Advanced Command Destruct System (ACDS)
Enhanced Flight Termination System (EFTS)

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Agenda

• Program Overview / Background
• Initial Operating Capability (IOC)
• Final Operating Capability (FOC) - Advanced Command Destruct System (ACDS) - AFFTC and DFRC Combined Implementation
• Testing
• Questions
• Initial Operating Capability (IOC) - NASA DFRC started working towards single vehicle EFTS system January 2008
• Final Operating Capability (FOC) - NASA DFRC and AFFTC combined effort working towards FOC for multiple vehicle and multiple missions simultaneously – effort to be completed by end of 2011
• Several potential users – all UAVs
Initial Operating Capability

- Developed to support one vehicle per mission
- Developed to support one frequency per mission
- Planned to support Unmanned Aerial Vehicles (UAVs) at NASA DFRC
- Started development in January 2008
- Completed 95% of design and hardware builds by May 2008
- NASA DFRC software safety change of scope/requirements caused delays after May 2008 to date
- IOC accepted as “Operational” ready by NASA DFRC – one test remaining; near complete
IOC Cont.

- Development included:
  - Command / interface panel (updated development)
  - Command controller (CC) (updated development)
  - Encoder (existed under EFTS)
  - Monitor (existed under EFTS)
  - Triple Data Encryption Standard (DES) Unit (TDU) (existed under EFTS)
  - Configuration software (updated development)
  - Logging software (updated development)
  - Test equipment (new development)
  - Existing transmit equipment (no development)
IOC Pictures – EFTS FTR
Test Case (EFTC)
Final Operating Capability

• Upgrading / refurbishing some existing equipment
• Request for proposal (RFP) for full integration
• FOC development work and requirements based upon the work done on the IOC
Requirements Summary

- ACDS system setup time < 1 hour
- EFTS mission configuration manual setup
- Pre-launch FTR checks done via portable test sets
- ACDS FTR key loading
- ACDS system take down < 30 minutes
- Situational awareness – monitor RF status
- Status feedback – command panel
- Status feedback – signal in < 500 ms
• Data logging – command panel output
• Data logging – unencrypted EFTS message
• Data logging – monitor data
• Data logging – signal transmission
• Data logs – storage and archival
• Data logs – time source – IRIG-B
• Primary control sites – RMCC
• Primary control sites – NASA DFRC
• Primary mission control able to support 4 command panels
• Backup control sites
• Transmitted signal power 1 kW
• Operating frequency range (420-450 MHz)
• Operating frequency range (370-380 MHz)
• Two operational transmitter sites
• Antenna – high gain directional
• Antenna – omni-directional
• Universal Command Panel – EFTS and IRIG
• Commands on Command Panel – Arm, Terminate, Check, +1-5 optional commands
• Simultaneous missions – two
• Support IRIG until 2015
• One vehicle per frequency for IRIG
• Four vehicles simultaneously for EFTS
• Remote sites
• One vehicle per command panel
• One command panel per RSO
Requirements Summary
Cont.

- No commercial operating system in command path
- System response time < 500 ms
- RCC 208-06 compliant
- System redundancy – triple
- ACDS IV&V
- FTS physical security
IOC Testing

• **Component level testing**
  - Fully tested each individual command path component
  - Exercised every possible error mode that could be thought of
  - Exercised every known and expected function
  - Test procedures
  - Recorded data – electronically and manually

• **System level testing**
  - End to end testing – open loop and closed loop – see next slide
• Full end-to-end system testing completed
  - Included exercising of RSO command panel through entire FTS network; transmitted out and fed into monitoring device to verify properly transmitted FTS commands
    - Viewed EFTS command signal response via the EFTS FTR and EFTS Monitor

• Test item testing
  - PETS – full functionality
  - EFTC – full functionality
  - End to end testing with test items – output of PETS; into EFTC; verified with EFTS Monitor simultaneously
Questions??
Backup Slides
Documentation

- Requirements for System
- Functional and Performance Requirements Document (FPRD) for all EFTS components of system
- Software Requirements Specification (SRS) for CC
- Analysis of Alternatives (AoA) for System
- Design Review Packages for all EFTS equipment
- Training Guide for EFTS equipment
- Software Design Document (SWDD) for CC
- Software Hazard Analysis for CC
- User’s Guide for CC
- System Verification Plan
- System Verification Report
- Reliability Analysis for System and CC
- COMSEC Briefing (CSOP-13, dated 14 Feb 2007)
- Acceptance test reports, user’s guides for EFTS hardware
- EFTS ConOps