

Architecture Options for Protected SATCOM

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Architecture Options for Protected SATCOM

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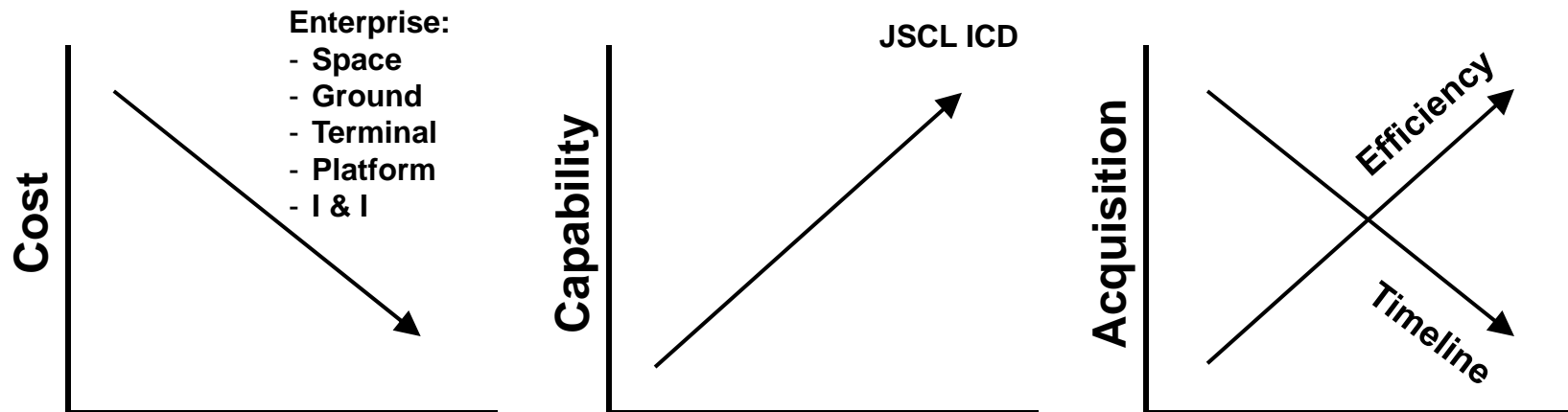


Background

- **The Air Force is exploring alternative architectures for affordable next generation Protected SATCOM systems**
- **Concept development and Risk Reduction contracts are currently underway (Protected SATCOM BAA)**
- **Trades between ground and space are a major focus**



Future Protected MILSATCOM Goals



- **Achieve affordable, efficient procurement and timely delivery of capabilities to warfighter through:**
 - ***Mission specific system(s)***
 - Disaggregation
 - Smaller satellites; resiliency; information assurance; industry base
 - Lower terminal costs
 - ***Trade off placing processing complexity in payload versus ground***
 - ***Procurement efficiency***
 - Apply methods and products from commercial industry



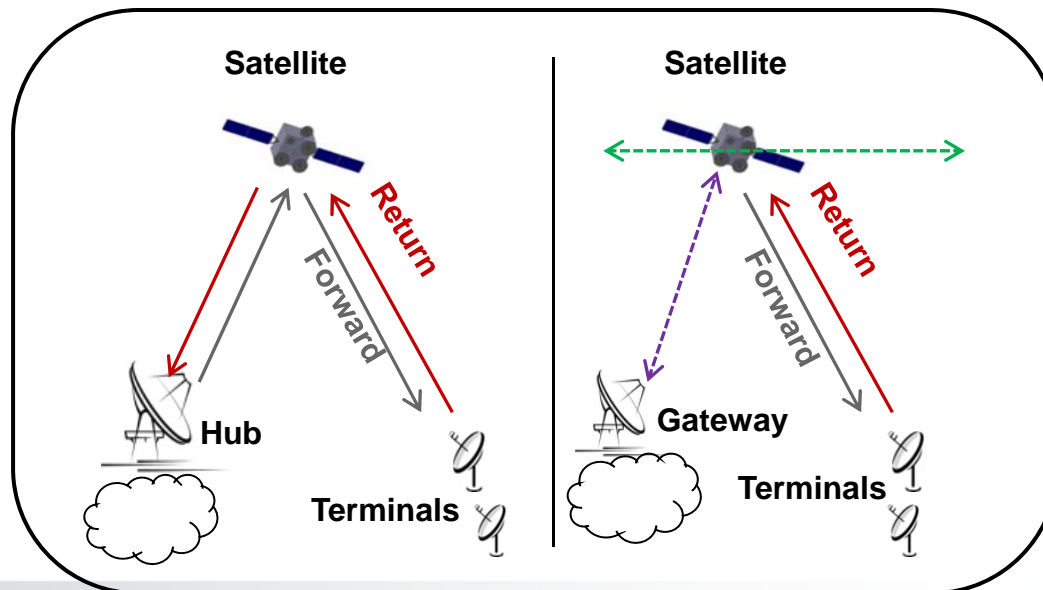
Protected Waveform

- All terminals and satellite establish time sync
 - *Transmissions are time division multiple access*
- RF Transmission is cryptographically protected
 - *Transmitter changes frequency over wide range based on crypto output*
 - *Authorized receivers get crypto keys to enable following transmitter*
- Terminals also code, interleave, and modulate
- Waveform may be processed on satellite, forwarded to signal processing hub, or by destination terminals
- Majority of traffic is terminal-to-terminal, but some is “reachback” to GIG

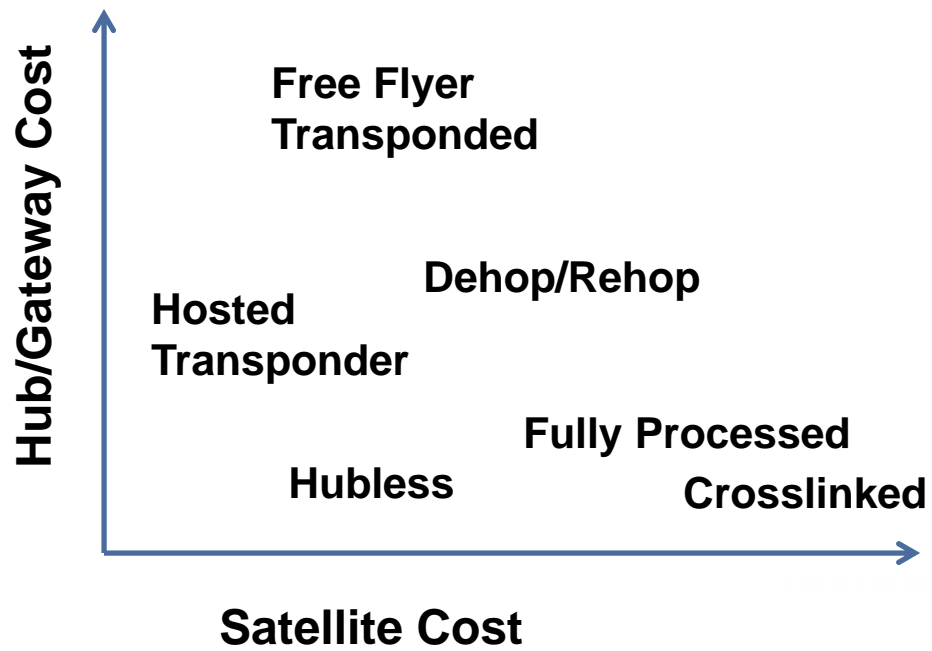


Major Options

	Onboard Processing	Crosslinks	Signal Processing Hub	Gateway to GIG	System Controller Location
Crosslinked	Full	Yes	--	Few	Satellite
Fully Processed	Full	--	--	1 per Sat	Satellite
Dehop/Rehop	Some	--	Yes	1 per Sat	Hub
Transponded	None	--	Yes	N per Sat	Hub
Hubless	None	--	--	1 per Sat	Terminal



Cost Trade



Resiliency Trades

	Ground Attack Vulnerability	Jamming Vulnerability	Single Sat Impact	Connectivity
Crosslinked	Blue	Blue	Red	Blue
Fully Processed	Green	Blue	Red	Green
Dehop/Rehop	Red	Green	Yellow	Green
Transponded	Yellow	Yellow	Green	Green
Hubless	Green	Red	Green	Yellow

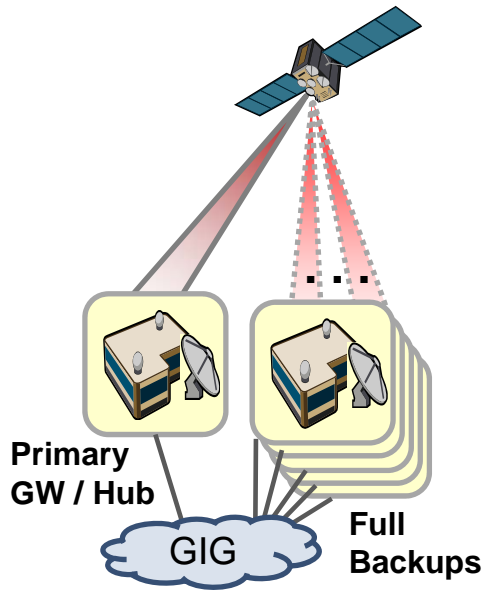


Best \leftrightarrow Worst

- Onboard processing mitigates ground attack and jamming, but high cost limits number of satellites
- Transponded satellites can be cheaper and more numerous, but are more subject to ground attack and jamming

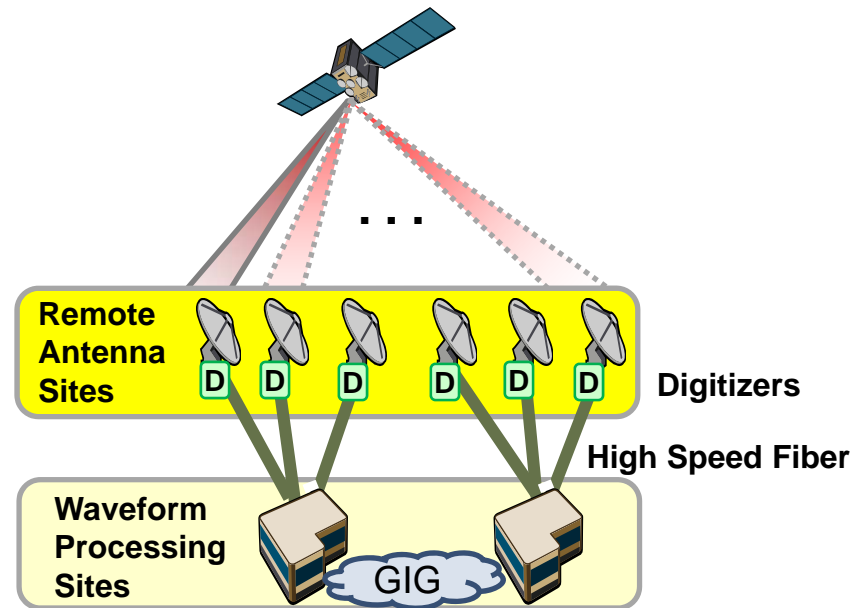


Resilient Ground Processing of Waveform



More processing
Equipment needed

- Less Secure
- More Secure



More ground comm
Capacity needed



Summary

- **Different allocations of functionality between space and ground are possible**
- **No single design optimizes cost, performance, and resiliency**
- **Architectures allowing a mixture of solutions (for different users/missions) may be attractive**
- **Trading processing versus comm costs on ground also provide interesting options**
- **Analysis is continuing under the Protected BAA**





Thank you