



Leveraging The Space Domain Transport Layer

Black Core Transport Must Leverage Commercial Interconnect Agreements for Federation

Marc Boswell, CISSP

Red Hat



Agenda

Historical overview: Birth of Space-Based C2 and ISR

Project Corona and Corona knock offs
Physical Transport Layer
NRO/NGA Birth

The Physical to Transport layer really was Physical

LIMFACS to Waveform Transport Layer
Spectrum
Gateway Routing (internal Gov Only)

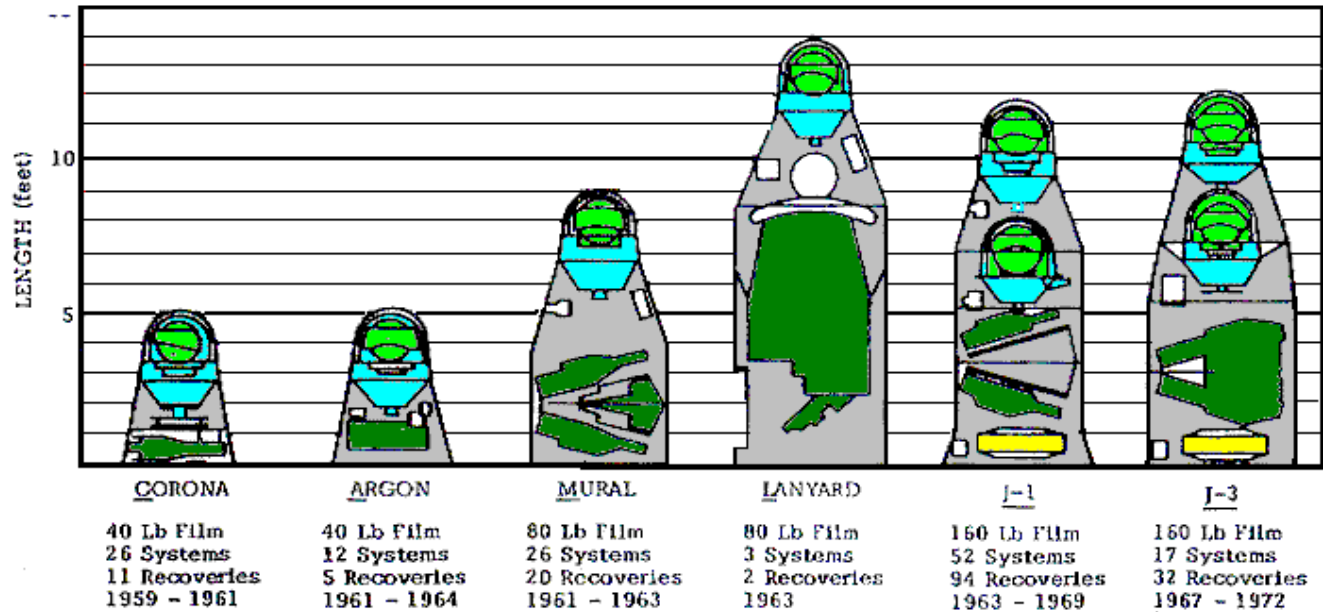
Commercial Augmented Space Reserves (CASR)
Inmarsat
Intelsat
Starlink LEO

Redundancy and Resiliency Via Service Interconnects
Can be staged, planned and tested today
Lines of Effort to Provision Seamless CASR Access
Staging ISR Service Delivery Points of Presence

Discussion and Conclusion



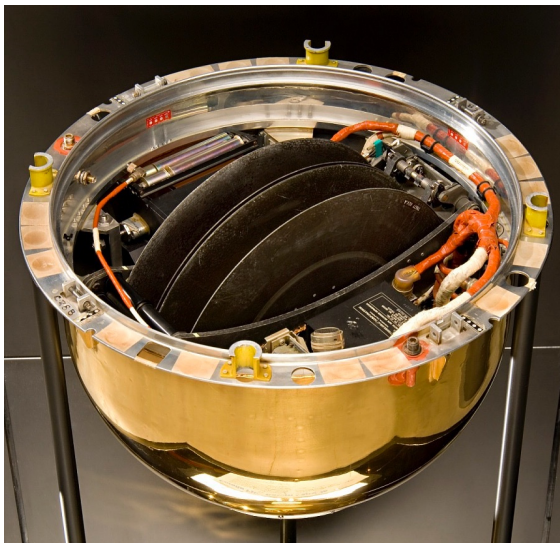
Corona And Analog ISR



Source: NRO Archives



Corona And Analog ISR



Recovered Corona Film Capsule

Source: Smithsonian



Corona And Analog ISR

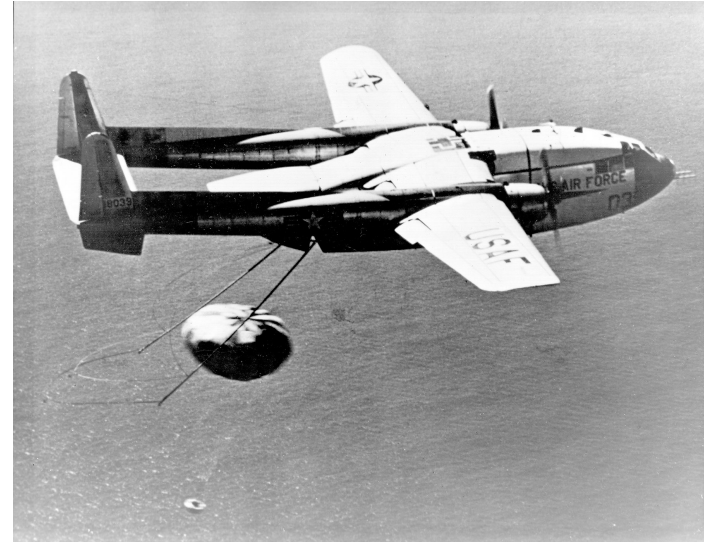
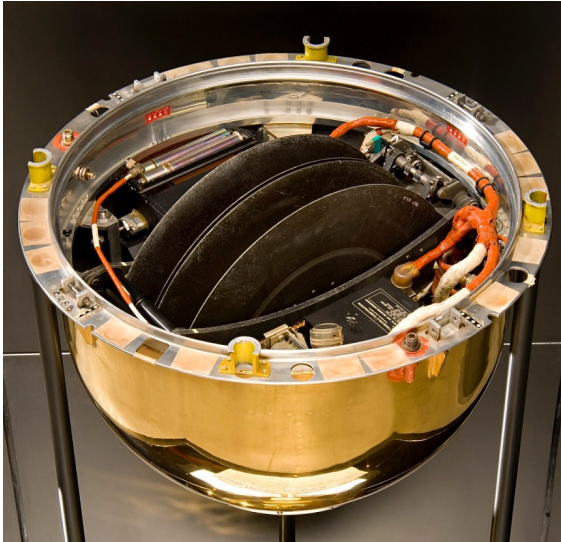


Fairchild Flying Boxcar Recovery

Source: Smithsonian



Corona And Analog ISR

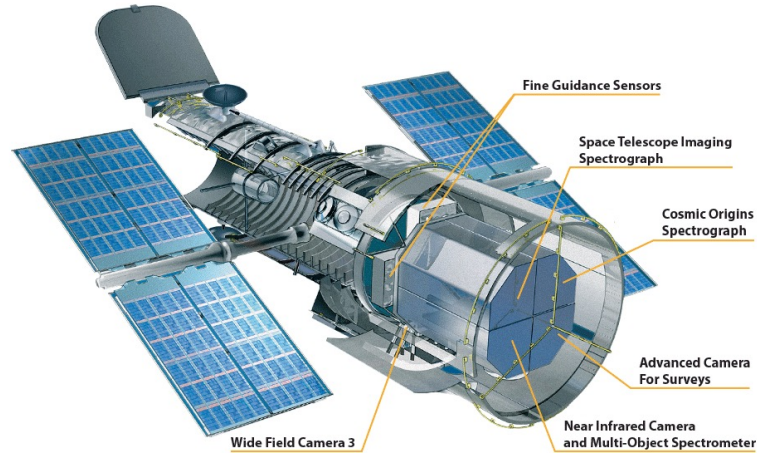


Analog Space Transport Layer

Source: NRO and Smithsonian



Keyhole (KH11) Digital Imaging Revolution

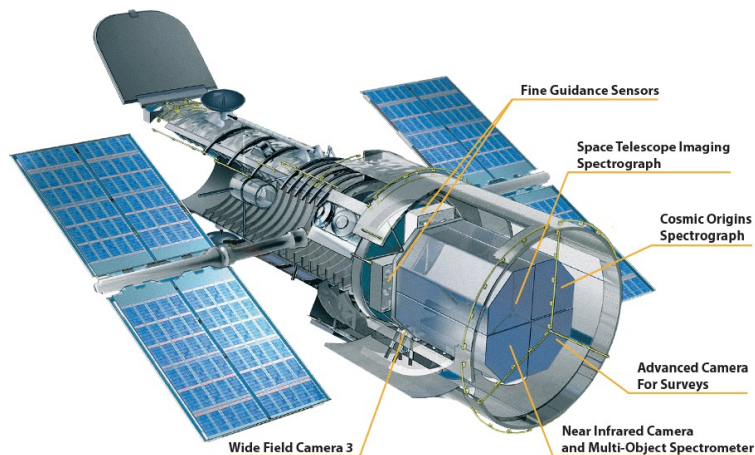


First Telemetry Capture Satellite Program

Source: NRO and NASA



Keyhole (KH11) Digital Imaging Revolution



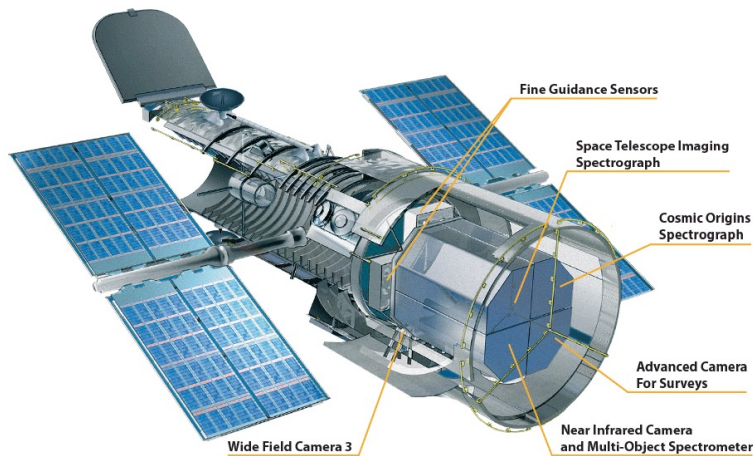
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KH-11 Kennen Design Still Classified But Believed To Be Similar to the Hubble Space Telescope

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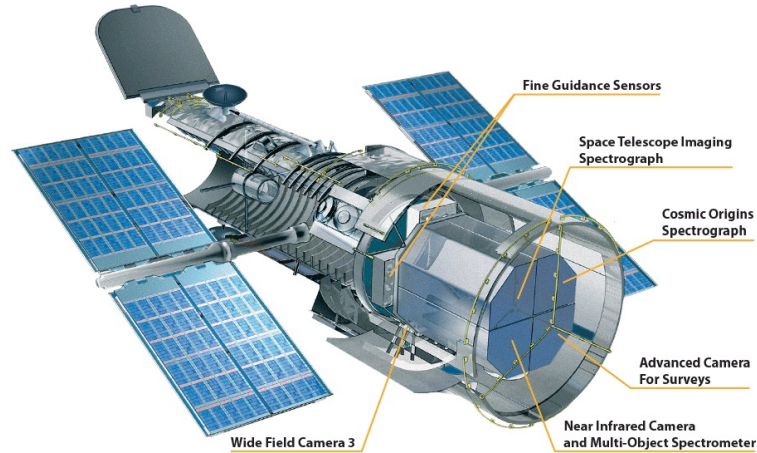
First Telemetry Capture Satellite Program

KH-11 Kennen Design Still Classified But Believed To Be Similar to the Hubble Space Telescope
Edwin Land Is Thought To Have Designed The Lens, Aperture and Capture Fabric While Designing The Folding Polaroid Instant Camera

Source: NRO, NASA and Polaroid



Keyhole (KH11) Digital Imaging Revolution

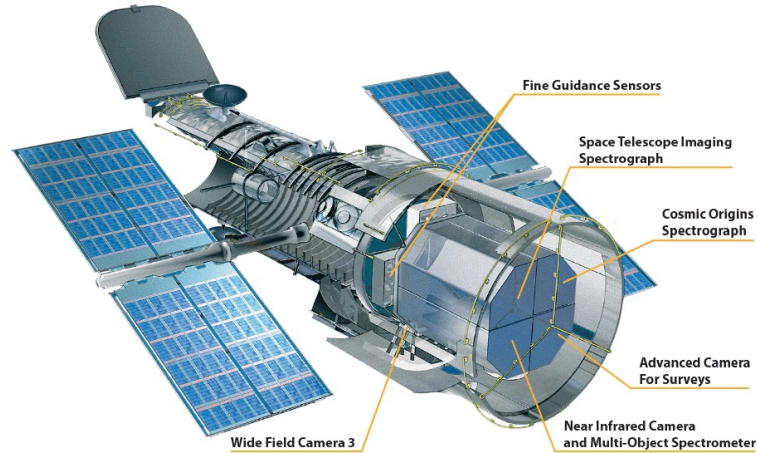


First Telemetry Capture Satellite Program
Telemetry Transport Proprietary Until 1999

Source: NRO and NASA



Transformation Of ISR Via Open Standards



First Telemetry Capture Satellite Program

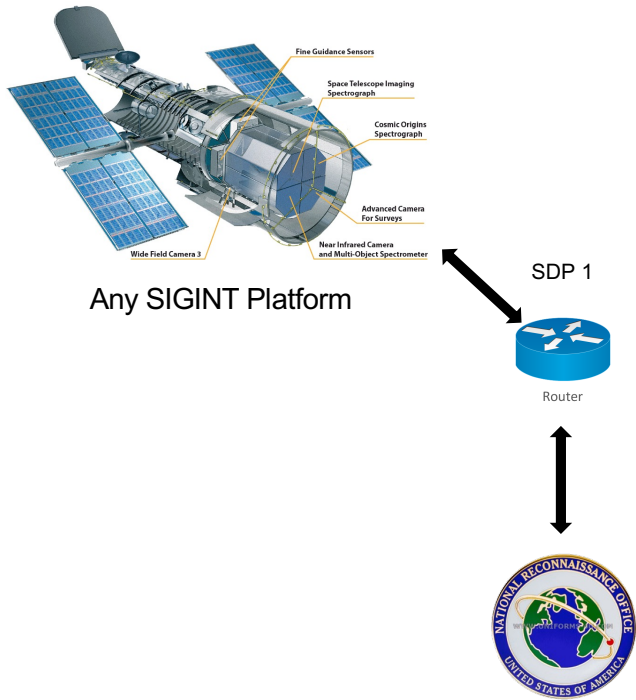
Telemetry Transport Proprietary Until 1999

IBM Invents Message Queue Telemetry Transport (MQTT)
and Publishes To Public Domain

Source: NRO, NASA and IBM



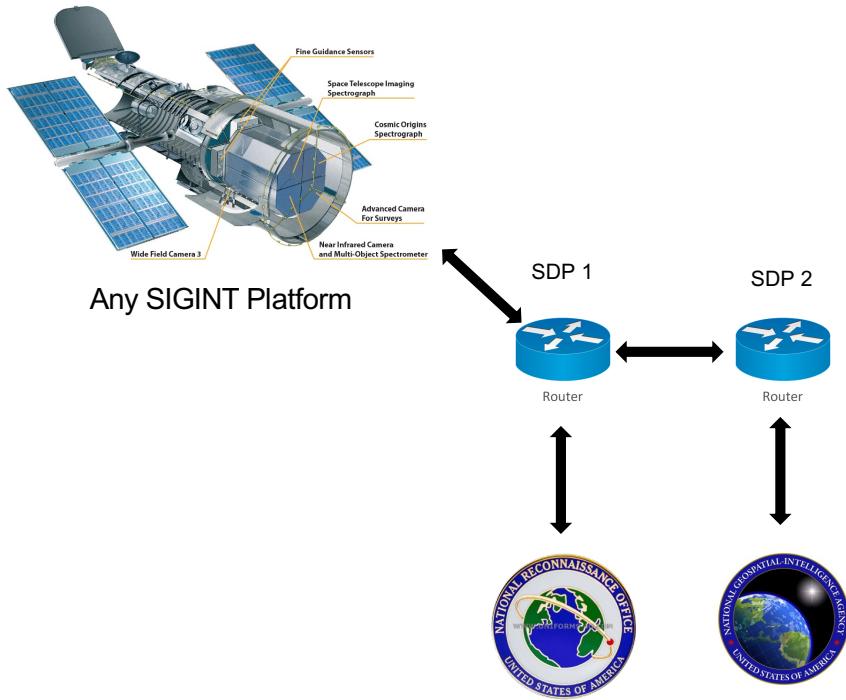
Encapsulation Is A Transport Multiplier



Source: NRO



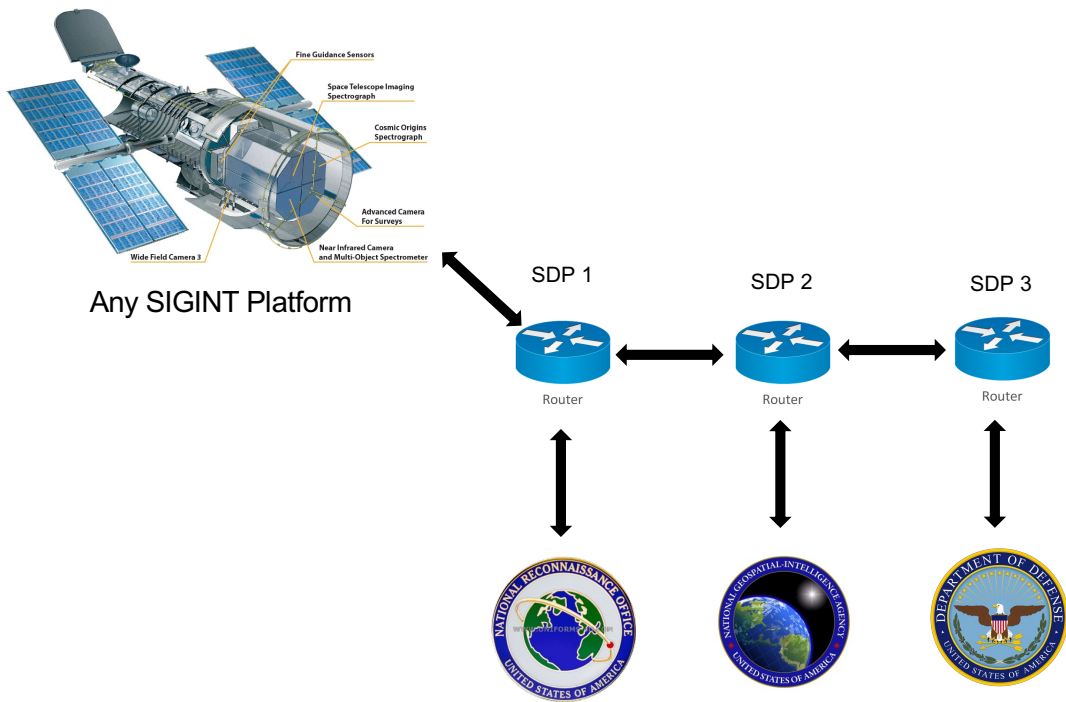
Encapsulation Is A Transport Multiplier



Source: NRO and NSA



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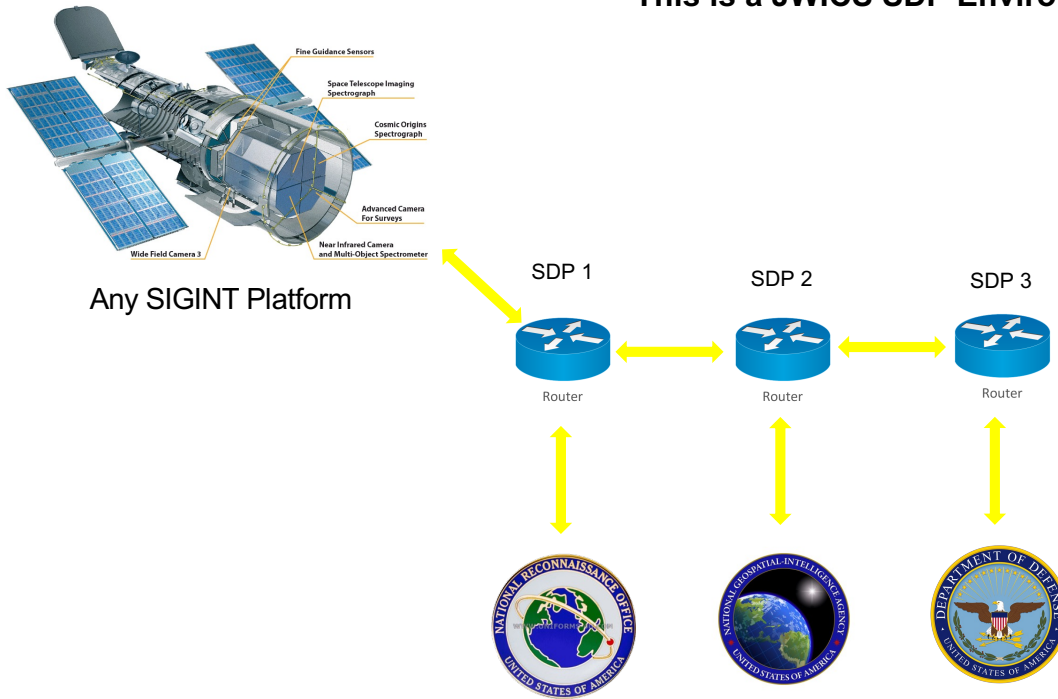


Source: NRO and Inmarsat



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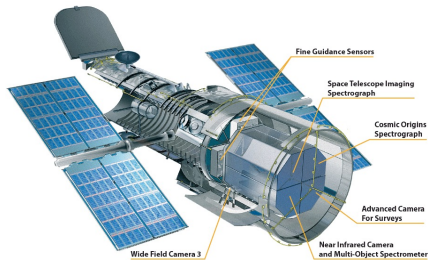
This is a JWICS SDP Environment



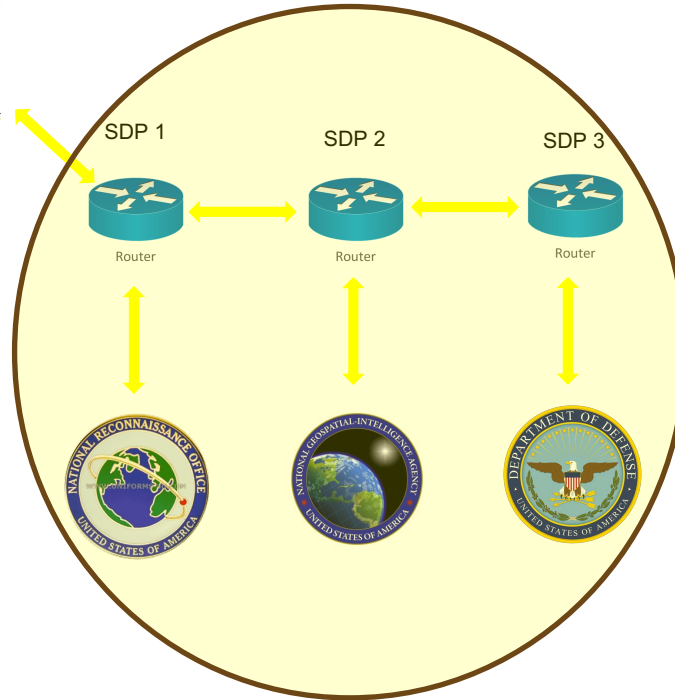
Source: NRO, NGA and DoD

Encapsulation Is A Transport Multiplier

This is a JWICS SDP Environment



Any SIGINT Platform

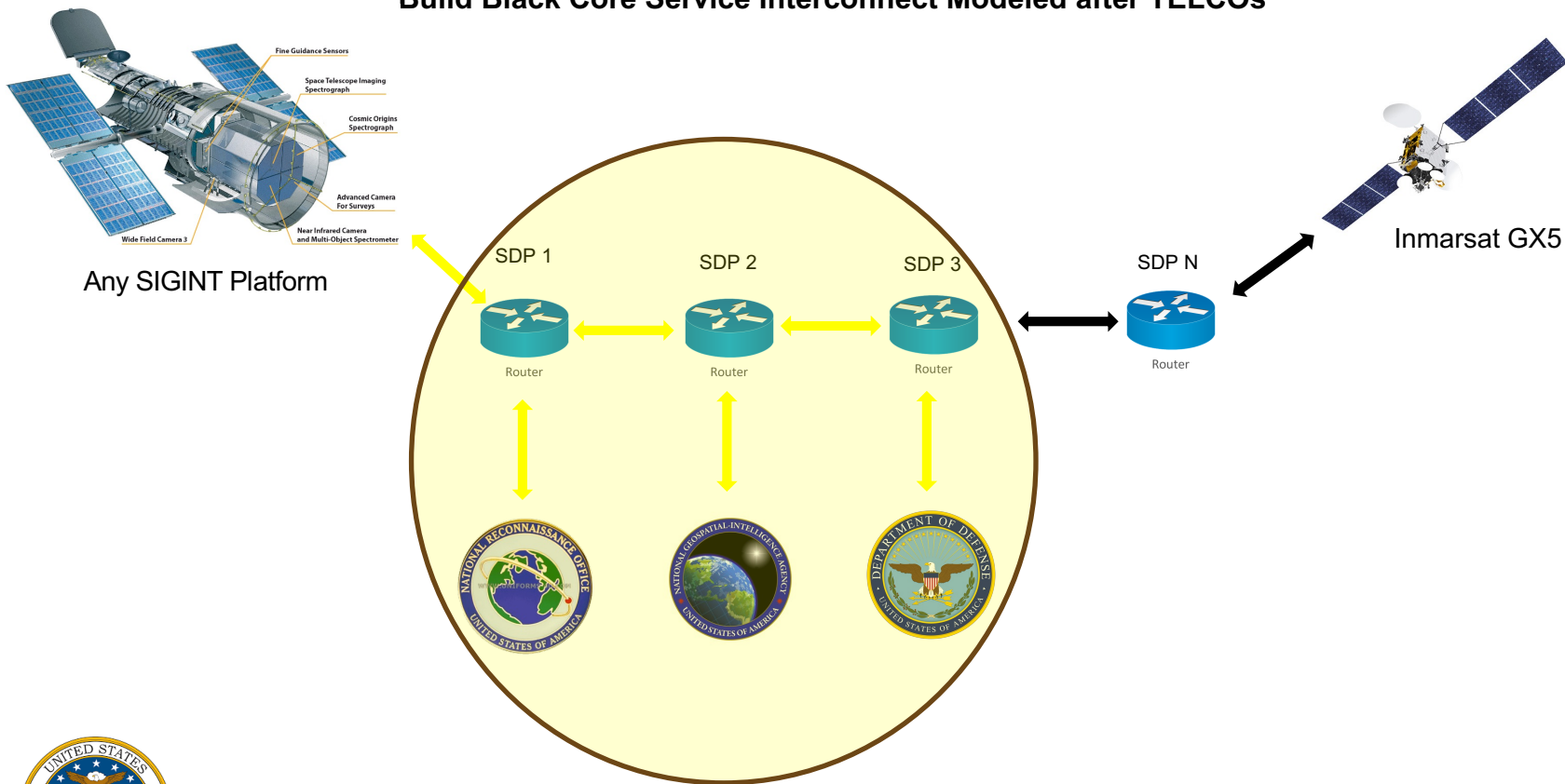


Source: NRO, NGA and DoD



Encapsulation Is A Transport Multiplier

Build Black Core Service Interconnect Modeled after TELCOs

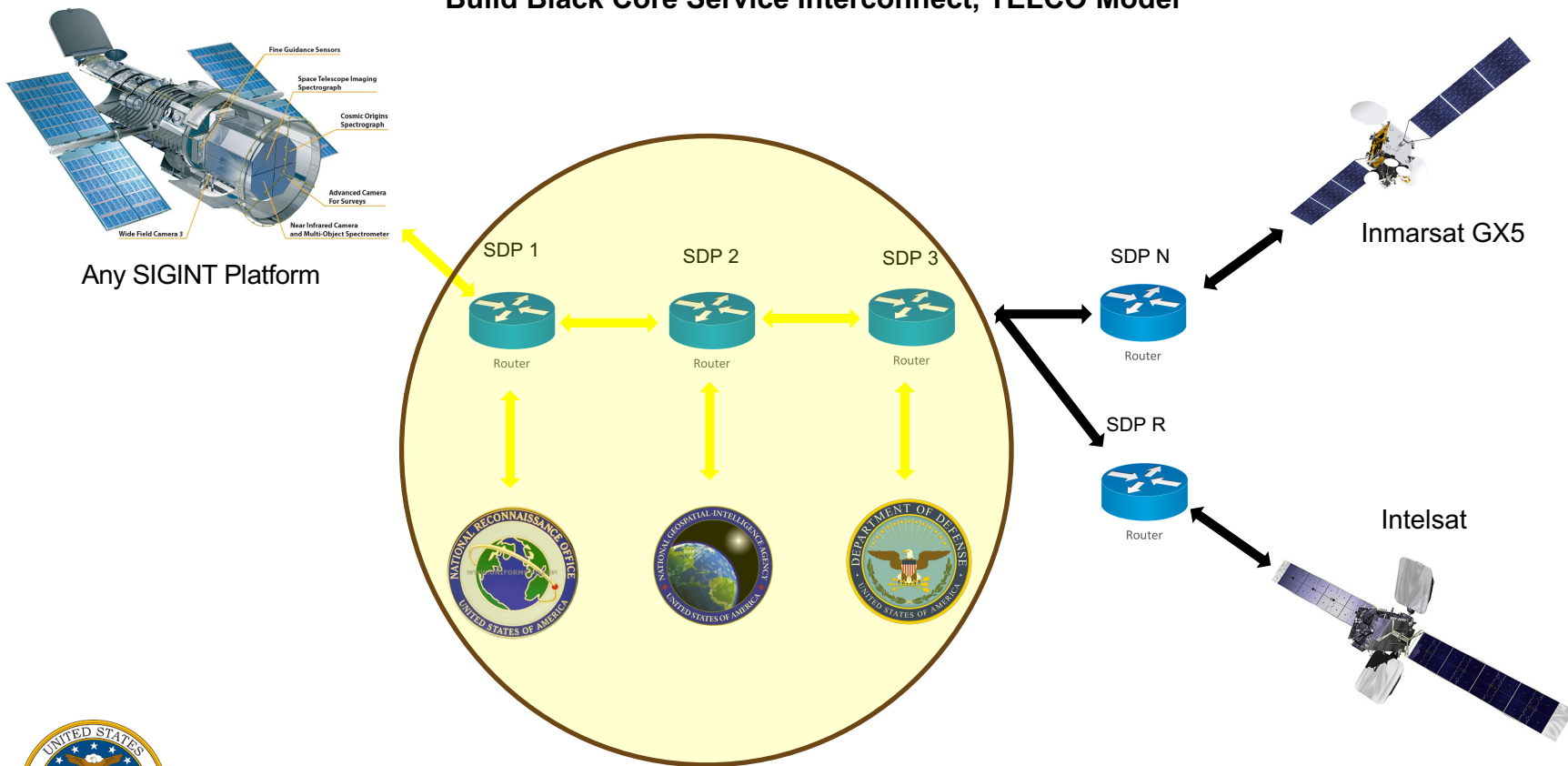


Source: NRO, NGA, DoD, Inmarsat



Encapsulation Is A Transport Multiplier

Build Black Core Service Interconnect, TELCO Model



Source: NRO, NGA, DoD, Inmarsat, Intelsat



Commercial Augmented Space Reserves (CASR)

Proposed: Modeled after Civil Reserve Air Fleet



Source: NRO and Inmarsat



Commercial Augmented Space Reserves (CASR)

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Limitations To Address In Advance

Transponder Limited Quantity



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Provisioning: Core and Edge



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Proposed: Modeled after Civil Reserve Air Fleet
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Transponder Limited Quantity
Gateway Limited Quantity
Provisioning: Core and Edge
Yellow to Black: Physical too?



Source: NRO and Inmarsat



Commercial Augmented Space Reserves (CASR)

Proposed: Modeled after Civil Reserve Air Fleet
Limitations To Address In Advance

DoD should Procure Transponder Subset Now To Plan

Transponder Limited Quantity
Gateway Limited Quantity
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Commercial Augmented Space Reserves (CASR)

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DoD should Procure Transponder Subset Now To Plan
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Commercial Augmented Space Reserves (CASR)

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Orients to Private Sector SAR/GAR→SAA/GAA Process

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Commercial Augmented Space Reserves (CASR)

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Limitations To Address In Advance

DoD should Procure Transponder Subset Now To Plan
From As Many Satellite Providers As Possible
Orients to Private Sector SAR/GAR→SAA/GAA Process
Facilitates Heterogeneous Satellite Provider COAs

Transponder Limited Quantity
Gateway Limited Quantity
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Building Redundancy and Resiliency At The Tactical Edge



Building Redundancy and Resiliency At The Tactical Edge



Quad Band SATCOM Antenna Can Receive Military and Civilian Waveforms

Building Redundancy and Resiliency At The Tactical Edge



Quad Band SATCOM Antenna Can Receive Military and Civilian Waveforms
One Transponder From One Carrier Is A Single Point Of Failure (or Attack)



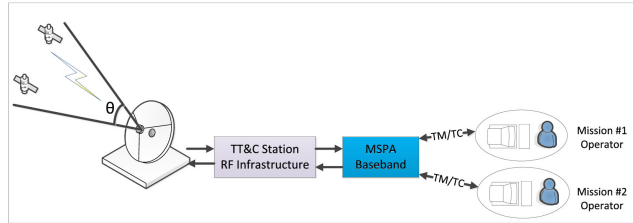
Building Redundancy and Resiliency At The Tactical Edge



Quad Band SATCOM Antenna Can Receive Military and Civilian Waveforms
One Transponder From One Carrier Is A Single Point Of Failure (or Attack)
Consider Development And Use Of Carrier Neutral Software Defined Transponder

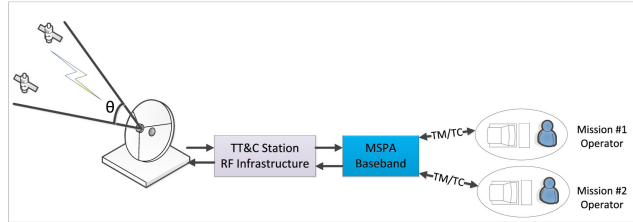
Automate Provisioning At Tactical Edge

Feasibility of using a software-defined baseband for multiple space per aperture (MSPA) ground operations



Automate Provisioning At Tactical Edge

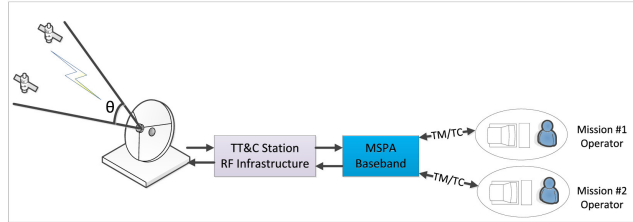
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Multiple Spacecraft Per Aperture SD Transport

Automate Provisioning At Tactical Edge

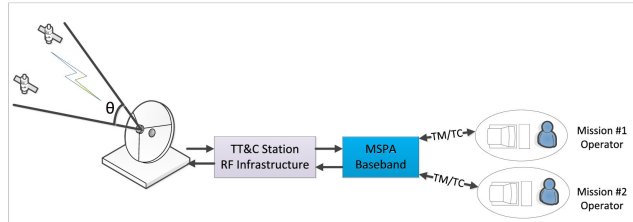
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Multiple Spacecraft Per Aperture SD Transport
Multiple Baseband Links Require Automation:

Automate Provisioning At Tactical Edge

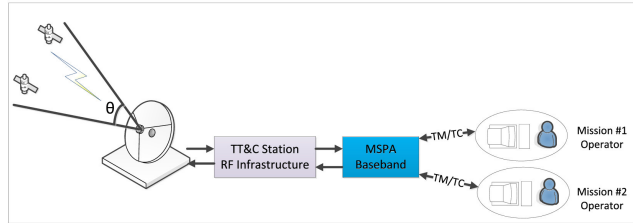
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Multiple Spacecraft Per Aperture SD Transport
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Per Transponder IP Schema

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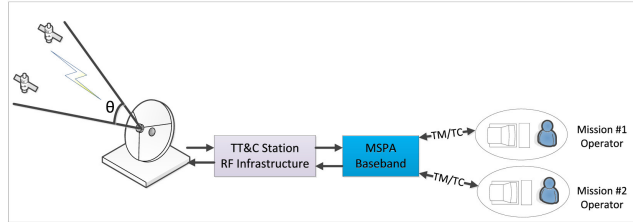


Multiple Spacecraft Per Aperture SD Transport
Multiple Baseband Links Require Automation:
Per Transponder IP Schema
Per Transponder CODEC



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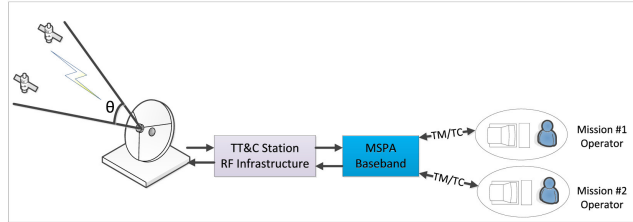
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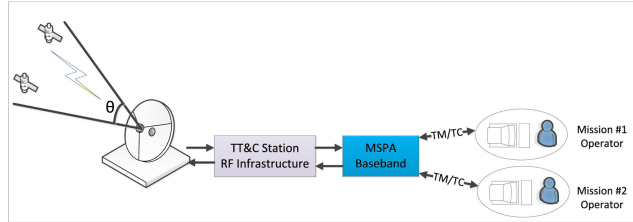
Open Source Provisioning

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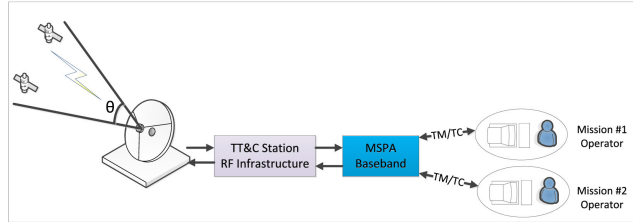
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Automate Provisioning At Tactical Edge

Feasibility of using a software-defined baseband for multiple space per aperture (MSPA) ground operations



Open Source Provisioning
Predeveloped Playbooks
Based upon ACE Scenarios
“Click to Connect”

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Summary



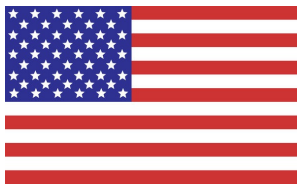
Summary

Creating Private Sector Service Delivery Points Enhances Redundancy and Resiliency.



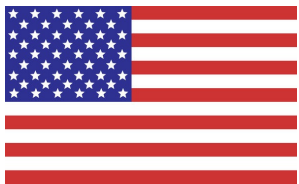
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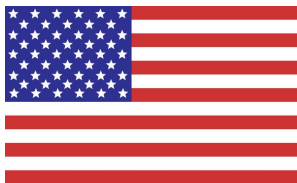


Variable Carrier Options Are A Tactical Edge Advantage for COOP, PACE and ACE.



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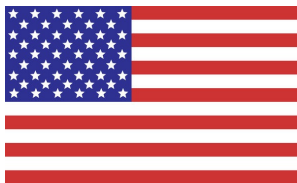


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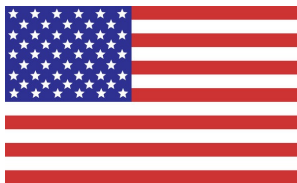


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All Of Which Can Be Preplanned In Advance.



Questions and Discussion



Thank You!

