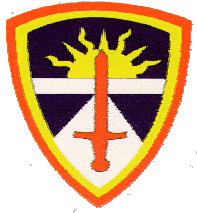




Transformation of Army Test and Evaluation

Army Views on T&E/SE Interactions

C. David Brown, PhD
Director, Test and Technology
17 August 2004



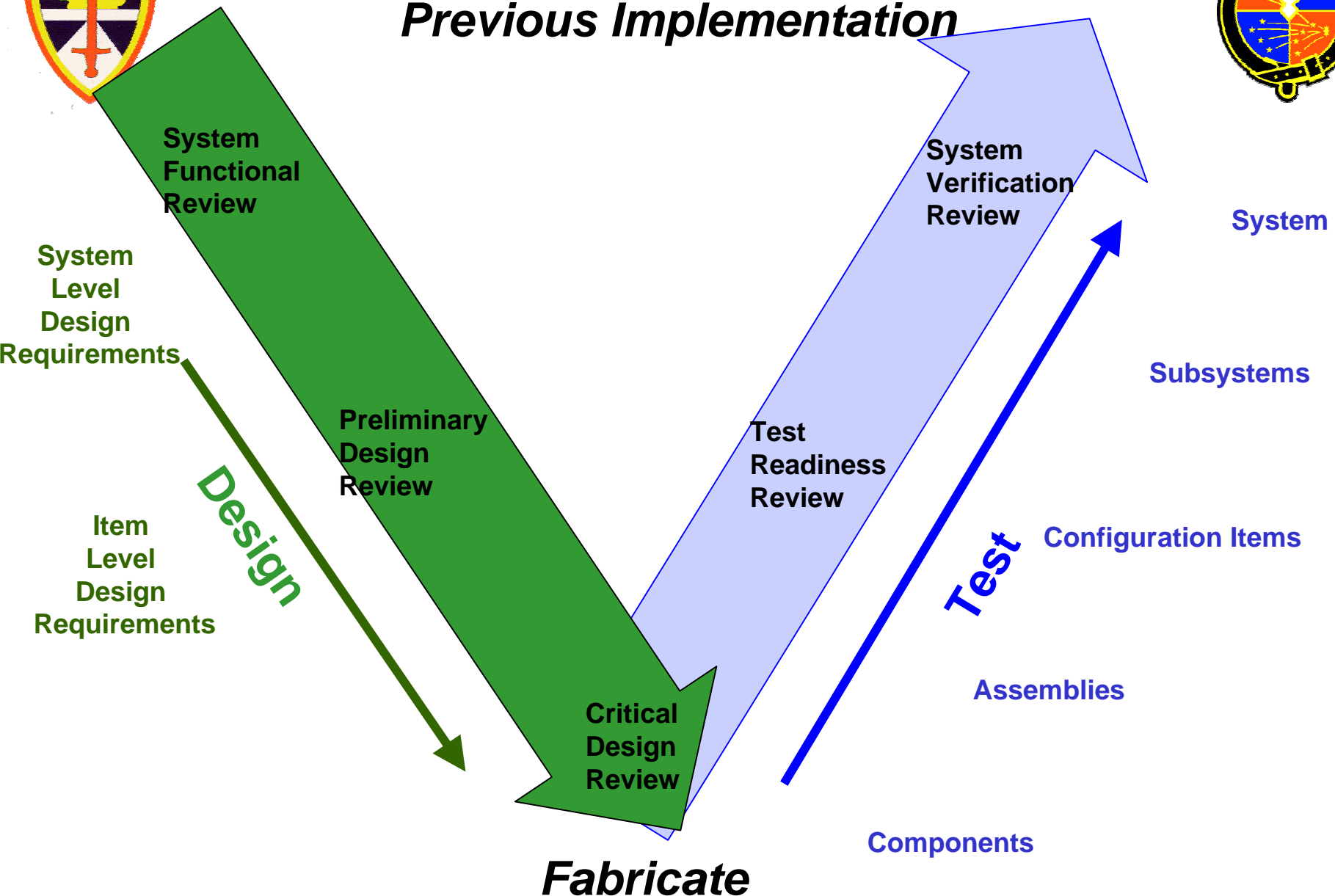
Outline



- Systems Engineering and Verification
- Future Combat Systems (FCS) Overview
- FCS “V Chart” w/ Tools Links
 - ◆ Combined Test Organization
 - ◆ SoSIL
 - ◆ Distributive Test Capability
 - ◆ Synthetic Test Capability
 - ◆ Built-in Test (BIT) and Training
- Highlights



Systems Engineering and Verification Previous Implementation



Developmental Test Command



FCS Combat Systems Increment 1



■ Manned Systems

■ Unmanned Air Platforms

1,530

735

Class I
810

Spiral Forward
Class II
540

Spiral Forward
Class III
180

Class IV
450

Infantry Combat Vehicle

Command and Control Vehicle

900

450

• Unmanned Payloads

• Unattended Munitions

Mounted Combat System

Recon and Surveillance



• Unattended Ground Sensors

• NLOS LS - 900
• Intelligent Munitions

270

360

■ Unmanned Ground Vehicles

Non-Line of Sight Cannon

Non-Line of Sight Mortar



Spiral Forward

1,215
Small Manpackable UGV

150

435

Armed Robotic Vehicle
ARV R - 405
ARV A - 270

10 Ton HEMMT Wrecker

FCS Maintenance and Recovery Vehicle

Medical Treatment and Evacuation

Mule - 900
ARV-L - 270





Mission Need for Future Combat Systems

Validated 31 Oct 02 (AROC); 23 Jan 03 (JROC)



- **FCS Description:**

- ◆ *Comprised of a **Family of Systems***

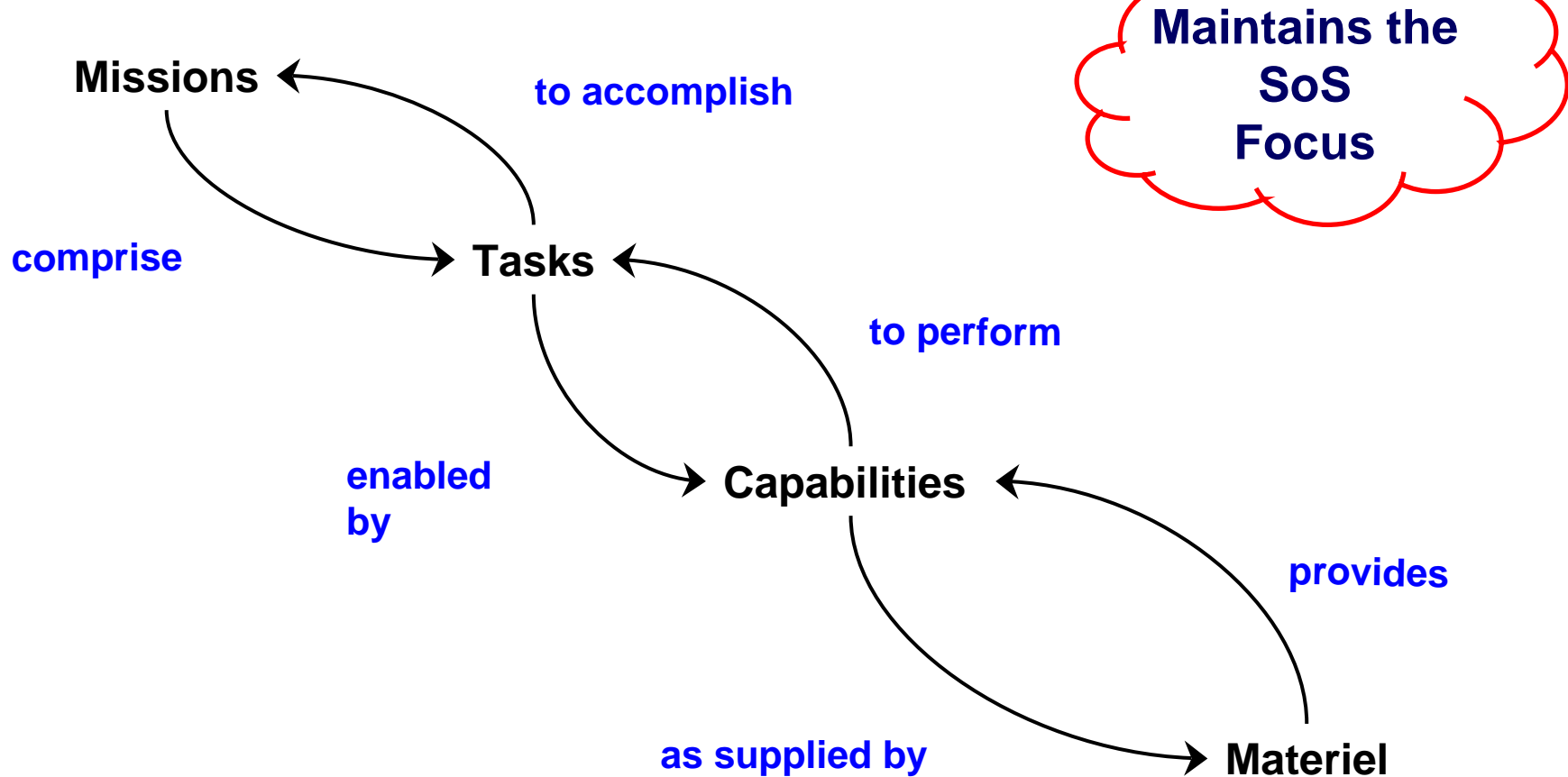
- Advanced, networked air- and ground-based maneuver, maneuver support, and sustainment systems
- Includes manned and unmanned platforms
- Networked via a C4ISR architecture

- ◆ *Will operate as a **System of Systems***

- Network existing systems, systems already under development, and new systems to be developed to meet the needs of the UA.
- Network will enable:
 - improved Information Surveillance Reconnaissance, enhanced analytical tools, joint exchange of blue and red force tracking down to the tactical level, real time sensor-shooter linkages, and increased synergy between echelons and within small units
 - the UA to connect to UE, joint capabilities, and national assets



Army FCS Transformation Mission to Capability Trace





Army FCS Transformation

Mission to Capability Trace

Missions

to accomplish

Answers the
"So What?"
Question

Operational Test

comprise

Tasks

to perform

ORD and AoAs

enabled
by

Capabilities

Developmental Test

provides

Aligns: Systems Eng,
Test, Evaluation,
Force Development,
Training

as supplied by

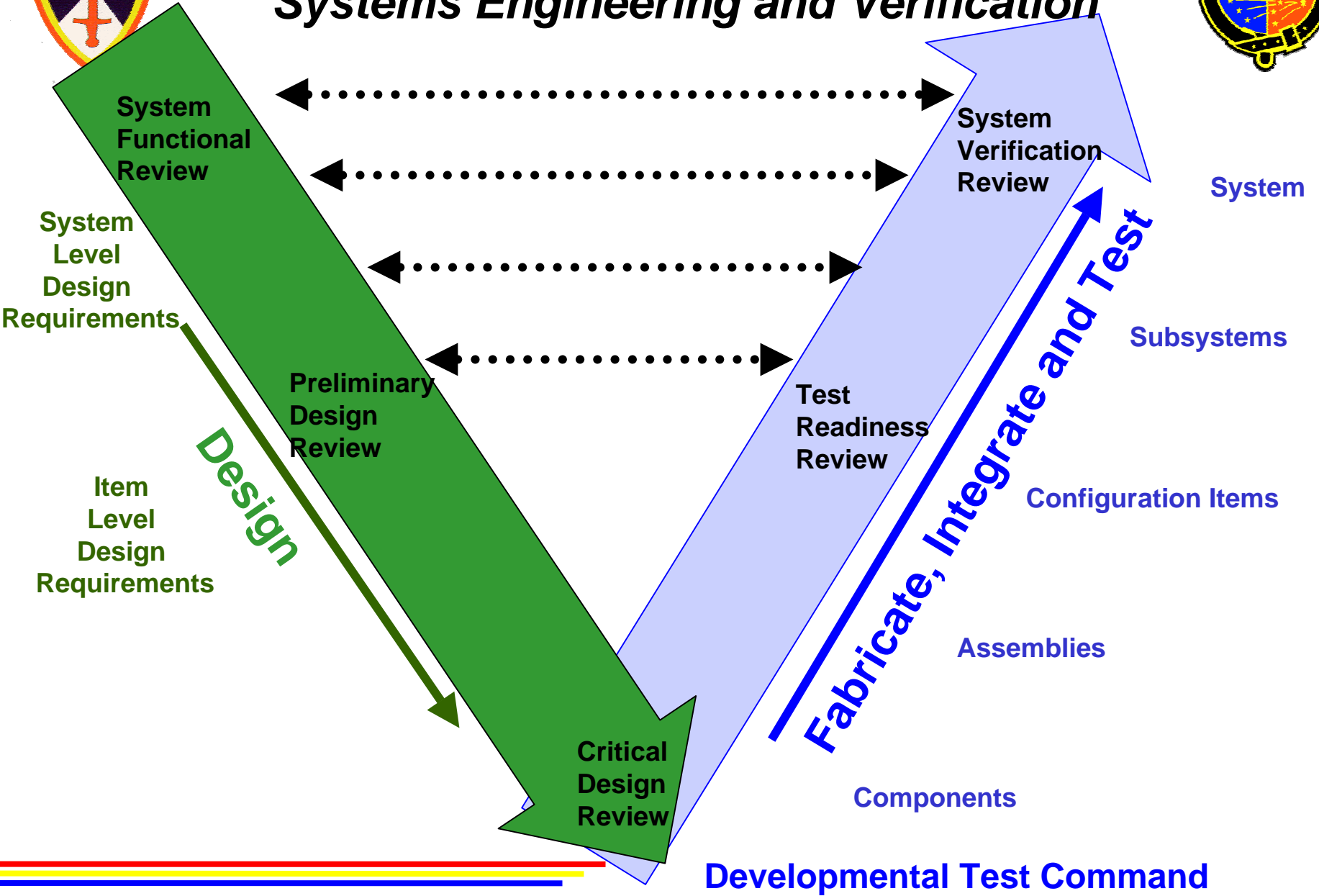
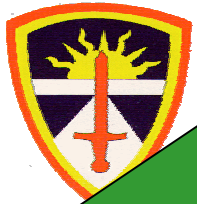
Materiel

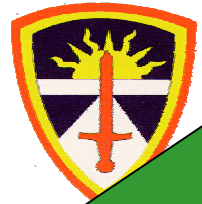
Systems Engineering
& Specifications

Developmental Test Command

* Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities

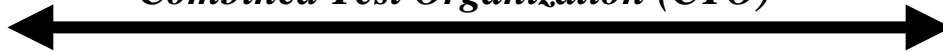
Systems Engineering and Verification





Systems Engineering and Verification

Combined Test Organization (CTO)



System
Functional
Review

System
Verification
Review

System

System
Level
Design
Requirements

Subsystems

Preliminary
Design
Review

Test
Readiness
Review

Configuration Items

Design

Item
Level
Design
Requirements

Assemblies

Critical
Design
Review

Components

Developmental Test Command





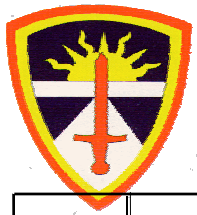
Combined Test Organization (CTO)



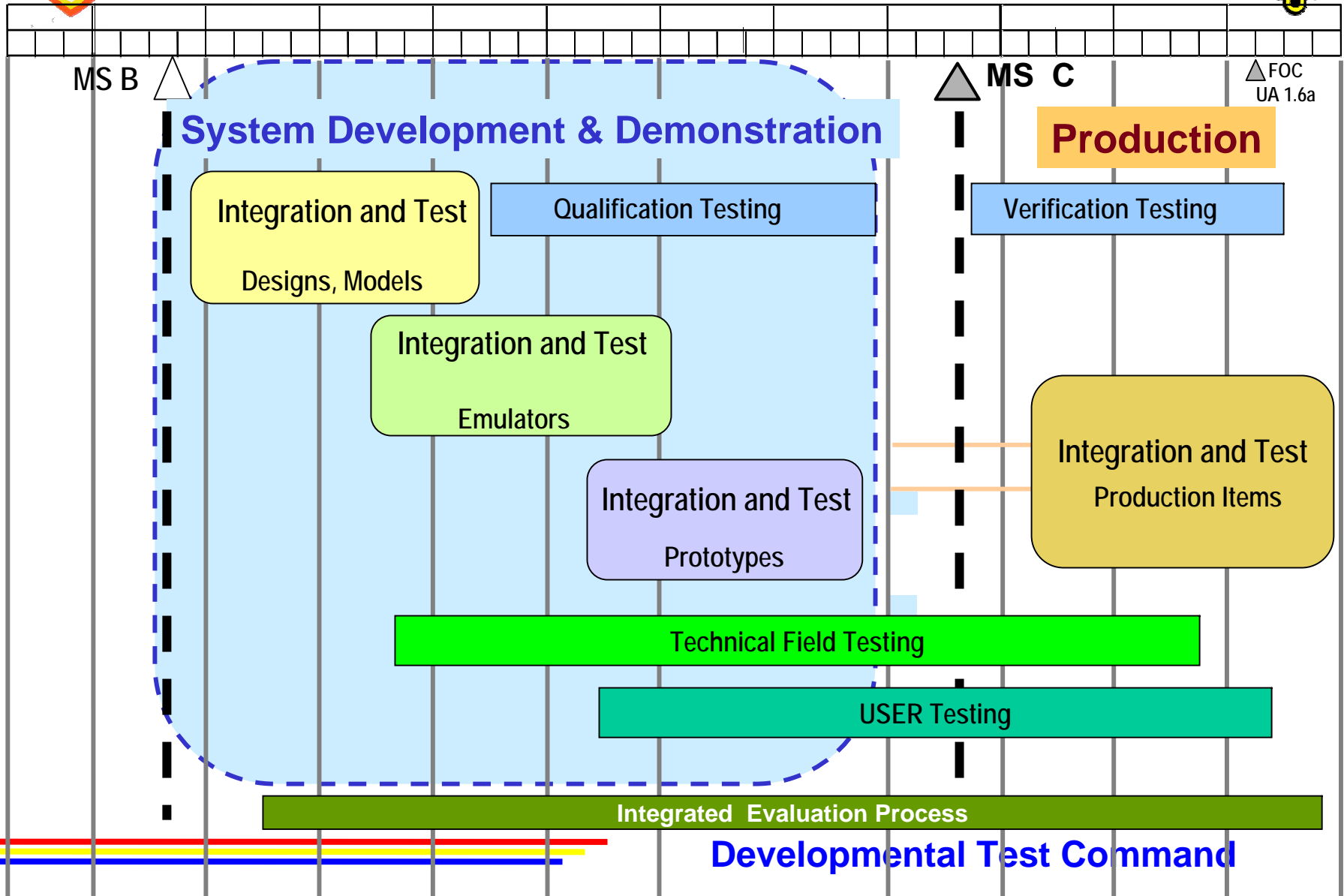
- **Equal Partnership – PMO / ATEC / LSI**
- **Supplants PMO Test Management and Augments ATEC and LSI Top Level Test Management**
- **Strives for Most Efficient Testing Through Integration, Combination, and Sharing**
- **PMO, ATEC, and LSI have Pledged Commitment and Support**

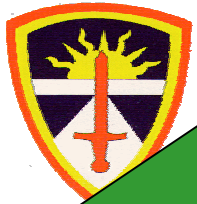
Plan Together, Test Once, Share the Data

Developmental Test Command



FCS Test & Evaluation Plan





Systems Engineering and Verification

Combined Test Organization (CTO)

Sys of Sys Int Lab (SoSIL)

System
Functional
Review

System
Verification
Review

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Review

Test
Readiness
Review

Configuration Items

Item
Level
Design
Requirements

Assemblies

Design

Fabricate, Integrate and Test

Components

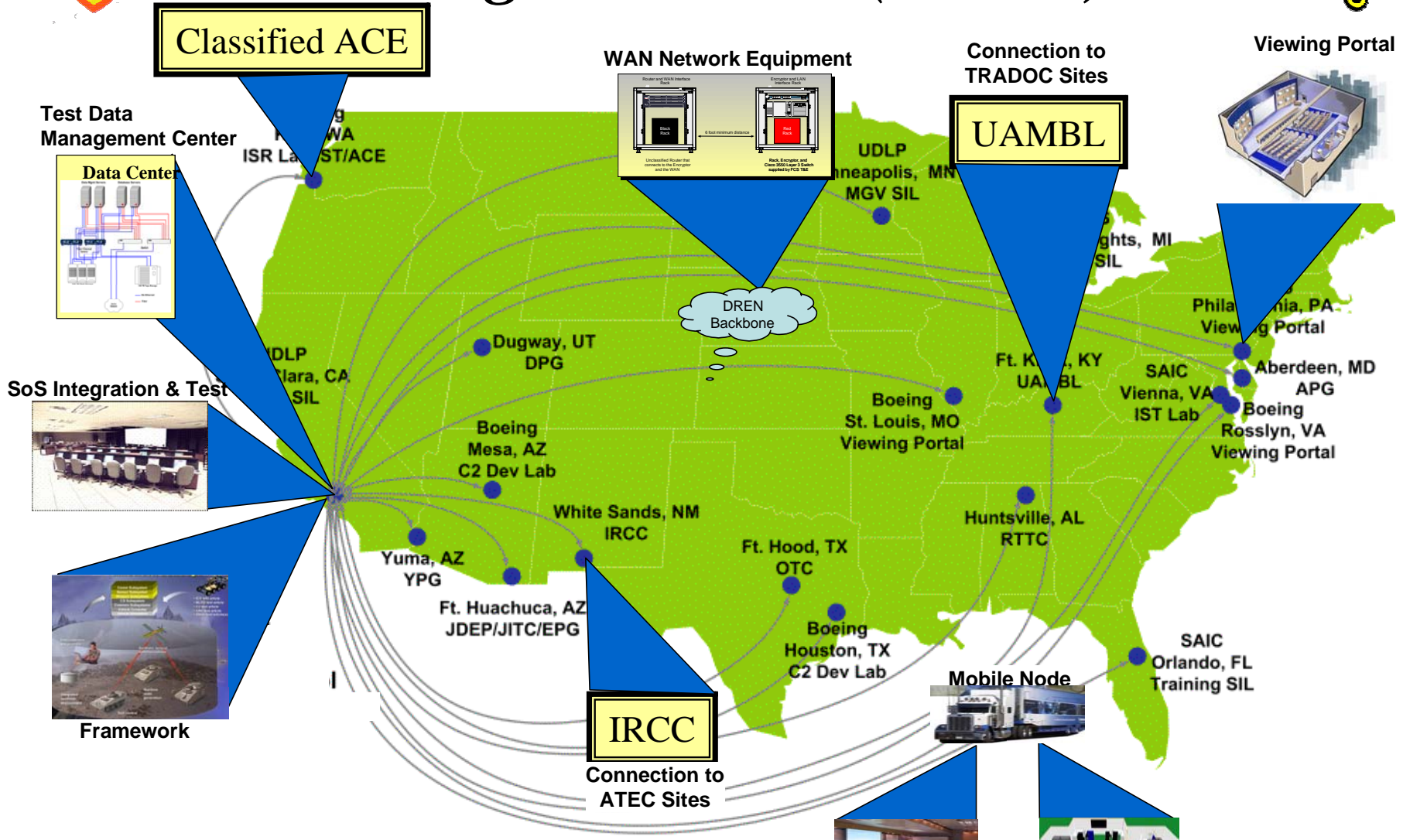
Critical
Design
Review

Developmental Test Command

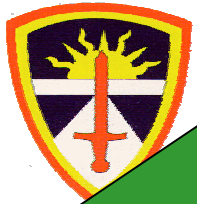




System of Systems Integration Lab (SoSIL)



Nationwide Distributed FCS Test Environment



Systems Engineering and Verification

Combined Test Organization (CTO)

Sys of Sys Int Lab (SoSIL)

Distributed Test Capability

System Functional Review

System Verification Review

System

System Level Design Requirements

Subsystems

Preliminary Design Review

Test Readiness Review

Configuration Items

Item Level Design Requirements

Assemblies

Design

Critical Design Review

Components

Fabricate, Integrate and Test

Developmental Test Command

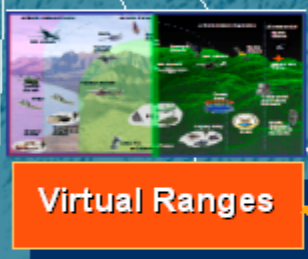
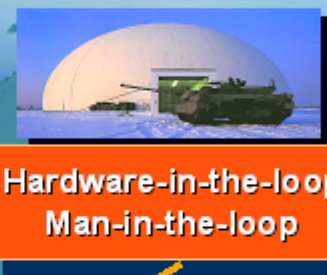
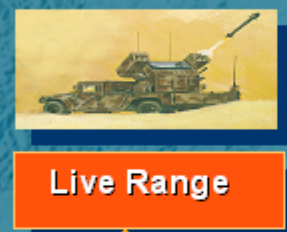


A TEC Distributed I & E Architecture

OV-1

Instrumentation Architecture

Testing (OT/DT/Eval) Architecture



TECOE
T&E Common
Operating Environment



Data Collection/Analysis

TEST ARTICLE(S)
Unit of Employment
Unit of Action
Platform
Subsystem
Component

Simulation/Stimulation Data

Tactical Communications

Test Conduct and Control

Combined DT/OT



System of Systems



Customer

Combined Contractor/Govt.

Distributed Capability

M&S Architecture

Physical Infrastructure Architecture

Wrap-around Environment





Systems Engineering and Verification

Combined Test Organization (CTO)

Sys of Sys Int Lab (SoSIL)

Distributed Test Capability

Synthetic Test Capability

System
Functional
Review

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Verification
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Review

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Components

Developmental Test Command

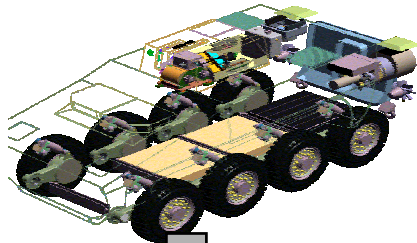




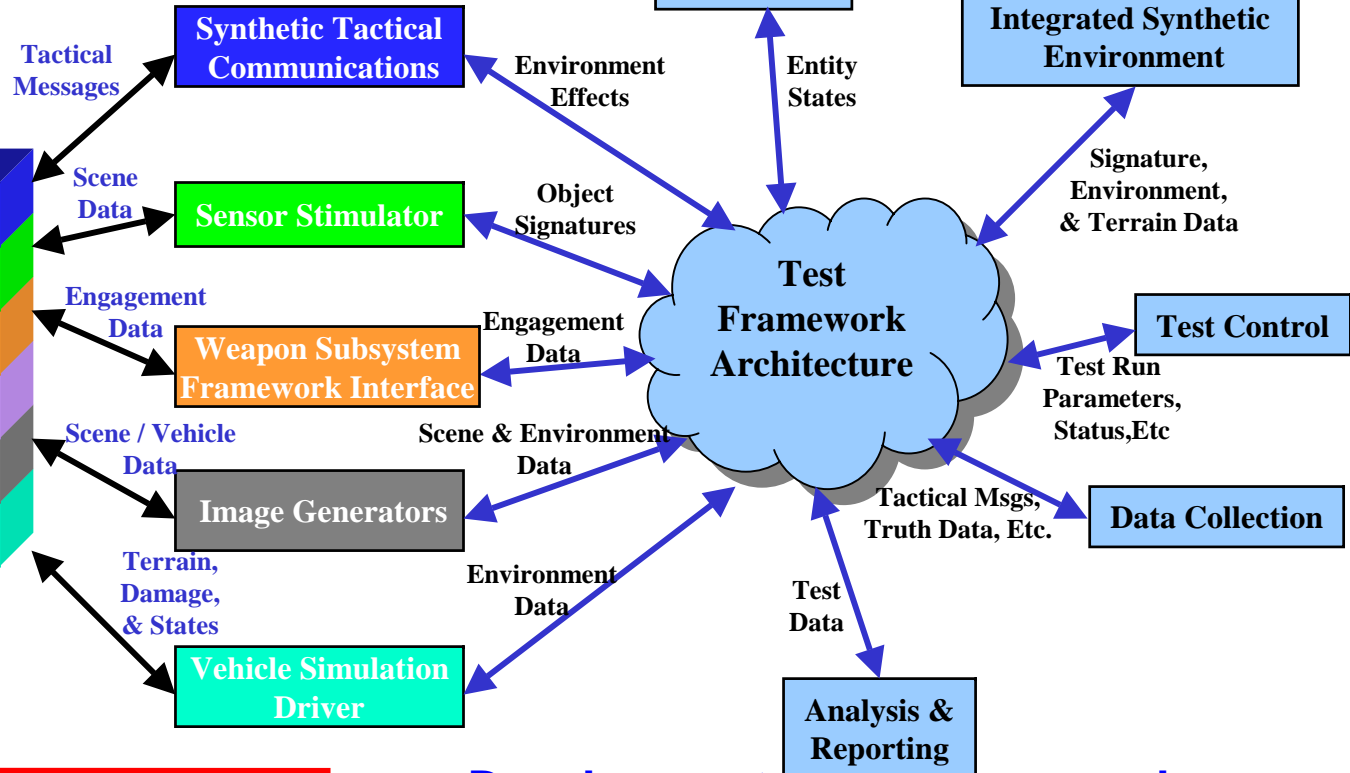
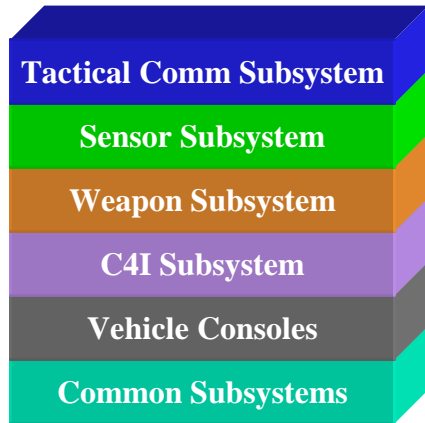
Synthetic Test Capabilities



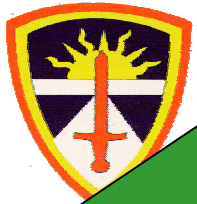
FCS System



FCS Subsystems and/or Representations



Developmental Test Command



Systems Engineering and Verification

Combined Test Organization (CTO)

Sys of Sys Int Lab (SoSIL)

Distributed Test Capability

Synthetic Test Capability

*Built-in
Test and Training*

System
Verification
Review

System

Subsystems

Configuration Items

Assemblies

Components

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Functional
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Design
Review

Item
Level
Design
Requirements

Fabricate, Integrate and Test

Design

Critical
Design
Review

Developmental Test Command





Built-in Test and Training



- Embedded Instrumentation
 - Design-in test and training instrumentation
- Test instrumentation
 - Data bus capture
 - Specialized critical test requirements
- Training instrumentation
 - Real-Time Casualty Assessment
 - Tactical Engagement Simulation
 - Embedded training



Highlights



- How do we ensure that T&E planning process is integrated into the SE process?
 - Early involvement of the tester.
- How do we integrate the SEP and TEMP?
 - Build them together using a CTO approach.
- How do we ensure the tester is part of the SE process?
 - Get the CTO involved early
- How do we make T&E support verification of the SE process?
 - T&E is the verification part of SE
 - Implement the right tools and proactive planning
- Are there process changes need by industry and Govt?
 - CTO ensures an effective, integrated T&E strategy



How Much *is* *Testing* *Enough*

- To gather information to reduce the risk to a level acceptable to those responsible for the application
- Who is really responsible for the application and can determine the acceptable risk; tester, evaluator, contractor, PM, developer, user, Congress, media, taxpayer, or a combination of these?
- To test until risk has been adequately reduced
- What determines adequately reduced risk; resource constraints, schedule constraints, environmental and safety concerns, a driving requirement to immediately employ the technology, political or social considerations?



How much testing is Enough?

Concept Development Production Post-Production

SYSTEM LIFE CYCLE

Enough is a function of how ***Early*** in the development cycle testing is accomplished

The ***Earlier*** it is accomplished,
the less testing is required
and the greater the value



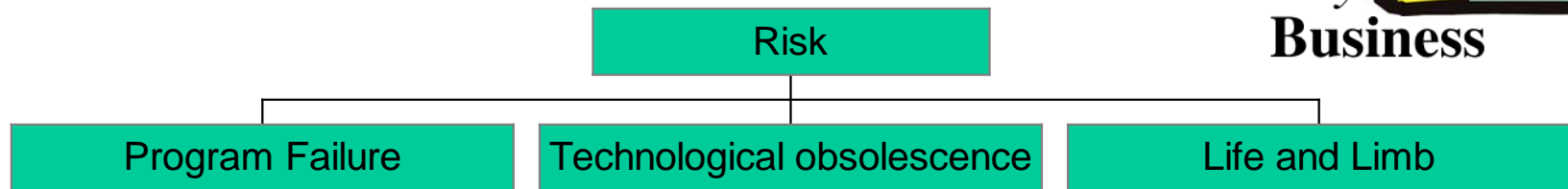
Understand the Risk

How much ~~Testing is Enough?~~

Risk are we willing to accept?



Risky
Business



Testing must be conscious of, highlight, and explore all risk areas.



*Thank you for the invitation to
speak here today...
any questions?*