

# Breakout Session 10C: **Satellite Control Network Trends and Prospects for Interoperability**

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What is interoperability?

Are there standards and architectures that can meet both military and civil space needs?

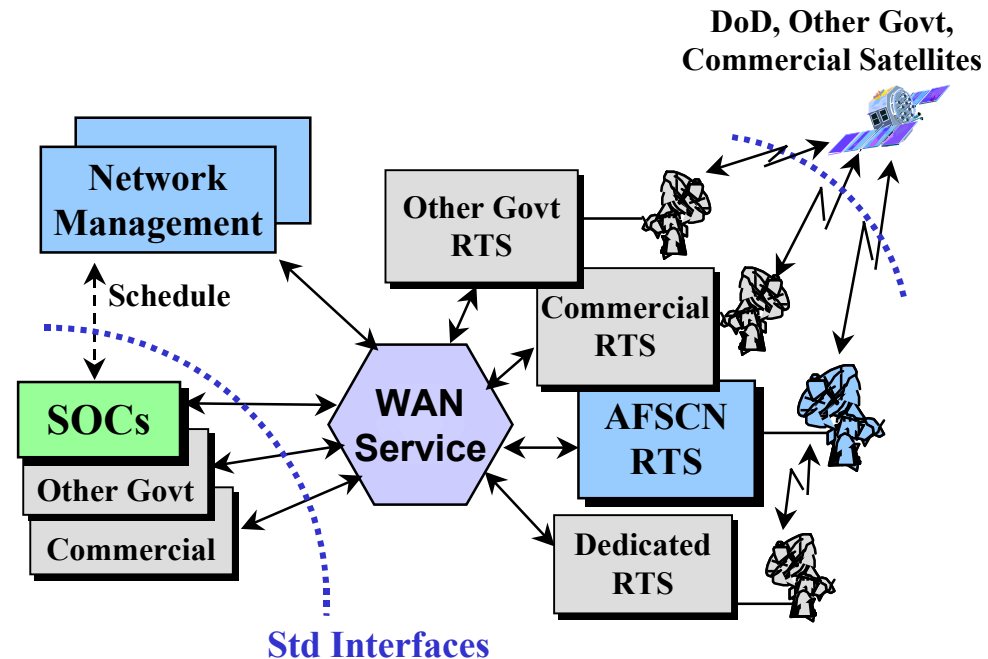
What must we do to achieve interoperability?

Will it bring cost savings or cost increases?

# Infrastructure Evolution

## • 2007

- Interconnected military, other gov't, and commercial WANs and Remote Tracking Stations
- Continued legacy bit streams
- COTS comm (frame mode) for civil and some military missions
- User comm control, “federated” scheduling



## • 2015

- Interconnected ground stations plus space relay
- Reduced legacy bit stream traffic
- COTS comm (packet mode) for civil and most military missions
- User comm control, integrated scheduling

## **Position Statements:**

- *AFSCN Evolution*, Carl Sunshine, Aerospace Corporation / SMC
- *NASA Ground Network Evolution*, Edward Burns, NASA HQ
- *CCSDS and NASA Standards*, Peter Shames, Jet Propulsion Lab
- *Achieving Interoperability*, Adrian Hooke, JPL
- *Commercialization Trends*, Michael Anderson, Honeywell

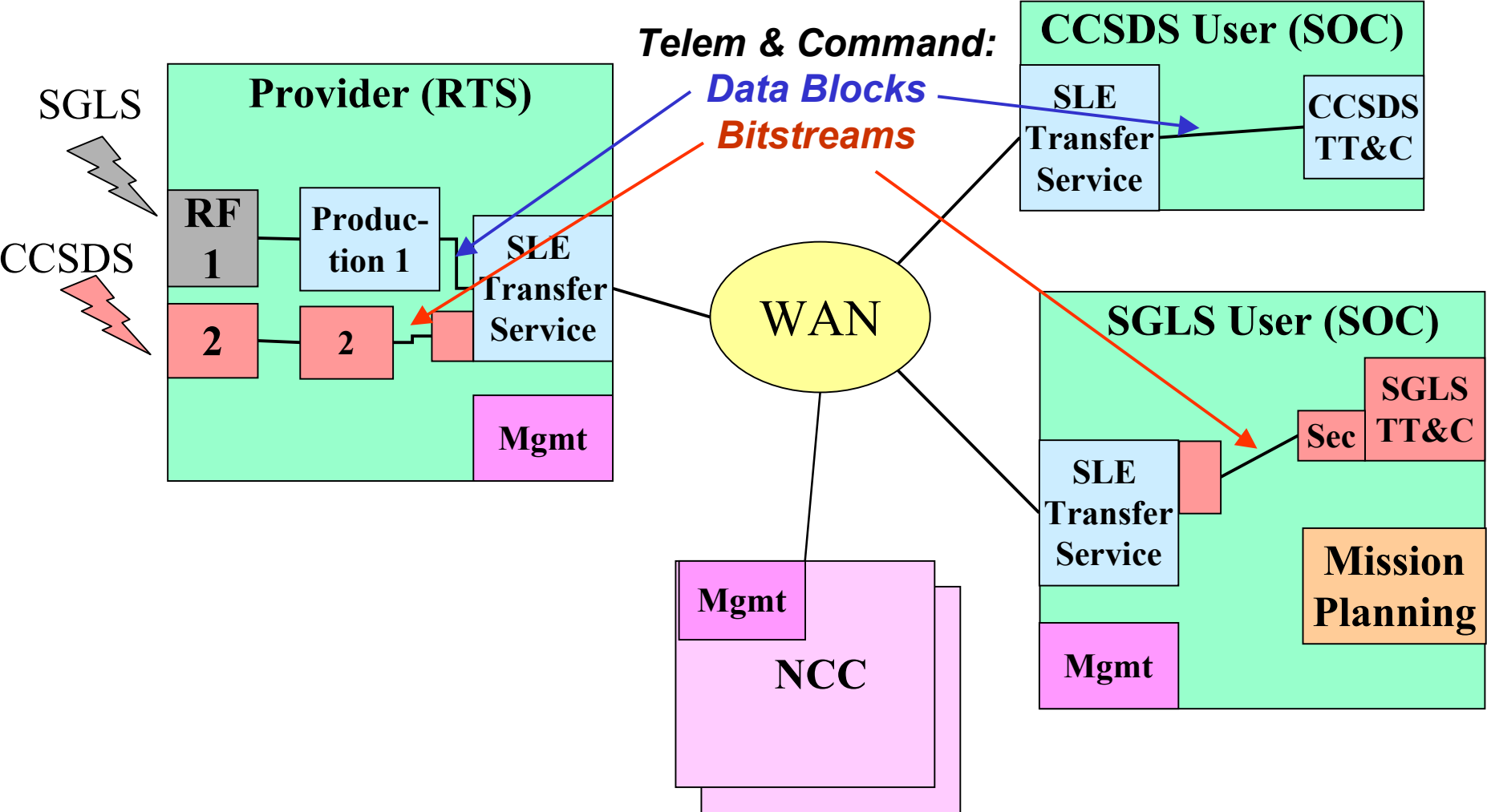
## **Others in attendance (presentations at other sessions):**

- *CCSDS Space Link Extension*, Fred Brosi and John Pietras, GST
- *SLE adaptation for AFSCN*, Jim Noles, GST
- *Universal Space Network*, Greg Hollister
- *NASA Space network evolution*, Roger Flaherty or Aaron Weinberg, NASA GSFC
- *NASCOM Block phaseout*, Larry Muzny, NASA JSFC
- *SLE use for ESA missions*, Hugh Kelliher, BNSC/Vega
- *Future AFSCN architecture*, John Chiang, Aerospace

# Major Standards Interest and Trends

- Space to ground link
  - CCSDS standards widely used -- 200 missions flying
  - Several COTS vendors
  - BUT, no support for link level security currently used in AFSCN
    - Need to resolve for DoD use of USB
- RTS to SOC
  - Many similar but mission specific formats in use today
  - Major trend toward migration to Space Link Extension Standard
    - Adopted by NASA Deep Space Network and ESA
    - Testbed underway for NASA Ground net and Space Net
    - Holds promise for cost effective “cross support”
    - Testing underway for AFSCN -- BUT must assess bitstream service
  - Control and management more difficult than SV telem and cmd

# DoD-NASA Interoperability Concept



# Other Areas of Activity

- Internet from SOC to SV
  - So far mainly “science projects”
- Spacecraft Onboard Interfaces
  - Hardened LAN variants and IP between onboard subsystems
- File or message oriented services
  - “911” concepts; common file delivery protocol
- Standard representation of TT&C data formats
  - Eases hand-off and replacement of systems
- Internet mobility protocols
  - Potential to automatically maintain connectivity to ground Internet
- Commercial use of optimized TCP/IP over satcom links
  - SCPS variants originally developed for space-to-ground

# Business Cases

- Benefits of interoperability
  - Potential reduction of total assets needed through sharing
  - Avoiding need to buy or build more assets, large up-front costs
  - Wider set of assets available to meet surge or emergency
- Obstacles to greater use of “external” assets
  - Cost of providing compatibility
  - Reduction of organization size (budget, personnel, assets)
  - Need to change Ops Concept (e.g., greater automation)
  - Potential loss of control or priority for access
  - General slowdown in commercial space
- Resources already developed and highly utilized may not be good candidates for sharing or outsourcing