Trend in Military Satellite Communications

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Today's content

Space asset
HEO, GEO, MEO, LEO
Communication, Earth observation, Navigation, Reconnaissance, ・・・・

Military Communication Satellite

Resiliency (Mission Assurance)

SSA
(identify, characterize and attribute all threatening actions in space)

Sanctuary

Trend in MILSATCOM

Threat

Disaggregation
Distribution
Diversification
Proliferation
Protection
Deception

Deterrence theory
(by punishment)
(by denial)

Sanctuary

Congested
Contested
Competitive

LASER JAMMING
EMP
ASAT
CYBER
**PROTECTED**:
- Secure, survivable (nuclear resistant), anti-jam and low probability of detection / interception (LPD/LPI) communications for high priority strategic and tactical users. The president and the national command authority to communicate and direct strategic operations in a nuclear.
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**WIDEBAND**:
- High Capacity, High Data Rates, Rain resilience and governmental use (X).
- Used for mission critical, sensitive command and control, Information sharing.

**BROADCAST**:
- High-capacity product dissemination (Imagery, UAS full-motion video, large data files) for mission-essential situational awareness.

**NARROWBAND**:
- Main for mobile users, High availability for jungle foliage, extreme weather and urban terrain.
Depending on the mission and characteristics of the military, the core part of satellite communication is developed and operated on its own, but the others are supplemented by utilizing commercial and international cooperation. Considerations: Sovereignty, autonomy, Security

Keyword: Resiliency, Affordability, Flexibility, Availability, PPP/PFI, International Partnership.

U.K.: Skynet 5A, 5B, 5C, 5D (X, UHF) [PFI], AEHF(EHF)[US Partner]
France: Syracuse 3A, 3B (X, EHF), Athena-Fidus (Ka, EHF), Sicral 2 (X, UHF) [French-Italian Coop]
Italy: Sicral 1A, 1B (X, UHF, EHF), Athena-Fidus (Ka, EHF), Sicral 2 (X, UHF) [Italian-French Coop]
Germany: COMSAT Bw1, Bw2 (X, UHF)
Spain: XTAR-EUR(X), Spanisat(X, Ka)
Luxembourg: GovSat-1 (X, Ka), WGS(X, Ka)[US Partner]
Australia: Optus C1(UHF, X, Ka), Intelsat22(UHF), WGS(X, Ka)[US Partner]
Canada: WGS(X, Ka), AEHF(EHF)[US Partner]
International Partnerships

Build geopolitical Partnership

Achieve economy of scale

Promote interoperability

Share technologies and best practice’s

Heightened resilience

Strengthens stability, safety and security in space
Definition: Resilience is the ability of an architecture to support the functions necessary for mission success in spite of hostile action or adverse conditions.

An architecture is “more resilient” if it can provide these functions with higher probability, shorter periods of reduced capability, and across a wider range of scenarios, conditions, and threats. Resilience may leverage cross-domain or alternative government, commercial, or international capabilities.
Risks & Threats

- Space debris, Solar flare etc.
- kinetic Physical Attack
  - direct-ascent ASAT
  - co-orbital ASAT
  - Ground stations
- Non-kinetic Physical attack
  - high-powered laser
  - high-powered microwave
  - EMP
- ELECTRONIC ATTACKS
  - uplink jammer
  - downlink jammer
  - Spoofing
- CYBER ATTACKS
  - Data Intercept/Monitoring
  - Data Corruption
  - Seizure of control

Requirements

- Coverage
- Capacity
- Availability
- Flexibility
- Protection
- Anti-Jam
- LPD/LPI (EMP)
- Resiliency
- Affordability
- Interoperability

U.S. Effort

Build resilient and affordable architecture

Protected Tactical Waveform Development

Improve anti-jamming and LPD/LPI feature of Wideband satellite communication

Commercial Pathfinder

Efficient and flexible use of commercial satellite communication

Wideband Communication Services (WCS) Analysis of Alternatives (AoA)

Determine the best mix of military and commercial SATCOM and allies/international partners
The PTW is designed with frequency-hopping spread spectrum (FHSS) to provide greater anti jamming capability, featuring a mix of the current protected waveform and the commercial waveform.

- PTW provides secure, anti-jam, low-probability-of-intercept capabilities.

2010: forecasted the 2020-2025 timeframe Requirements
2012: developed prototypes for a new protected tactical communications system.
2016: contracted for Protected Tactical Service Field Demonstration (PTSFD). PTSFD will demonstrate the ability to provide wideband anti-jam communications to tactical users using WGS constellation and commercial SATCOM.
2018: PTW Remote Modems field testing with WGS terminals.
2023: Early fielding over WGS satellites.
2025: Fielding over Commercial satellite.
2028: Fielding Protected Tactical Satellite (PTS)

Protected Tactical Service (with PTW) provide affordable, resilient and flexible communication against harsh operating environments. It is possible to integrate WGS, commercial satellite, and future new satellite (PTS), construct resilient global wideband satellite communication system.
The United States Government (USG) is pursuing a series of five (5) Pathfinders in support of future Commercial Satellite Communication (COMSATCOM) procurements. The COMSATCOM Pathfinder series is developing the business and technical capabilities necessary for the USG to more effectively access available satellite communication (SATCOM) resources for the warfighter worldwide.

Commercial pathfinder’s goal
Stabilize the price of satellite communication, Secure the flexibility of communication operation,
- Build a hybrid architecture that shares satellite communication capacity of US dedicated satellite, commercial and international partners.
- Build capacity pool structure in which the US, allies, coalition partners share capacity
- Provide capacity according to mission needs under centralized resource pooling and aggregated situational awareness.
- The choice of satellite to use greatly expands.
- Access to robust global satellite communication capacity is possible.

As a result, not only affordable, flexibility but also resilience would be greatly improved.
International Invitation

Our vision for this effort includes, to the extent our partners wish to participate, interoperability with allies and international partners.

We will soon begin an Analysis of Alternatives (AoA) to guide our future Wideband SATCOM program. The AoA will assess a combination of architecture options including purpose-built platforms, commercial SATCOM services, hosted payloads, and contributions from international partners. Our aim is to balance capability, resiliency, and affordability.

Areas of Specific Interest (RFI)
1) Wideband Transport (Space and Air) Segment
2) Operations Management
3) End-User Equipment and Platform Capability
4) Ground Infrastructure
5) Resiliency, Mission Assurance and Cybersecurity
WCS AoA International Partnerships

WCS AoA
15 Nations + NATO accepted participation in the AoA

CURRENT

FUTURE

Resiliency
Affordability
Interoperability
Operational Flexibility
Operational Superiority
CONCLUSION

Ways to achieve resiliency

- Protection
- Disaggregation
- Distribution
- Diversification
- Proliferation
- Deception

Solution e.g.

- FHSS Waveform
- Commercial
- International Partners
- LEO/MEO
- Small SAT
- Hosted Payload
- New Technologies
- Multi Domain

The best mix of ... ?

- Protected Tactical Waveform
- Commercial pathfinder
- Wideband AoA
- GEO, HTS
- LEO, MEO constellation
- PFI/PPP
- Quantum communications
- Laser communications
- High-altitude platform
- Aerial Layer Network