

Next Generation SATCOM Terminals

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MITRE Sponsored Research

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow, orange, and blue to the left of the text.

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Problem

- **Current MILSATCOM systems are not amenable to integration into a network-centric communications model. The problem is not lack of investment, but limitations inherent in the current terminal and space segment architectures and implementations.**

Background

- **The Transformational Communications (TC) program is a national effort to field a network centric satellite constellation beginning in 2010 timeframe.**
- **While there is much development work on the RF waveform and use of optics, very little effort has gone into the analysis and development of sound Layer 2 and Layer 3 protocols optimized for the space environment.**

Objective

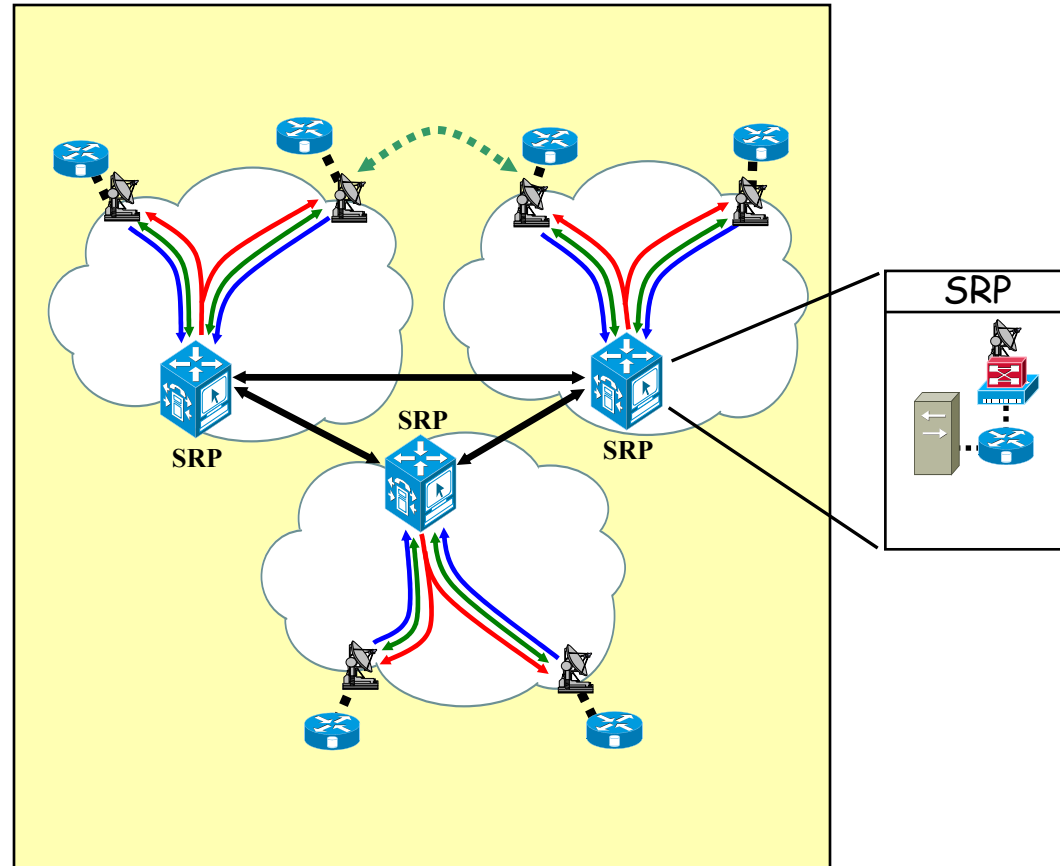
- **Our objective is to impact current and future MILSATCOM terminal and system development efforts through analysis, experimentation, and design of:**
 - **Flexible, network centric terminal architectures**
 - **Efficient packet-switching protocols optimized for IP internetworking in the space segment**
 - **Unicast and multicast routing protocols well suited for the space environment**
 - **etc.**

Activities

- Design of a flexible Layer 2 terminal architecture
- Design & prototyping of a Layer 2 packet-switching protocol for next-generation MILSATCOM
- Creation of a satellite Data-Link Emulator for the verification of our packet-switching protocol (and any other protocols)
- Simulation of standards-based IP routing protocols over the packet-switched space segment
- Submission of a white paper titled “An Efficient Packet Switching Protocol for Next-Generation Military Satellite Networks” to MILCOM 2003

Highlight

- Network centric constellation of GEO satellites supports dynamic creation of Layer 2 Switch Paths (L2SPs) based on IP routing topology.
- Terminals are an integral part of overall system.
- Each payload supports at least one Satellite Registration Point (SRP).
- Network provides capabilities such as QoS, Multicast, and Flow Control.

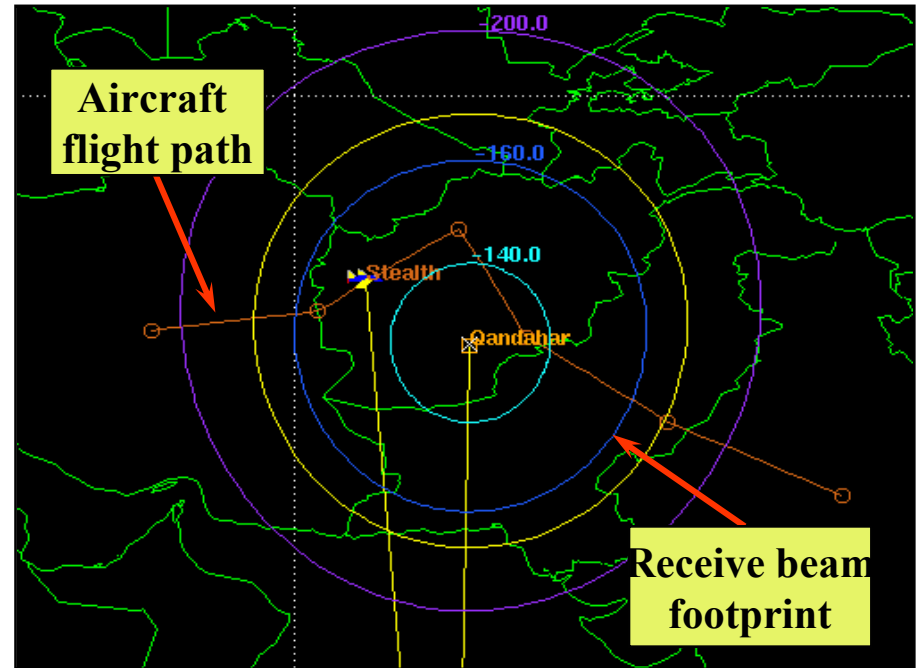


Demonstration

Emulation of packet-switched MILSATCOM data-link

- STK provides BER info based on simulated position of terminal (supports mobile platforms)
- Used for validation of L2 protocol suite.
- Data-link emulator interfaces to IP routers via standard network interface. Routing protocols, transport layer protocols (e.g., TCP) and user applications can be run *live* over emulated SATCOM network.

STK Scenario Test Case



Impacts

- **Influencing TC network architecture activities**
- **Influenced next-generation MILSATCOM terminal architecture**
- **Providing MILSATCOM data-link emulation facility to support ongoing airborne networking studies**
- **Data-link emulation can also be leveraged by other organizations seeking verification/analysis of alternative switching protocols**

Future Plans

- Investigation and integration of dynamic bandwidth allocation mechanisms at Layer 1 according to the adopted layered terminal architecture model
- Customized multicast delivery protocol for space-based networks (standards-based approaches designed for wire-line networks are extremely wasteful)
- Investigation of transport-layer protocols for reliable data delivery