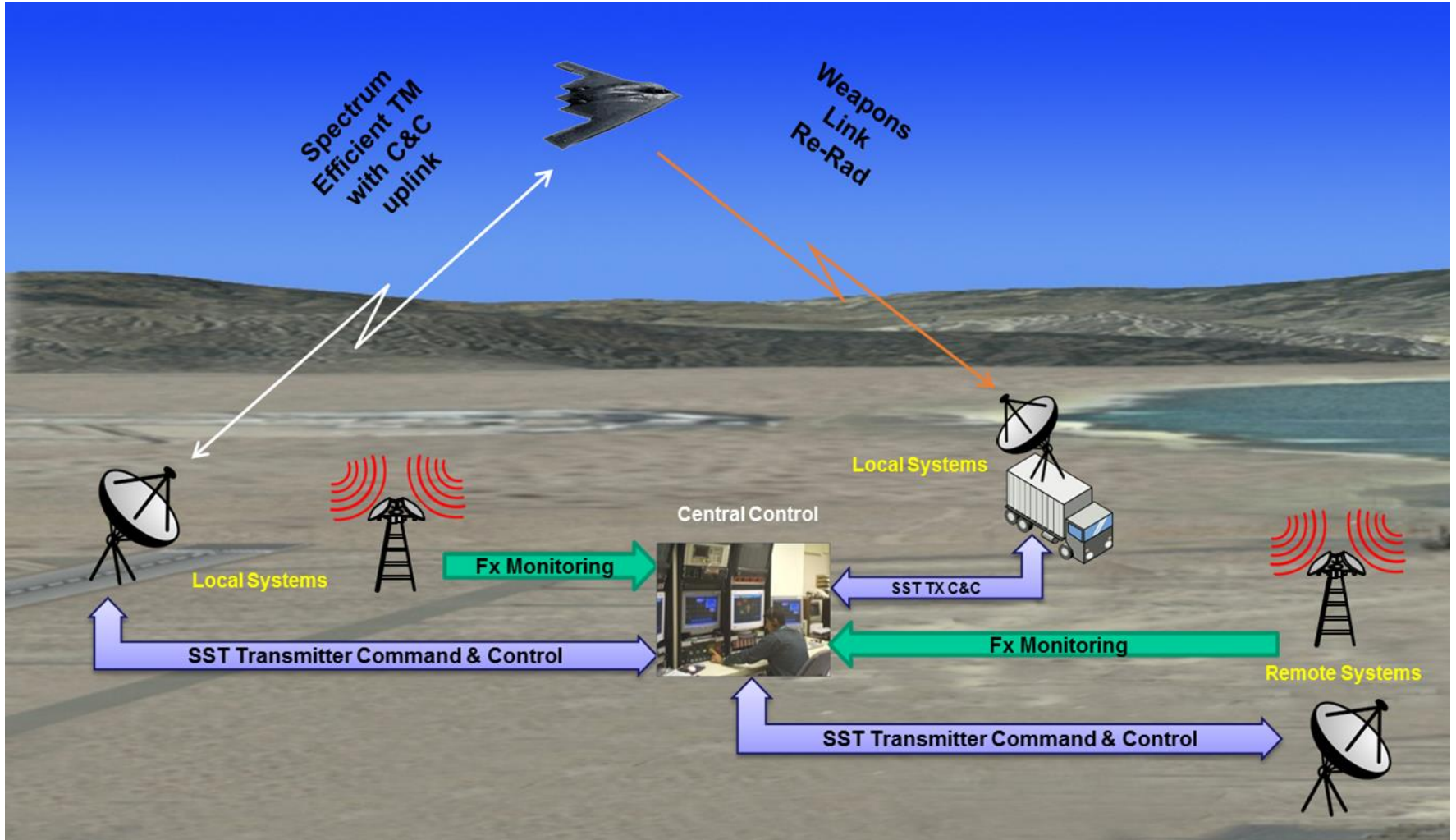
SRF & SWR SRF Requirements



- SRF Requirement – Vacate 1755-1780 MHz
- SWR SRF – Compress TM operations into available bands
 - AMT operations must be protected from LTE-A operations
 - LTE-A operations must not be impacted by AMT (ka-ching!)
 - Flight test data quality cannot be impacted
 - Flight test ops tempo cannot be impacted
- SWR SRF – Requires upgrades to
 - Scheduling and deconfliction tools
 - Spectrum monitoring
 - Airborne and corresponding ground systems
 - Real time TM command and control



SW AF Ranges – OV-1





Spectrum Monitoring



- Must detect, analyze, and locate disruptive RF signals
 - During Flight Test Missions
 - Ability to monitor and manage AWS-3 system deployment
- Bands to be Monitored
 - Primary Band > 1755-1850 MHz
 - Secondary Bands > 1435-1525 MHz, 2200-2290 MHz, 2360-2395 MHz, 4400-4940 MHz, 5091-5150 MHz
- System Requirements
 - Prefer COTS turn key solution
 - Manned-Mobile
 - Unmanned-Transportable
 - Unmanned-Fixed
 - Interoperable between ranges



Spectrum Monitoring



- Current Activities
 - Evaluating qualified COTS products starting in May 2017
 - Kerberos International
 - System is based on Rohde & Schwarz COTS equipment
 - Monitor and DF 20 MHz – 26.5 GHz
 - CFRS Incorporated
 - Systems based on CRFS Array 300
 - Monitor and DF 20 MHz – 18 GHz
 - Planning for deployment
 - Site locations will be based on selected equipment
 - Nominal locations
 - Edwards AFB/R-2508 Complex
 - AF Plant 42 Palmdale
 - Appropriate sites across SW AF Ranges



Airborne Segment Upgrades



- RF equipment upgrades
 - Tri-band transmitters – Key Characteristics
 - Band Agile
 - 1435-1525 MHz
 - 1780-1850 MHz
 - 2200-2395 MHz
 - 4400-4940 MHz
 - 5091-5150 MHz
 - All Modulations – PCM/FM, SOQPSK, ARTM CPM
 - Coding (selectable) – LDPC, STC
 - Power nominally 5-20 W – split to upper and lower antennas
 - Real time controlled – interface with TM C&C system
 - Sized for design and aircraft mod considerations
 - Tri-band antenna (standard or conformal)
 - Hooks for C&C uplink



Airborne Segment Upgrades



- On applicable Edward's test aircraft
 - F-16
 - B-1, B-2, B-52
 - C-17, C-130, KC-135
 - F-22
 - F-35
 - UAV
- Lab equipment
- Ground support equipment
- Current Upgrade Activities
 - Lab design and equipment procurement
 - Pathfinder transmitter procurement
 - Pathfinder design in work for initial F-16



Ground Segment Upgrades



- Antenna System Upgrades
 - L-Band, S-Band, C-Band Receive and Auto-Track
 - 3-Channel Rotary Joint for future Command and Control link
- Receiver System Upgrades
 - Band Agile
 - 1435-1525 MHz
 - 1780-1850 MHz
 - 2200-2395 MHz
 - 4400-4940 MHz
 - 5091-5150 MHz
 - All Modulations – PCM/FM, SOQPSK, ARTM CPM
 - Coding (selectable) – LDPC, STC
 - Adaptive Equalization
 - Data Quality Metrics



Ground Segment Upgrades



- Other Actions In Progress
 - LTE equipment Out Of Band Emissions (OOBE) study with National Advanced Spectrum and Communications Test Network (NASCTN)
 - Adjacent Band Interference (ABI) study with RCC TM lab at Edwards
- Current Upgrade Activities
 - Over half the Antenna Systems are on order, being delivered, installation commencing as appropriate
 - Receivers on order, delivery starting in July, installation as appropriate



Issues and Challenges



- It is imperative that the AF and Navy Ranges in the Southwest work together to ensure we remain interoperable...WSMR too...
 - L-, S-, and C-Band; ARTM CPM, common C2 link design, compatible spectrum monitoring capabilities, etc.
- Technology for multiband aircraft transmitters, antennas and command & control capability still developing – medium risk
 - Mitigate by allowing time to develop and/or modify schedule or requirement
- Throughput of aircraft mods in transition plan timeline – low risk
 - Refine schedule as mods progress and accept some may be completed post FY2024, but will not affect transition date
- Recent changes to IA processes may add to cost or schedule to implement transition plan – low risk
 - Potential cost increase should be well within 10% of the approved transition plan budget; await ATO as needed



SRF for the AF SW Ranges



Questions, comments, concerns,



Background



- Advanced Wireless Services 3 (AWS-3) Spectrum Auction
 - 1695-1710 MHz
 - 1755-1780 MHz (affected Aeronautical Mobile Telemetry)
 - 2155-2180 MHz
- DoD asked to submit Transition Plans
 - AF, Navy and Army Submitted Plans in late 2013
 - Transition funding only available to those Ranges who had Frequency Assignments in the affected band(s)
 - Air Force Spectrum Management Office (AFSMO) maintains AF assignments
 - AFSMO Controlled Transition Plan development for AF
 - Edwards argued for (and won) that the other AF Ranges in the Southwest that didn't have Frequency Assignments still needed to be covered to support the mission of the 412th Test Wing



Background



- Approved AF Transition Plan for AMT has three components
 - AF-8 Edwards and Associated AF Ranges in the Southwest
 - AF-9 East side of the Eglin Range
 - AF-10 West side of the Eglin Range
- Auction complete January 2015
 - Auction netted roughly \$45B
 - DoD receiving \$3.1B to implement approved Transition Plans
 - Funds may ONLY be used for spectrum relocation/sharing activities as approved in the Transition Plans.
 - All SRF funding is in an account managed by OMB and apportioned each year to DoD as one year money (even though funds never expire)
 - Due to sequestration, all unobligated current year funding left in DoD accounts at end of year will have 9.1% sequestration tax