CERDEC GRA Initiatives

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
thomas.j.rittenbach.civ@mail.mil

- "Distribution A – Unlimited Public Release"

CERDEC GRA Discussion Agenda

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*

High Bandwidth High Throughput (HBHT)
Government Reference Architecture (GRA)
for
Above 2 GHz (A2G) Satellite Communications Terminals
1 August 2009
Draft Version 2.9.01 (toward HBHT GRA Version 3.0)
Prepared by
Product Manager Multichannel Satellite Terminals (PdM MST)
Program Manager, Warfighter Information Network-Tactical (PM WIN-T)
Program Executive Office, Command Control Communications Tactical (PEO C3T)
Ft Monmouth, New Jersey 07703
HBHT GRA
DRAFT

GRA 3.0

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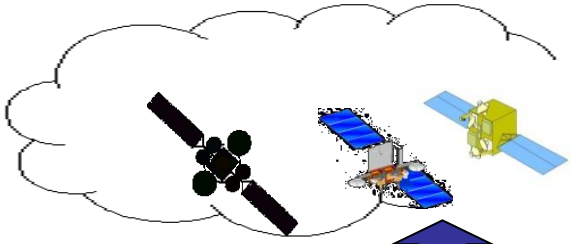
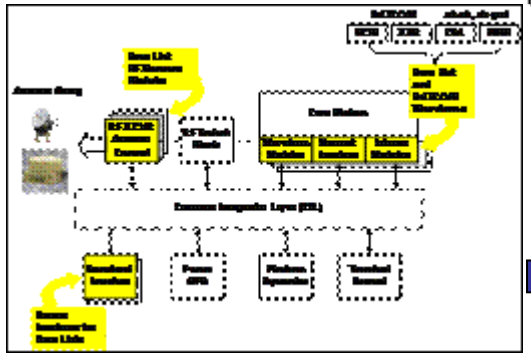
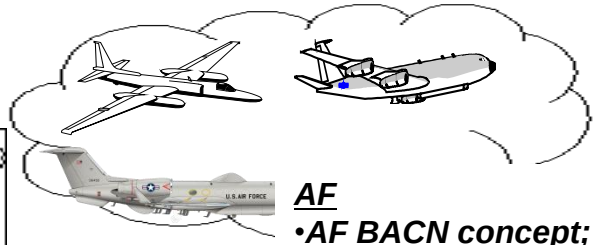
- Use of Open GRA standards in multiple programs (within a service or across services)
- Allow companies to offer modules outside their traditional markets & customer base
- Companies that are typically Army suppliers can effectively compete on Navy Programs)
- Larger volumes (across multiple programs)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





GRA Airborne Networking Terminal



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

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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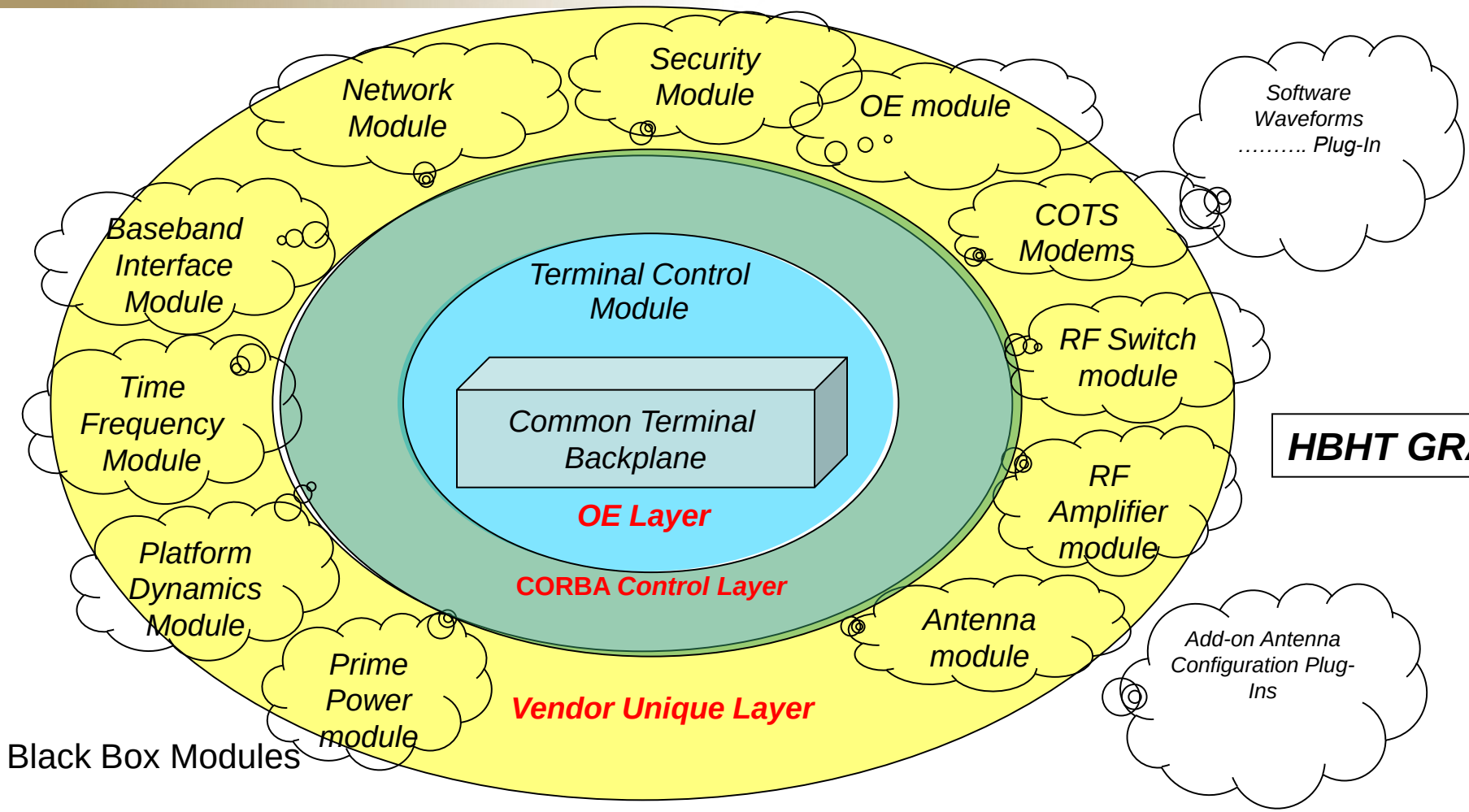
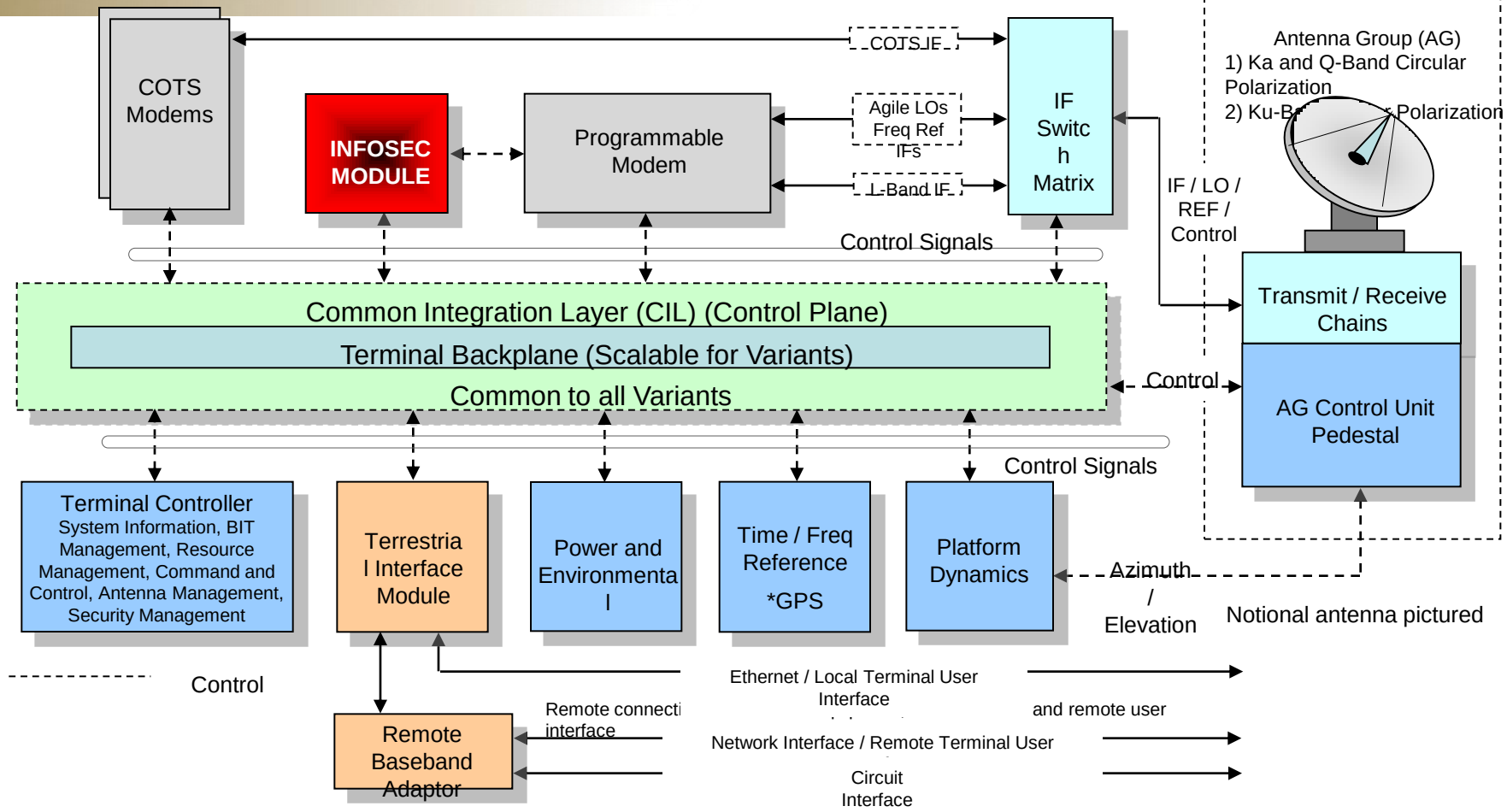
GRA Intellectual Property Architecture



HBHT GRA

- *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*

GRA Architecture



- *GRA Dual Gigabit Ethernet Back Plane*
- *Separate "Control" and "Data" Planes*
- *Functional Decomposition*

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"Distribution Statement A.
Approved for public release, distribution unlimited."

"Distribution A – Unlimited Public Release"

GRA Module Definitions: PIM UML Module

PIM Structure Diagram

for each Device, Service, Application, Adapter Module

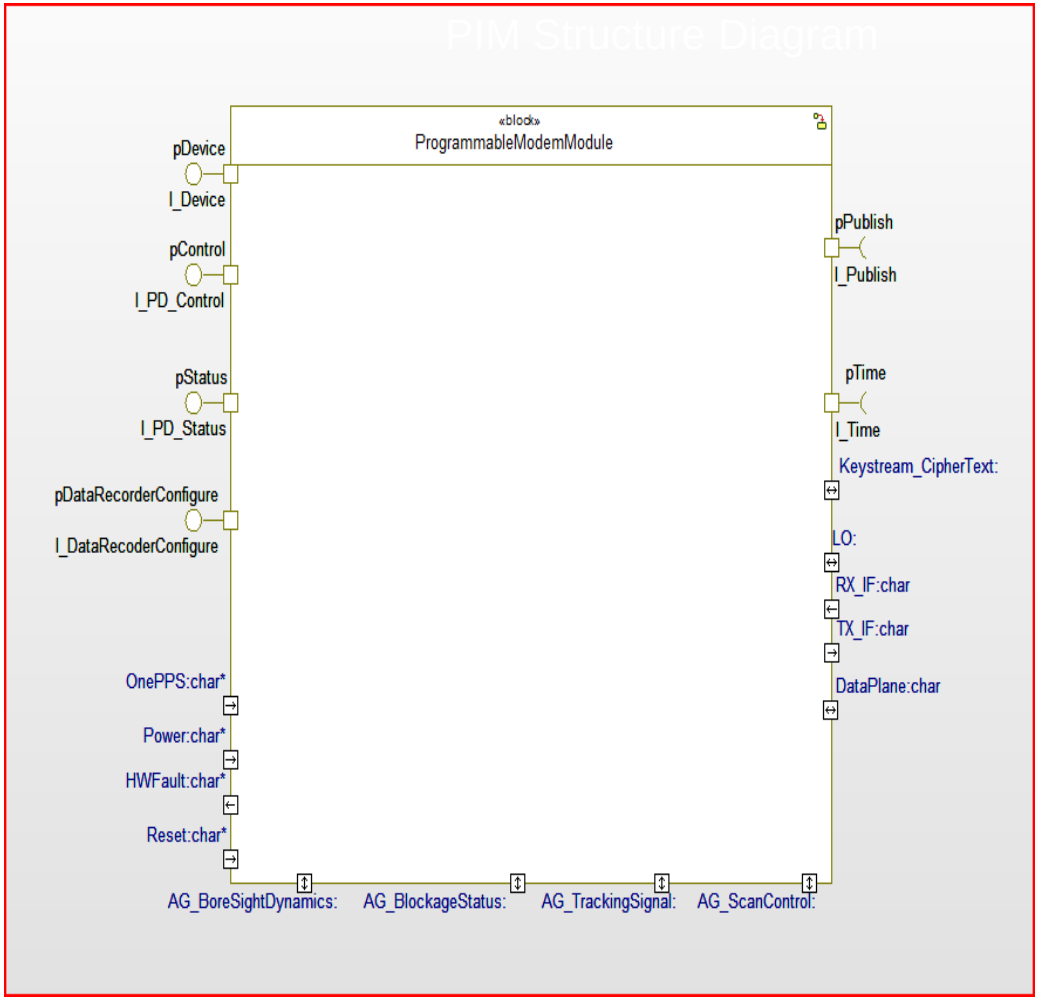
PIM defines *Provides* and *Requires (I/O)*

for each module type

Defines Protocol for each port

PIM written in UML

PIM derived from CIM



CERDEC GRA Initiatives

L3 communications

HARRIS

Rockwell Collins

LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Raytheon

CERDEC
US ARMY – RDECOM

SAIC
From Science to Solutions

VirginiaTech
Invent the Future

SPACE COAST
COMMUNICATION SYSTEMS

GENERAL DYNAMICS
C4 Systems

NORTHROP GRUMMAN

LOCKHEED MARTIN

PRISMTECH

Innovative Integration
a subsidiary of ISI
... real time solutions!

DataSoft

ITT

Green Hills SOFTWARE

Ellus Research

• The GRA Consortium

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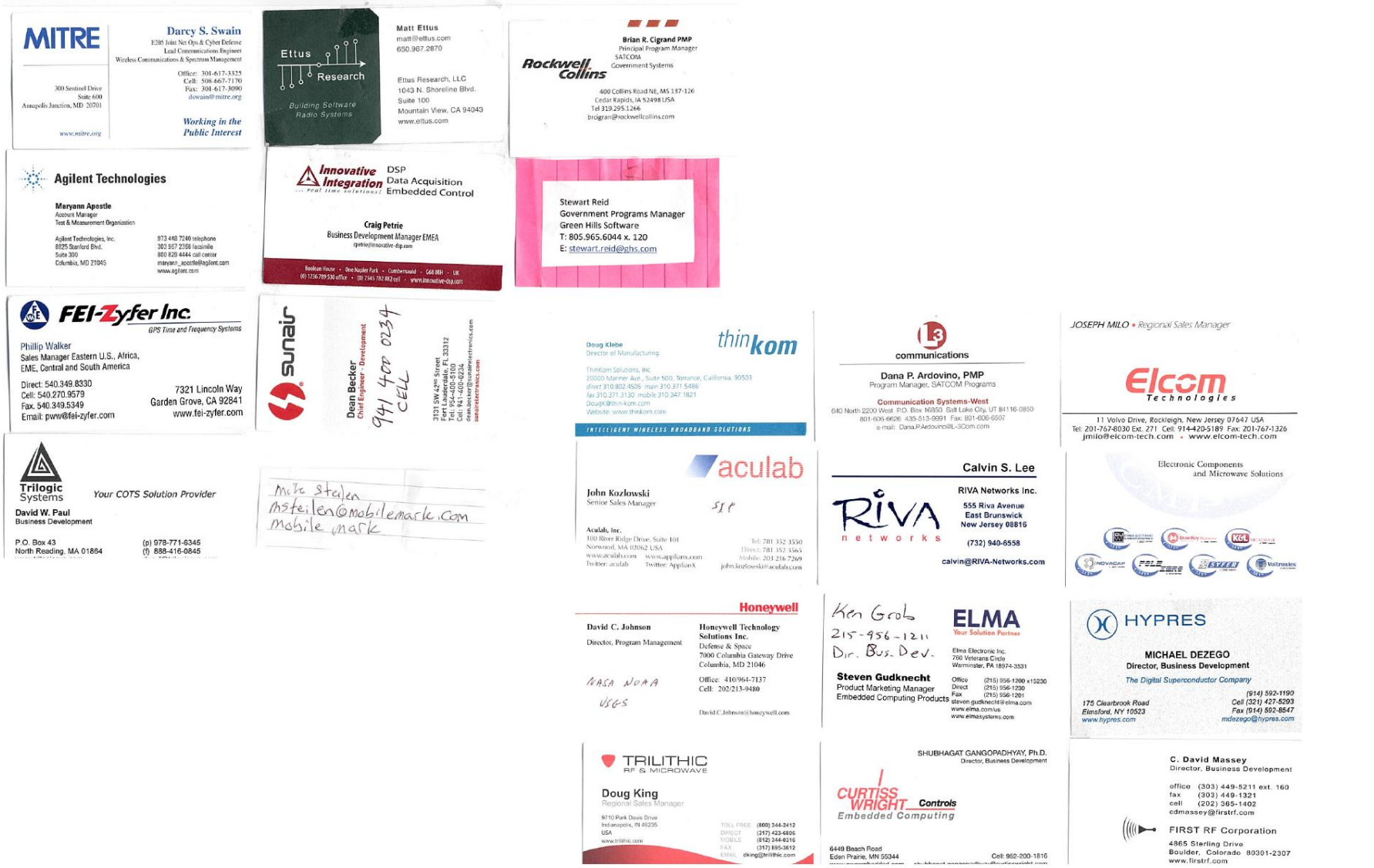
GRA CRADA

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			
CTC - Canada	SDR Forum			
Indiana Purdue Fort Wayne Univ	SDR Forum			
L3 Corp	GRA Developer			

GRA CRADA is unique Legal Framework that provides legally binding definition of Intellectual Property Ownership.

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.

GRA CRADA New Companies MILCOM 2011



GRA SharePoint Site Collaboration Libraries

- *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*

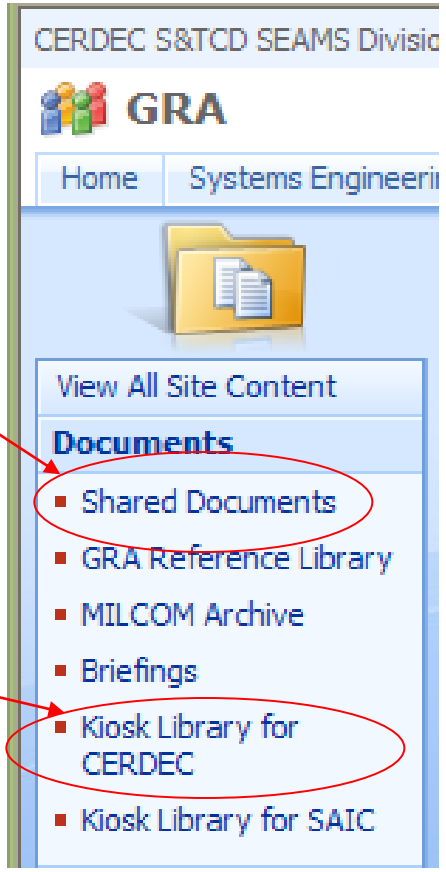
  for past MILCOM papers

- *3) Briefings*

  for background PowerPoint briefings of general interest.

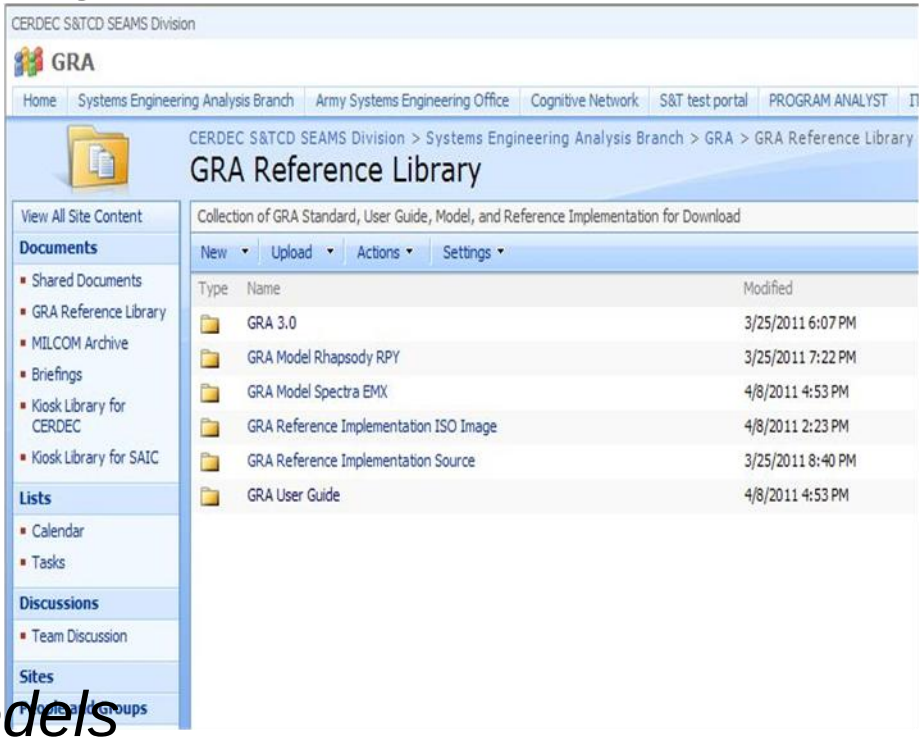
- *Kiosk Libraries are set up for Private Document Libraries for each CRADA partner*

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



GRA SharePoint Site
GRA Document Libraries

- *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*



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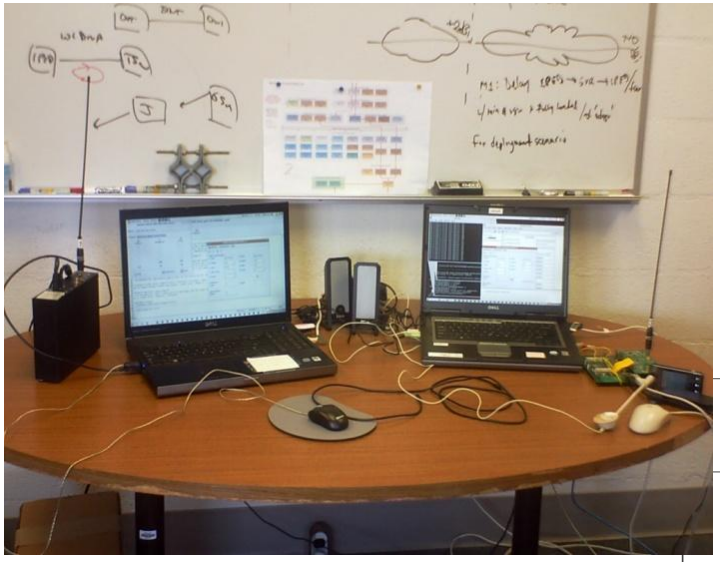
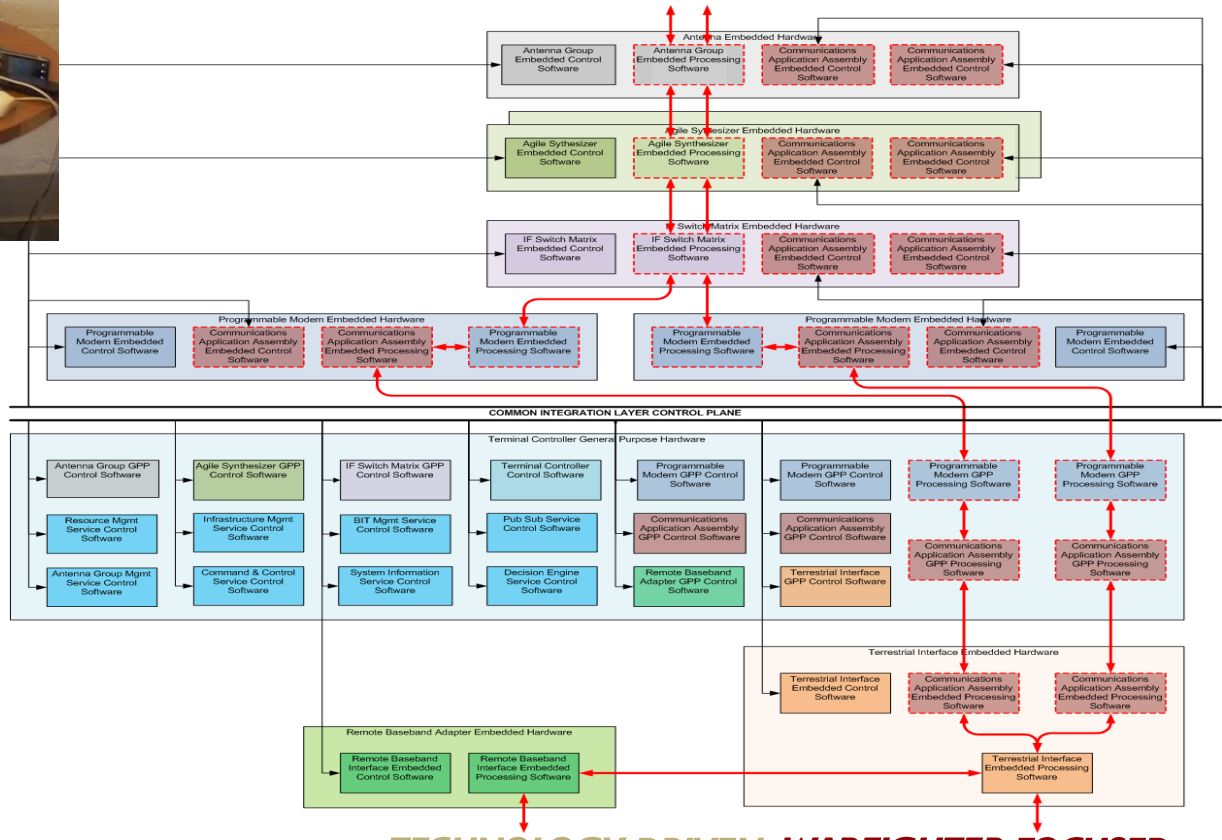
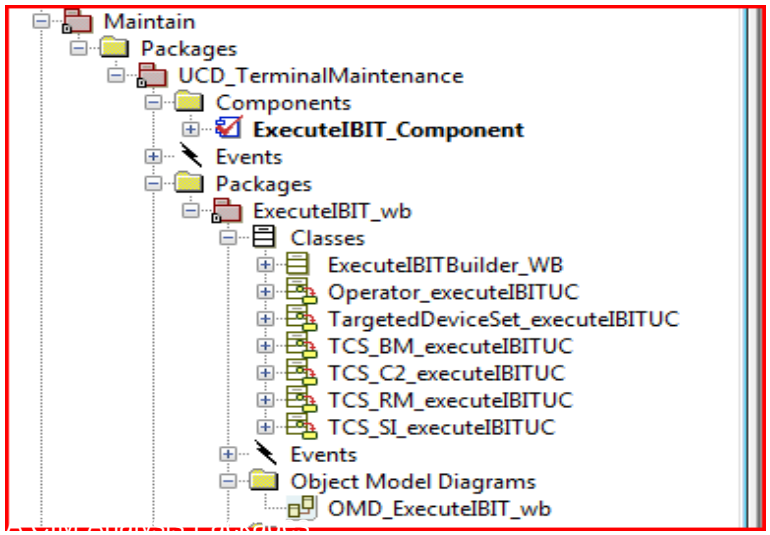
GRA SharePoint Site
GRA Cognitive Radio
Live DEMO



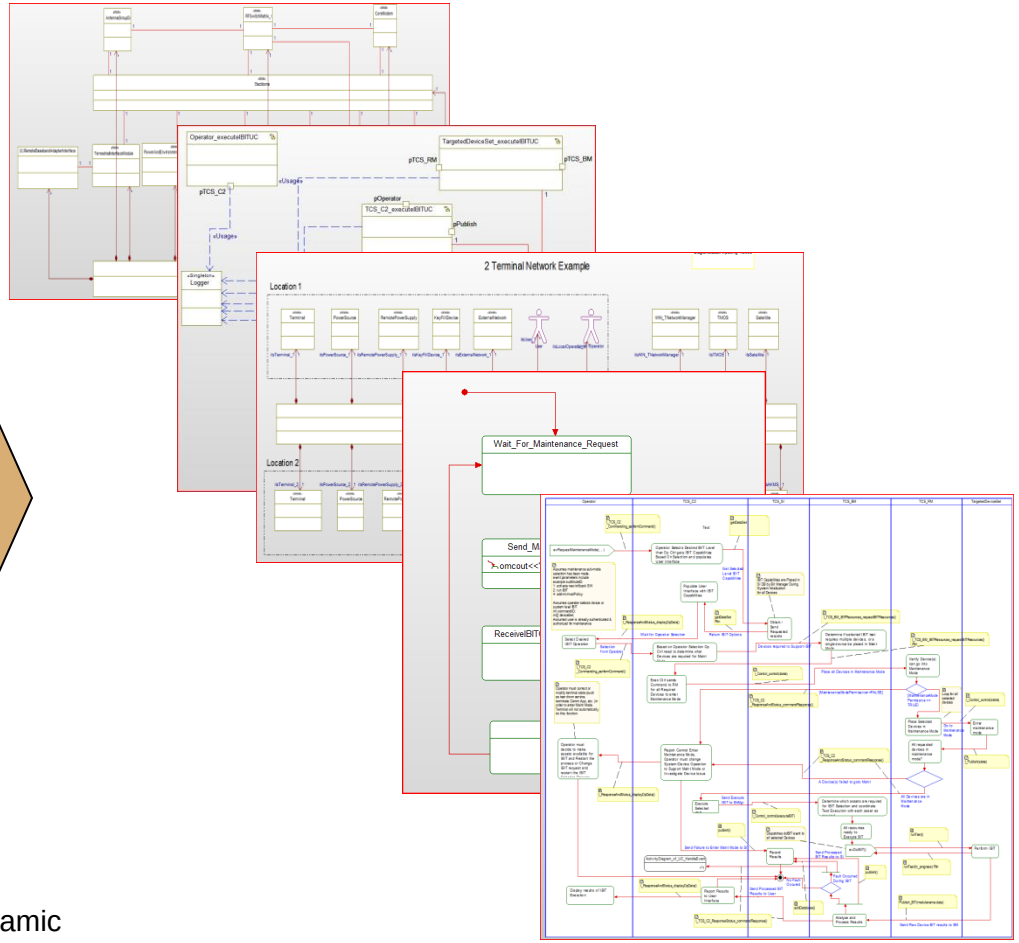
GRA Cognitive PIM ISO download is fully functioning GRA PIM Implementation that can be downloaded from GRA Sharepoint and lab tested by GRA CRADA Partners. Demonstrates the GRA Modular Software Interfaces in a functioning Radio Demonstration





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

GRA SharePoint Site
Published MILCOM GRA Papers
MILCOM 07,08,09,10,11

MILCOM PROVIDES FORUM For CERDEC - INDUSTRY 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

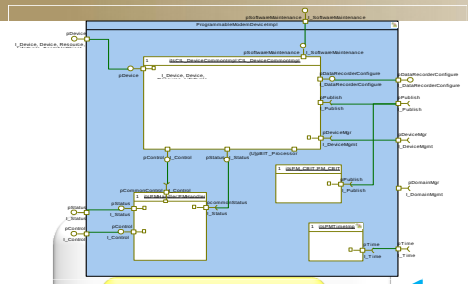
Published MILCOM 2009
OSSIE-based GRA Testbed
Eric Redding Harris
Tom Rittenbach CERDEC,
Hiroshi Satake SAIC
Dr. Carl Dietrich Virginia Tech

Published MILCOM 20010
3 Papers
Published MILCOM 2011, 2 Papers

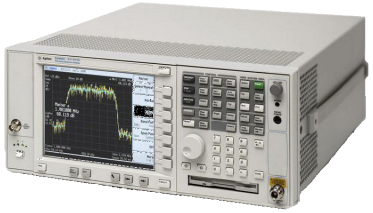
2010 L3 GRA MILCOM Live Demo

RDECOM

CERDEC US ARMY – RDECOM



GRA Software

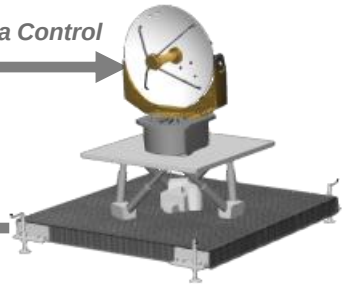


Splitter

GRA GUI

Antenna Control

INS



Antenna Group in Platform Dynamics

WMR Ruggedized Router

IP Network

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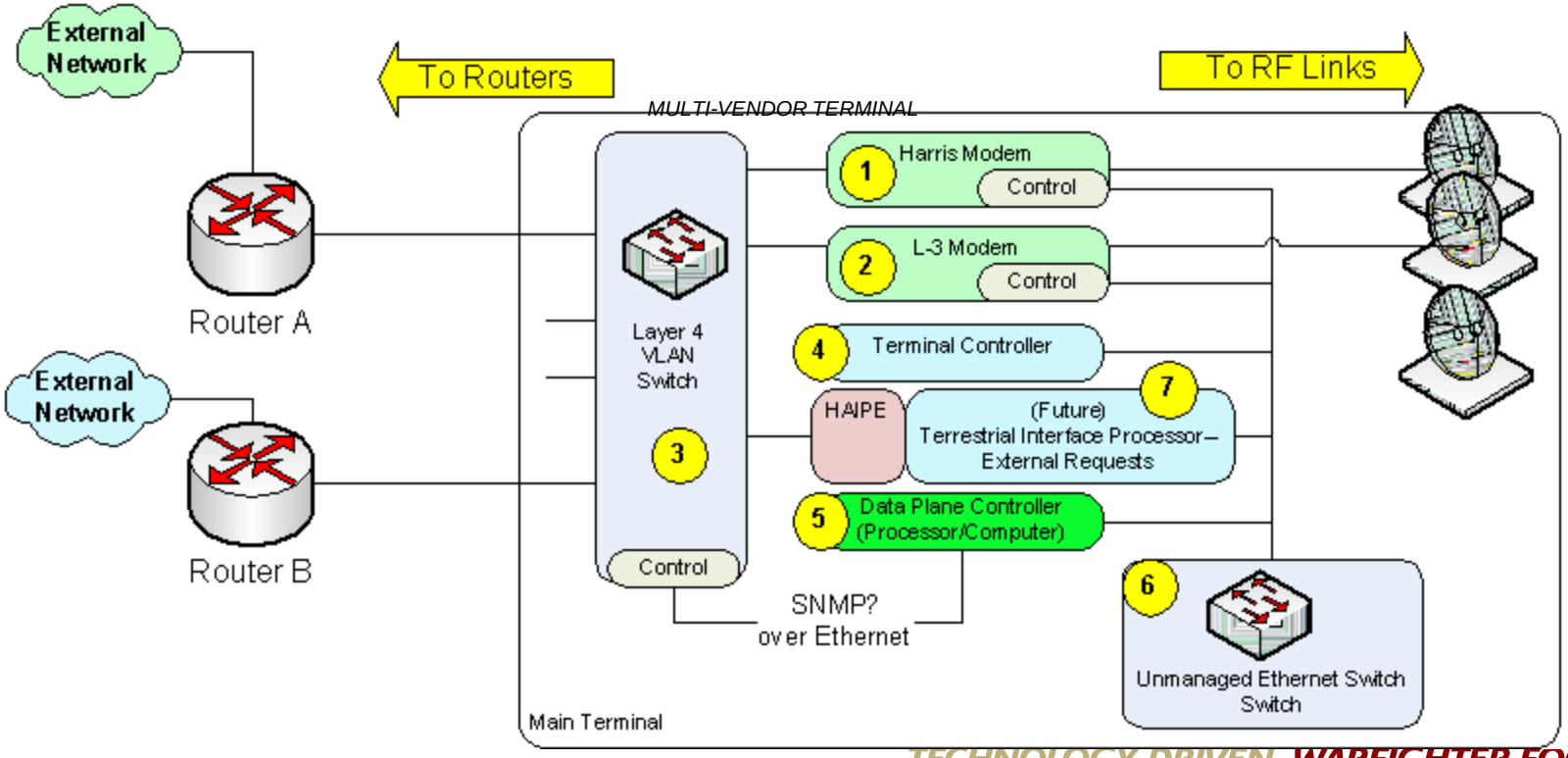
GRA 2012 MILCOM Demo (STCD Net Mining Funded) MULTI-VENDOR TERMINAL

- *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*



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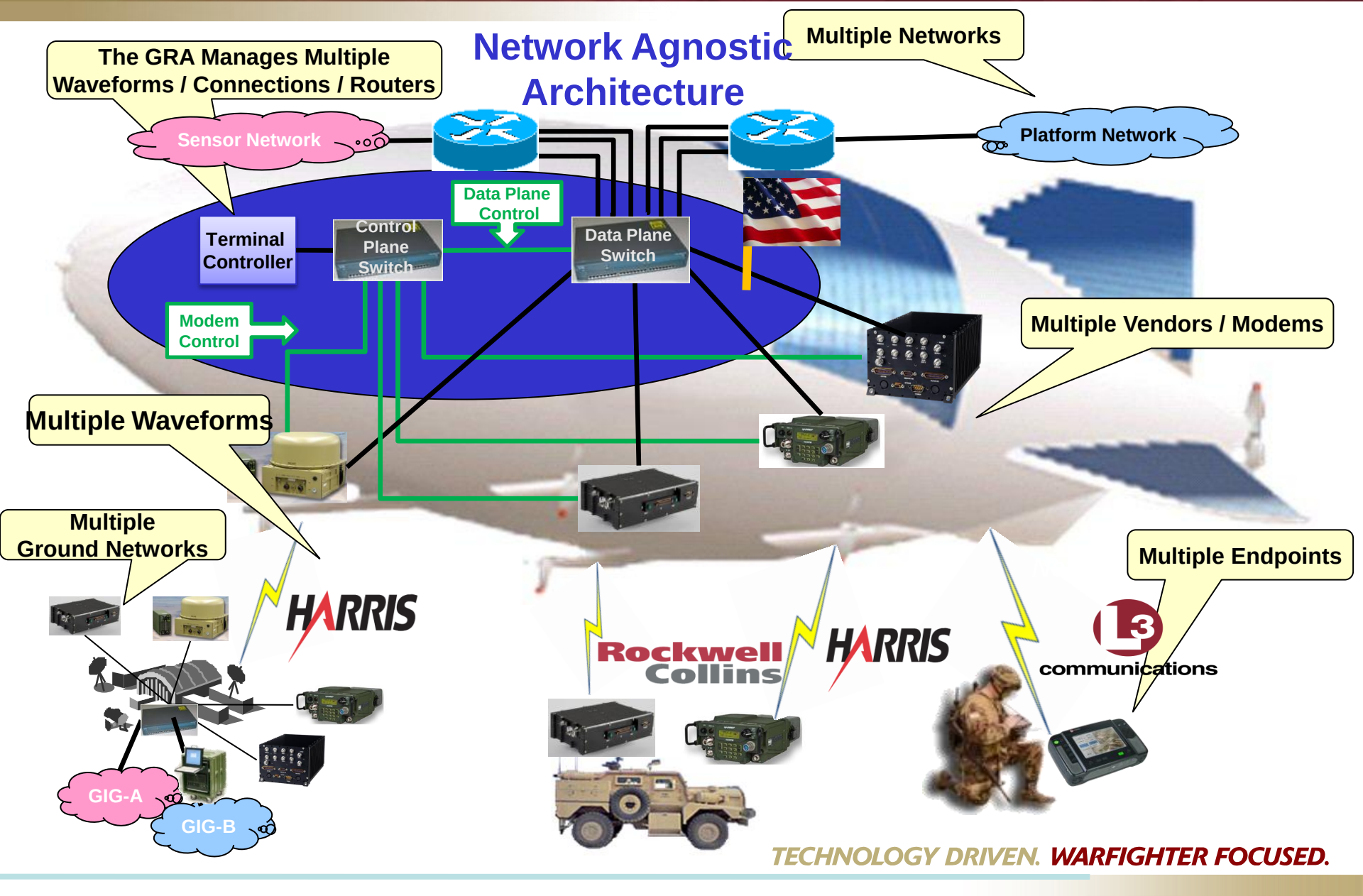
GRA Evolution and path forward
GRA ISRNET Open Architecture Concept
(Proposed GRA Advanced Proof of Concept demonstrator)

RDECOM

CERDEC US ARMY – RDECOM



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Questions?