



Ground Systems Architecture Workshop 2014

Innovative Commercial Satellite Approaches for Space Related Ground Systems

February 26, 2014

Mark Daniels
VP Engineering and Operations
Intelsat General Corporation

General Shelton Quote On January 7, 2014 In Response To Question About Commercial Industry's Role In Military Space:

“ Why couldn't we contract for all standard wideband communication services?

“Why couldn't that be written by commercial providers instead of us buying our own satellites?”

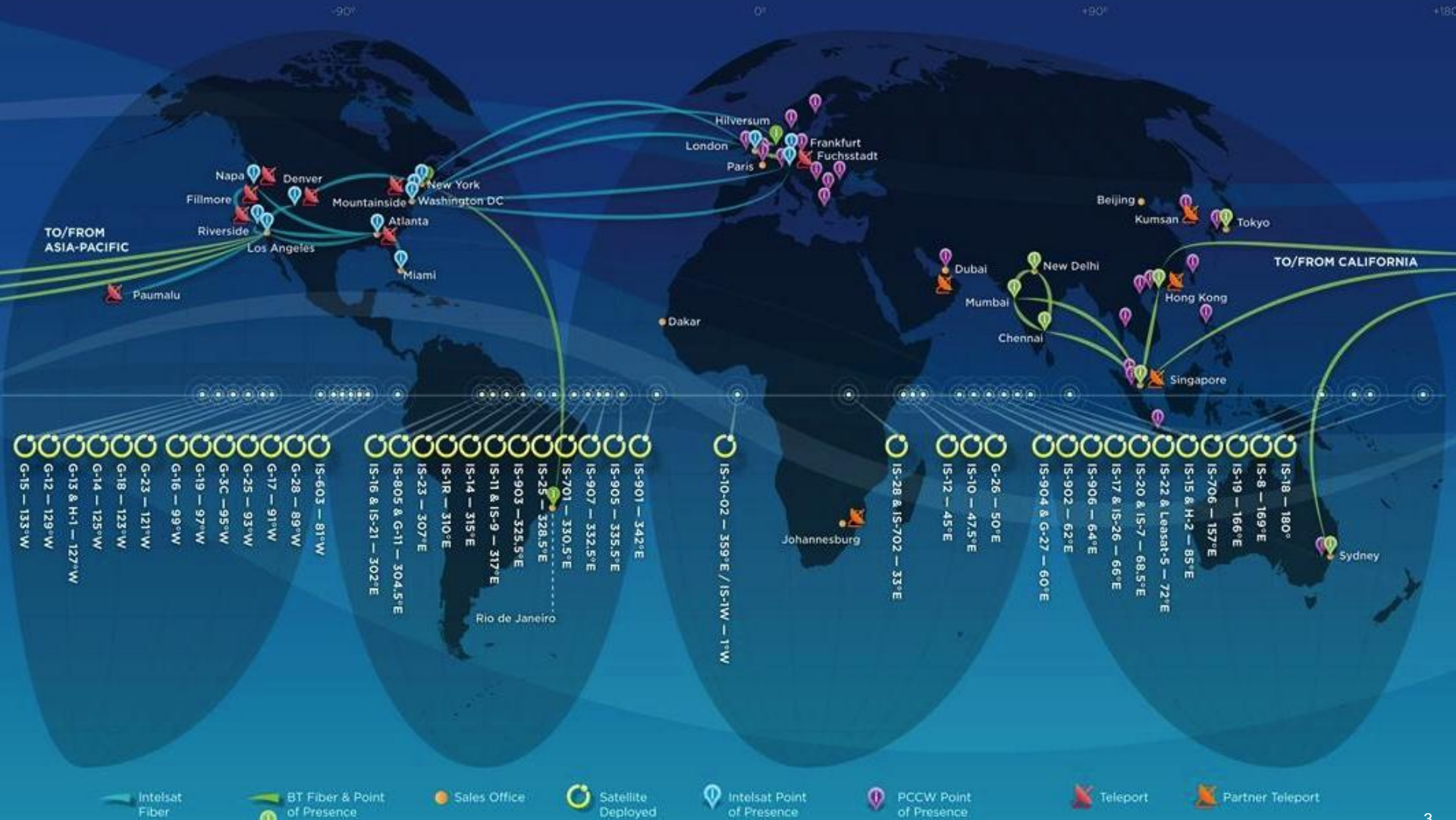


June 28, 2010

The U.S. government will use commercial space products and services in fulfilling governmental needs, invest in new and advanced technologies and concepts, and use a broad array of partnerships with industry to promote innovation.

IntelsatOneSM

50+ satellites in geostationary orbit
 40,000 miles of MPLS terrestrial infrastructure
 Global presence, global footprint



Intelsat Satellite Operations Experience

**Currently 76 Satellites Operated
(51 Intelsat and 25 Third Party)**

14 Bus platforms



Astrium E2000

Astrium E3000

Boeing 381

Boeing 393

Boeing 601

Boeing 601HP

Boeing 601MEO

Boeing 702

Boeing 702MP

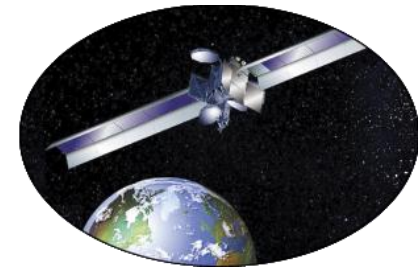
LM 7000

OSC Star 2

SSL 1300 Omega

SSL FS1300

Thales Spacebus 3000B



Satellite Operations

- Fully redundant primary and back up control centers in Washington, DC and Long Beach, CA
- Operational experience with all major manufacturers and satellite platforms
- Highly functional and automated control system (combination of COTS and in-house product) provides efficient and reliable fleet operation
- Knowledge and experience with industry COTS satellite control products
- Extensive experience with satellite management, anomaly resolution and mitigation, and life extension

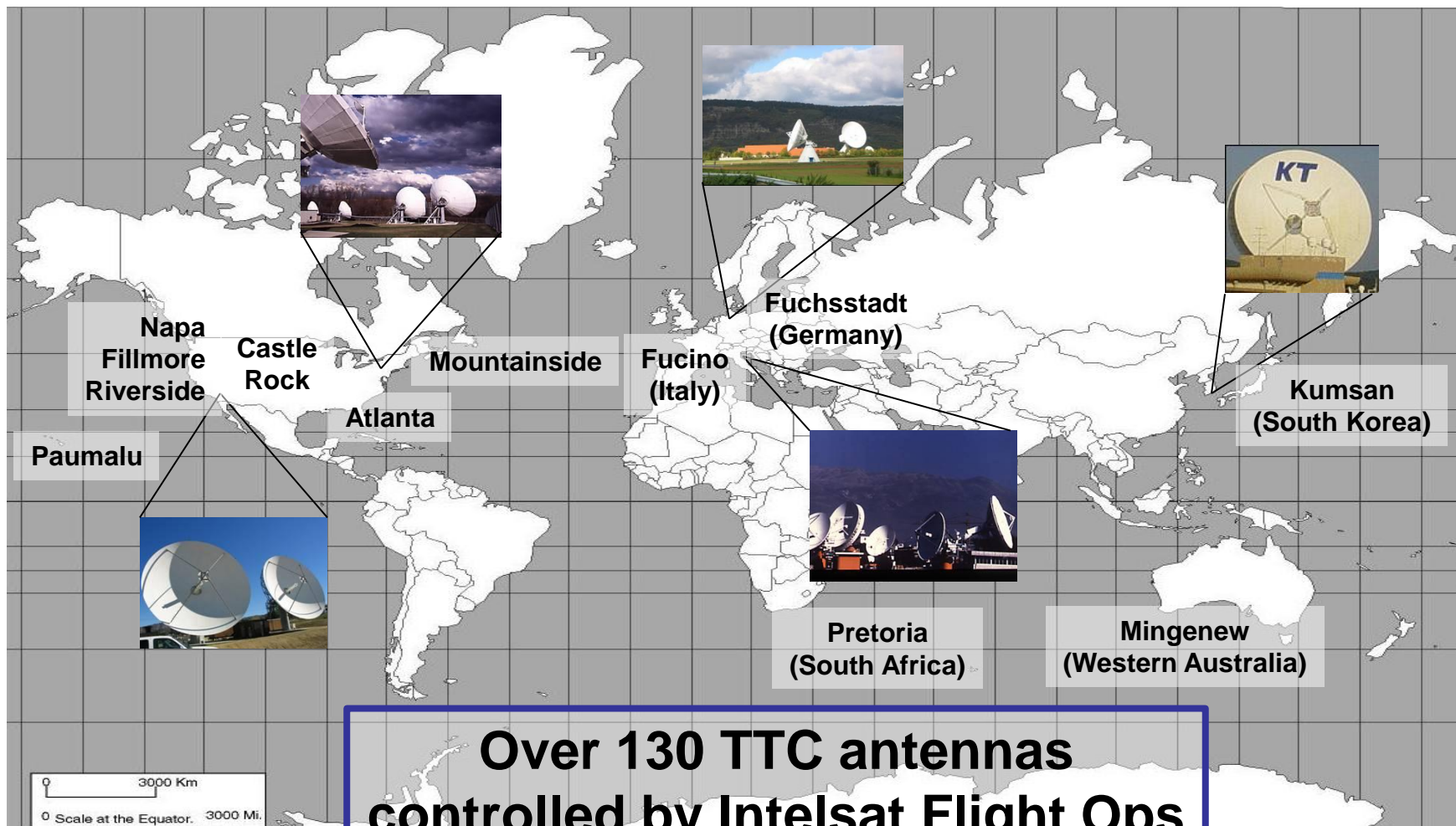


Long Beach Sat Operations Center (LSOC)



East Coast Sat Operations Center (ESOC)

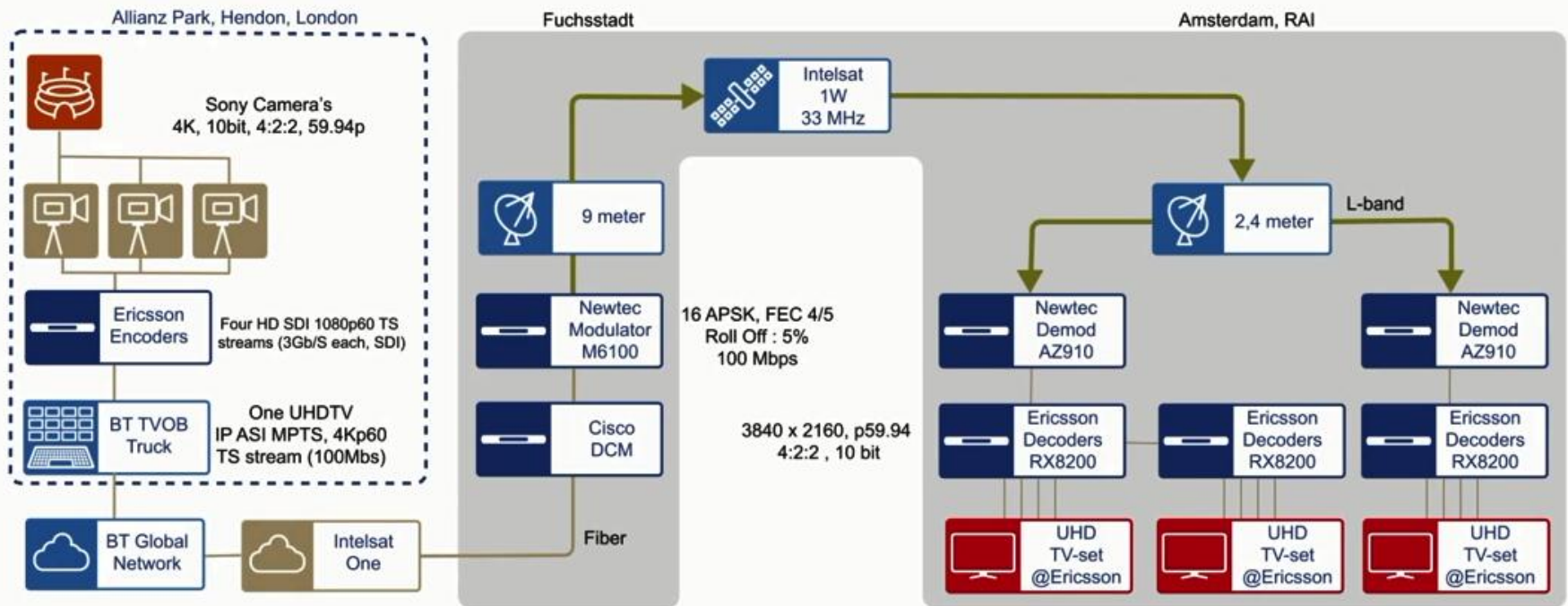
Intelsat TTC (C2) Sites



**Over 130 TTC antennas
controlled by Intelsat Flight Ops**

Automation and simplification are the keys

UHDTV Demonstration IBC2013 – Live Sports London-Amsterdam





Ultra High Definition (4K) Live Event Coverage



Intelsat Hosted Payload Heritage



WAAS on Galaxy 15
S/C Mfgr: Orbital Science Corp.
P/L Mfgr: Lockheed Martin
Launched: 2005
P/L Dry Mass:60 kg
P/L Power:300 W



IRIS on Intelsat 14
S/C Mfgr: Space Systems/Loral
P/L Mfgr: Cisco and Seakr
Launched: 2009
P/L Dry Mass:90 kg
P/L Power:450 W



UHF on Intelsat 22
S/C Mfgr: Boeing
P/L Mfgr: Boeing
Launched: 2012
P/L Dry Mass:350 kg
P/L Power:2000 W

Hosted payloads with a range of application and SWaP

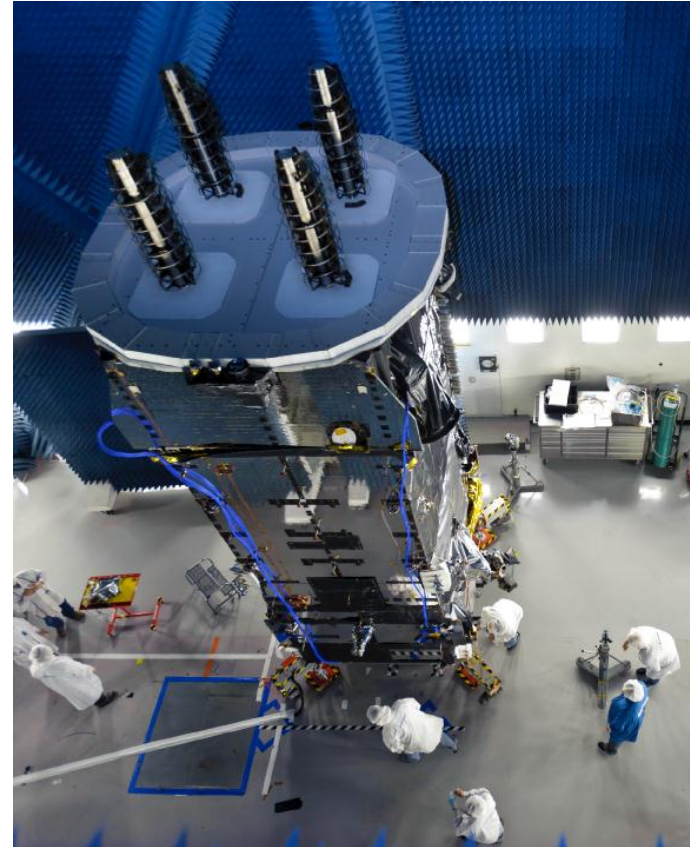
Hosted Payloads Provide Cost-effective, Fast Access To Space

- The key drivers for hosted payloads are as follows:
 - Speed: Time to orbit can be as short as 2 to 3 years
 - Cost: The cost of hosted payloads is lower due to shared infrastructure with other payloads on the satellite
 - Risk: Risk can be spread out on several hosted payloads as compared to one free flyer

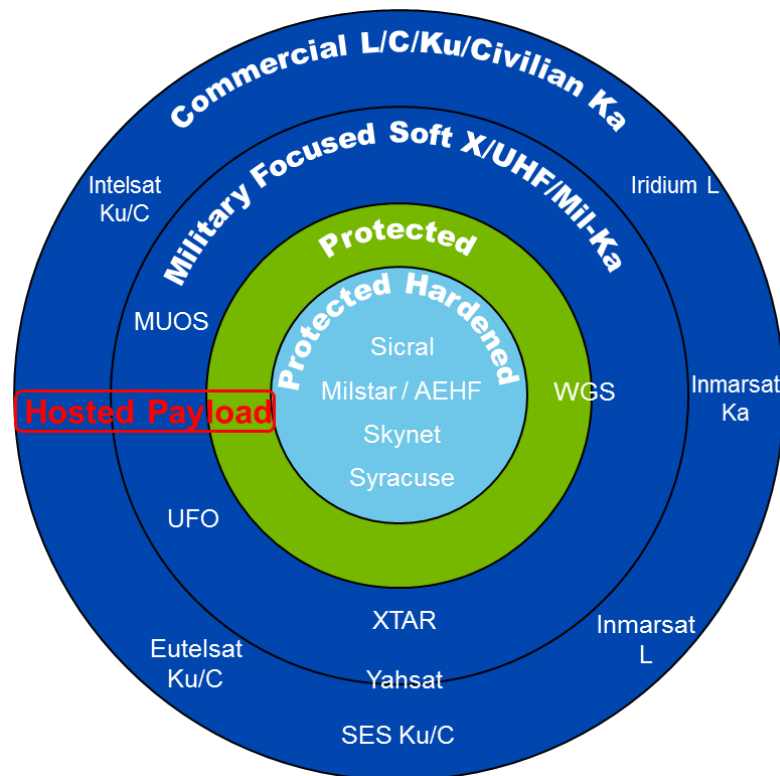
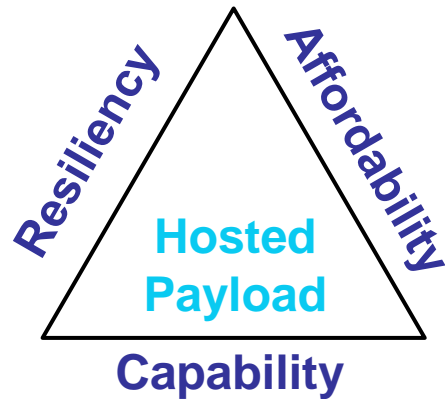
“Compared to launching its own satellite Defence will save over \$150m through this initiative and is a good example of the types of reforms required to ensure the most efficient use of Government finances.”

- Australian Minister of Defence, May 2009

UHF Hosted Payload on IS-22



Hosted Payloads Can Be A Key Element To Enhance Resiliency In Space Affordably In The Future



Key Benefits

- Provide disaggregation and resiliency
- Accommodate Milsatcom payloads like EHF, Wide field IR, SSA, others

From National Space Transportation Policy, dated November 2013

Departments and agencies shall explore the use of hosted payload arrangements, ... when planning space-based missions to meet United States Government requirements.

Five Successful Launches in 2012

- Diverse launch providers ensure timely access to space.
- 8 satellites under procurement



Sea Launch

- IS-19 (Loral) 1 Jun 12
- IS-21 (Boeing) 19 Aug 12



Proton

- IS-22 (Boeing) 25 Mar 12
- IS-23 (Orbital) 14 Oct 12
- IS-31 (Loral) 2015



Ariane 5

- IS-20 (Loral) 2 Aug 12
- IS-30 (Loral) 2014
- IS-34 (Loral) 2015
- IS-29e (Boeing) 2015
- IS-33e (Boeing) 2016

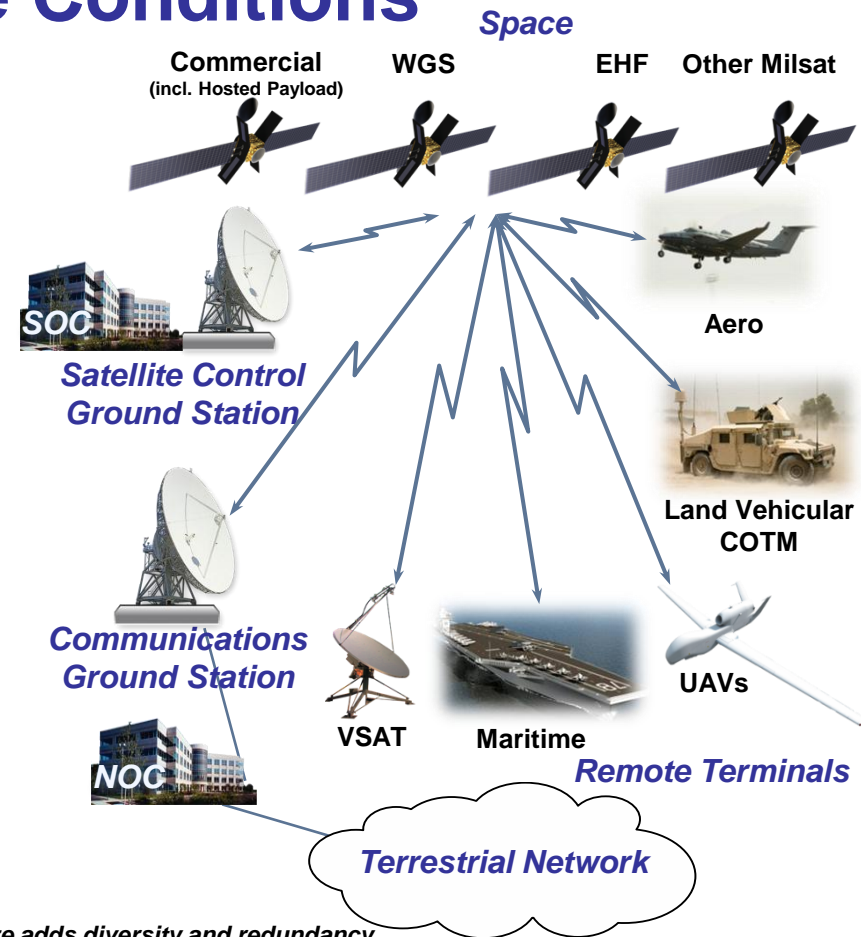


**Space X
Falcon Heavy
TBD**

Intelsat has averaged 3 satellite launches per year over last 25 years

IA And Security Measures Defend Against Hostile Attacks & Adverse Conditions

Asset	Intelsat Defense Measures
Space	<ul style="list-style-type: none"> Redundancy & diversity; backup satellites Backup and augmentation payloads (hosted payloads via disaggregation) Interference management / Anti-jam / Signal nulling
Ground Stations, NOC, SOC	<ul style="list-style-type: none"> Secure facility; physical security, backup facilities with geographic diversity; power backup; hurricane & blizzard rated antennas Out-of-band management / monitoring; redundancy Encrypted command link (TT&C); encrypted comms link
Terrestrial Network	<ul style="list-style-type: none"> Intrusion monitoring, firewalls, virus protection Diverse path & redundancy Carrier grade equipment & hardened infrastructure
Remote Terminals	<ul style="list-style-type: none"> Intrusion monitoring and firewalls; content management Encryption for sensitive data; virus protection
General	<ul style="list-style-type: none"> Defense in depth strategy; Intelsat Interference Management Initiative (I³) Automatic network path rerouting (e.g., IRIS) Conformance to standards (NSS, DoD, NIST, ISO)



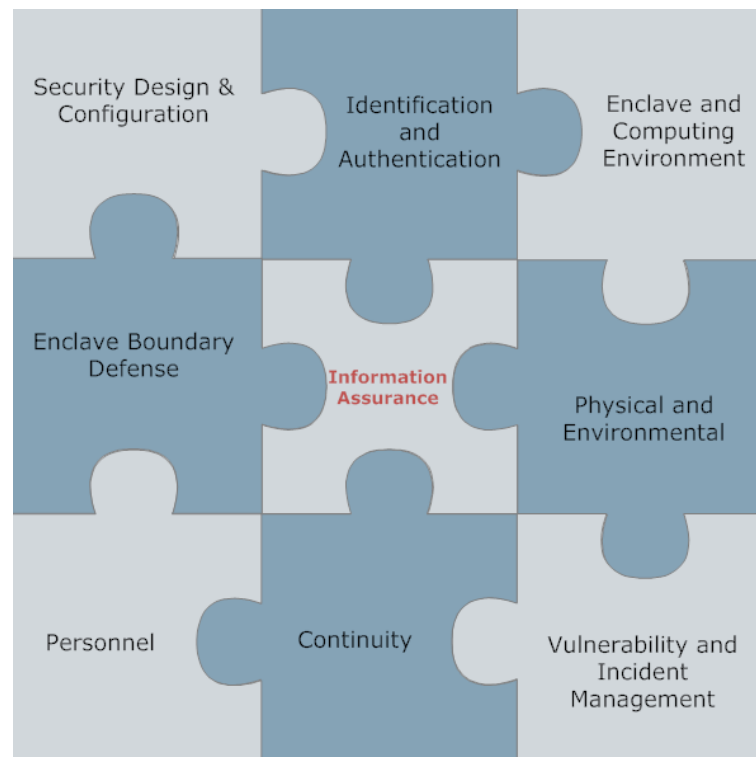
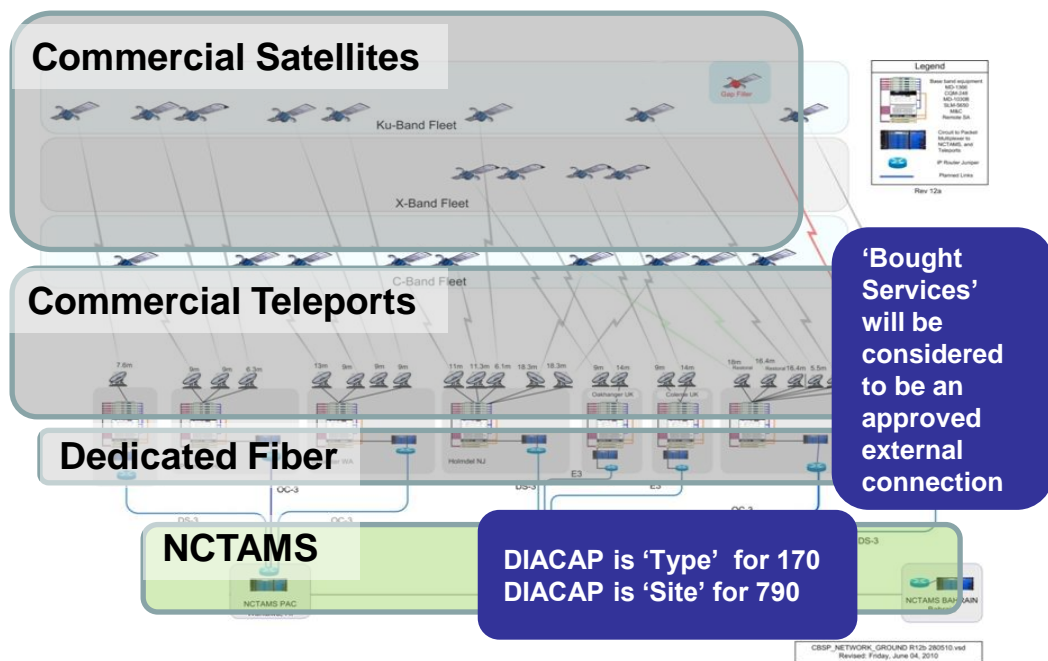
- Defense of infrastructure**
- Defense in depth: customer networks**

Fleet size adds diversity and redundancy

Command	No. of Intelsat Satellites w/ Coverage
NORTHCOM	29
SOUTHCOM	29
CENTCOM	26
AFRICOM	29
EUCOM	33
PACOM	35

The numbers are representative only as fleet transitions and launches are occurring regularly.

The CBSP Network Is DIACAP Certified For MAC II Confidential IA Standard



- The approach included identifying, implementing & validating IA controls, developing security documentation, and activities to mitigate vulnerabilities
- The strategy involved using type accreditation for equipment at teleports and a site accreditation at teleports or NCTAMS that would inherit controls for physical & environment protection and personnel security

- Extensive coordination with the Navy and C&A along with complete DIACAP package reduced the review time (submitted 6/2010)
- ATO was granted in 8/2010 for teleports to NCTAMS and in 10/2010 for leased services

Concluding Thoughts on Innovation

Skunk Works

- U2, SR71 Blackbird, F117 Nighthawk, F-22 Raptor
- Kelly Johnson's rules of management
 - Small number of good people
 - Streamlined requirements
 - Specifications agreed in advance of contracting
 - Simple drawing and release system with great flexibility for making changes
 - Minimum reporting
 - Inspections – push more responsibility to contractors, reduce duplicate inspection
 - Timely funding required

Intelsat – Commercial approach

- 50 + commercial GEO satellites and robust ground architecture
- Intelsat's rules of management
 - Small number of good people
 - Streamlined thorough requirements
 - Specifications agreed in advance of spacecraft contracting
 - Use spacecraft contractor drawing system and design review cycle
 - Minimum reporting
 - Inspections – small, highly skilled Intelsat team embedded at spacecraft factory – speeds decision making
 - Funding provided by internal cash flow

Thank you!



INTELSAT.
General Corporation

Mark Daniels
VP, Engineering & Operations
301-571-6016
mark.daniels@intelsatgeneral.com