



# An Architecture for AFSCN Ground Interface Modernization

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# *Overview*

- **Background**
- **Limitations of the current architecture**
- **Proposed changes**
- **Implications**
- **Prior related work**
- **Conclusions**
- **References**

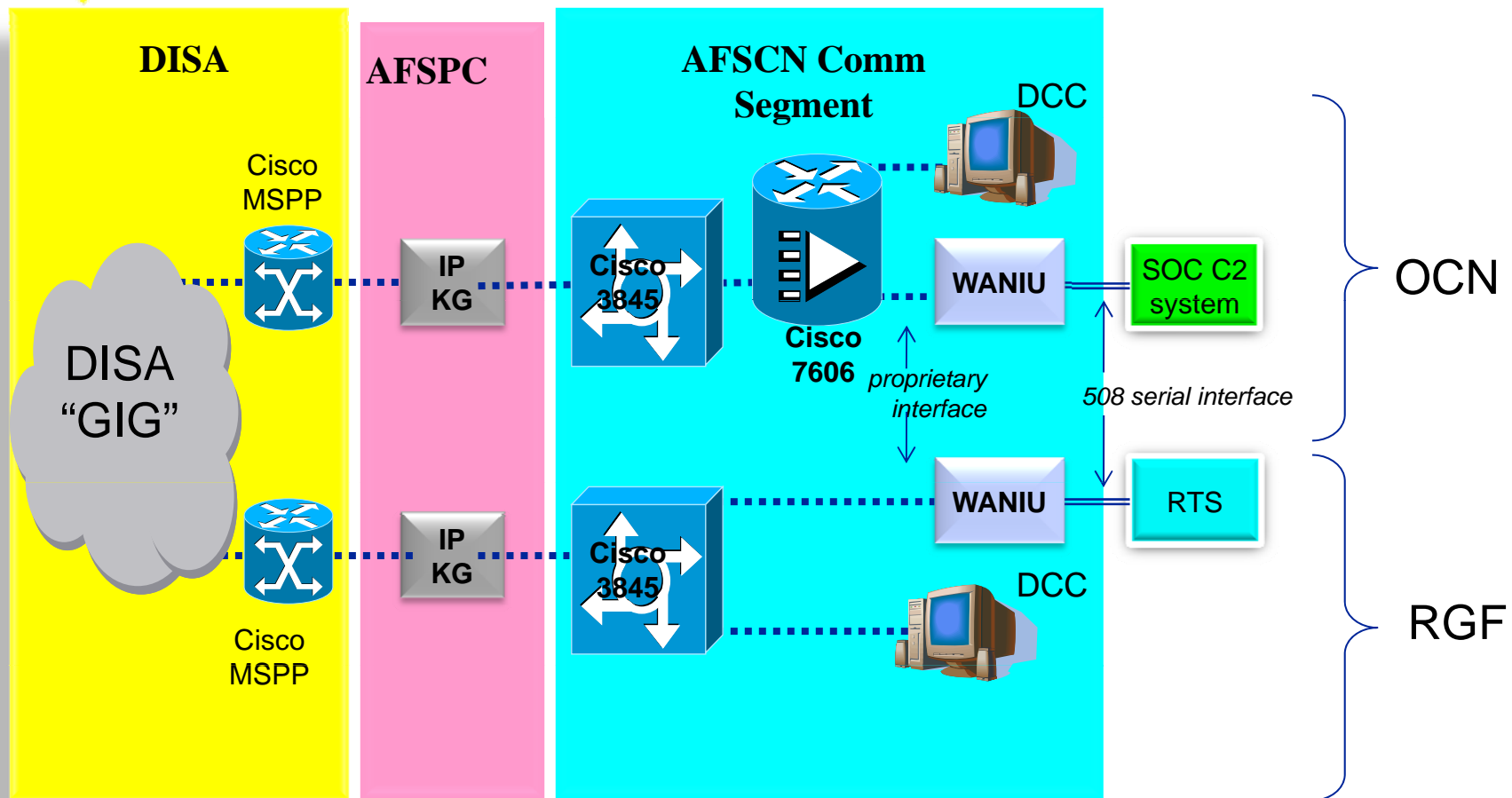


## ***Background***

- **AFSCN ground network is almost 50 years old**
  - **Has many obsolete and proprietary protocols and equipments hindering its efficiency**
- **Satellite Control and Network Systems Division (SMC/SN) has identified many areas for modernization**
  - **Ground interface modernization**
  - **Compatible Sat C2**
- **GIG WAN ATM to IP transition is scheduled for 2014**



# AFSCN after IP transition



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## ***Limitations Addressed***

- **SOC to RTS interface is serial, based on link layer protocols EXU or IBM's ADCCP**
  - **Sustainment is costly**
  - **Seamless interface with other networks impossible**
  - **Interface not extensible**
- **Proprietary edge devices to translate serial interface, called WANIU**
- **No centralized Network Management System (NMS) and the server associated with that**



## *Elements of the Architecture*

- **Implementation of an open standard ground interface in AFSCN range segment**
  - **TCP/IP based on CCSDS/SLE (ANSI/AIAA S-123,124-2007) for SV telemetry and commands**
  - **HTTP/XML for RTS monitor and control**
- **Implementation of the same interface in serial-to-WAN converter for legacy serial users**
- **Implement network operations server for RTS administrative software for RTS status and NMS for network management**



# *Open Standards Interface*

- **ANSI/SLE**
  - Unframed telemetry
  - Analog timing
  - Ternary command streams
  - Binary command streams
  - Command echo streams
- **XML/HTTP**
  - RTS control and monitor



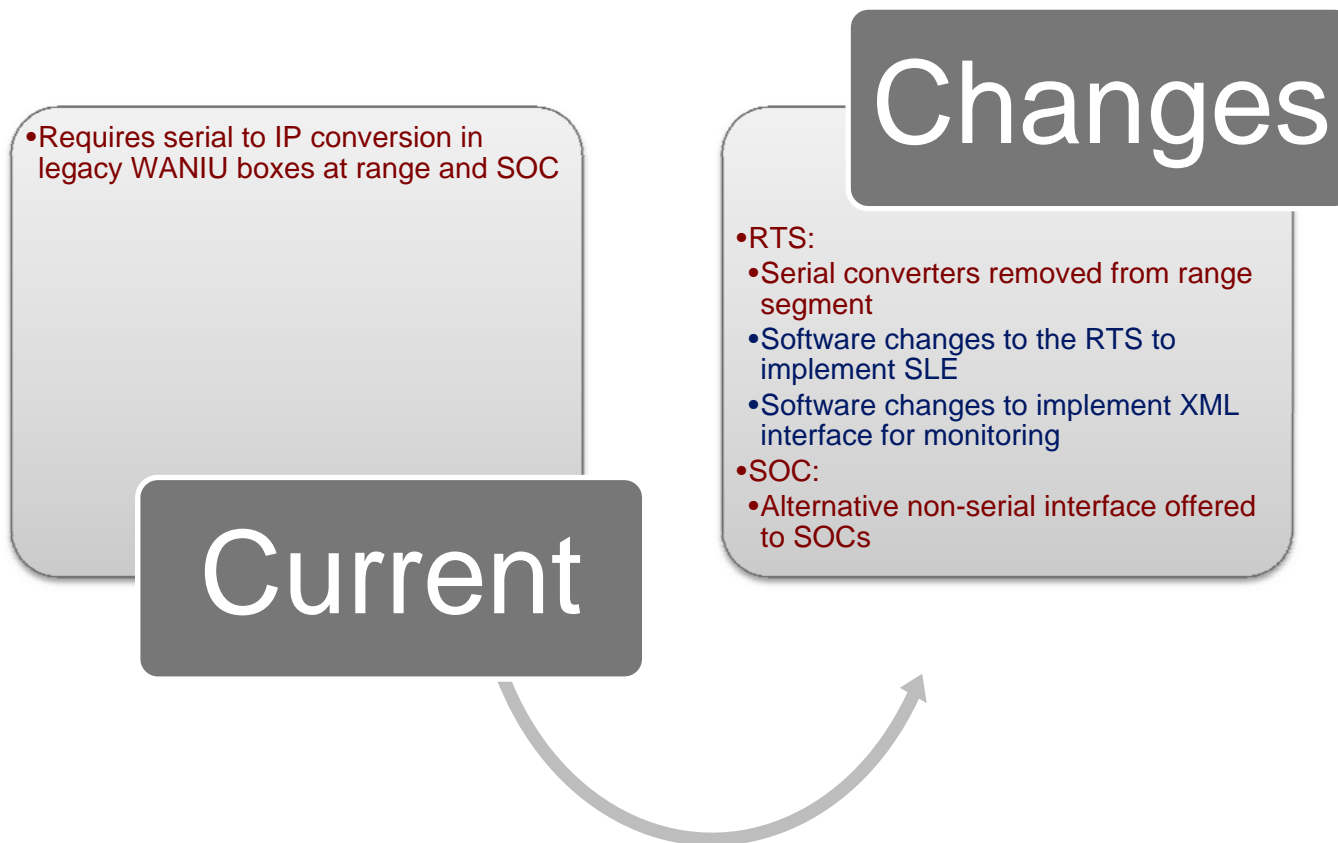
# ***Architectural implications of the open standard interface***

- **Flexibility in interface implementation**
  - In existing systems
  - In new systems
- **Allows vendor choice for user C2 systems**
- **Eliminates reliance on proprietary multiplexers**
  - Reduces sustainment costs



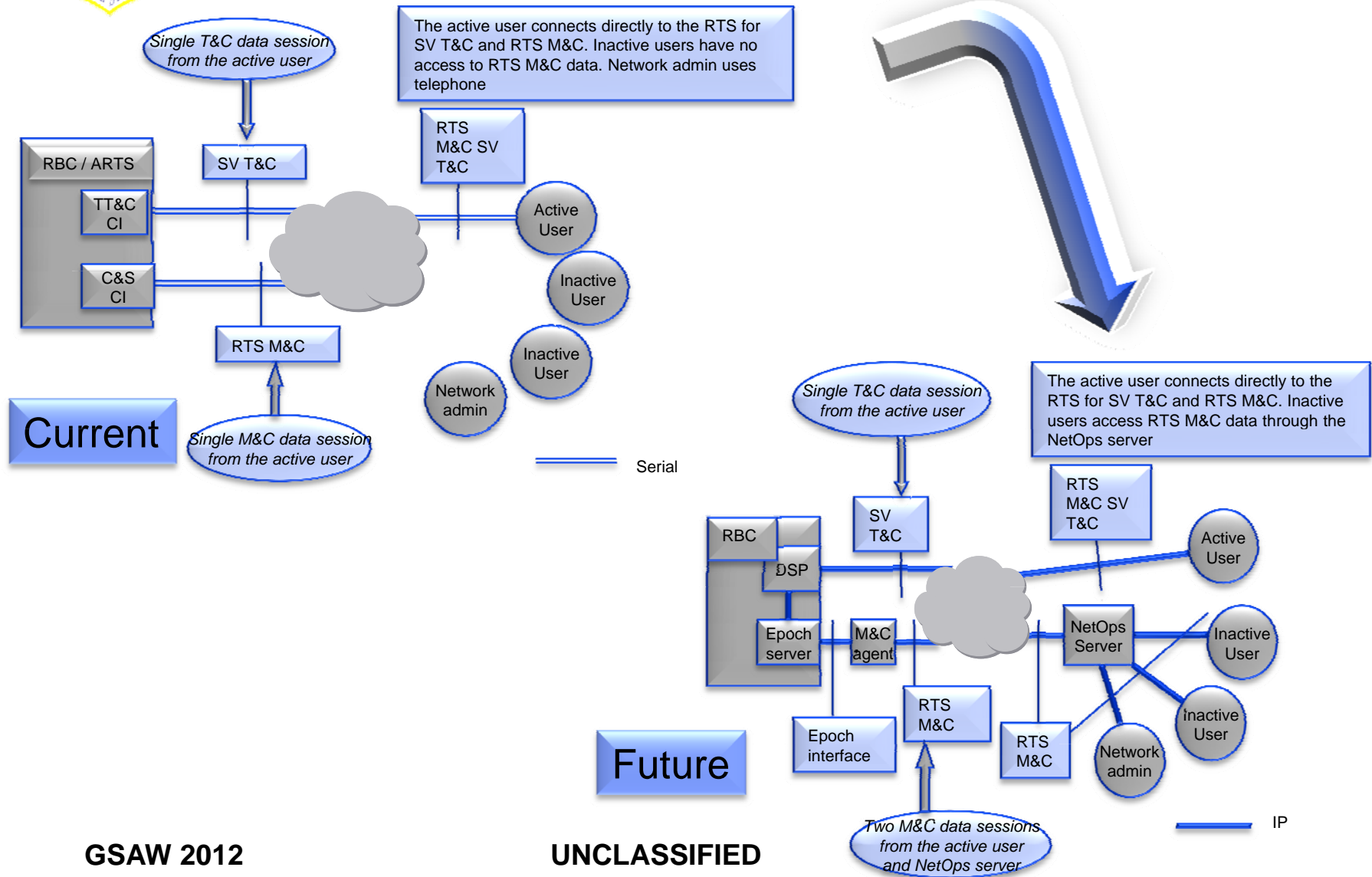


# *Changes to proprietary interfaces*





# Range Architecture Changes



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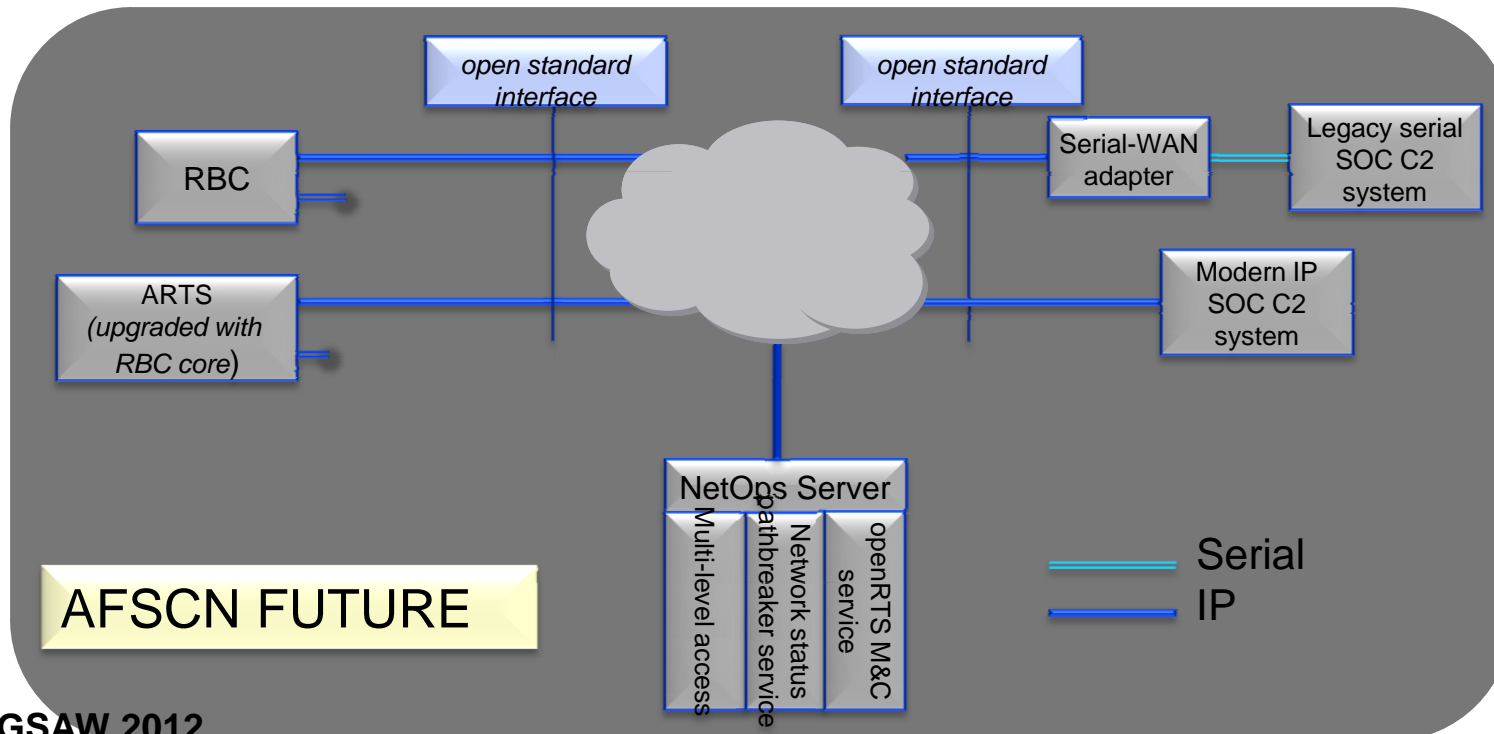
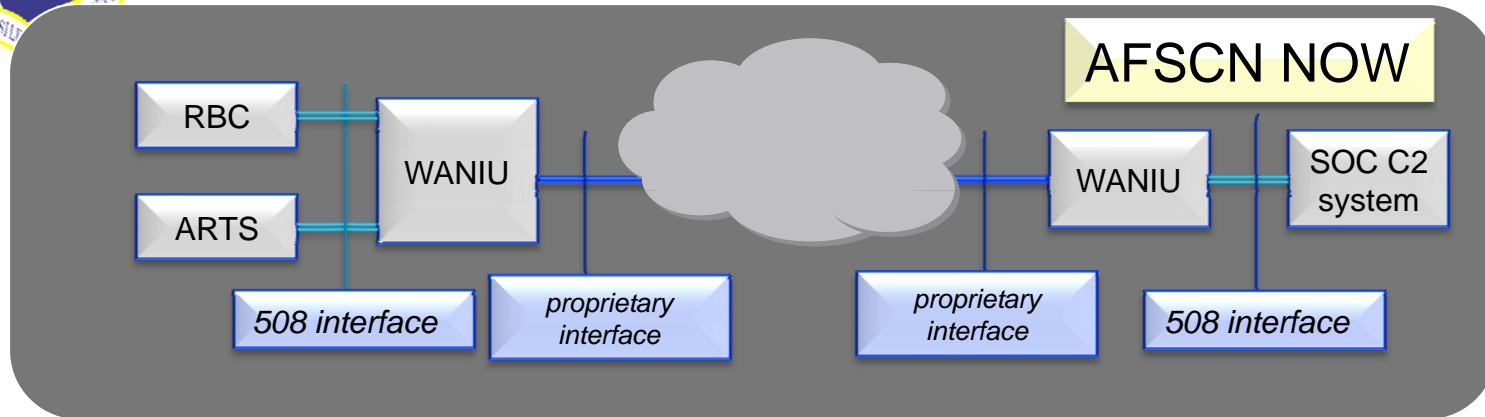
# ***Network Management Element***

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- **Centralized network management at the NOCs**
  - **Distributes RTS status to non-active AFSCN users**
  - **Provides centralized administrative control of RTSs**
  - **Provides network management for AFSCN**



# Interface Modernization





# ***Prior Proof-of-Concept Demonstration***

*(status presented to GSAW 2007 Session 9)*

- **Civil Reserve Space Service project executed 2003-2006**
- **Developed ANSI standards for translation from legacy serial TT&C interfaces (ICD 508) to CCSDS SLE**
  - **ANSI/AIAA S-123-2007 and ANSI/AIAA S-124-2007**
- **Demonstration in 2007 to connect NOAA Wallops and Fairbanks tracking stations, and John Hopkins APL station, to AFSCN**
  - **Collaboration led by SMC/SN**
  - **Implemented ANSI standards in COTS front-end processors from 2 vendors**
  - **Successfully performed hundreds of satellite contacts on test satellites**
  - **Demonstrated**
    - **interconnectivity to NOAA CDA stations**
    - **Interface coordination of US Govt. networks facilitated by agreement on open standards**
    - **Support of AFSCN-unique performance requirements**



## ***Capability enhancements***

- **Will add broader range of RTS monitor and control points than the dozen or so supported on the current serial interface**
- **Packaging of unframed encrypted telemetry in time-tagged ANSI/SLE frames guarantees perfect time/data correlation**
- **Will provide unified capabilities as dictated in DoD I 8100.04**
- **Enables federation with other ground systems**



## ***Changes to business logic***

- **SOC users retain real time control and status of RTS, but with more control and status points**
- **NOC gets electronic real time control and status (currently only by telephone)**
- **RTS status provided to non-active AFSCN users (not currently flying a satellite)**



## ***Conclusions***

- **Identified the current limitations of the AFSCN architecture**
- **Proposed an open architecture based interfaces for the AFSCN ground systems that will overcome the limitations of the current network**
- **Discussed implications of the architecture**





## ***References***

1. Pietras, J., "Air Force Satellite Control Network Interoperability," Space Internet Workshop #4, June 2004.
2. CCSDS SLE Development related: ANSI/AIAA S-123-2007 and ANSI/AIAA S-124-2007.
3. Ledlow, L., Spindler, J., & Williams, L., "harmonization of USG Satellite Ground Systems," GSAW 2007.
4. Pietras, J., "Application of ANSI Standards for Ground Transfer of Space Vehicle Command and Telemetry," GSAW 2007.