



# Use of M&S in Major System Acquisition

*DMSO Industry Days*

**Dr. Hank Dubin  
Analysis Division  
Office of the Assistant Secretary of the Army  
(Acquisition , Logistics and Technology)**

May 24, 2000

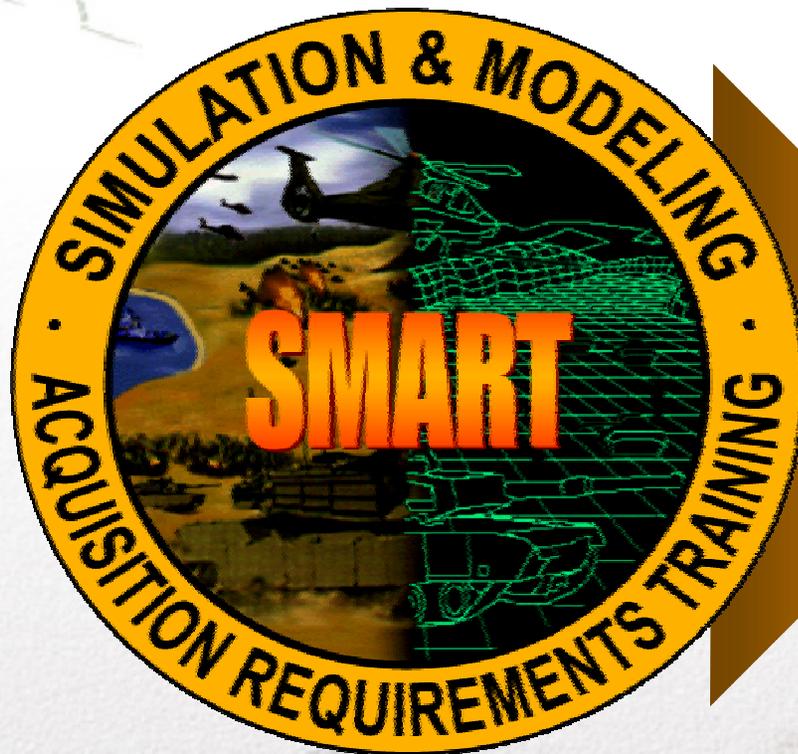


# Background

**Army's strategy for modeling and simulation is Simulation and Modeling for Acquisition, Requirements and Training (SMART).**

**SMART is the Army's version of Simulation Based Acquisition (SBA).**

# SMART



**SMART** is a concept in which we capitalize on Modeling and Simulation (M&S) technology to address the issue of system development and life-cycle costs through the combined efforts of the **requirements, training and acquisition** communities.



# SMART Vision



*“Be a world leader in **Modeling and Simulation** to continuously improve Army effectiveness through a disciplined collaborative environment in partnership with industry, government, and academia.”*

**Larry R. Ellis**  
Lieutenant General, GS  
Deputy Chief of Staff  
for Operations and Plans

**Paul J. Kern**  
Lieutenant General, GS  
Military Deputy to the  
Assistant Secretary of the  
Army (Acquisition, Logistics  
and Technology)

**Walter W. Hollis**  
Deputy Under Secretary  
of the Army  
(Operations Research)



# SMART is about Collaboration which can be achieved through...



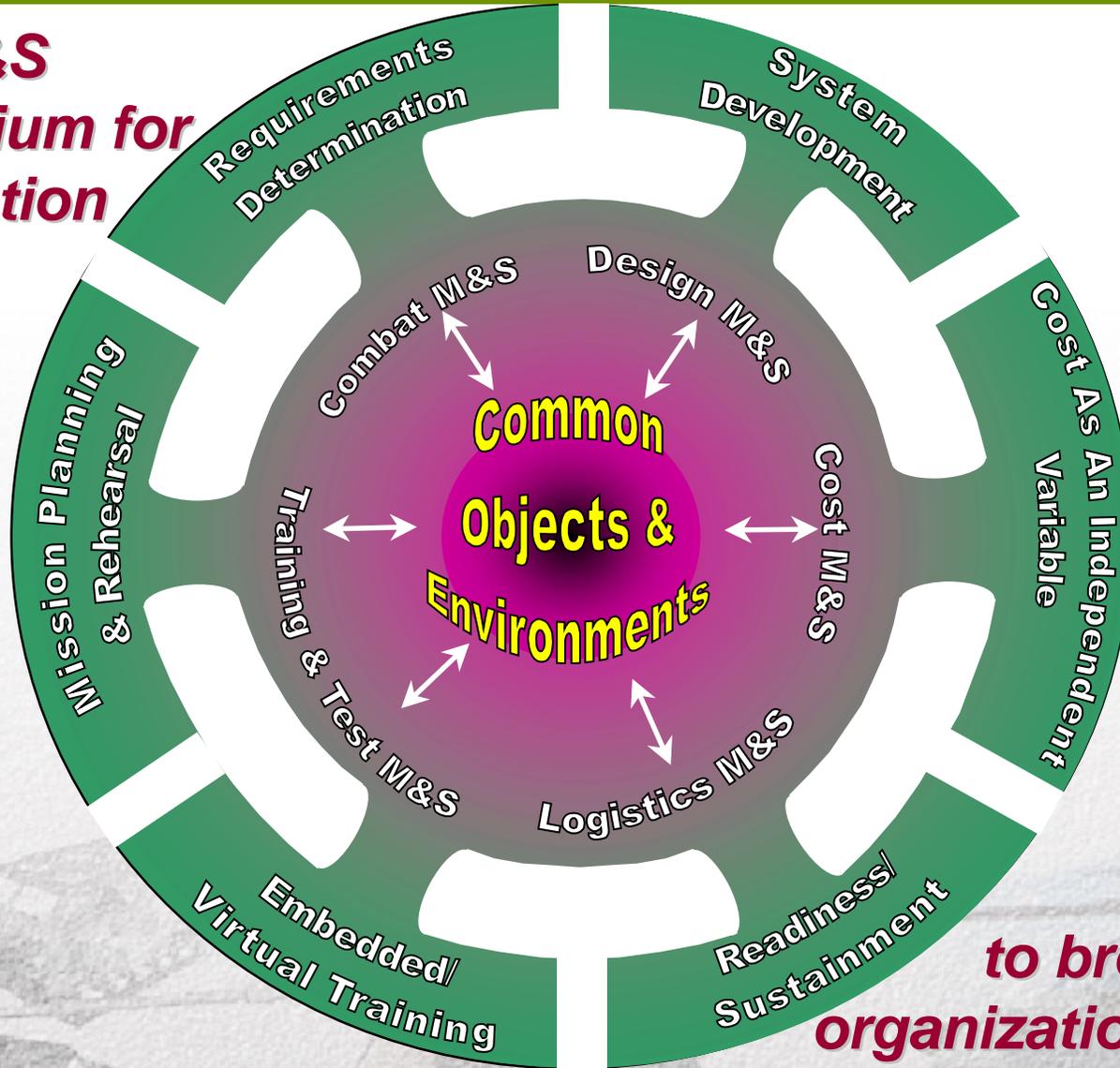
- **Integrated Product Teams**
  - **Distributed Product Descriptions**
    - **Federated Models & Simulations**



# SMART Collaboration Trade-offs...



**Using M&S  
as a medium for  
collaboration**



**Using M&S  
to break through  
organizational barriers**



# What Will SMART Achieve?

- **Reduced Total Ownership Cost (TOC), Time to Initial Operating Capability (IOC), and Logistics Tail**
- **Increased Supportability, Maintainability, and Military Worth**
- **More Effective, Cost Efficient Training at Individual, Crew, and System Level**





# What is the Role of the Requirements Community?



***“Context is worth 50 IQ points.”***

*Alan Kay, Walt Disney Imagineering Fellow*

- **Provide Continuous User Context**
- **Cost/Performance Tradeoff Analysis**
- **Early ID of Unrealistic Requirements**
- **Early ID of Enabling Technologies**
- **Earlier Opportunity to Address Life Cycle Cost**
- **Use Virtual Prototypes to Aid Threat Assessment and Mission Area Analysis**



# What is the Role of the Training Community?



- **Provide Early and Continuous Training Context**
- **Assess Impact of TTP and Doctrine on Design Concepts**
- **Trained Crew Simultaneous with 1st Unit Off Production Line**
- **Re-use of Software and Simulation to Support Embedded and Distributed Training, Operation Planning, Course of Action (COA) Analysis; Part of Deployed Capability**





# Flagship Programs



- **Crusader** program operates within an Integrated Digital Environment that links the Program Management Office, Contractor, Research Center, assorted test ranges, and other activities



- **Apache** poised to re-assess basic load, capitalize on product improvements to re-engineer logistic support

- **Future Scout Cavalry System** ideally poised to benefit from M&S and Systems Engineering



**CCTT** can be Employed to Explore Doctrine and TTP for Future Systems to Influence Final Design



# Crusader Simulation Support Plan



The Crusader Program started with a comprehensive Simulation Support Plan (SSP).

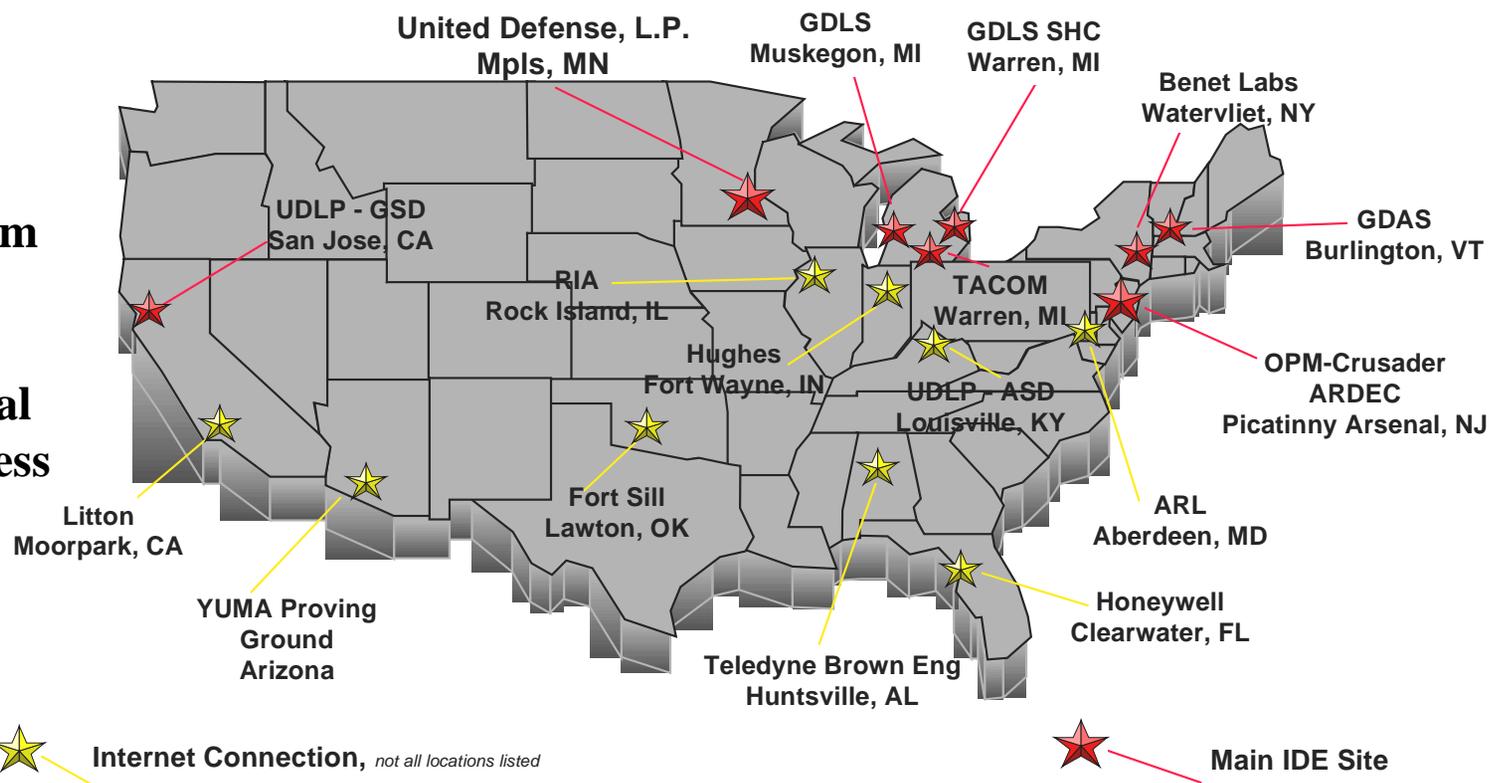
- Utilized simulators, emulators, and stimulators that resulted in an Integrated Crusader Emulator (ICE).
- Contains a Virtual Crew Station that allows man-in-the-loop simulation that provides for human factor designs and also functions as a crew trainer.
- Developed visual prototypes during concept and design phases.
- Integrated real world C4I systems (AFATDS) with the M&S.
- Addresses embedded training to allow use of actual Crusader crew station man-machine interfaces.



# Crusader Collaborative Environment

## Objective

- **Link all Team Crusader players to facilitate total system process**



## Lessons Learned

- **Integrated Environment must have capacity to share entire master model**
- **Advanced tools require greater learning time and must be tailored to Program needs**
- **Engineering models provide data to CAIV process**



# Crusader- A System for the 21st Century



## Lethal Firepower

- Cooled Cannon for Continuous Fires
- 10-12 Rnds/minute out to 40-50 km
- Enhanced Accuracy with Projectile Tracking System



## Crew Cockpit Enables Information Dominated Warfare

- Mission Planning
- Situational Awareness
- Decision Aids

XM2001



## Fully Automated

- Resupply
- Ammunition Handling
- Aiming
- Loading & Firing



RSV-T

XM2002

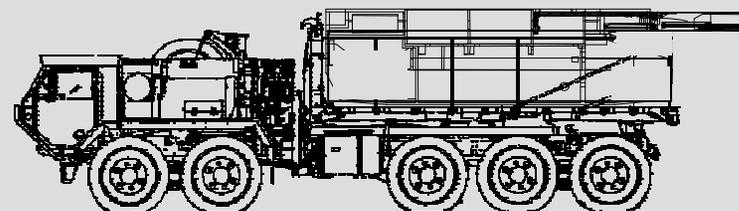
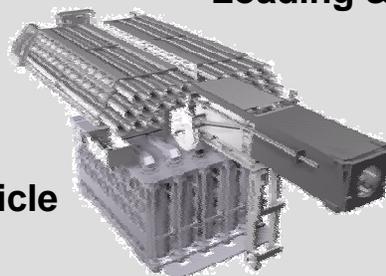


RSV-W

XMXXXX

## Highly Mobile

- 1500 HP to Meet & Exceed M1/M2
- First Drive-by-Wire Ground Combat Vehicle
- Ride Quality Better than M1/M2



## Unmatched Survivability

- Separate Crew & Weapon Stations
- Composite Armor
- Ballistic & Non-ballistic Protection

## Track / Wheeled RSV

- Greater O & O Flexibility
- Match Systems to Intensity

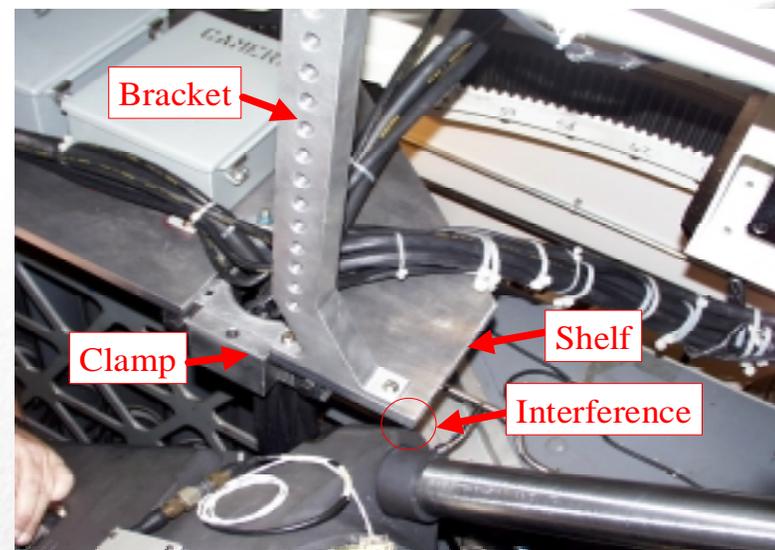


# M&S Support



## Engineering Design:

- Dynamic visualization helps designers deal with complexities
- Changes cannot be unilateral
  - requires continuous communication



Cable Tray Shelf Interference With Breech

## Software Development:

- Pursued early evaluation and validation of SW requirements and designs.
- Distributed modeling tool to accommodate multi-site, concurrent SW development



# M&S Support (continued)

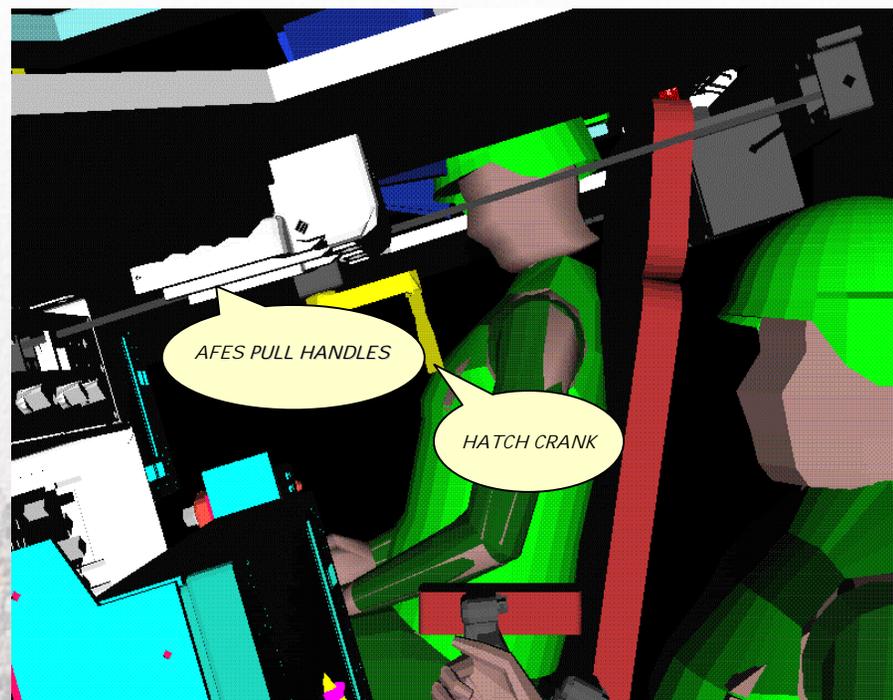


## Test

- Using test data to validate models
- Live fire testing can be enhanced by selective use of M&S
- Helped develop Tactics, Techniques and Procedures

## MANPRINT

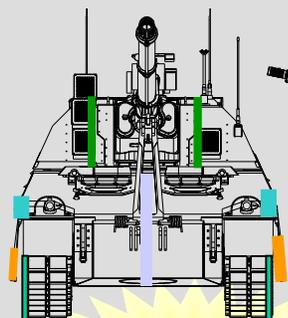
- Reduced requirements for maintenance assets and lowered O&S costs early in the program
- M&S Dynamic Visualization helps designers deal with complex situations.



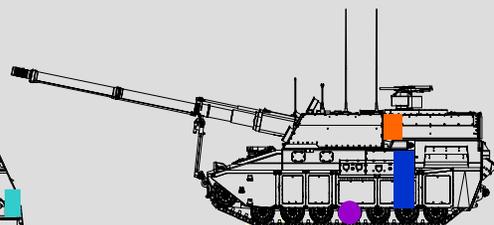
Hatch Linkage Mechanism



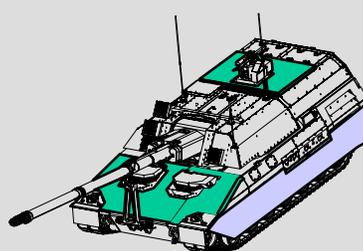
# Notional Weight Savings Summary



**Width**  
Saves 1-2 Tons

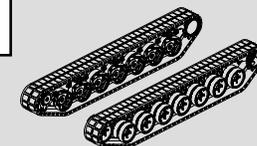


**Length**  
Saves 1-1.5 Tons



**Protection by Kits**  
Saves 3 Tons

Power Package?

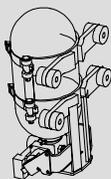


Suspension System

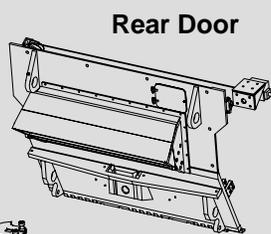
**Mobility**  
Saves 5-6 Tons



Gun Cradle



AFES Bottles



Rear Door



Projectile Carrier

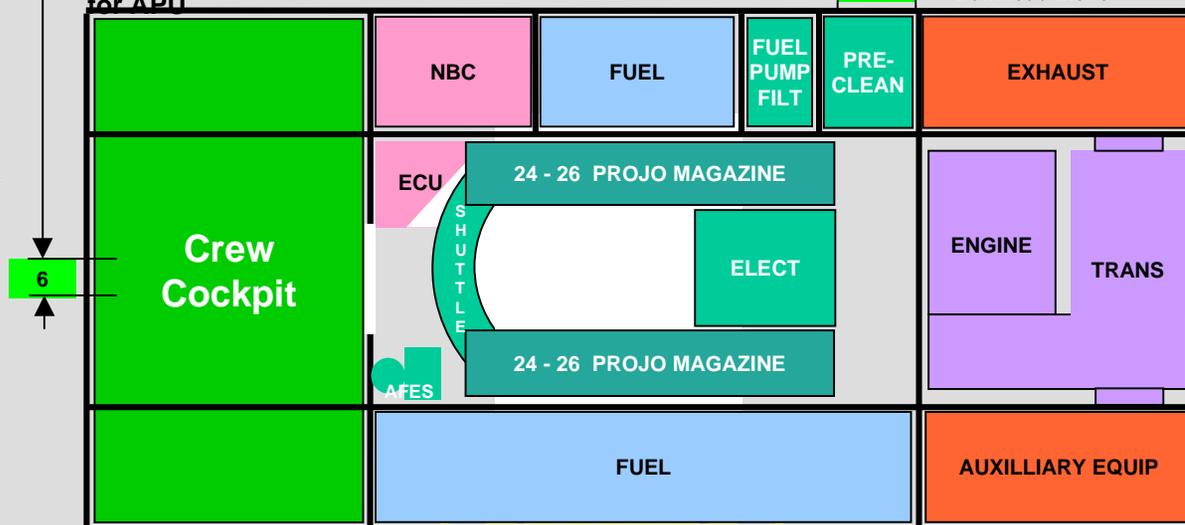
**Material Changes**  
Saves 4 Tons

Trade Fuel (Range) for APU

Reduce Propellant Charges From 260 to 176

16

Bulkhead Move



**Payload**  
Saves 1 Ton

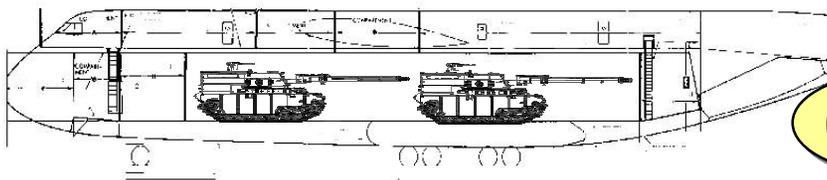


# Crusader Design Refinement

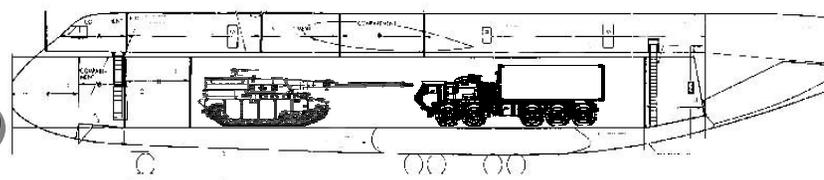




# Crusader's New Direction



**C5B**



**2 SPH's @ 84 Tons - 3200 NM**

**1 SPH & 1 RSV-W @ 73 Tons - 3916 NM**

**1 SPH & 1 RSV-T @ 80Tons - 3500 NM**

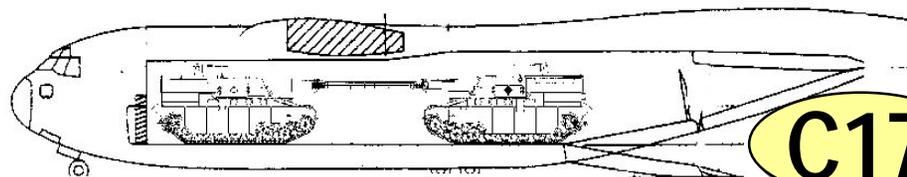
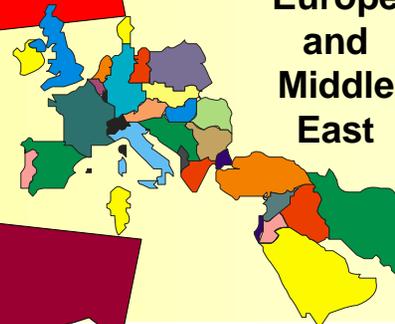
**N.E. Asia**



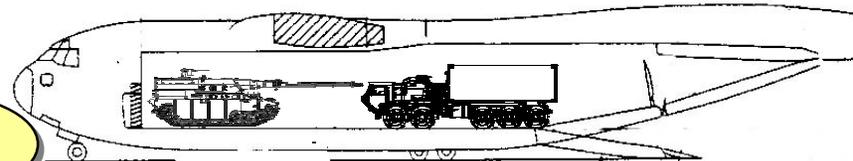
**Ft. Hood, Tx**



**Europe and Middle East**



**C17**



**2 SPH's @ 84 Tons - 2276 NM**

**1 SPH & 1RSV-W @ 73 Tons - 2782 NM**

**1 SPH & 1 RSV-T @ 80 Tons - 2425 NM**



# The Army Vision



*Soldiers on point for the nation...  
persuasive in peace, invincible in war*

*“...light forces must be more lethal,  
survivable and tactically mobile.”*

*“Heavy forces must be more strategically  
deployable and more agile with a  
smaller logistical footprint...”*



# Future Combat System



- The Future Combat System will be a multi-functional, multi-mission re-configurable system of systems to maximize joint inter-operability, strategic transportability and commonality of mission roles including direct and indirect fire, air defense, reconnaissance, troop transport, counter mobility, non-lethal, and C2 on the move.



- Joint DARPA/Army program that will be a SMART managed program.



# SMART Initiatives



- **CONOPS for Threat M&S** Developed by DSCINT with input from the RDA, ACR and TEMO Domains. CONOPS incorporates requirements integration early in the acquisition process to maximize potential for reuse and minimize redundancy. Also reduces potential for development of invalid or non-validated threat M&S.
- **ICT** The Army is giving \$45 million to the University of Southern California over the next five years to create the Institute for Creative Technologies, to leverage the technologies of the entertainment industry.
- **RDEC Federation** In initial development and is aimed at providing the infrastructure to link the Army's geographically separated Research, Development, and Engineering Centers (RDECs) engineering level tools through high level architecture (HLA).



# Near Term Challenges

- **Tool compatibility can be a significant hidden pitfall**
- **Models must be properly supported to ensure ease and speed of use. They must be “user-friendly”**
- **Dynamic systems must be modeled in a time-dependent way, not statically**
- **Improvements in computing power, storage capacity and tool compatibility have increased significantly, even over our limited time span - the future looks even brighter !**
- **Total Team Involvement**

**M&S OPPORTUNITIES ABOUND**



# The Next Steps

**Leverage Partnership Interest by National Institute of Standards and Technology (NIST):**

- **CAD/CAM Interoperability Standards**
  - **BRL CAD expertise w/ interoperability**
  - **NIST Coalition of OEMs\* to work standards**
- **Integrated Logistics Modeling/Simulation**
  - **CASCOM interest**
  - **establish connection with Logistics Community**

**Transition SMART from the ASA(ALT) [RDA Domain] to:**

- **AMSEC as the proponent for SMART**
- **AMSO as the AMSEC Executive Agent**

\* OEM - Original Equipment Manufacturers