Joint Capability Technology Demonstration (JCTD)

Bridging the Innovation Gap

IRIS JCTD

Internet Routing in Space (IRIS)

Operational Utility Assessment (OUA)

U.S. Army Space and Missile Defense Battle Lab

Mr. Mike Florio, Operational Manager

IRIS JCTD
Operational Utility Assessment (OUA)
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    5. NC3A, The Hague, NL
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I. IRIS JCTD Overview
A. Purpose and Scope
1. Development Process

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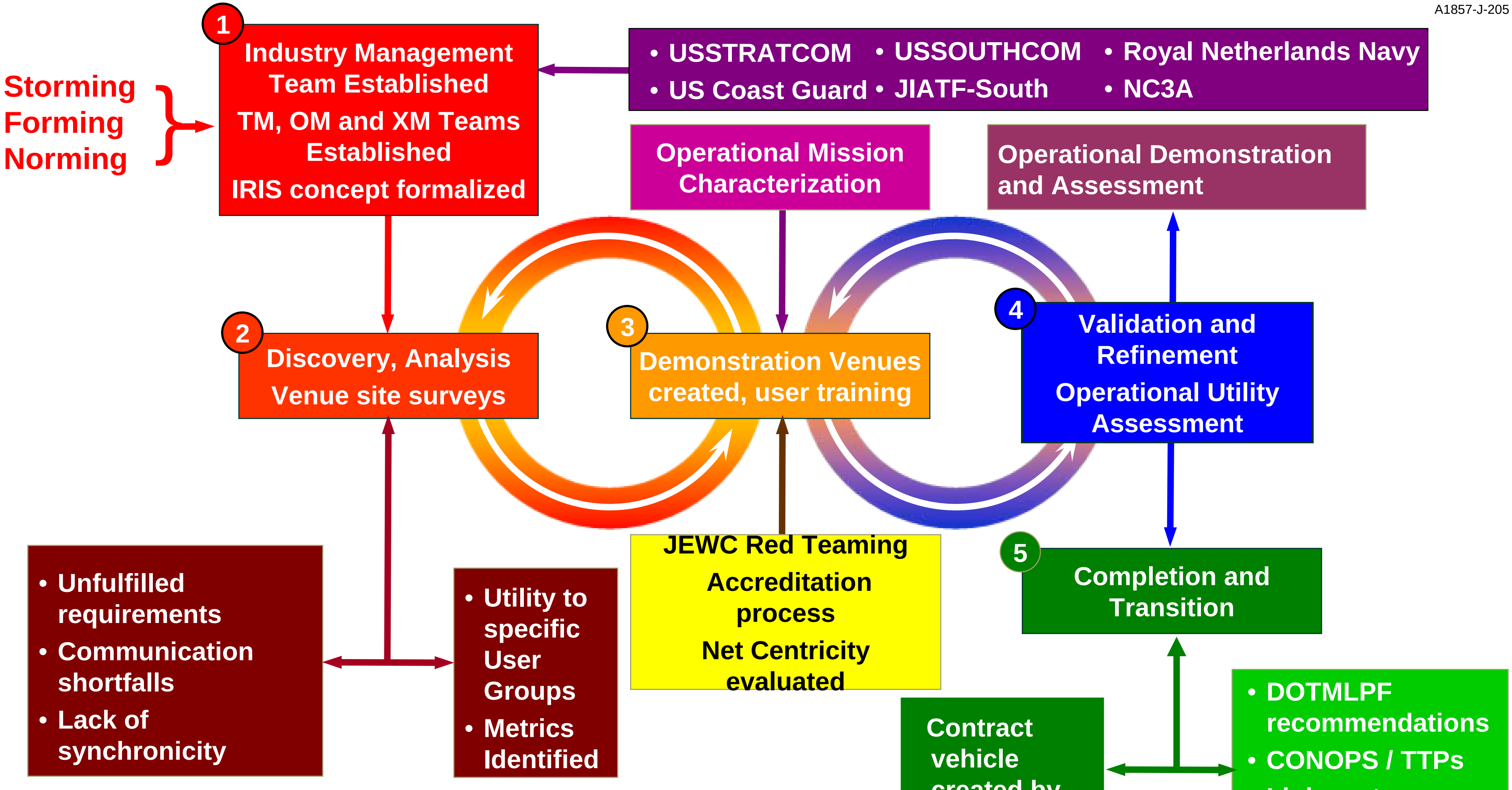
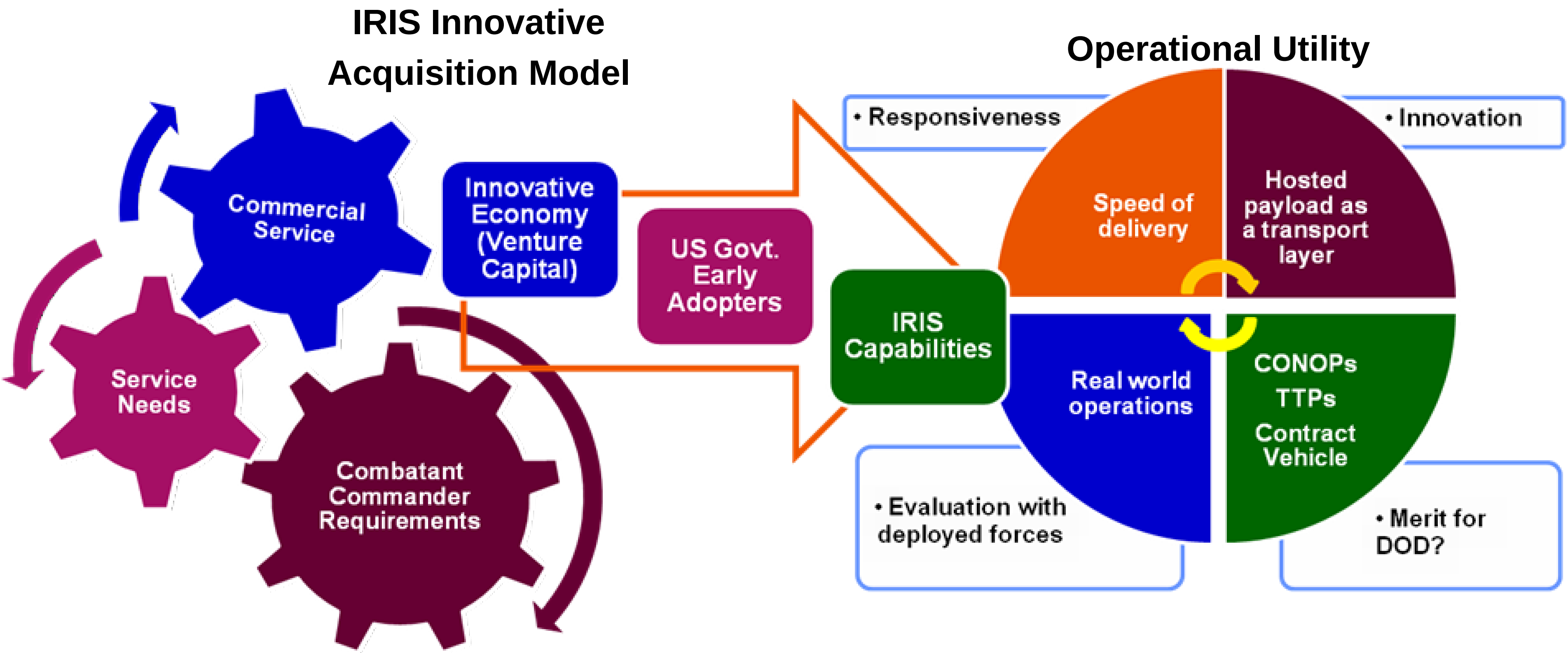


"Innovation is the ability to see change as an opportunity - not a threat"

I. IRIS JCTD Overview
A. Purpose and Scope
2. DOD Hosted Payloads on Commercial Satellites

Do commercially Hosted Payloads provide technologies or capabilities that are timely, relevant and affordable for the DOD and the JIIM community?



The IRIS JCTD findings correlate completely with the new direction given in the National Space Policy's Commercial Space Guidelines.
National Space Policy of the United States of America dated 28 June 2010

I. IRIS JCTD Overview
B. Hosted Payload
1. Intelsat's IS-14

Commercial Program:	Intelsat-14
Mission lifetime:	15 years
Launched:	November 23, 2009
IRIS JCTD airtime:	February 1 – May 24, 2010

The IRIS payload consists of:

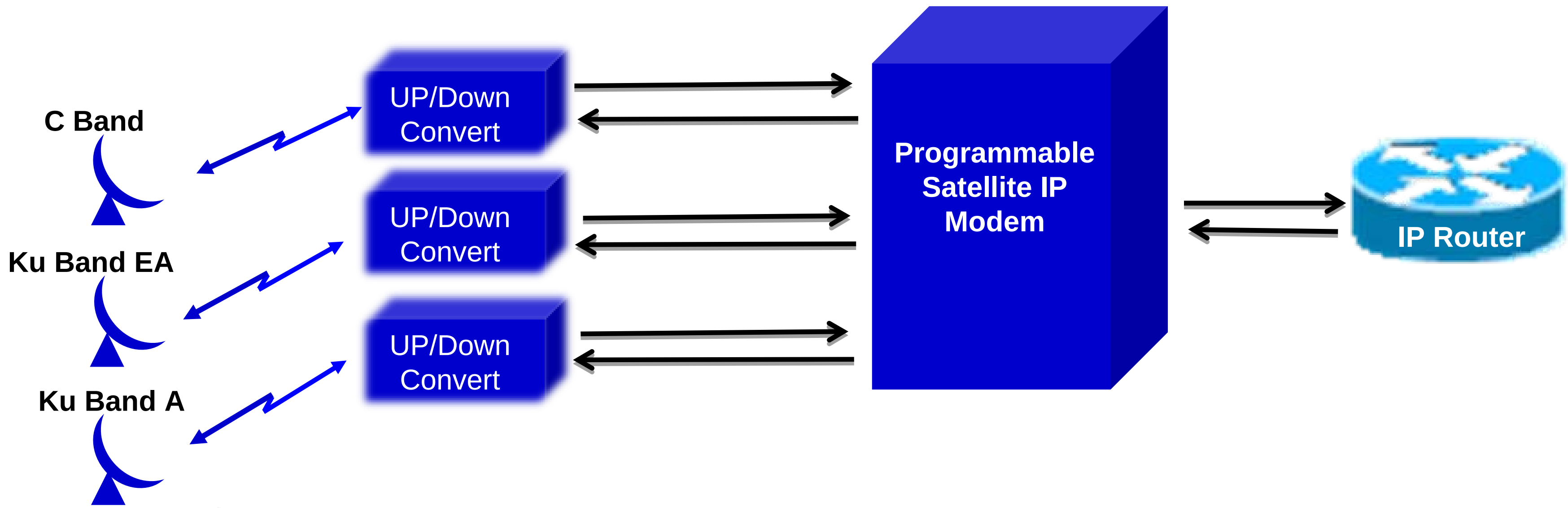
- A space certified Cisco IP Router
- Programmable Satellite IP Modems (PSIM)
- Field Programmable Gated Arrays (FPGA)
- Digital signal processing equipment.

The payload is connected to transceivers and antennas that will provide C-band beam coverage over most of the Western Hemisphere

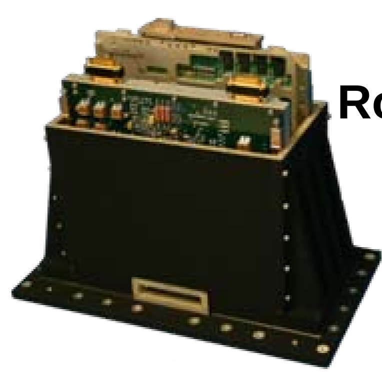
It provides focused Ku-band coverage over most of North America, almost all of South America, the Caribbean as well as Western Europe and Western Africa

I. IRIS JCTD Overview
B. Hosted Payload
2. On Orbit Hardware

A simplified block diagram of the IRIS satellite payload hardware and the payload just prior to flight integration and testing is shown below:

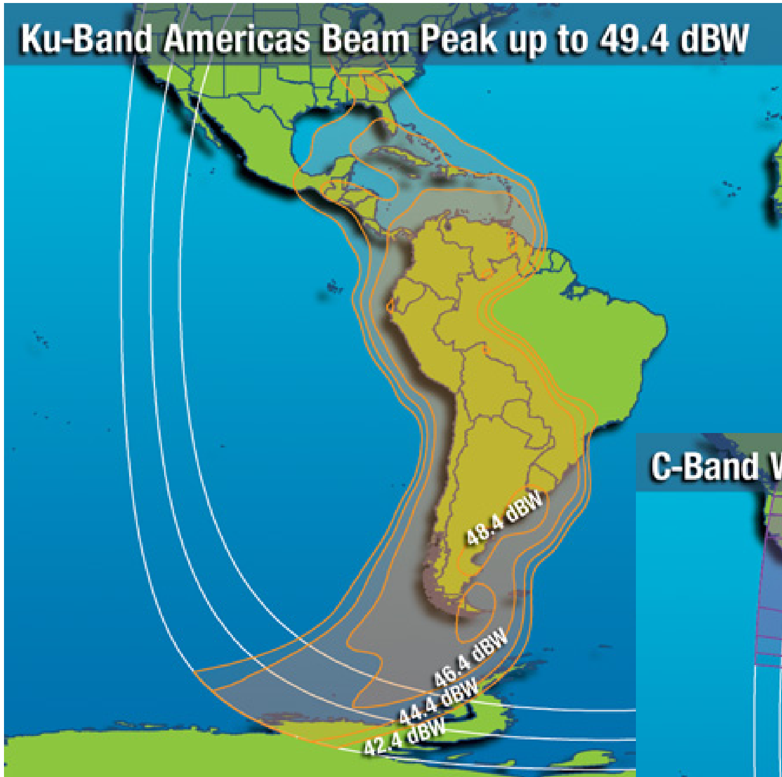


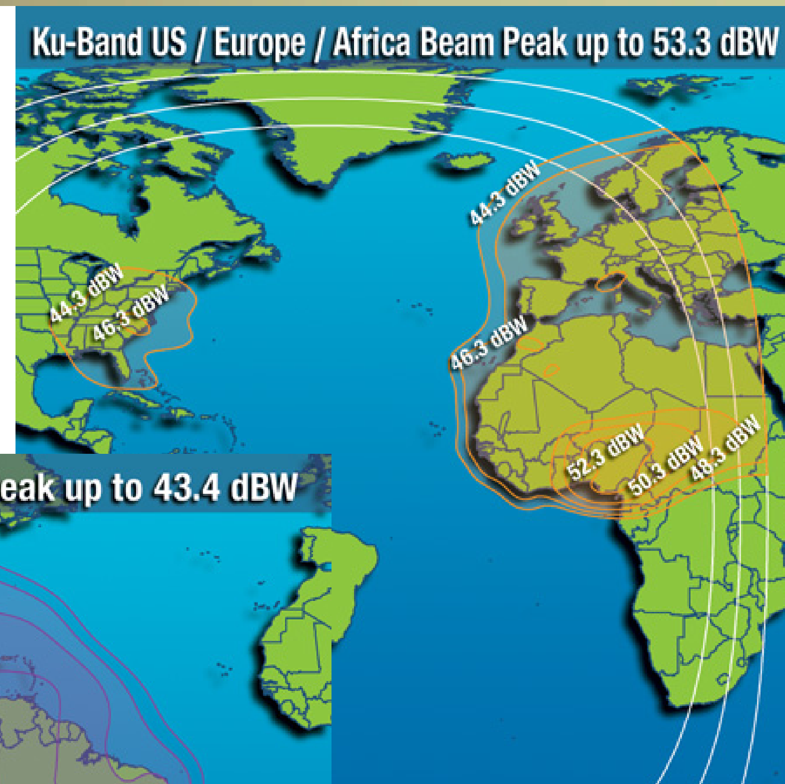
Modem Dimensions:
14” by 17” by 9”
55 lbs.
250 Watts

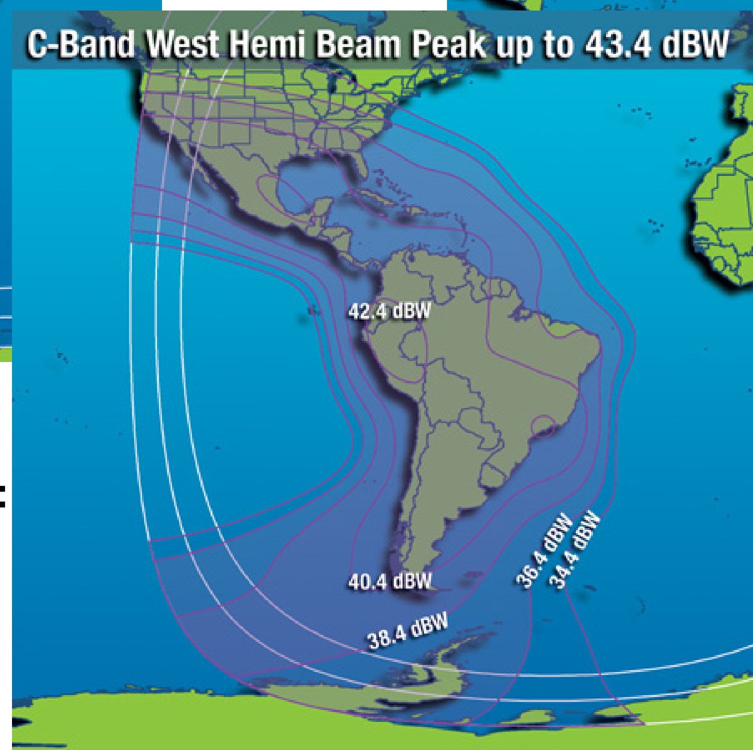


Router Dimensions:
14” by 8” by 9”
32 lbs.
32 Watts

I. IRIS JCTD Overview
B. Hosted Payload
3. IRIS Coverage Areas







Geosynchronous Orbital slot:

45º West Longitude

I. IRIS JCTD Overview
C. Purpose

- This report serves as the capstone reporting document on the IRIS JCTD from the Operational Manager and the assessment team from the Johns Hopkins University / Applied Physics Lab (JHU/APL)
- JHU/APL was tasked to provide an Operational Utility Assessment (OUA) of the IRIS JCTD's Concept of Operations (CONOPS), Tactics , Training and Procedures (TTP) and Capability Solution.
- The report provides results for technical and operational assessments in quantified and qualitative terms and data. It addresses two technical and four operational demonstrations.
- Subjective and objective data provide results to understand the impact and resolution of the Joint, Interagency, Intergovernmental and Multinational (JIIM) Operational Problem, Critical Operational Issues, Top Level Capabilities and Metrics.
- Operational deficiencies and recommendations are described where applicable.
- This OUA also provides the transition plan, and Doctrine, Operations, Training, Materiel, Leadership and Education, Personnel, Facility (DOTMLPF), CONOPS and TTP recommendations.
- This report provides the necessary data to draw conclusions about IRIS's applicability to the JIIM community and make decisions regarding IRIS improvements, transitioning IRIS to a contracted service or IRIS technology fielding to DOD and JIIM forces.

I. IRIS JCTD Overview

D. Joint / Interagency / Intergovernmental / Multinational (JIIM) Refined Operational Problem

What is the impact to net centric operations, specifically to the JIIM community of interest, of placing an internet hub (i.e. the IRIS system) in space?

- Currently it is a challenge to provide robust communication networks to small units in austere locations (land and sea).
- DOD and partner nations have created clever solutions that mitigate some of the challenges and have closed some of the tactical divide between the headquarters and the units in the field or on the sea.
- While these workarounds have had some success, there is no workaround for true high-throughput requirements, including high-resolution imagery, multi-point chat, full-motion video and video teleconferencing.
  - These products are at the heart of net-centric and digitally synchronized operations.
  - They require connectivity in austere and remote places.
- “The [U.S.] Army’s demand for connectivity continues to grow. Warfighters need connectivity not bandwidth, more than anything else.”*
- The IRIS JCTD assessed the commercial IRIS program to determine if IRIS had the potential to provide connectivity and net centric solutions to the Joint Interagency Task Force – South and the Royal Netherlands Navy during counter narcotics trafficking operations in the Caribbean Basin.

* **Major General Nickolas Justice, USA, Executive Officer for PEO C3T, *Satellite and Content Delivery Conference*, New York City, NY, October 15, 2009**

I. IRIS JCTD Overview
E. Desired Capabilities

- **Increased connectivity and throughput to support collaboration and synchronization with remote forces. Provide access to large data files of all types, collaboration tools and VTC**
  - The gap between tactical users and available bandwidth is growing much faster than planned
  - Tactical forces must either accept a disparity between requirements and SATCOM realities or shift the majority of throughput to commercial satellite communication providers
- **Affordable communications for the JIIM community**
  - A current challenge is the cost of commercial satellite links
  - Non-DOD partners run the spectrum of both technologic capabilities and resource challenges
  - Non-NATO coalition partners generally cannot afford to devote expensive satellite throughput to multiple networks
  - Tasks that are taken for granted at headquarters are insurmountable for deployed tactical units
  - Tactical units are limited to low throughput systems due to antenna size and the high cost of service
  - Mobile systems like INMARSAT require that the circuit be dialed in and fully “on charges”, resulting in major costs for deployed units, combatant commanders, and communication providers
- **Flexible architectures, reduced latency and common standards**
  - Bent-pipe communications and available frequencies result in rigid communication architectures
  - Bent-pipe architectures use varying satellite systems, frequencies, and gateways for access
  - This multitude of architectures requires multiple frequency conversions, digital processing, routing via terrestrial networks and additional satellite links between distant ends
  - Result: traffic between the headquarters and a tactical users require multiple hops
  - Each hop adds latency, lowers effective throughput and creates undue complexity

I. IRIS JCTD Overview

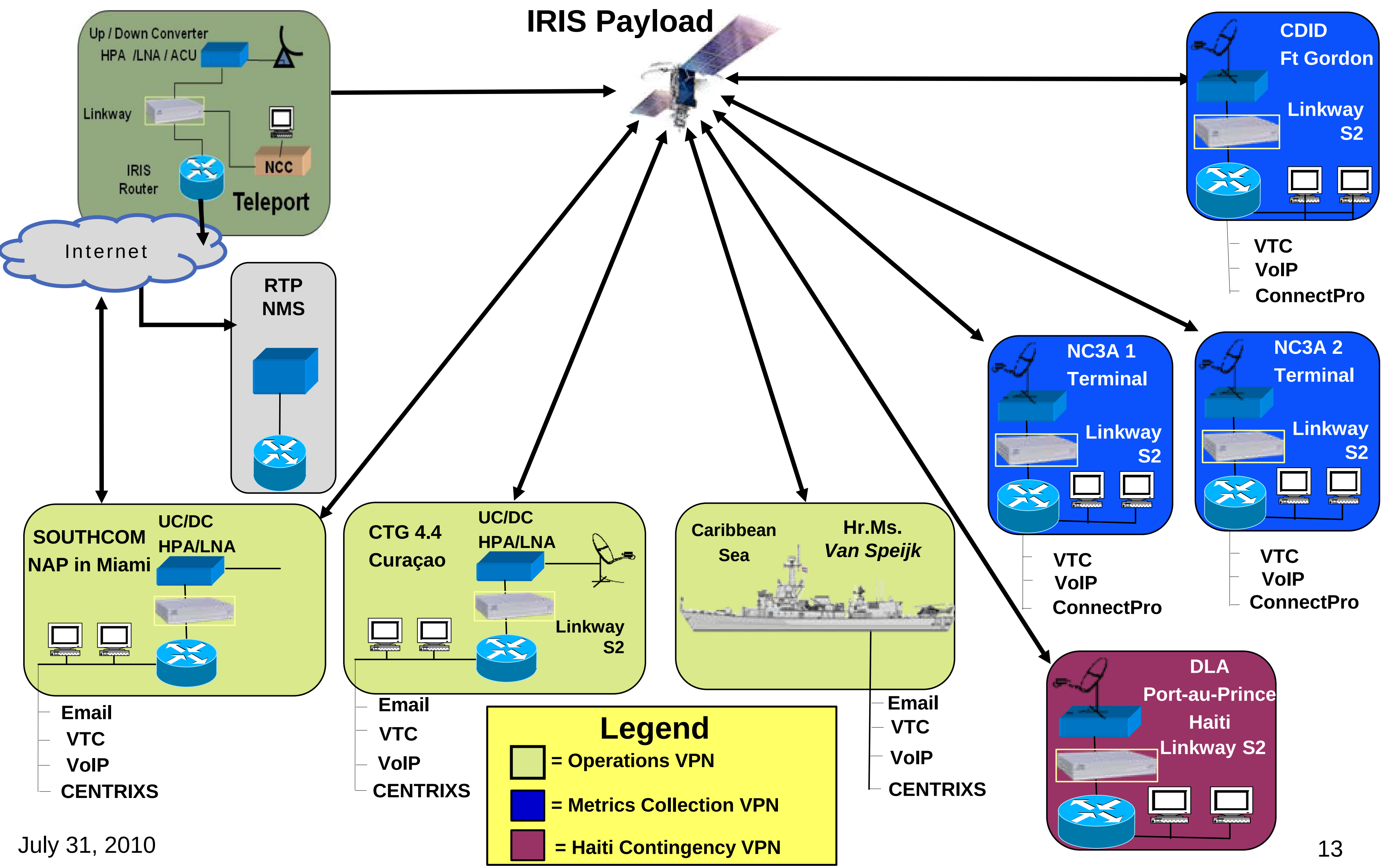
F. Capabilities Solution

- **Reduced latency**
  - Communications between multiple units have additional delays because of multiple hops to the satellite
  - Currently, all processing, frequency conversion, and IP routing must be done on the ground at a gateway
  - The high packet latency using traditional bent-pipe services also causes problems with many types of off-the-shelf network software, especially for establishing virtual private network (VPN) connections
  - Off the shelf software often cannot tolerate a high delay or latency between endpoints; DOD networks are especially affected by this constraint since encryption is done via tunneling
  - IRIS or hosted payloads with programmable IP modem and routing functions improved each of these characteristics for the DOD and its partners by cutting time delays in half as the router is in orbit rather than on the ground
- **Improved network flexibility**
  - The IRIS payload serves as an internet hub in space
  - When a customer connects to the satellite, the end user is talking to the satellite router rather than to a router on the ground at the gateway
  - The signal is digitally processed by the IP modem on the satellite rather than a modem on the ground; therefore, the total signal noise is reduced, allowing an increase in throughput for the same power received at the satellite
- **Reduced Cost or improved performance for current SATCOM prices**
  - By charging a cost-per-bit or service levels and harnessing the inherent flexibility of IP routing, IRIS or an IRIS-like commercial offering *could* eliminate the resourcing and scheduling difficulties of provisioning adequate throughput for contingency and normal requirements
  - The satellite router can also perform special Internet Protocol functions such as multicast and Quality-of-Service (QoS) functions automatically, with no action from the ground
  - For units that operate on different frequencies, different beams, or from different ground stations, this could dramatically increase service levels as the packets are routed directly on the satellite to other IRIS-connected terminals, rather than having to go through an intermediate gateway

I. IRIS JCTD Overview
G. Top Level CONEMP or CONOPS

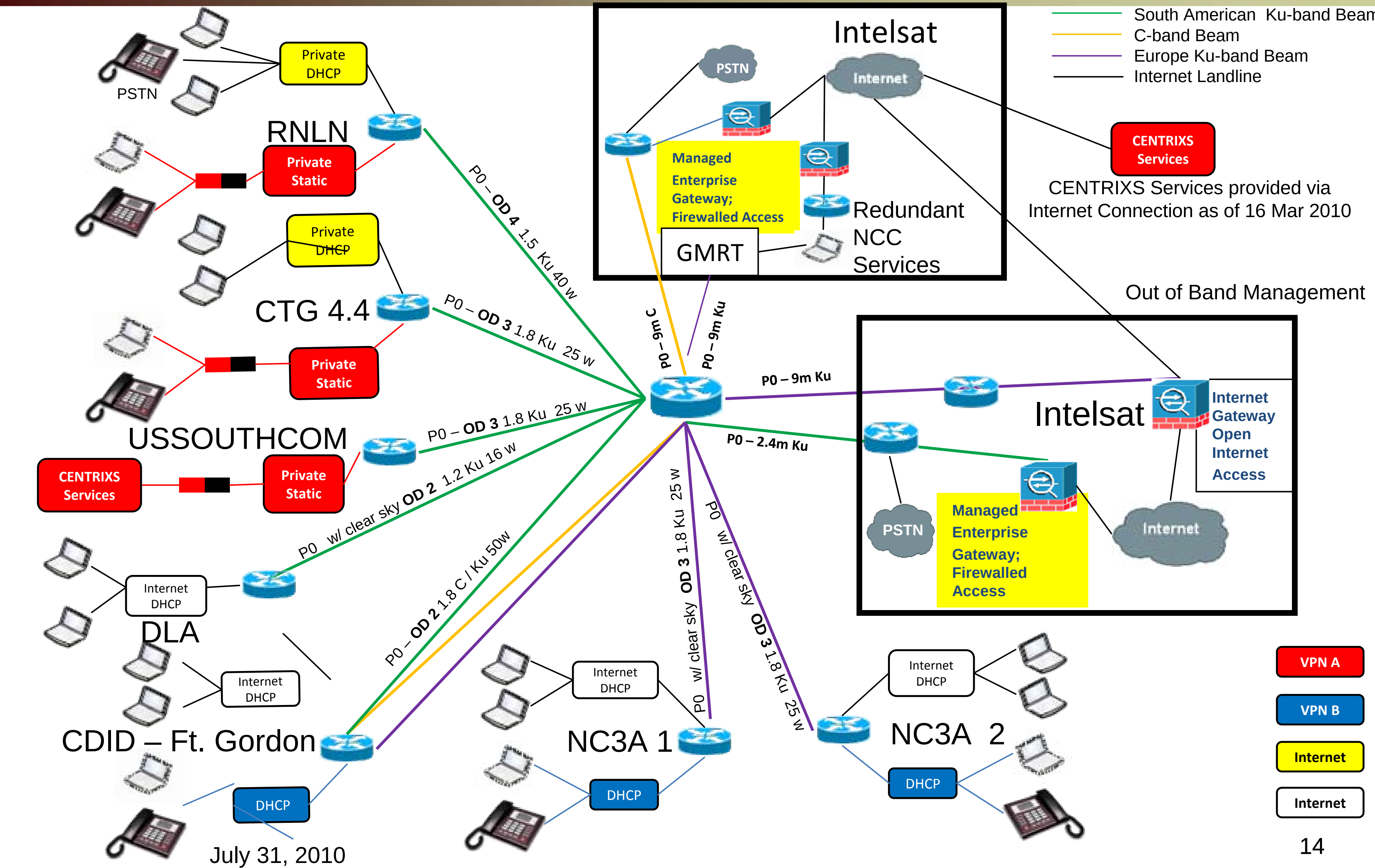
- **The IRIS concept has already shown in operations that it can provide services that exceed current capabilities, to remote and disadvantaged users**
  - As demonstrated in April – May 2010 during counter narcotics operations in support of JIATF-S and the USCG
- **IRIS will be available for contract and purchase through DISA like other communication services**
  - As DISA PEO-STS is the IRIS JCTD XM, they are uniquely situated to find the correct contract vehicle for commercial IRIS services after the JCTD
- **IRIS is a commercial entity that is available internationally**
  - DOD and JIIM partners can purchase IRIS services without having to pay for paying for expensive infrastructure
  - JIIM customers using IRIS will all have a common infrastructure for EoIP communications and collaboration
- **DOD customers may share access to the IRIS with foreign governments, private companies and other paying customers of an IRIS service**
  - The IRIS satellite service provider has a strong incentive to prevent unauthorized satellite access in order to ensure its services remain available for paying customers.
  - Classified and unclassified IRIS VPNs keep data packets separated
  - IRIS is also designed for network separation to ensure IP packets are routed properly
- **There will always be a need for hardened, jam-resistant and robust military satellite communications**
  - It should be emphasized that **commercial IRIS services are not designed or intended to replace military satellite communications** but rather to complement them
  - As approved High Assurance Internet Protocol Encryption (HAIPE) equipment and software continue to proliferate, information assurance is not a major obstacle for meeting the bulk of secure IP-based DOD network requirements

I. IRIS JCTD Overview
H. Operational View-1 (OV-1)

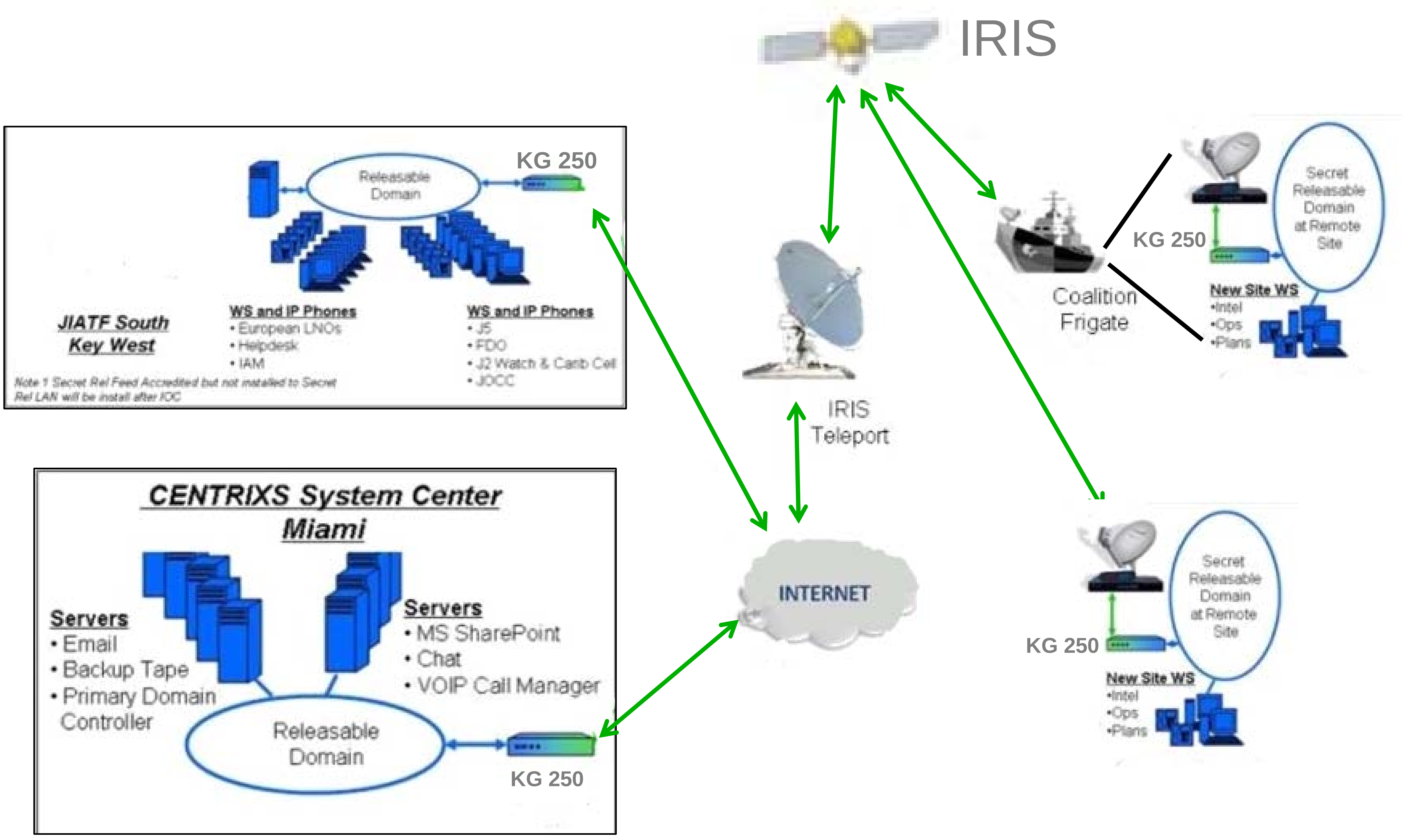


I. IRIS JCTD Overview

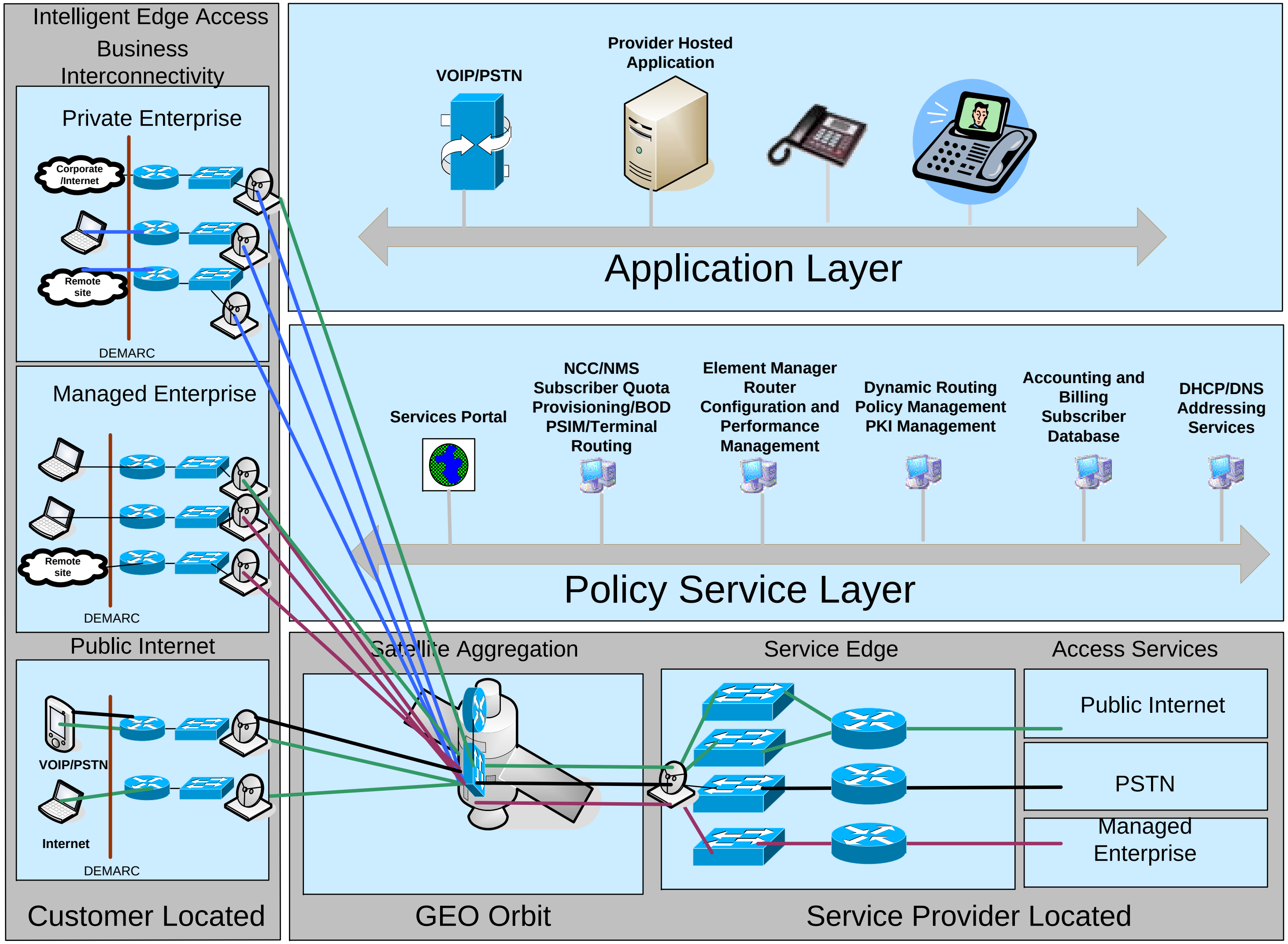
I. System View - 1 (SV-1)



J. Combined Enterprise Regional Information Exchange System (CENTRIXS) Architecture and Service Features



I. IRIS JCTD Overview
K. Network Managed Service



Provides an Architectural Framework for Scalability, Security and Performance across multiple Customer Connectivity Options

I. IRIS JCTD Overview
L. Demonstration Venues and Participants

Operational Demonstration One
Lexington, MA

- MIT Lincoln Labs
- Emulated IRIS in a laboratory setting
- Counter Narcotics scenario provided by USCG

June 07

Operational Demonstration Two
Alameda, CA

- USCG PACAREA
- Maritime mounts
- Training
- Operational USCG assessment

September 08

Network Services One and Two
Raleigh, NC

- Net Services
- Industry Lead
- End-to-end technical assessment

August 08 / June 09

Operational Demonstration Three
The Hague, NL
Hanover, MD

- NC3A and Army Asymmetric Warfare Group
- Cross Atlantic Information Ops Assessment

May 09

Operational Demonstration Four: two networks
1. *Van Speijk*, Curaçao, JIATF
2. The Hague- Ft. Gordon

- Hr.Ms. *Van Speijk* on patrol
- CTG 4.4 in Curaçao
- JIATF-S JOC
- NC3A
- Actual Counter Narcotics Operations

February-May 10

I. IRIS JCTD Overview
M. Details on the Demonstration Venues

- **Locations:** The JCTD was conducted on three continents with two combatant commands and NATO. It also provided communications support to the Defense Logistics Agency (DLA) during Haiti Earthquake relief operations
  - OD 1: MIT/LL in Lexington, MA
  - OD2: USCG PACAREA and USCG Cutter *Sherman* in Alameda, CA and the San Francisco Bay
  - NS 1 and 2: Research Triangle Park (RTP) in Raleigh-Durham, NC
  - OD 3: Satellite Management Center in Hanover, MD and NC3A in The Hague, The Netherlands
  - OD 4: underway on the Caribbean Sea with Hr.Ms. *Van Speijk* (F828), CTG 4.4 in Curaçao, Netherlands Antilles, JIATF-S JOC in Key West, FL and at NC3A in The Hague, The Netherlands. Earth terminals were also located at USSOUTHCOM in Miami, FL and at the CDID in Fort Gordon, GA
  - The IRIS terminal supporting DLA was at Port au Prince airport in Haiti
- **COCOMs:** USSTRATCOM was the user sponsor while USSOUTHCOM provided the on orbit assessment venue
  - Operational units included JIATF-S , the RNLN warship and the Dutch headquarters in the Caribbean Basin..
- **U.S. Army (SMDBL and CDID):** The lead agency was SMDBL as the OM. SMDBL validated the emerging coalition and partner nation requirements identified in the JCTD capabilities statement, planned and executed the utility assessments, and created the draft CONOPS. The OM coordinated, identified and provided the operational analysts and warfighters from joint and partner nations for the four ODs as well as a real world operations in Haiti with DLA. The CDID at Fort Gordon, GA provided a multiband terminal location and excellent on site support.
- **DISA:** DISA PEO STS provided the XM and contractor support for the IRIS JCTD. DISA will provide a contract mechanism to procure commercial IRIS services at the end of the JCTD.
- **U.S. Air Force:** The U.S. Air Force SMC provided TM guidance. In traditional JCTD's, the TM has a much stronger role. However, the IRIS JCTD provided an assessment of a proposed commercial industry offering. The IMT (primarily Cisco and Intelsat) paid for the IRIS system and drove all of the performance, cost, schedule and risk. It should be noted that MIT/LL, as an agent of the TM, did provide much needed assistance, technical expertise and support.
- **JHU/APL:** JHU/APL supported the OM by developing the OUA, observing key technical events and supporting the conduct of the ODs, NSs and OUA. JHU/APL conducted an independent and tailored utility assessment and issued reports, providing complete analysis of the results of the assessments for the demonstrations and network tests at RTP.

I. IRIS JCTD Overview
N. Assessment Management Team

Operational Test Agency (JHU/APL) and Assessment Participants

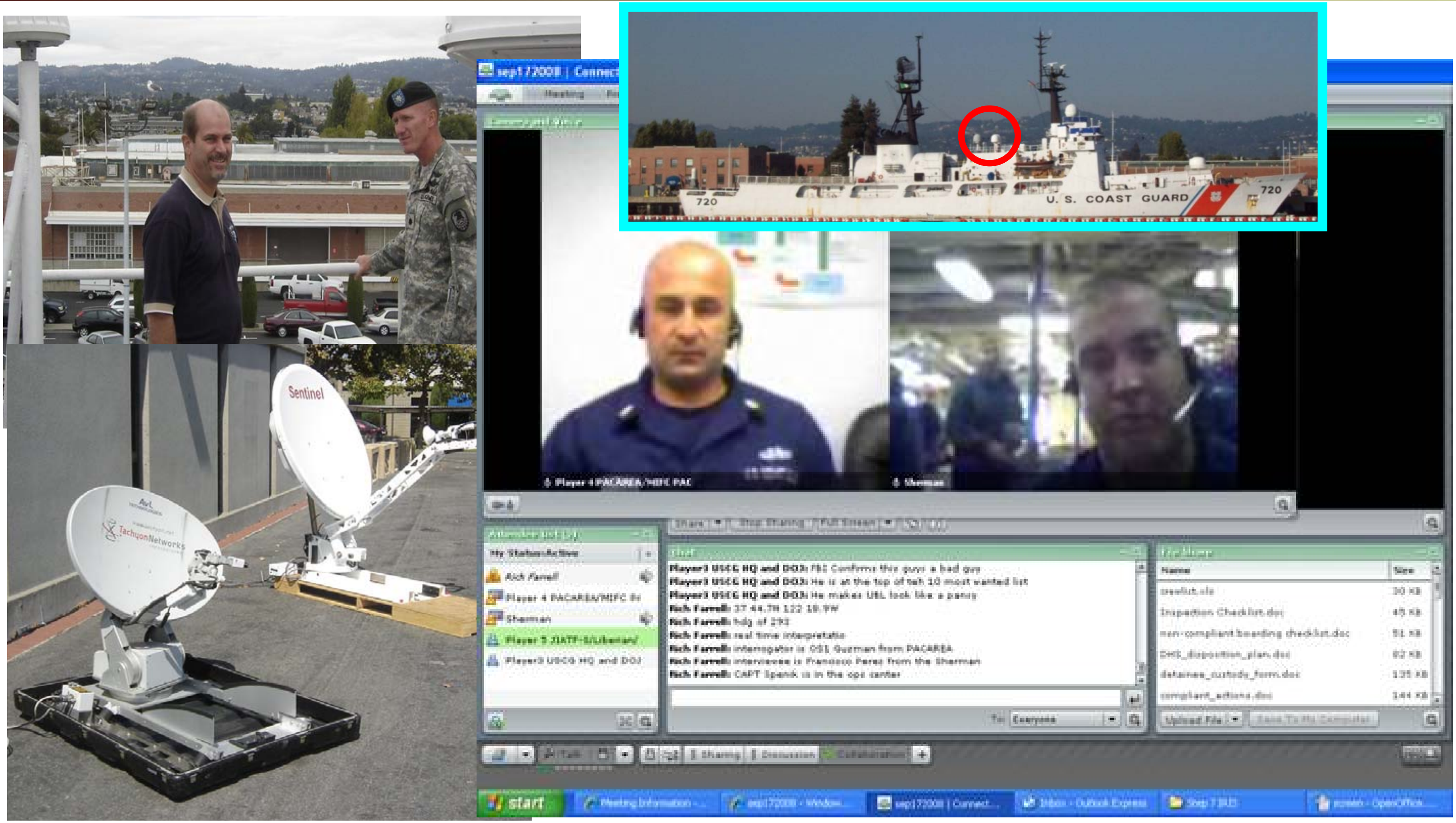
- **Johns Hopkins University / Applied Physics Lab, Laurel, MD:**
  - Dr. Harshavardhana Paramasiviah [Harsh.Harshavardhana@jhuapl.edu]
    - 1 man year of LOE as the Program Manager for the OTA during the IRIS JCTD
  - **Dr. Enrique Cuevas** [Enrique.Cuevas@jhuapl.edu]
    - 3 man years of LOE, **Principal technical evaluator for JHU/APL** during Operational Demonstrations One-Four (OD 1-4) and Network Services One and Two (NS 1-2)
  - Dr. Xia Xiang [@jhuapl.edu]
    - One half man year of LOE, technical evaluator during OD 1 and 2
  - Dr. Zhuangbo Tang [Z.Bo.Tang@jhuapl.edu]
    - One half man year of LOE, technical evaluator during OD 1 and 2
  - **Mr. Warren Kim** [warren.kim@jhuapl.edu]
    - 3 man years of LOE, **Principal operations evaluator** during OD 1-4 and NS 1-2
  - Mr. Brad Ward [Brad.Ward@jhuapl.edu]
    - One quarter man year of LOE, operational evaluator during OD 4 at JIATF-S
  - Mr. Hadi Esiely-Barrera [Hadi.Esiely-Barrera@jhuapl.edu]
    - One quarter man year of LOE, technical evaluator during OD 3-4
- **Massachusetts Institute of Technology / Lincoln Labs, Lexington, MA**
  - **Dr. Andrew Worthen**, [worthen@ll.mit.edu] and Mr. Matt Weyant [mweyant@ll.mit.edu]
    - Provided two man years of LOE total over OD 1-4 and NS 1-2
    - Heavily invested in development, planning and technical assessment of IRIS
- **Joint Electronic Warfare Center, San Antonio, TX**
  - **Mr. Steven Heacox**, CISSP-ISSAP, CISA; [steven.heacox.ctr@jiowc.osis.gov]
  - Principal Systems Security Engineer that conducted Information Assurance on the IRIS network during OD 2 and 4
- **NATO Consultation, Command and Control Agency, The Hague, The Netherlands**
  - **Mr. Huub Simons**, PM for CAT 9 Directorate, NATO SATCOM [Huub.Simons@nc3a.nato.int]
  - Dr. Klaus-Dieter Tuchs, Senior Scientist and technical assessor during OD 3-4 [Klaus-Dieter.Tuchs@nc3a.nato.int]
  - Dr. Michael Winkler, Principal Scientist and technical assessor during OD 3-4 [Michael.Winkler@nc3a.nato.int]
  - Mr. Heico Salfeld, Senior Engineer and technical assessor during OD 3-4 [Heico.Salfeld@nc3a.nato.int]

I. IRIS JCTD Overview
O. Constraints

- Although the IRIS concepts were tested in the first three Operational Demonstrations, the actual On Orbit Assessment of the IRIS payload was assessed from 01 February to 24 May 2010.
- Limited duration and assessment events of the JCTD precluded collection of data pertaining to all potential users.
- The economic, social and political issues and priorities of other U.S. agencies and partner nations will necessitate different CONOPs and national employment concepts.
- The assessment can directly address only the issues observed for NC3A, the Royal Netherlands Navy and JIATF-S.
- The assessment team identified a host of issues that are generally applicable to any JCTD employment such as creating demonstration venues and partners, logistics, installation, technical performance characteristics and operational considerations.

I. IRIS JCTD Overview

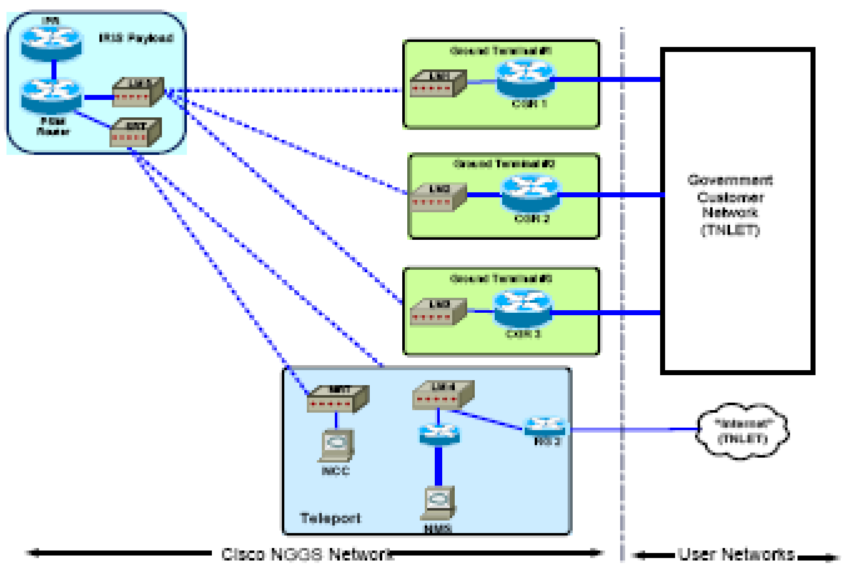
P. Operational Demonstration Two (OD 2) with the U.S. Coast Guard (USCG) Pacific Area (PACAREA)



The first time a USCG Cutter held a VTC underway and conducted a VTC enabled interview between a simulated suspect at sea and a linguist/law enforcement interrogator in port.

NS 1

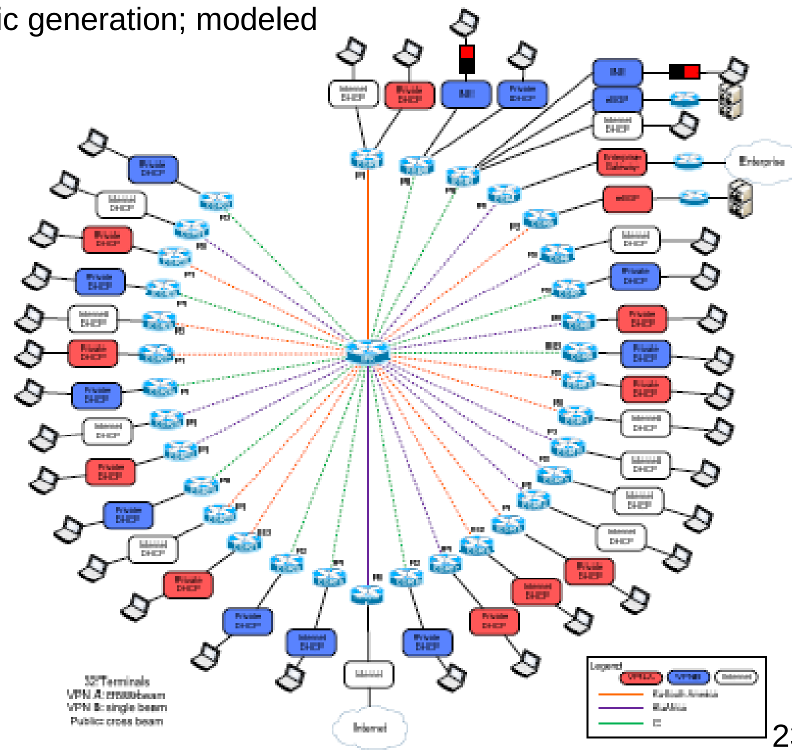
- NS 1 was conducted at Cisco's Research Triangle Park facility, in Raleigh, NC August 4-8, 2008
- NS 1 used an earlier version of the Cisco Next Generation Global Services (NGGS)4F 5 test bed along with the emulated government customer network
- Because the actual IRIS payload was not available at the time of the demonstration, the Cisco NGGS test bed used an IRIS payload surrogate that consisted of a Cisco router for the IPR and two Linkway modems and another Cisco router for the PSIM; In addition, the payload emulated a single RF channel within a single transponder vice the three IRIS-enabled transponders on the actual payload
- The Cisco NGGS supported a total of four ground terminals with each terminal consisting of a Linkway modem (LM) and a Cisco Ground Router (CGR)
- The Ground Control Network was built upon MIT-LL's Traveling Network and Link Emulation Test Bed (TNLET) and the Lincoln Adaptable Real-time Information Assurance Test bed (LARIAT)
- The overall scope of NS-1 was to assess the functionality and performance of the Cisco NGGS capability that was available at the time
- Two test configurations were used to assess a range of anticipated network and service requirements



I. IRIS JCTD Overview
Q. Network Services One and Two (NS 1 and 2)
2. NS 2, June 2009 at Cisco Systems RTP, NC

NS 2

- NS 2 was conducted from June 22-26, 2009 at Cisco's Research Triangle Park facility, in Raleigh, NC.
- NS events are laboratory-based technical demonstrations whose goal is to provide early insights into the network capability
- Fine-tune the design as more knowledge is gained both from function and capacity.
- NS-2 test bed provided greater fidelity and provided a more realistic network scale of the Cisco Next Generation Global Services (NGGS) system than the NS-1 emulation test bed demonstrated in June 2008.
- NS 2 included payload engineering models of the PSIM and the IP Router.
    - The ground segment included a total of 35 terminals
    - Each terminal consisting of a modem and router.
    - Emulation of the satellite links was enhanced with noise and delay.
- The simulated Network Under Test provided significant additional capabilities beyond those used in NS-1.
- The test network provided automated, repeatable, instrumented traffic generation; modeled hundreds of users connected to the 32 IRIS ground terminals, simulated internet and enterprise networks, and provided real-time graphical representations of the generated traffic.
- The scope of the NS-2 assessment was limited to the evaluation of the functionality and performance of the Cisco NGGS with emphasis on bandwidth utilization, quality of service (QoS), connectivity, applications and network performance, and information assurance.
- One key objective was to evaluate the end-to-end performance of applications under various traffic loading conditions, network configurations, and network impairments.
- Although some minor problems were encountered during the set-up, these were quickly corrected allowing the data collection process to be carried out as planned.
- Owing to the complexity and scale of the tests, a large amount of data was collected for further analysis.



I. IRIS JCTD Overview

R. Operational Demonstration Three (OD 3) with NC3A/AWG

- May 2009 at CapRock Communication's Satellite Management Center in Hanover, MD and at the NATO Consultation, Command and Control Agency (NC3A) in The Hague, The Netherlands
- U.S. Army Asymmetric Warfare Group (AWG) collaboration with NATO on an Information Operations scenario with a NATO Reaction Force
- Capitalized on insight of leading edge commercial capability
- Utilized lessons learned from the NC3A bench test report for the on orbit assessment as well as follow-on participation in the on-orbit assessment of IRIS

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)

USSOUTHCOM, JIATF-S, a USCG Law Enforcement Detachment and the Royal Netherlands Navy (RNLN) provided an operational assessment of the IRIS capability

- The assessment occurred at the following venues:
  - Ashore at JIATF-S in NAS Key West
  - Ashore at Willemstad, Curaçao in support of CTG 4.4
  - Underway on the RNLN Frigate *Van Speijk* (F828)
    - *Van Speijk* had a USCG Law Enforcement Detachment onboard
- The relationship between CTG 4.4, JIATF-S, the RNLN and the USCG provided a unique assessment of IRIS by providing CENTRIXS MLEC afloat to assess:
  - Encrypted collaboration afloat
  - IRIS operational impact
  - IRIS JIIM utility

Koninklijke Marine

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
1. Port - au - Prince airport, Haiti

Defense Logistics Agency's (DLA) Nick Heller with the IRIS terminal in Haiti.

IRIS supported DLA earthquake relief operations during UNIFIED RESPONSE in February-March 2010.The IRIS modem, router, laptop and other equipment inside the DLA tent is on the right.

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
2. Hr. Ms. *Van Speijk* (F828), Caribbean Sea

The 1.5 m maritime terminal was on the port side of the ship. The modem, router and associated electronics are located directly below the maritime antenna in the Harpoon Room.

Cables were run to laptops and VoIP phones in the Radio Room, Combat Information Center and in the Harpoon Room.

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
3. CTG 4.4, Willemstad, Curaçao, Netherlands Antilles

The IRIS 1.2 m dish was the antenna on the left. The antenna was outside the Royal Netherlands Navy Caribbean Squadron Headquarters in Curaçao, Netherlands Antilles. Rack space was in the CONEX box to the right of the antenna.

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
4. Network Access Point (NAP), USSOUTHCOM, Miami, FL

The IRIS 1.8 m dish was the smaller green antenna to the left.

The antenna was on the roof of the Terramark Building in downtown Miami, FL.

U.S. Southern Command contracts rack space and connectivity at the NAP.

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
5. NC3A, The Hague, The Netherlands

Mr. Huub Simons, SATCOM PM for the CAT 9 Directorate, demonstrates IRIS to the Royal Netherlands Navy on top of CAT 9's Lab at NC3A in The Hague, The Netherlands

I. IRIS JCTD Overview
S. Operational Demonstration Four (OD 4)
6. CDID, Fort Gordon, GA

The 1.8 m IRIS terminal at the CDID in Fort Gordon was a dual C-Ku band antenna. It communicated in all three IRIS beams from one location.

II. IRIS JCTD OUA Results

A. Capabilities Impact on Joint / Interagency / Intergovernmental / Multinational Operational Problem

✓ ***IRIS provided increased connectivity and throughput to support collaboration and synchronization with remote forces ashore and land based in the Caribbean and Europe.***

✓ ***IRIS provided access to large data files, collaboration tools, classified and unclassified VTC.***

✓ ***IRIS provided flexible architectures, reduced latency and a common standard.***

- IRIS delivered encrypted EoIP communications on an allied warship during counter narcotics operations with a USCG Law Enforcement Detachment (LEDET) embarked
- IRIS provided unclassified EoIP communications for the crew: MWR, news, logistics
- IRIS provided an encrypted VTC capability between the JIATF-S JOC, the Royal Netherlands Navy LNO, the French Navy LNO and *Van Speijk*
- IRIS was a "one stop shop" for transport layer
- Before IRIS was installed, Hr. Ms. *Van Speijk* C band capabilities were:
  - 512 kbps total bandwidth divided up into 12 different networks, services and ports using TDMA
  - NATO communications: (32k)
  - Open Internet (144K), Ships Intranet (230K),
  - Messaging systems (2.4 K each for receive/transmit)
  - Telephone/SATCOM (9.6 Kbps each for four phones)
  - INMARSAT voice, fax and internet (Note: *Van Speijk* did not use INMARSAT once on this cruise, *Van Speijk* used the Iridium phone as it was less expensive than INMARSAT)
- IRIS flexible architectures: Cisco was able to reroute a new VPN from NC3A to the *Van Speijk* quickly and with minimum interruption in service
- IRIS provided the common standard between the U.S. Army, USCG, JIATF-S, NATO and the RNLN in this demonstration

Net Centric (Primary): IRIS provided operational utility to the RNLN and the USCG Law Enforcement Detachment

- ***Classified Collaboration with the US and RNLN on a separate network***
  - Used by USCG Law Enforcement Detachment for building sensitive cases and boardings
  - Encrypted VTC, Sharepoint, Chat, Email, VoIP from USSOUTHCOM
  - Used for collaboration with RNLN Headquarters and JIATF-S
  - Netherlands Antilles and U.S. Coast Guard actions

- ***Unclassified Information Sharing***
  - Local news feeds
  - Unclassified Ops coordination
    - Updates to higher headquarters
    - Exercise coordination
    - Logistics
  - Extremely popular MWR internet café
  - VTC collaboration with families

Hr. Ms. *Van Speijk's* Boarding Team

II. IRIS JCTD OUA Results
B. Joint Functional Capability Area
2. CENTRIXS MLEC Afloat and Command and Control

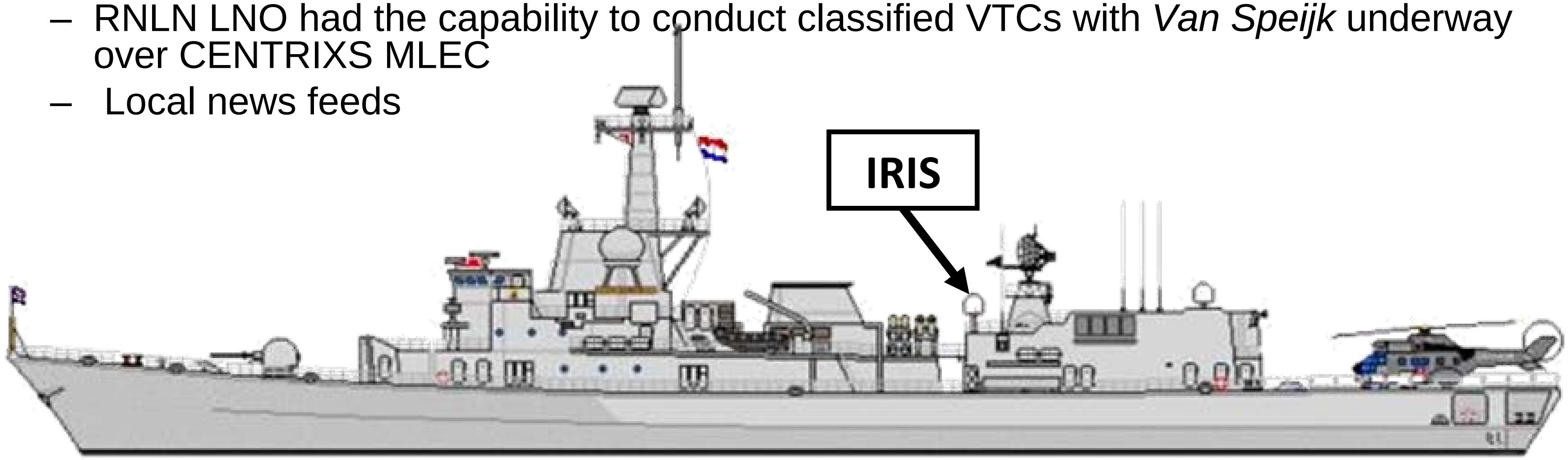
Command and Control (Secondary): IRIS demonstrated operational benefits

- IRIS provided improved command and control via CENTRIXS VoIP
  - VoIP sitreps to *Van Speijk's* higher headquarters: Commander, Netherlands Caribbean, CTG 4.4 and JIATF-S
  - Coordination, collaboration and self-synchronization due to fuller appreciation of Commander's Intent
- IRIS provided increased awareness and adaptive decision making by providing access to the CENTRIXS Sharepoint portal and Chat
  - The Captain of *Van Speijk* gained access into JIATF-S classified operational briefings and Commander's Intent
  - Visibility of multinational actions
  - Classified chat with the USCG D7
- IRIS provided unclassified information, operational pictures and insights
  - Ad hoc coordination during JIATF-S Ops
  - Long-haul reach-back to information and operations centers

Battlespace Awareness (Tertiary): IRIS provided improved fidelity

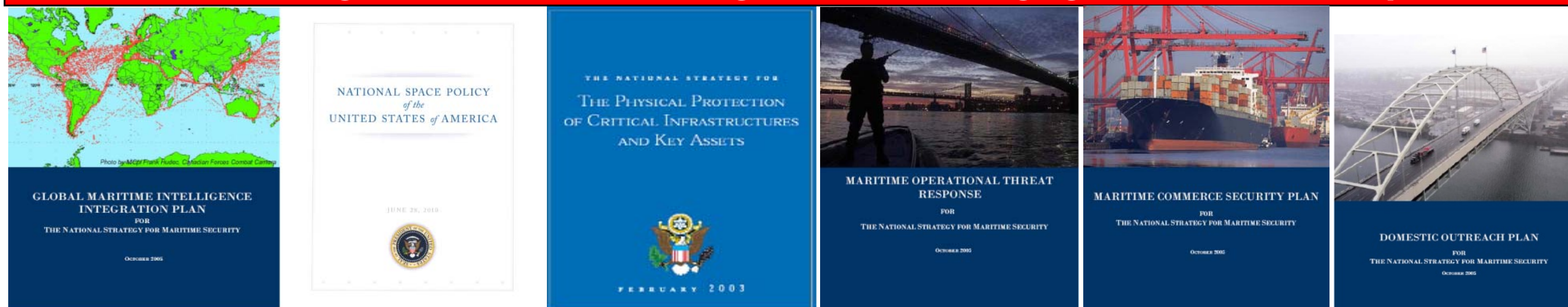
- **Encrypted VoIP sitreps to *Van Speijk's* higher headquarters** (Commander, Netherlands Caribbean / CTG 4.4) by reducing the time to make the call
  - IRIS reduced voice latency from multi-second time delays to instantaneous communications
  - IRIS provided clear voice and video collaboration

- **IRIS provided increased awareness and adaptive decision making** by providing access to the CENTRIXS MLEC Sharepoint portal
  - The Captain of *Van Speijk* gained access into JIATF-S classified operational briefings and Commander's Intent
  - *Van Speijk* was able to observe real time what other multinational partners were doing
  - RNLN LNO had the capability to conduct classified VTCs with *Van Speijk* underway over CENTRIXS MLEC
  - Local news feeds



II. IRIS JCTD OUA Results
C. Required Capabilities Summary

National Strategic Plans and Strategies stress Engagement and Cooperation



Strategic Direction: Being *Joint* is just not enough

How do we fulfill Strategy and Direction?
Applications + Architectures + Actions =
Net Centric Operations

Governance

- International Law
- US Title Code
- Presidential intent
- Grand Strategy
- Operational Direction
- Tactical Action

Systems and Applications

JIIM Community of Interest

Applications
Chat
Voice
Video
Software

Self Synchronization
Collaboration
Shared awareness

Operations

- Homeland Defense
- Homeland Security
- Humanitarian Assistance
- Counter Narcoterrorism
- US Interagency actions
- Multinational / Coalition

II. IRIS JCTD OUA Results
D. Critical Operational Issues

Does IRIS Capability provide increased net centricity across the JIIM community?

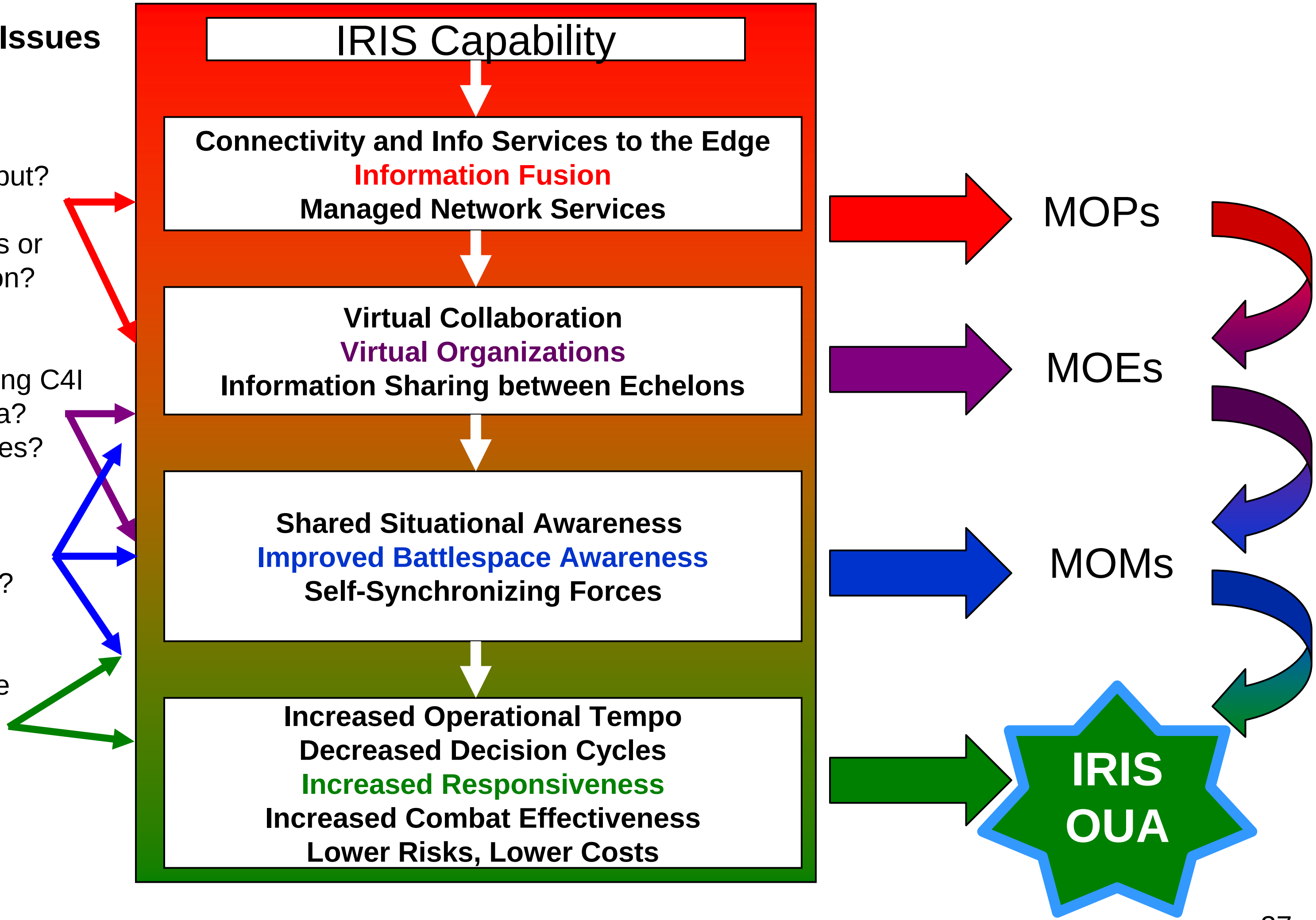
Critical Operational Issues

Functionality:
- Increased data throughput?
- Reduced latency?
- Reduced coverage gaps or reduced channel utilization?

Interoperability:
- Interoperable with existing C4I systems and existing data? dissemination architectures?

Suitability:
- Suitable for JIIM users?
- Integration into the GIG?

Operational Impact:
- Enhance and extend the capability to conduct net-centric operations?



II. IRIS JCTD OUA Results
E. Critical Operational Issues (COI)
1. IRIS Functionality with Satellite Communications

COI 1: How does IRIS affect satellite communications capabilities?					
Demonstrated Capability	**COI Sub-elements**	**MOMs**	**MOEs**	**MOPs**	**Data Collection Requirements**
BoD, QoS, PSIM/IPR, Cross-band, intra-beam, inter-beam connectivity, PEP	**COI 1.1:** How does IRIS affect capacity utilization and spectrum utilization?		**Information Sharing:** The degree in which critical information is available or denied and how that impacts operations.	**Network Performance:** Terminal Utilization Rates (BoD), Network Capacity, NCC bandwidth allocation, PSIM and IPR (Uplink and Downlink Utilization Rates), PEP performance. **Connectivity:** Cross-band, Intra-beam and inter-beam connectivity performance.	**Information Sharing:** Incidents when critical information may or may not have been shared, improved data sharing than prior capability (user feedback) **BoD:** NCC BW request vs. allocation **Network Capacity:** Cisco estimates per transponder against measured utilization **Uplink and Downlink Utilization:** Netflow, NCC reports, Improved throughput than prior capability (user feedback), PEP and no PEP results **Connectivity:** Network performance results during cross-beam, inter-beam and intra-beam configurations
QoS (Service Class), BoD, Single Hop Latency	**COI 1.2:** What effect does IRIS have on collaboration among disparate JIIM users?	**Quality of Collaboration (Consistency):** The extent to which planning is conducted consistently between all participating units.	**Information Sharing:** Ability to support collaboration among disparate JIIM Users. **Congruence of Command:** Having same/similar information among disparate JIIM Users during/after collaboration.	**Application Performance:** Objective and subjective performance of collaboration apps (specifically real-time apps such voice and video and chat).	**Collaboration:** User feedback on the consistency of the ability to plan, observations (how was collaboration conducted?) **Information Sharing:** User feedback, successful collaboration, outcome (observation) **Congruence of Command:** Collaboration and sharing of information among disparate users (observation and user feedback) **Application Performance:** TNLET and DVQattest results, subjective survey of collaboration app performance (i.e., voice, video, desktop sharing)
QoS (CGR/LM Integration), BoD, Single Hop Latency, Terminal service Types	**COI 1.3:** What Quality of Service (QoS) is experienced by the users of IRIS?		**Interoperability:** Ability/effectiveness of user applications to be serviced at appropriate/designated QoS classes. **QoS:** Demonstrated QoS Arch and Terminal types.	**Application Performance:** VoIP and VTC performance (compare higher service class apps vs. best effort apps). **Connectivity:** Performance of QoS.	**Interoperability:** QoS features/integration between CGR and LM **QoS:** Application performance under heavy traffic loads **Application Performance:** VoIP and Video performance vs Web and as a function of DSCP (subjective feedback) **Connectivity:** Latency as a function of DSCP
Cross-band, intra-beam & inter-beam connectivity, VPN Separation, PSIM/ IPR, Mesh topology, support for different terminal service grades and terminal sizes	**COI 1.4:** What effect does IRIS have on connectivity among JIIM users?	**Degree of Synchronization:** Completeness of all users connected and communicating without gaps or pause in operations.	**Information Sharing:** Ability to share information (number of new JIIM users, percentage able to participate). **Mobility:** Ability to connect via IRIS while mobile and/or at sea, antenna/terminal size and form factor.	**Network Performance:** IP throughput, latency, cross-band and cross-beam performance results. **Connectivity:** VPN Separation, cross-band and cross-beam connectivity.	**Degree of Synchronization:** Observation and ability for users to participate in planning and C2 meetings (w/o gaps or pause) **Information Sharing:** Number of new disadvantaged users, percent of users able to participating in VTC, chat, etc. **Mobility:** Extent of comms on the move (observation) **Network Performance:** Latency as a function of DSCP. IP Throughput **Connectivity:** Performance over Cross-band and cross-beam configurations. BoD allocation. Performance of various terminal service grades (P0, P2)

II. IRIS JCTD OUA Results
E. Critical Operational Issues (COI)
2. IRIS Interoperability and Net Centricity

COI 2: Does IRIS enhance and extend the JIIM user's capability to conduct net-centric operations?					
Demonstrated Capability	**COI Sub-elements**	**MOMs**	**MOEs**	**MOPs**	**Data Collection Requirements**
Ability to share complex and detail information	**COI 2.1:** Does the IRIS capability enhance the quality of situational awareness for the JIIM user?	**Degree of Shared Situational Awareness:** Accuracy and consistency of shared information.	**Timeliness of Situational Awareness:** Measures the delay (or the lack of) in receiving new information or updates to maintain accurate SA. **Information Sharing:** The degree in which critical information is available or denied and how that impacts operations.	**Application Performance:** Email, File Transfer, Web browsing, Chat, Common Operational Picture (COP) application Performance	**Degree of Shared SA:** User Feedback on ability to share complex information **Timeliness of SA:** The amount of time it takes to transfer new information such as imagery or video **Information Sharing:** Number of times critical information was denied **Application Performance:** User feedback on app performance, objective data from TNLET on app performance (Session throughput)
Ability to share timely information across geographically dispersed units, CENTRIXS C2PC COP	**COI 2.2:** Does the IRIS capability enhance the sharing of situational awareness between JIIM users?	**Degree of Shared Situational Awareness:** Completeness of shared SA **Quality of Collaboration:** Extent of Collaboration	**Information Sharing:** Ability to share information to among disparate units (and to conduct it well) **Timeliness of Situational Awareness:** Reduced time to gain SA (by improved capability to transmit SA information over IRIS)	**Network Performance:** IP throughput, Network capacity	**Degree of Shared SA:** User Feedback on ability to share information in a timely manner, Effectiveness of IRIS to support C2PC COP (User Feedback) **Quality of Collaboration:** Ability to use voice, video, chat, desktop sharing, etc. during collaboration (observation) **Information Sharing:** Ability to share information with disparate and disadvantaged users **Timeliness of SA:** User feedback on ability to exchange information **Network Performance:** Latency as a function of DSCP. Netflow, NCC reports
Ability to exchange information and decisions in a timely manner, VTC capability where none existed before	**COI 2.3:** Does the IRIS capability decrease the time required by the JIIM user to make critical command and control decisions?	**Quality of Decision Making:** Relevancy and Timeliness **Quality of Collaboration:** Conciseness	**Timeliness of Decisions:** Measures the time required to make decisions based on user feedback on accuracy of information received and SA **Timeliness of SA**: User feedback on timeliness in support of C2 decisions		**Quality of Decision Making:** User feedback on relevancy and timeliness of information required to make C2 decisions **Quality of Collaboration:** How concise was the collaboration? (observation) **Timeliness of Decisions:** User feedback on ability to make timely decisions **Timeliness of SA:** User feedback on timeliness of SA information (Interview)
Ability maintain IP connectivity as required without significant constraint on bandwidth usage or degradation of application performance, Maritime IRIS terminals	**COI 2.4:** Does the IRIS capability enhance synchronization of geographically disparate JIIM users?	**Degree of Synchronization:** Completeness and Consistency, ability to remain connected and plan. **Degree of Shared Situational Awareness:** Completeness of SA information.	**Information Sharing:** Ability for users to pull information from different sources (does not require direct support from higher echelons) **Operational Tempo:** Likelihood of the intended operation to be conducted in a timely manner.		**Degree of Synchronization:** Observations (remain connected and ability to plan and replan as required) **Degree of Shared SA:** User feedback on the completeness of the SA information transmitted or received **Information Sharing:** User feedback and observation of users pulling information as required **Operational Tempo:** User feedback and observation on the ability to complete tasks in a timely manner
Ability to collaborate using full range of services across wide range of participants, (e.g., using Connect Pro and MS Communicator)	**COI 2.5:** Does the IRIS capability enhance the ability of the JIIM user to plan, execute and report through collaboration?	**Quality of Collaboration:** Consistency and Conciseness (to plan, execute, and report in support of the mission). **Degree of Shared Situational Awareness:** Consistency of shared information among all participants.	**Information Sharing:** Ability to share information plans, COAs, and reports to other JIIM users **Operational Flexibility:** Ability to develop and maintain multiple options (COAs) and contingencies through planning and collaboration	**Application Performance:** Collaboration application performance (e.g., VTC, VoIP)	**Quality of Collaboration:** User feedback on ability to plan, execute and report status **Degree of Shared SA:** Observation that information is being shared among everyone with a need to know **Information Sharing:** Observation of plans, COAs, and reports are being transmitted and received **Operational Flexibility:** Observation - Having multiple COAs and contingencies in place through planning and collaboration **Application Performance:** Performance results from VoIP and VTC testing)

II. IRIS JCTD OUA Results
E. Critical Operational Issues (COI)
3. IRIS and JIIM Suitability

COI 3: Is IRIS suitable for the JIIM user community?					
Demonstrated Capability	**COI Sub-elements**	**MOMs**	**MOEs**	**MOPs**	**Data Collection Requirements**
VPN, Managed Internet Gateway (F/W and no F/W), VoIP service , PSTN connectivity	**COI 4.1:** Are the IRIS network managed services suitable for the JIIM user community?		**Trainability:** Can IRIS services be effectively leveraged by current personnel without significant training (based on feedback from users in support of system setup (ZTD) and troubleshooting faults). **Mobility:** Effectiveness of the Maritime nodes (based on user feedback on deploying IRIS on ground mobile and airborne units).	**Network Performance:** IP throughput, allocated versus requested bandwidth, VPN Separation. **Application Performance:** Performance metrics (e.g., VoIP, VTC, Web, etc.).	**Trainability:** Observation of ZTD and NMS and potential impact to training, User feedback **Mobility:** Weight and form factor of the IRIS terminal, Observation of maritime system, User feedback to other terminals **Network Performance:** NCC reports, VPN Separation test results **Application Performance:** Application performance results. Potential issues identified by users.
IRIS Coverage, PSIM/IPR, downlink and uplink separation, robust RF links, Bandwidth per user terminal	**COI 4.2:** Does the availability of IRIS services meet JIIM user's requirements?		**Timeliness of Situational Awareness:** Time to transmit and receive critical SA information.	**Connectivity:** Link and network availability (including periods of outages). **Scalability:** Maximum number of terminals (with and w/o CIR from NS-2).	**Timeliness of SA:** Observation to the extent of time required to send critical SA information **Connectivity:** Periods of network issues or conditions (including environmental) affecting availability. Was uplink and downlink performance impacted by weather? Weather data **Scalability:** Number terminals demonstrated, maximum terminal count by type per transponder
ZTD. Cisco NGGS User Web Portal	COI 4.3: Is IRIS supportable by the JIIM user community?		**Supportability:** Ease of the ZTD process and the capabilities offered by the Web portal.		**Supportability:** User feedback and observation on ZTD process
VPN separation, JRT Vulnerability Assessment	COI 4.4: Do the IRIS network managed services meet JIIM user's security requirements?	**Degree of Shared Situational Awareness:** Completeness of Shared SA.	**Vulnerability:** ref JRT Assessment Plan **Security//IA:** ref JRT Assessment Plan	**Connectivity:** VPN Separation validation.	**Degree of Shared SA:** Observation - ability to shared information and not being degraded due to security requirements/constraints **Vulnerability:** ref JRT **Security:** ref JRT **Connectivity:** VPN separation test results

II. IRIS JCTD OUA Results
E. Critical Operational Issues (COI)
4. IRIS Operational Impact

COI 4: Does the IRIS capability and supporting technologies integrate into current command and control infrastructure and are they interoperable with evolving network architectures?

Demonstrated Capability	COI Sub-elements	MOMs	MOEs	MOPs	Data Collection Requirements
Interoperability with INE used for CENTRIXS network extension	**COI 3.1:** Are the IRIS network managed services interoperable with Defense Information Services Network (DISN) services?		**Interoperability:** Degree of interoperability of the INE used for CENTRIXS MLEC with IRIS.		**Interoperability:** Demonstrated connectivity and services with INEs, trusted gateway with one-way COP feed from SIPRNET to CENTRIXS. Extrapolate requirements necessary to support DISN services based on what has been demonstrated (i.e., HAIPE/INEs)
Extension of the CENTRIXS network over IRIS, IRIS QoS and NMS interoperability with CENTRIXS services	**COI 3.2:** Are the IRIS network managed services interoperable with JIIM user networks and applications?		**Interoperability:** The extension and ability to integrate IRIS QoS and capabilities with CENTRIXS systems and applications.	**Network Performance:** IP throughput and latency as a function of DSCP. **Application Performance:** Demonstrated application performance.	**Interoperability:** User feedback on the issues (if any), observed issues associated with integration of CENTRIXS services and systems on IRIS services **Network Performance:** IP throughput (Netflow, NCC reports) **Application Performance:** Objective metrics from TNLET and DVQattest. Subjective questionnaire results on application performance
C-Band and Ku-Band coverage area, Cross-band/beam, Single hop/mesh connectivity, IP connectivity	**COI 3.3:** Does the IRIS provide transparent interconnectivity between JIIM user networks located in different regions of the world?	**Quality of Collaboration:** Consistency of collaboration.	**Information Sharing:** Ability to share information and without restriction to geolocation (within coverage area). **Interoperability:** Ability to integrate CENTRIXS MLEC over IRIS.	**Network Performance:** The ability to dynamically share bandwidth (uplink and downlink utilization rates). **Connectivity:** Ability to Cross-band and connect to Internet. Reachback, peer-to-peer, IP convergence.	**Quality of Collaboration:** Observation - Conducting collaboration in a consistent manner **Information Sharing:** Observation - minimal restriction to share due to geolocation **Interoperability:** List of identified constraints and their impacts **Network Performance:** Uplink and Downlink utilization rates (Netflow and NCC reports) **Connectivity:** Demonstrated Cross-band and cross beam. Ability to connect to the Internet and Enterprise networks
Managed Enterprise, Managed VPN, Public Internet access, PSTN access	**COI 3.4:** Are the IRIS services easily integrated into the JIIM user's network?	**Degree of Shared Situational Awareness:** Accuracy of shared SA.	**Security//IA:** Observed issues and potential constraints identified by the user group and JRT (ref. vulnerability assessment). **Interoperability:** Through comparison of network protocols used by the user group with protocols supported by IRIS, the ability of user group applications and networks to leverage IRIS QoS arch.	**Connectivity:** The ease of interconnecting CENTRIXS and using CENTRIXS capabilities over IRIS.	**Degree of Shared SA:** Observation - was there a requirement to modify systems or to extend CENTRIXS over IRIS **Security:** Observation - Issues and potential constraints **Interoperability:** Observation of protocols used by the user group **Connectivity:** Observation and user feedback on integration issues between CENTRIXS with IRIS
ZTD, NOC services	**COI 3.5:** Is the IRIS Network Management system interoperable with other JIIM user's network management systems?		**Trainability:** The ease/difficulty in performing ZTD. **Supportability:** The ease/difficulty in using IRIS services (e.g., NOC services, PSTN).		**Trainability:** User feedback on the amount of training required to ZTD and IRIS services (user feedback) **Supportability:** Observation - how was IRIS services incorporated during the demonstration

III. IRIS JCTD OUA Summary, Conclusions and Recommendations
A. Operational Utility Determination

Conclusions:

- An IRIS-like capability is needed to improve information sharing among edge users in net centric operations.
- As an initiative to provide greater access, IRIS will promote greater cooperation among JIIM partners. IRIS access will enable JIIM partners to counter terrorism and other criminal activities.
- IRIS will promote greater intelligence and operational cooperation as well as information-sharing among JIIM partners.

Issues Requiring Resolution (Operational Deficiencies):

- Operational Issues: In addition to determining jurisdictional issues from a law enforcement perspective, more detailed agreements are needed to develop protocols for operational support during situations that require more than one partner to respond. Development of coalition doctrine will require a continued level of interaction by operational forces and periodic exercises to test combined doctrine.
- Technical Issues: The most significant technical issues have to do with developing the information interfaces between U.S. and foreign information systems. In addition to detailed information-sharing arrangements, a set of commonly accepted terminology and standards must be developed to ensure the accuracy and mutual understanding of information that is shared.
- Transition Issues: Applying IRIS technologies in other regions will also require an effort by the Industry Management Team to market the IRIS solution.

III. IRIS JCTD OUA Summary, Conclusions and Recommendations
B. Transition, DOTMLPF, CONOPS, TTP Recommendations

- **Transition Recommendation:**
  – IRIS services can be leased through the DISA's GSA SATCOM II contract mechanism
    - Available to DOD for Research and Development via KnightSky LLC.
  – IRIS services for non-DOD organizations can be leased by contacting Cisco Systems Directly
    - Cisco Systems Point of Contact: Mr. Jeff Thompson, jefthomp@cisco.com
- **DOTMLPF Recommendations:**
  – Detailed in the IRIS JCTD DOTMLPF Recommendations Paper and high points given on the following slides:
    - III.B.1. Commercial Transport Layers and Military Opeations
    - III.B.2. Hosted Payloads
    - III.B.3. The IRIS JCTD Acquisition Model
- **CONOPS / TTP Recommendations:**
  – Separate stand alone briefing

III. IRIS JCTD OUA Summary, Conclusions and Recommendations

B. 1. Commercial Transport Layers and Military Operations

Reference: Appendix J. DOTMLPF Cross Reference

- **Doctrine:** DOD Policy must be updated to embrace the pace of commercial IT innovation in order to accommodate future JIIM operations
- **Organization:** No issues or recommendations
- **Training:** A hybrid military occupation specialty or rating to combine network specialists with satellite communications specialties will be required to fully embrace network convergence in the near future
- **Material:** DOD operations in the 21st century will increasingly include multinational partners and International Traffic in Arms Regulations (ITAR) compliant Commercial Off-The-Shelf (COTS) equipment is the most efficient way to extend collaboration and situational awareness to any coalition partner on short notice
- **Leadership and Education:** DOD needs to embrace commercial capabilities and start partnering with industry to create win-win business models and solutions
- **Personnel:**
  - A potential benefit of DOD's reliance on commercial transport would be shifting the burden of network management and service to commercial industry
  - This would require less DOD personnel to maintain and monitor DOD portions of the network and create an overall manpower increase for other DOD operations
- **Facilities:** No issues or recommendations

III. IRIS JCTD OUA Summary, Conclusions and Recommendations

B. 2. Hosted Payloads

References: Lessons Learned during the IRIS JCTD and four demonstrations:

- **Doctrine:** The IRIS JCTD process model validated operational utility through hosted payloads by rapidly defining requirements for DOD space acquisition
- **Organization:** No issues or recommendations
- **Training:**
  - DOD personnel need to train for familiarity on commercial capabilities
  - This training will give DOD operators the skill set to interface with industry to ensure that DOD equities are included and achieved
- **Material:** No issues or recommendations
- **Leadership and Education:** Senior DOD leadership should foster partnership with commercial industry to close communications gaps, as defined in the Commercial Space Guidelines of the National Space Policy of the United States of America, dated 28 June 2010
- **Personnel:** No issues or recommendations
- **Facilities:** No issues or recommendations

III. IRIS JCTD OUA Summary, Conclusions and Recommendations

B. 3. The IRIS JCTD Acquisition Model

References: General Cartwright, USMC; IRIS JCTD meetings with industry, IRIS JCTD lessons learned and IRIS JCTD trip reports:

- **Doctrine:** There is a need to complement the Joint Capability Integration and Development System (JCIDS) process with rapid acquisition of space, IT and cyber technologies
- **Organization:** No issues or recommendations
- **Training:**
  - DOD personnel need familiarity training on new commercial capabilities
  - This insight and training will give them the skill set to have a meaningful interface with industry and ensure that DOD equities are met
- **Material:** The IRIS JCTD leveraged a relatively mature technology that was funded by commercial stakeholders to address a capability gap in the near-term
- **Leadership and Education:** No issues or recommendations
- **Personnel:** No issues or recommendations
- **Facilities:** No issues or recommendations

IV. Acronyms and Terms

- ACU - Antenna Control Unit
- BUC - Block Up Converter
- C4I - Command Control Communications Computers and Intelligence
- CDID - U.S. Army Capability Development & Integration Directorate at Fort Gordon, GA
- CENTRIXS - Combined Enterprise Regional Information Exchange System
- CGR - Cisco Ground Router
- CIR - Committed Information Rate
- CONOPS - Concept of Operations
- COTS - Commercial Off the Shelf
- COI - Critical Operational Issue
- CTG - Commander Task Group
- DHCP - Dynamic Host Configuration Protocol
- DHS - Department of Homeland Security
- DISA - Defense Information Systems Agency
- DLA - Defense Logistics Agency
- DNS - Domain Name Service
- DOD - Department of Defense
- DOJ - Department of Justice
- DOS - Department of State
- DOTMLPF - Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities

IV. Acronyms and Terms
(page 2 of 6)

- EoIP - Everything over Internet Protocol (e.g. data, voice, video)
- FPGA - Field Programmable Gated Array
- GEO - Geosynchronous
- GMRT - Ground Master Reference Terminal
- HAIPE - High Assurance Internet Protocol Encryption
- HPA - High Power Amplifier
- Hr. Ms. - Her Majesty's Ship
- IA - Information Assurance
- IAM - Information Assurance Manager
- IF - Intermediate Frequency
- IFL - Intermediate Frequency Link
- IMT - Industry Management Team (e.g. Cisco Systems, Inc. and Intelsat General Corporation)
- IP - Internet Protocol
- IPSAT - Internet Protocol over Satellite
- ISAKMP - Internet Security Association and Key Management Protocol
- IRIS - Internet Protocol Routing in Space
- ITAR - International Trafficking in Arms Regulations
- JCIDS - Joint Capability Integration and Development System
- JCTD - Joint Capability Technology Demonstration
- JEWC - Joint Electronic Warfare Center

IV. Acronyms and Terms

- JHU/APL - Johns Hopkins University / Applied Physics Laboratory
- JIATF-S - Joint Interagency Task Force – South in Key West, FL
- JIIM - Joint, Interagency, Intergovernmental and Multinational
- JOCC - Joint Operations Command Center
- Kbps - Kilobits per second
- LAN - Local Area Network
- LANTAREA - U.S. Coast Guard Atlantic Area, a three star headquarters in Norfolk, VA
- LEDET - Law Enforcement Detachment
- LNB - Low Noise Block downconverter
- LNA - Low Noise Amplifier
- LNO - Liaison Officer
- MAA - Mission Area Analysis
- MARSITCEN - Maritime Situation Center, Naval Headquarters in Den Helder, The Netherlands
- Mbps - Megabits per second
- MIT/LL- Massachusetts Institute of Technology / Lincoln Laboratories
- MLEC - Multi Lateral Enduring Contingency (Coalition CENTRIXS system in the Caribbean)
- MOE - Measures of Effectiveness
- MOM - Measures of Merit
- MOP - Measures of Performance
- NAP - Network Access Point

IV. Acronyms and Terms

- NC3A - NATO Consultation, Command and Control Agency
- NCC - Network Control Center
- NCO - Network Centric Operations
- NGO - Non Governmental Organization
- NGGS - Next Generation Global services
- NS - Cisco Systems Network Services tests at the Cisco Campus in Research Triangle Park, NC
- NL -The Netherlands
- NMS - Net Managed Services
- NOC - Network Operations Center
- OE - Oversight Executive
- OD - Operational Demonstration
- OM - Operational Manager, SMDBL in Colorado Springs, CO
- OOA - On Orbit Assessment
- OV – 1 - Operational View One
- OSD - Office of the Secretary of Defense
- OTA - Operational Test Agency
- OUA - Operational Utility Assessment
- P0 - P Zero Service (service level provided by Cisco during OD 4 enduring a minimum committed information rate of 512 kbps symmetrical up and down to the satellite)
- PACAREA - U.S. Coast Guard Pacific Area, a three star headquarters in Alameda, CA
- PEO C3T - Program Executive Office for Command, Control and Communications Tactical

IV. Acronyms and Terms
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- PEO STS - Program Executive Office for SATCOM, Teleports and Services
- PSIM - Programmable Satellite IP Modem
- PSTN - Public Switch Telephone Network
- QDR - Quadrennial Defense Review
- QoS - Quality of Service
- QPSK - Quadrature Phased Shift Keying
- RF - Radio Frequency
- RNLN - Royal Netherlands Navy
- RTP - Research Triangle Park in Raleigh-Durham, NC; site of Cisco Systems' Network Operations Center and Campus for the Eastern U.S.
- RU - Rack Unit
- SHF - Super High Frequency
- SMC - U.S. Air Force Space and Missile Systems Center in Los Angeles Air Force Base, CA
- SMDBL - U.S. Army Space and Missile Defense Battle Lab in Colorado Springs, CO
- SV – 1 - Systems View One
- TBP - To Be Published
- TDMA - Time Division Multiple Access
- TM - Technical Manager, USAF SMC at Los Angeles Air Force Base, CA

IV. Acronyms and Terms
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- T-SAT - Transformational Satellite
- TTP - Tactics, Training and Procedures
- UC / DC - Up Converter / Down Converter
- UHF - Ultra High Frequency
- USCG - United States Coast Guard
- USEUCOM - U.S. European Command in Stuttgart, GE
- USPACOM - U.S. Pacific Command in Honolulu, HI
- USSOUTHCOM - U.S. Southern Command in Miami, FL
- USSTRATCOM - U.S. Strategic Command in Omaha, NE
- VHF - Very High Frequency
- VoIP - Voice over Internet Protocol
- VPN - Virtual Private Network
- VTC - Video Telephone Conference
- WAAS - Wide Area Application System
- WS - Work Station
- XM - Transition Manager, DISA PEO STS in McLean, VA
- ZTD - Zero Touch Deployment (Cisco Services)

V. Glossary
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- **Architecture:** A term applied to both the process and the outcome of thinking out and specifying the overall structure, logical components, and the logical interrelationships of a network.
- **Collaboration:** The act of working together, one with another; cooperate, as on a common mission.
- **CONOPS**: The set of descriptions or processes that provide instructions for how an idea/concept is executed or turned into reality
- **Data:** A representation of individual facts, concepts or instructions in a manner suitable for communication, interpretation or processing by humans or by automatic means. (IEEE 610.12)
- **Demonstration:** The act of showing conclusive evidence or proof.
- **Early Adopters:** Those people or organizations that embrace new technology before most other people do. Early adopters tend to buy or try out new hardware items and programs, and new versions of existing programs, sooner than most of their peers.
- **Effectiveness:** Adequate to accomplish a purpose; producing the intended or expected result.
- **Efficiency:** Accomplishment of or ability to accomplish a job with a minimum expenditure of time and effort.
- **Functionality:** Capable of serving the purpose for which it was designed.

V. Glossary
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- **Information:** The refinement of data through known conventions and context for purposes of imparting knowledge.
- **Innovative Acquisition Model:** A new model for government and industry cooperation. Allows the government to leverage commercial industry participation while technological market forces coupled with informed commercial investors develop solutions and services that meet varied demands and requirements
- **Innovation Economy:** a change in the thought process for doing something or "new stuff that is made useful"… followers of innovation economics stress using public policy to spur innovation and growth.
- **Interoperability:** Capable of being used or operated reciprocally.
- **Latency:** In a network, latency, a synonym for delay, is an expression of how much time it takes for a packet of data to get from one designated point to another.
- **Scalability:** How well a solution to some problem will work when the size of the problem increases.
- **Scenario:** An imagined or projected sequence of events of several detailed plans or possibilities.
- **Suitability:** How well the subject is appropriate for the given situation.
- **Throughput:** In a network, throughput is the amount of data moved successfully from one place to another in a given time period.

VI. Related Documents

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- National Security Presidential Directive/NSPD-25 February 19, 2003.
- JIATF-S Standard Operating Procedures, Change 2, November 27, 2007
- CJCS Joint Publication 3-07.4, Joint Counterdrug Operations, February 17, 1998.
- COMDTINST M16247.1C, USCG Maritime Law Enforcement Manual, August 10, 2003.
- U.S. National Strategy for Public Diplomacy and Strategic Communication, June 2007.
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- CJCS Joint Publication 3-08, Interagency Coordination During Joint Operations Vol. II, October 9, 1998.
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VII. IRIS Papers and Presentations

- U.S. Navy's CHIPS Magazine, *IRIS-Changing the Fixed Circuit Paradigm*, Vol. 24, No. 3, July - September 2009
- Paper presented at the Military Communications Conference 2008, "Space Borne Internet Routing for Joint, Interagency, Intergovernmental and Multinational Communications," November 17-18, 2008, San Diego, CA
- Paper presented at the Military Communications Conference 2008, "Technical Challenges and Operational Concepts for Future Military SATCOM with On-Board Processing," November 17-18, 2008, San Diego, CA
- National Security Space Institute Space News, *Router Headed for Orbit*, March 20, 2009, pp. 16-19.

VIII. DOTMLPF References

- Lessons Learned during the IRIS JCTD and four Operational Demonstrations:
  - Operational Demonstration One trip report to SMDBL, July 20, 2007.
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- IRIS JCTD Implementation Directive
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- National Space Policy for the United States of America, June 28, 2010