



CERDEC GRA Initiatives

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

thomas.j.rittenbach.civ@mail.mil

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GRA Origins

GRA Technical Overview

GRA Initiatives

- GRA CRADA
- GRA Consortia
- GRA SharePoint Site
- GRA MILCOM Publications
- GRA Live Demos
- GRA Multivendor-Vendor Terminal
- GRA ISR-NET Concept

JTRS High-Band High-Throughput (HBHT) AoA

JTRS AoA Study

MILSATCOM Above 2GHz Tiger Team January 2006

Institute for Defense Analyses

The Johns Hopkins University/Applied Physics Laboratory

Determine how the HBHT capability can be provided to the warfighter in a timely, operationally effective, and cost efficient manner in accordance with the ASD(NII) policy

HBHT Alternatives:

- Alternative 1: Status quo baseline (used for comparison only)
- Alternative 2: Implement HBHT in current JTRS Clusters
- Alternative 3: Create new HBHT terminal/radio family
- Alternative 4: Create new MILSATCOM and new LOS HBHT terminal/radio families
- Alternative 5: Develop reusable HBHT core hardware modules (components, not complete terminals)

AoA Study Team recommended an alternative in which core modules are developed and employed in HBHT terminals/radios (AoA Alternative 5)

BUT HOW?

1. Common Data Link (CDL)
2. Warfighter Information Network Tactical (WIN-T)
3. SHF SATCOM and Gapfiller
4. EHF SATCOM
5. Global Broadcasting System (GBS)
6. Data Distribution System (DDS) – Cooperative Engagement Capability
7. Network Data Link (NDL)
8. Soldier Radio Waveform (SRW)
9. Mobile Satellite Service (MSS)

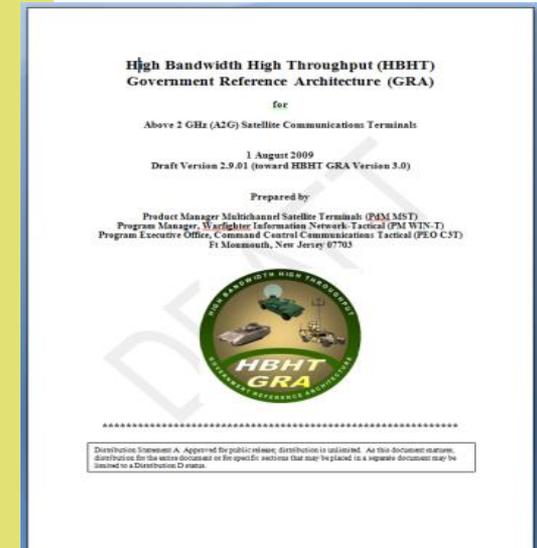


Numerous terminal/radios associated with each of the waveforms

- **GRA Definition:** *The **GRA** is a **Standard** Above 2 GHz Military Communication Modular Open Systems Architecture based on **MDA** (Model Driven Architecture) constructs*

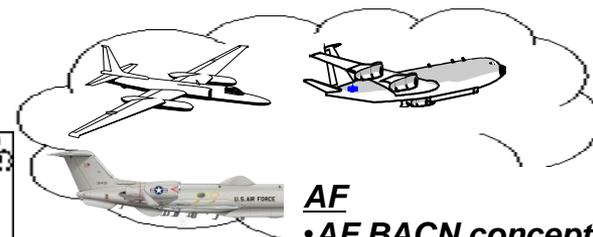
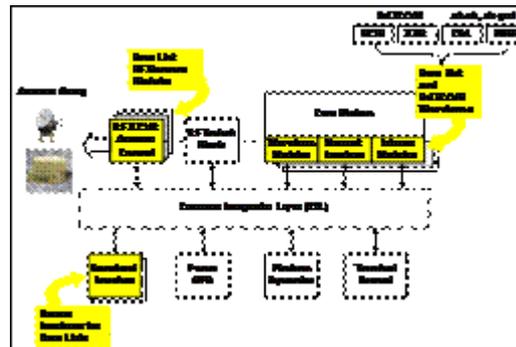
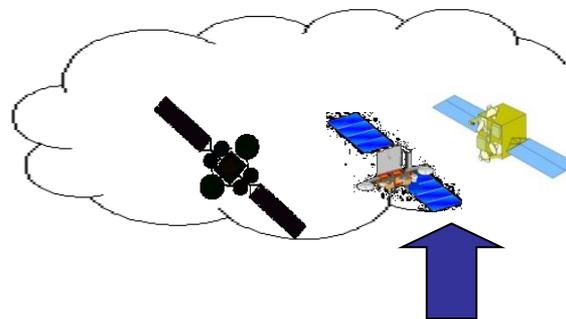
• **GRA Objectives:**

- ***Establish** a Functional Decomposition **Standard** pattern for terminals defining Common Integration Layer (CIL)*
- *Develop a **common** system level **architecture** that decouples H/W and S/W module dependencies to **enable reuse***
- ***Decouple** H/W & S/W **dependencies** in order to break the monolithic paradigm in current A2G terminal programs*
- ***Maximize** opportunities for **competition** and cost reductions across all life cycle phases*
- ***Collaborative development** between Gov't & Industry*
- ***Protect** industry's rights to their **intellectual property***
- ***Enable** integration of new capabilities through **tech refresh** or new program increment without significant terminal redesign*
- ***Objective** is to supporting **Plug and Play** system integration of COTS and third party module development efforts*



GRA 3.0

- Use of Open GRA standards in multiple programs (within a service or across services)
- Allow companies to offer modules outside their traditional markets & customer base
- Companies that are typically Army suppliers can effectively compete on Navy Programs)
- Larger volumes (across multiple programs) translate to lower production costs



- AF**
- AF BACN concept;
 - CABLE
 - Objective Gateway
 - FAB-T

GRA Airborne Networking Terminal



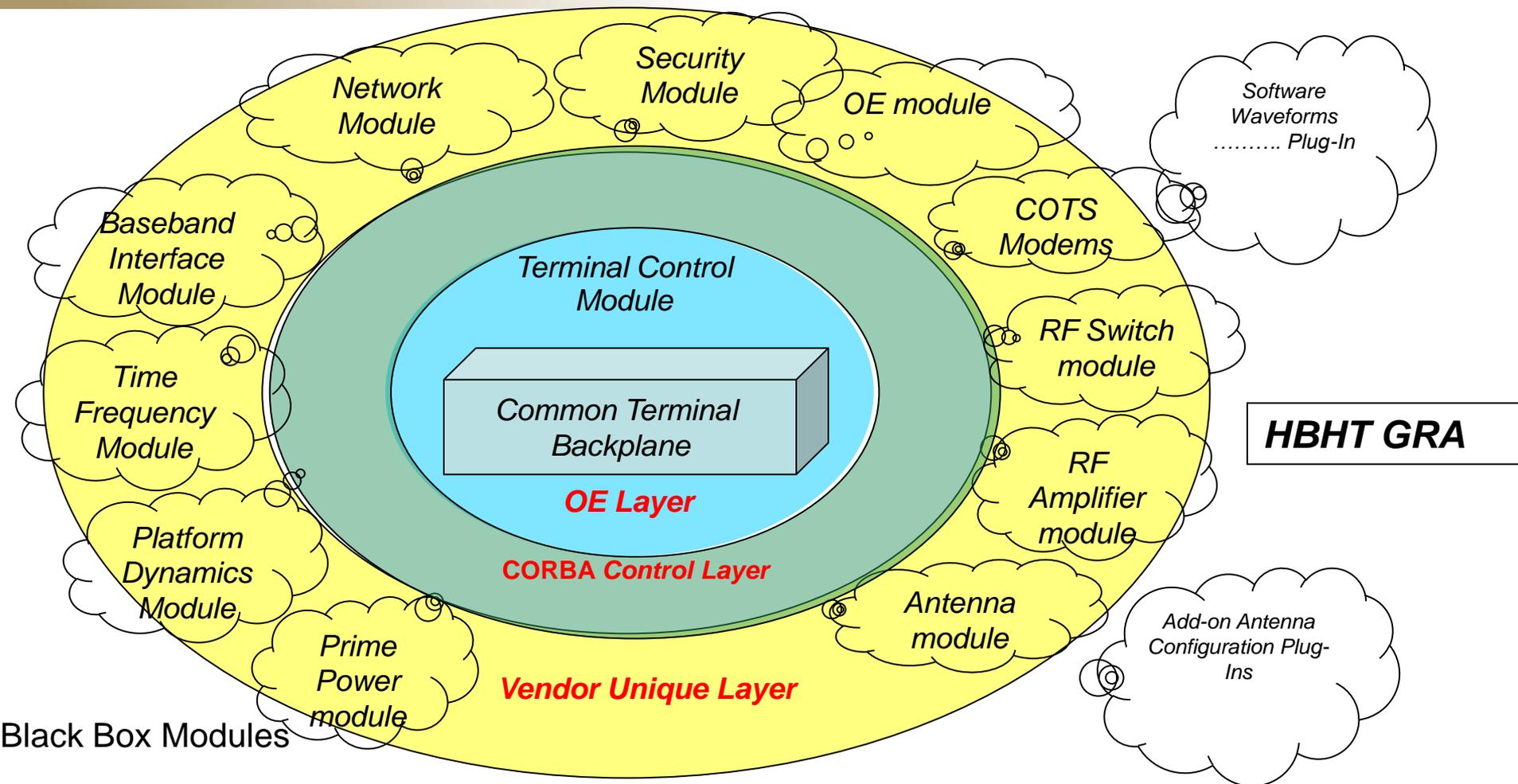
- NAVY**
- Navy Automated Digital Network System (ADNS)
 - MILES



- ARMY
- HBHT GRA ground terminal
- Data Link to WIN-T migration
- Integrated High Capacity backbone networks

GRA Brings MOSA to Joint A2G Development

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- **GRA Concept : GRA Intellectual Property Layers**
- **Vendor Unique Layer: Contains Vendor IP GRA layers provide utilities and infrastructure**
- **Government Owned Layers: Control Plane SCA 2.2.2, Data Plane & OE Interface**

PIM Structure Diagram

for each Device, Service,
Application, Adapter
Module

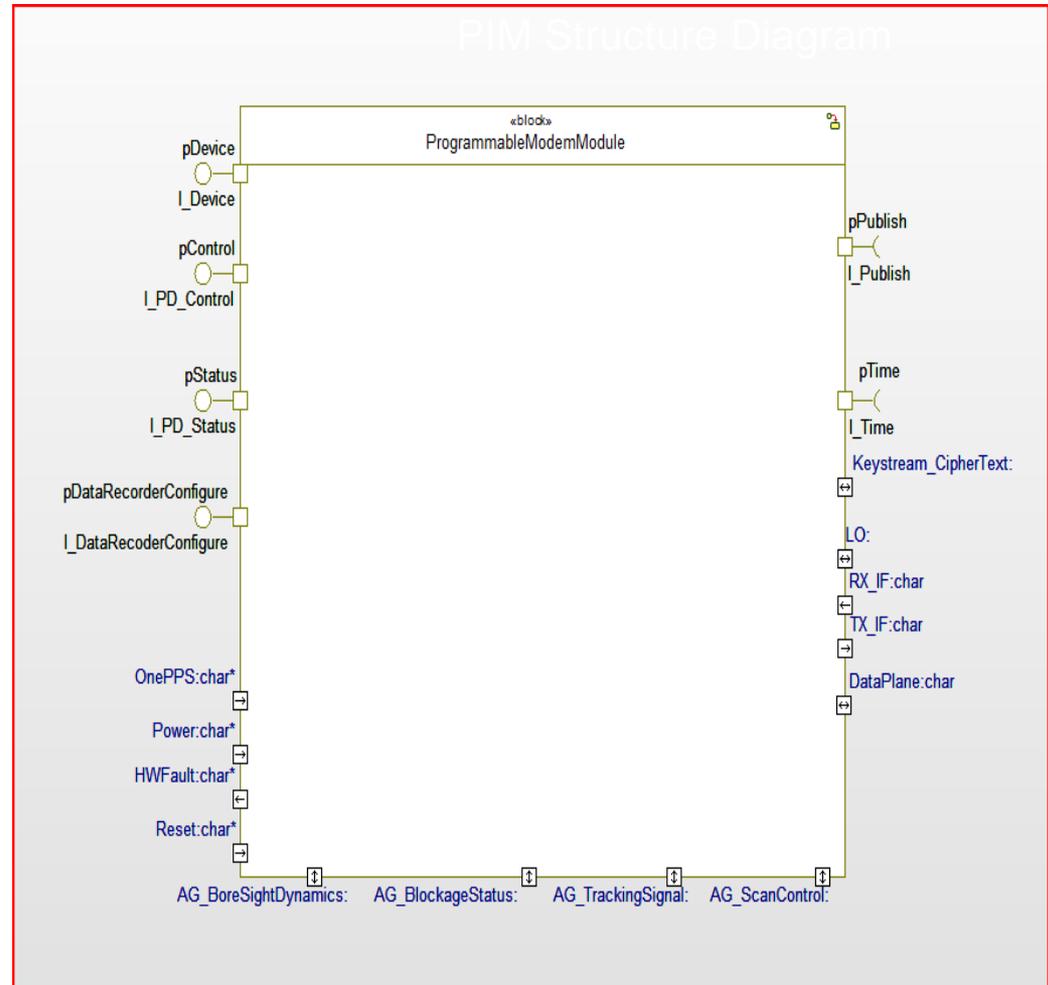
PIM defines Provides and
Requires (I/O)

for each module type

Defines Protocol for each
port

PIM written in UML

PIM derived from CIM





communications



**Rockwell
Collins**

Raytheon



NORTHROP GRUMMAN

GENERAL DYNAMICS
C4 Systems

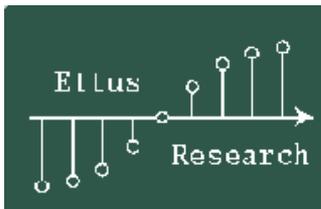
LOCKHEED MARTIN

PRISMTECH



ITT

Green Hills
SOFTWARE



•The GRA Consortium

Company Name	Task Description	CERDEC Signed	Company Signed	Completion Date
Space Coast	Develop Multi-Band Transceiver Test Bed	Sept 16 2011	Sept 16 2011	May 9, 2011
PrismTech	Demonstrating a GRA-compliant platform/waveform model and implementation within Spectra CX	Sept 16 2011	Sept 16 2011	May 9, 2011
DataSoft	SDR Forum	Sept 16 2011	Sept 16 2011	May 9, 2011
Radio Technologies	Software Defined Radio	Sept 16 2011	Sept 16 2011	May 9, 2011
ITT	IR&D SDR	Sept 16 2011	Sept 16 2011	May 9, 2011
OIS	SDR Forum	<p><i>GRA CRADA is unique Legal Framework that provides legally binding definition of Intellectual Property Ownership.</i></p> <p><i>US Gov. OWNS Full Data Rights (not merely Government Purpose Rights) to all GRA software and documentation. Industry owns all intellectual property developed in GRA Compliant modules.</i></p>		
CTC - Canada	SDR Forum			
Indiana Purdue Fort Wayne Univ	SDR Forum			
L3 Corp	GRA Developer			

MITRE

Darcy S. Swain
E301 Joint Net Ops & Cyber Defense
Lead Communications Engineer
Wireless Communications & Spectrum Management

Office: 301-617-3325
Cell: 508-667-7170
Fax: 301-617-3090
dswain@mitre.org

300 Sentinel Drive
Suite 400
Annapolis Junction, MD 20701

www.mitre.org

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Public Interest*

Ellus Research

Building Software
Radio Systems

Matt Ettus
matt@ellus.com
650.967.2870

Ellus Research, LLC
1043 N. Shoreline Blvd.
Suite 100
Mountain View, CA 94043
www.ellus.com

Rockwell Collins

Brian R. Cigrand PMP
Principal Program Manager
SATCOM
Government Systems

400 Collins Road NE, MS 137-126
Cedar Rapids, IA 52498 USA
Tel 319.295.1246
bcigrand@rockwellcollins.com

Agilent Technologies

Maryann Apostle
Account Manager
Test & Measurement Organization

Agilent Technologies, Inc.
8025 Stanford Blvd.
Suite 300
Columbia, MD 21045

973 440 7240 telephone
303 957 2358 facsimile
800 829 4444 call center
maryann_apostle@agilent.com
www.agilent.com

Innovative Integration

DSP
Data Acquisition
Embedded Control

Craig Petrie
Business Development Manager EMEA
cpetrie@innovative-dsp.com

Boston Office • Breckler Park • Culbourn Rd • G6 BR • UK
(6) 1546 709 535 office • (6) 1545 141 802 cell • www.innovative-dsp.com

Stewart Reid
Government Programs Manager
Green Hills Software
T: 805.965.6044 x. 120
E: stewart_reid@ghs.com

FEI-Zyfer Inc.
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Phillip Walker
Sales Manager Eastern U.S., Africa,
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Direct: 540.349.8330
Cell: 540.270.9579
Email: pww@fei-zyfer.com

7321 Lincoln Way
Garden Grove, CA 92841
www.fei-zyfer.com

sunair

Dean Becker
Chief Engineer - Development

941 400 0234
CELL

9101 SW 42nd Street
Fort Lauderdale, FL 33312
Tel: 954-400-0100
Fax: 954-400-0224
dean.becker@sunairtechnics.com

thinkkom

Doug Klebe
Director of Manufacturing

ThinkKom Solutions, Inc.
28000 Mariner Ave., Suite 500, Temecula, California, 92593
direct 910.802.4505 main 910.371.5496
fax 910.371.3130 mobile 910.347.1821
Doug@think-kom.com
Website: www.thinkkom.com

communications

Dana P. Ardivino, PMP
Program Manager, SATCOM Programs

Communication Systems-West
640 North 2200 West, P.O. Box 16950 Salt Lake City, UT 84116-0850
801-905-6628 435-513-9991 Fax: 801-606-6507
e-mail: Dana.P.Ardivino@CScom.com

JOSEPH MILO • Regional Sales Manager

Elcom Technologies

11 Volvo Drive, Rockleigh, New Jersey 07647 USA
Tel: 201-767-8030 Ext. 271 Cell: 914-420-5189 Fax: 201-767-1326
jmiло@elcom-tech.com • www.elcom-tech.com

Trilogic Systems
Your COTS Solution Provider

David W. Paul
Business Development

P.O. Box 43
North Reading, MA 01864

(p) 978-771-6345
(f) 888-416-0845

Mike Stalen
mstalen@mobilemark.com
mobile mark

aculab

John Kozlowski
Senior Sales Manager

Aculab, Inc.
100 River Ridge Drive, Suite 101
Newport, AA 03062 USA
www.aculab.com www.wapplans.com
Twitter: aculab Twitter: AppliX

Tel: 781.352.3550
Direct: 781.352.3545
Mobile: 203.216.7269
john.kozlowski@aculab.com

Calvin S. Lee

RIVA Networks Inc.
555 Riva Avenue
East Brunswick
New Jersey 08815
(732) 940-6558
calvin@RIVA-Networks.com

Electronic Components
and Microwave Solutions

ELMA
Your Solution Partner

Elma Electronic Inc.
700 Veterans Circle
Warrington, PA 18974-3331

Office (215) 956-1200 x15230
Direct (215) 956-1230
Fax (215) 956-1201
steven.gudknecht@elma.com
www.elma.com/us

Honeywell

David C. Johnson
Director, Program Management

7000 Columbia Gateway Drive
Columbia, MD 21046

Office: 410/964-7137
Cell: 202/213-9480

David C. Johnson@honeywell.com

Ken Grob
215-956-1211
Dir. Bus. Dev.

Steven Gudknecht
Product Marketing Manager
Embedded Computing Products

TRILITHIC
RF & MICROWAVE

Doug King
Regional Sales Manager

9010 Park Oaks Drive
Indianapolis, IN 46226
USA
www.trilithic.com

TOLL FREE: (800) 344-2412
VOICE: (215) 423-8856
MOBILE: (812) 344-0016
FAX: (317) 895-3472
E-MAIL: dking@trilithic.com

ELMA
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Elma Electronic Inc.
700 Veterans Circle
Warrington, PA 18974-3331

Office (215) 956-1200 x15230
Direct (215) 956-1230
Fax (215) 956-1201
steven.gudknecht@elma.com
www.elma.com/us

HYPRES

MICHAEL DEZEGO
Director, Business Development

The Digital Superconductor Company

175 Clearbrook Road
Elmsford, NY 10523
www.hypres.com

(914) 592-1190
Cell (321) 427-5093
Fax (914) 592-8547
mdezego@hypres.com

TRILITHIC
RF & MICROWAVE

Doug King
Regional Sales Manager

9010 Park Oaks Drive
Indianapolis, IN 46226
USA
www.trilithic.com

TOLL FREE: (800) 344-2412
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FAX: (317) 895-3472
E-MAIL: dking@trilithic.com

Ken Grob
215-956-1211
Dir. Bus. Dev.

Steven Gudknecht
Product Marketing Manager
Embedded Computing Products

CURTISS WRIGHT Controls
Embedded Computing

6449 Beach Road
Eden Prairie, MN 55344

Cell: 952-200-1816

SHUBHAGAT GANGOPADHYAY, Ph.D.
Director, Business Development

C. David Massey
Director, Business Development

office (303) 449-9211 ext. 160
fax (303) 449-1321
cell (202) 365-1402
cdmassey@firstfr.com

FIRST RF Corporation
4865 Sterling Drive
Boulder, Colorado 80301-2307
www.firstfr.com

FIRST RF Corporation
4865 Sterling Drive
Boulder, Colorado 80301-2307
www.firstfr.com

- *All GRA Members can Contribute (Upload and Download) to the following Collaboration libraries:*

- 1) *Shared Documents*

GRA User Guide, GRA 3.0 Standard

- 2) *MILCOM Archive*

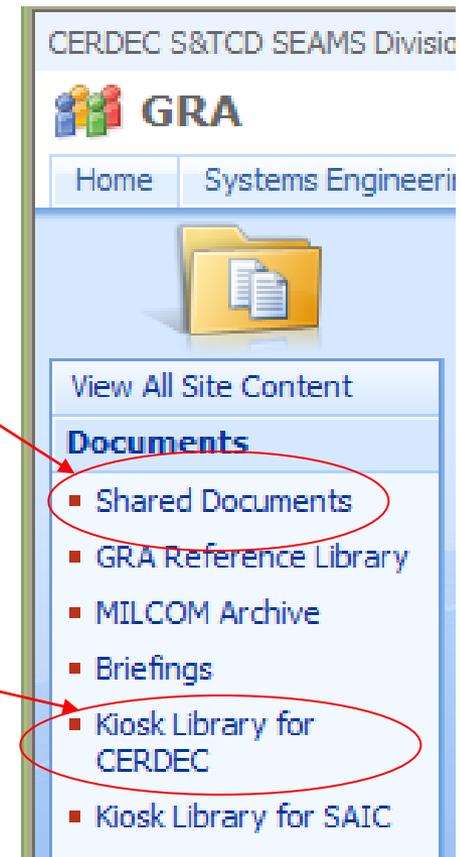
for past MILCOM papers

- 3) *Briefings*

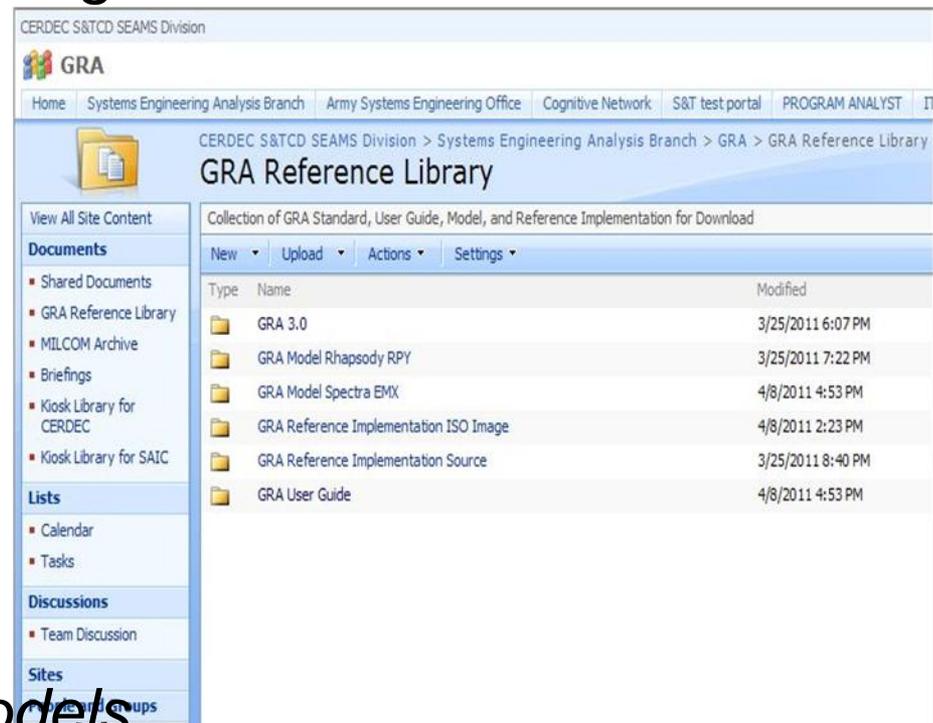
for background PowerPoint briefings of general interest.

- *Kiosk Libraries are set up for Private Document Libraries for each CRADA partner*

- *Each Team leader has Full Control over content, membership, and permission*



- *Purpose: to encourage collaboration and reuse of GRA framework, components, interfaces.*
- *Authentication thru AKO after signed GRA CRADA*
- *Landing Page*
- *Document Libraries*
 - *GRA Reference Library*
 - *Shared Documents*
 - *Restricted Kiosks*
 - *Rhapsody GRA UML Models*

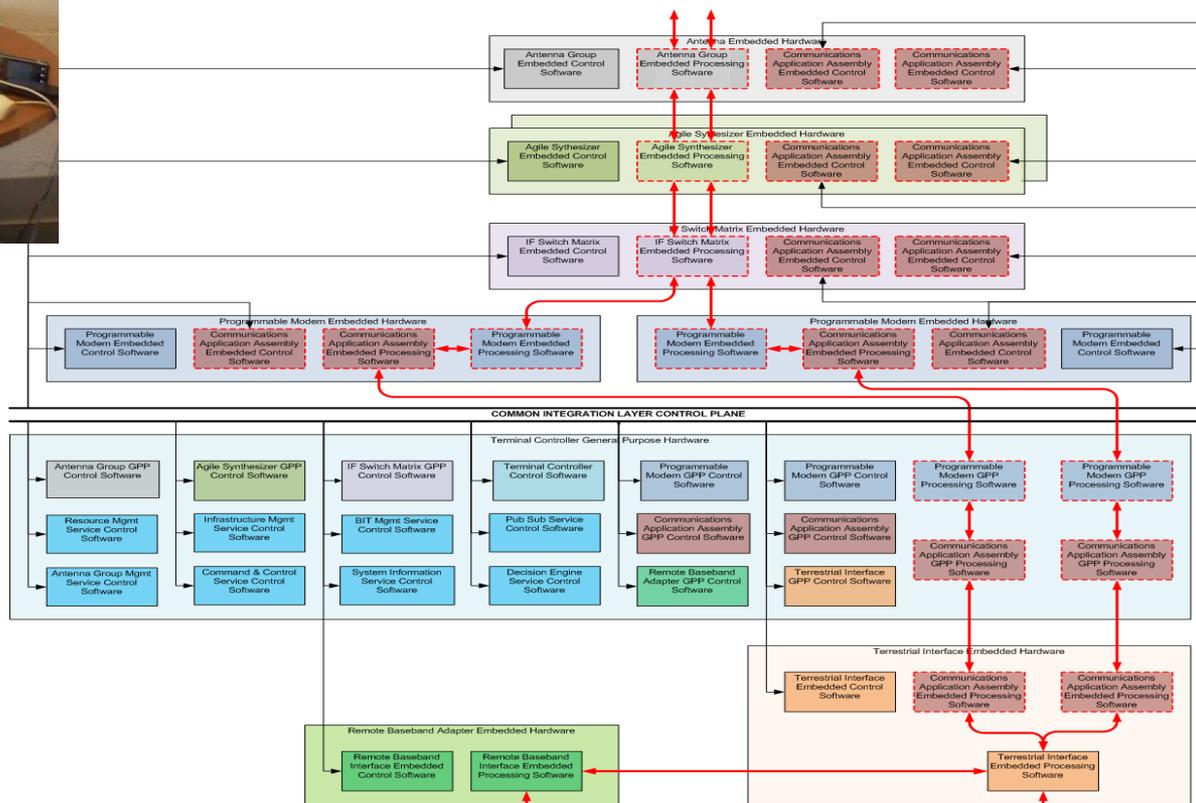


The screenshot shows the SharePoint interface for the GRA Reference Library. The breadcrumb path is: CERDEC S&TCD SEAMS Division > Systems Engineering Analysis Branch > GRA > GRA Reference Library. The page title is "GRA Reference Library" with a subtitle "Collection of GRA Standard, User Guide, Model, and Reference Implementation for Download". A table lists the following items:

Type	Name	Modified
Folder	GRA 3.0	3/25/2011 6:07 PM
Folder	GRA Model Rhapsody RPY	3/25/2011 7:22 PM
Folder	GRA Model Spectra EMX	4/8/2011 4:53 PM
Folder	GRA Reference Implementation ISO Image	4/8/2011 2:23 PM
Folder	GRA Reference Implementation Source	3/25/2011 8:40 PM
Folder	GRA User Guide	4/8/2011 4:53 PM



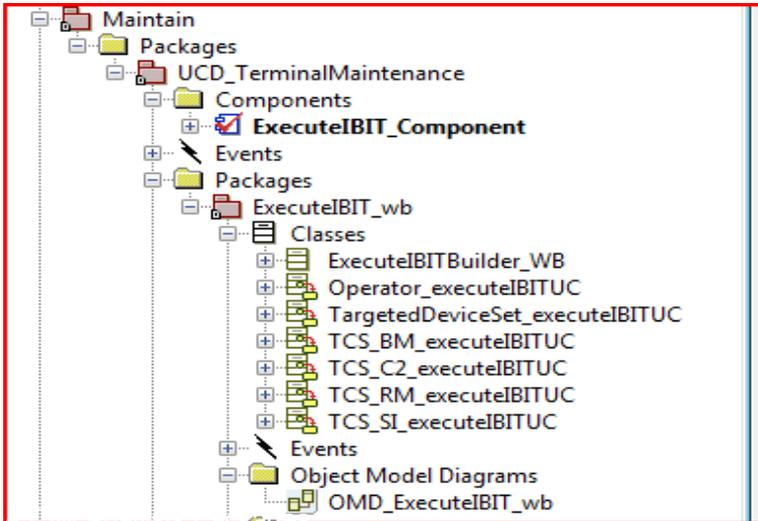
GRA Cognitive PIM ISO download is fully functioning GRA PIM Implementation that can be downloaded from GRA Sharepoint and lab tested by GRA CRADA Partners. Demonstrates the GRA Modular Software Interfaces in a functioning Radio Demonstration



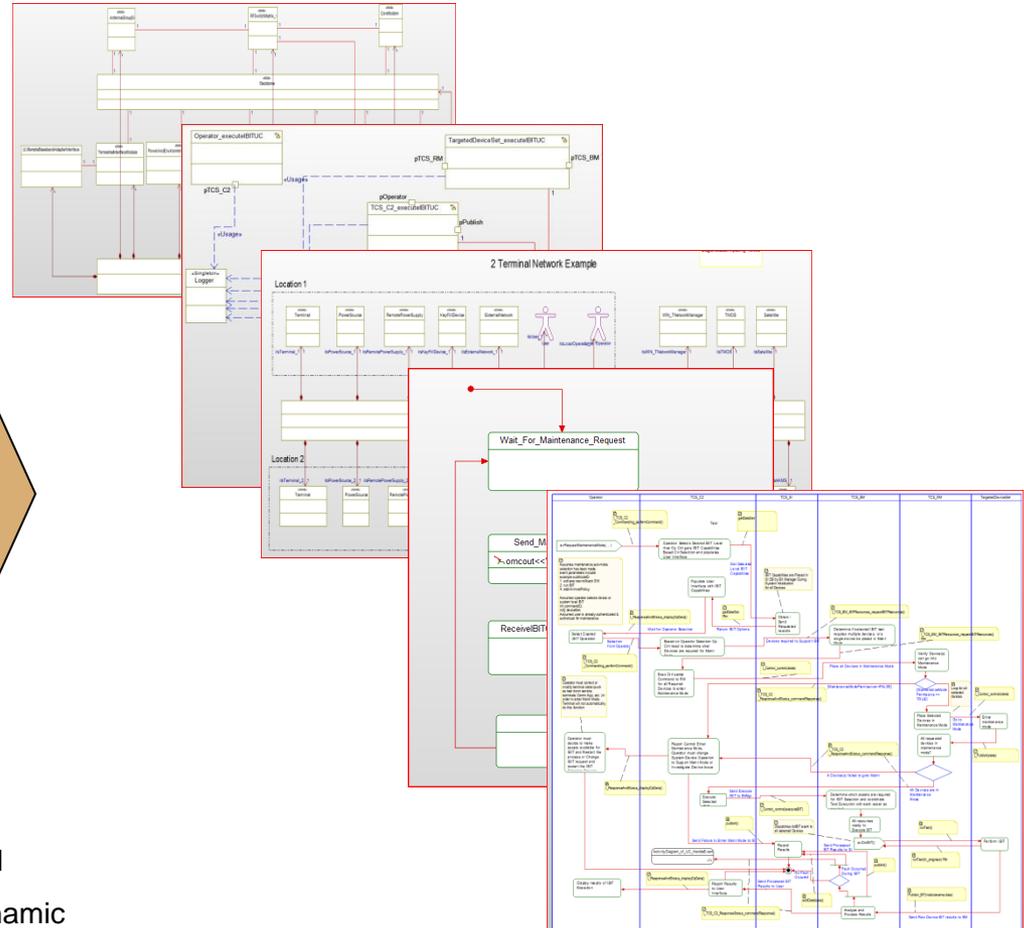
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Example CIM module model contents

– GRA CIM Maintain /Execute IBIT



- Contains:
 - Use Case
 - System Architecture Design Package
 - Object model diagram
 - Activity Diagram
 - Statechart
 - Sequence Diagram
 - Ports and Flows
- SysML Language Model can be compiled Run, tested
- Provides a detailed, graphically documented and dynamic Model of all SubSystem Functionalities
 - Critical for Software Reuse and Portability



**MILCOM PROVIDES
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Collaboration
30 Papers Published
GRA dedicated MILCOM
Sessions
GRA Hardware Demo Booth
2010 / 2011**



Published MILCOM 2007
ALL DIGITAL RF SATCOM TRANSCEIVER PROVIDES THE MODULAR
OPEN SYSTEMS ARCHITECTURE REQUIRED TO MEET HC3 GRA
Wes Littlefield, Dr. Oleg Mukhanov , Dick Hitt (Hypres), Thomas Rittenbach
CERDEC STCD

Published MILCOM 2007
High Capacity Communications Capability (HC3)
Government Reference Architecture (GRA):
Alternatives for Third Party A2G Waveform Porting
Thomas Rittenbach CERDEC, Kuan Collins SAIC/HC3

Published MILCOM 2008
AN EXCURSION TO DEFINE THE BOUNDARIES OF THE GOVERNMENT
REFERENCE ARCHITECTURE
Dr. Carl Dietrich Virginia Tech
Mindy Gavitt SED, U.S Army CERDEC
Hiroshi Satake Science Applications International Corporation
Sagor Hoque S&TCD, U.S Army CERDEC
Tom Rittenbach S&TCD, U.S Army CERDEC

Published MILCOM 2008
SOFTWARE DEVELOPMENT OF SATCOM TERMINALS
Piya Bhaskar, Jianxin Zhao, Lockheed Martin
Tom Rittenbach CIV USA AMC Fort Monmouth, NJ
Published MILCOM 2008

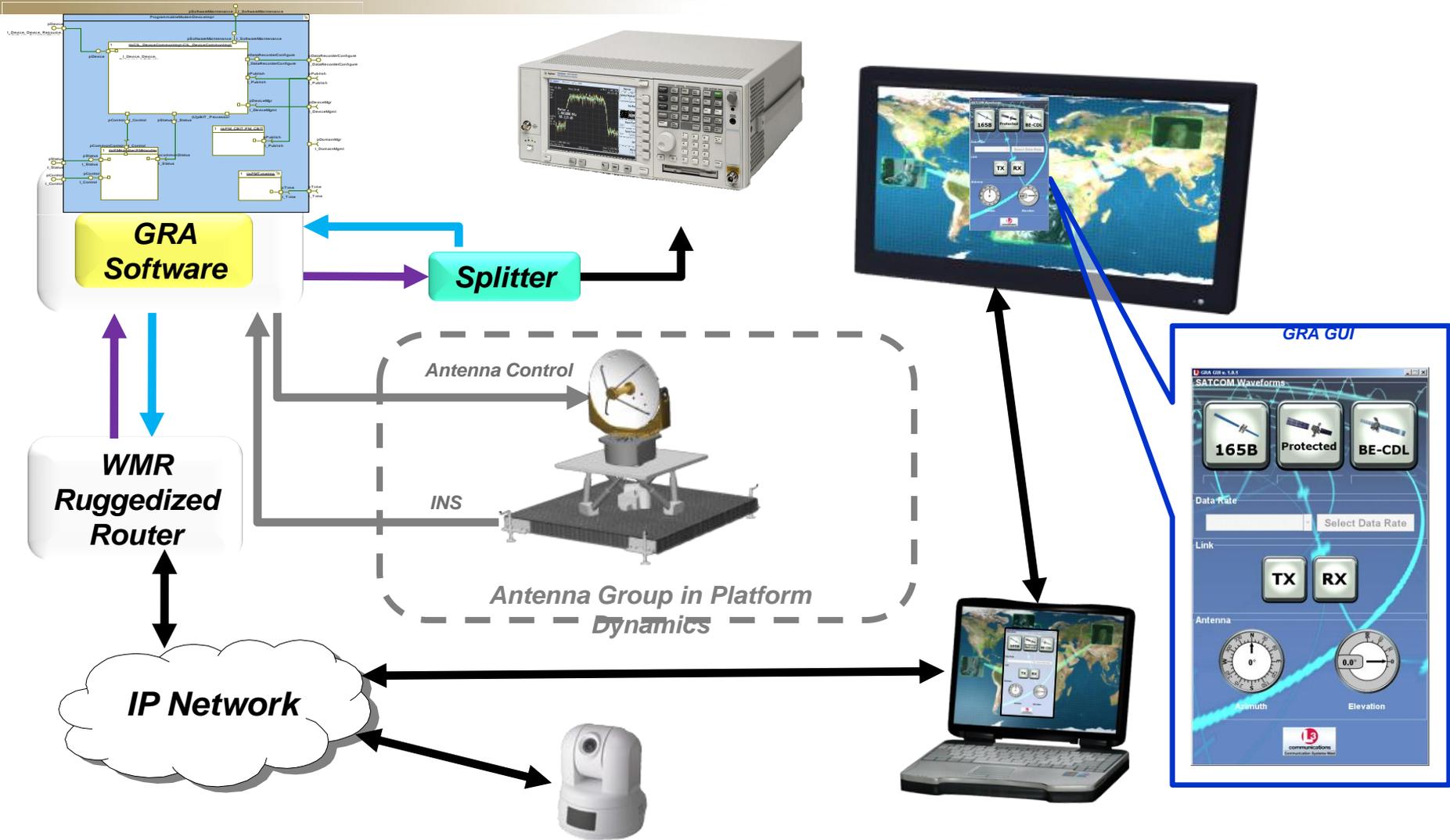
High Bandwidth High Throughput (HBHT) Government Reference Architecture
(GRA) Open Source Management and Compliance
Thomas Rittenbach CERDEC

Published MILCOM 2008
APPLICATION OF THE GRA TO DATA LINKS
Tom Rittenbach CERDEC
Dan Hampel Booz Allen Hamilton
Published MILCOM 2009
DODAF ANALYSIS OF THE HIGH BANDWIDTH HIGH THROUGHPUT
GOVERNMENT REFERENCE ARCHITECTURE MODEL DRIVEN
DEVELOPMENT
Rick Paroline BAH
Tom Rittenbach CERDEC
Mike Monteleone CERDEC

Published MILCOM 2009
HBHT GRA Validation
Tom Rittenbach CERDEC
Kuan H. Collins SAIC
Frank Waldman

Published MILCOM 2009
OSSIE-based GRA Testbed
Eric Redding Harris
Tom Rittenbach CERDEC,
Hiroshi Satake SAIC
Dr. Carl Dietrich Virginia Tech

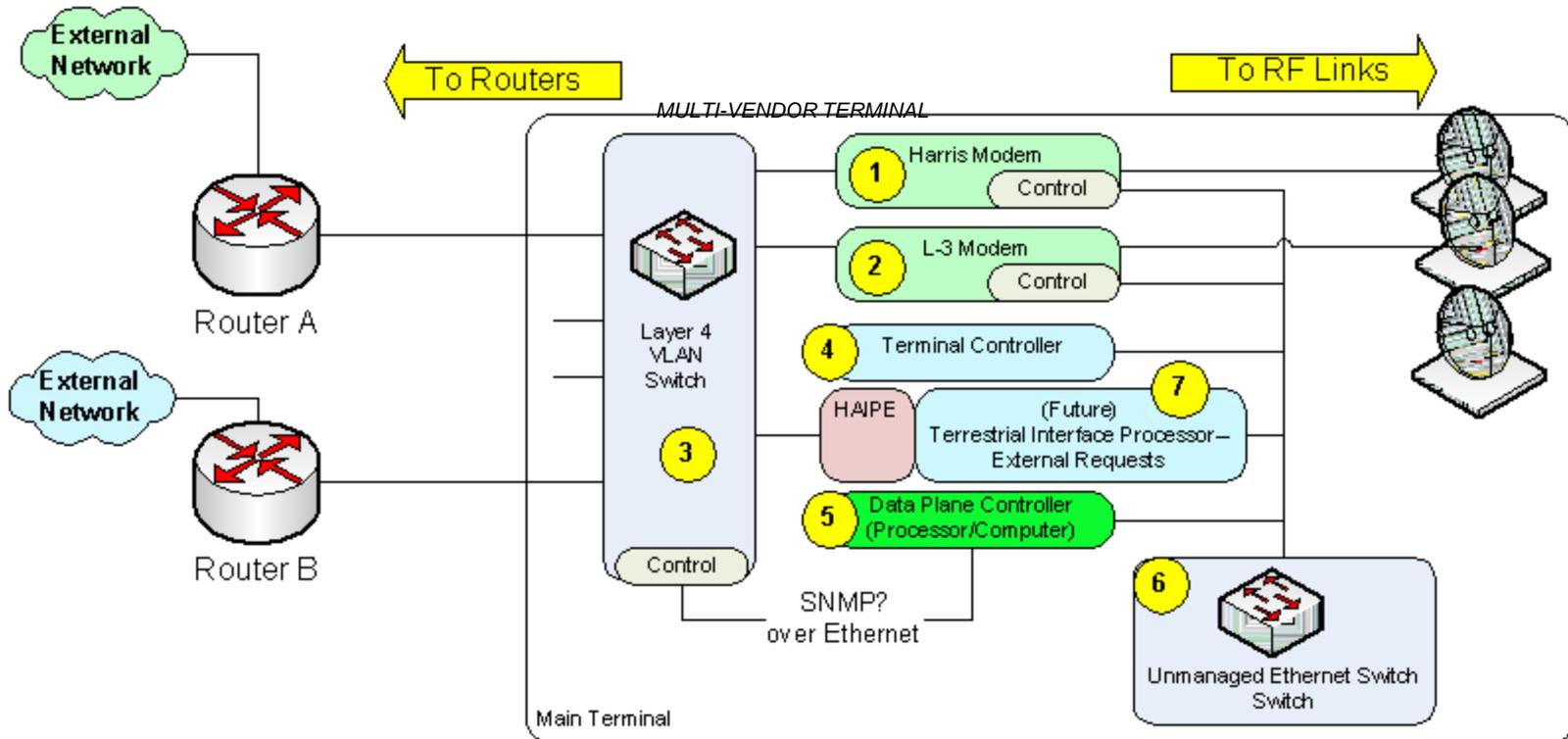
Published MILCOM 2010
3 Papers
Published MILCOM 2011, 2 Papers



GRA 2012 MILCOM Demo (STCD Net Mining Funded)

MULTI-VENDOR TERMINAL

- DATAPLANE DEMO DIRECTLY APPLICABLE TO ISRNET
- RF/Modems from *Rockwell, Harris, L-3* under Vendor Independent GRA Control of VLAN Traffic Switch
- REFERENCE DRAFT MILCOM 2011 PAPER



Network Agnostic Architecture

The GRA Manages Multiple Waveforms / Connections / Routers

Multiple Networks

Sensor Network

Platform Network

Terminal Controller

Control Plane Switch

Data Plane Control

Data Plane Switch

Modem Control

Multiple Vendors / Modems

Multiple Waveforms

Multiple Ground Networks

Multiple Endpoints



thomas.j.rittenbach.civ@mail.mil

Questions?