# MS 101

## Introduction to Modeling and Simulation


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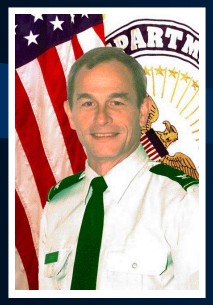

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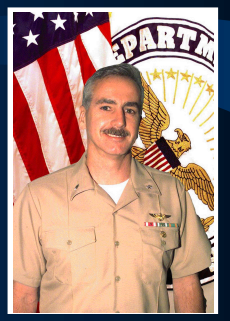

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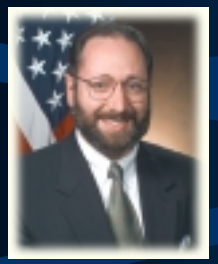

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# Questions that Modeling and Simulation 101 will answer for you:

- Where have we been with M&S and how did we get here?
- Where is M&S Today ?
- What are the key DoD M&S programs?
- How is representation done in M&S?
- What is VV&A?
- What is the DoD role in M&S?
- What are the key M&S terms and what do they mean?
- What is the Common Technical Framework?
- What are the benefits and challenges of M&S?
- What M&S information sources are available?

# Schedule for M&S 101

## Block 1

- Overview
- History
- Basic Jargon
- DoD Role in M&S
- DoD M&S Structure

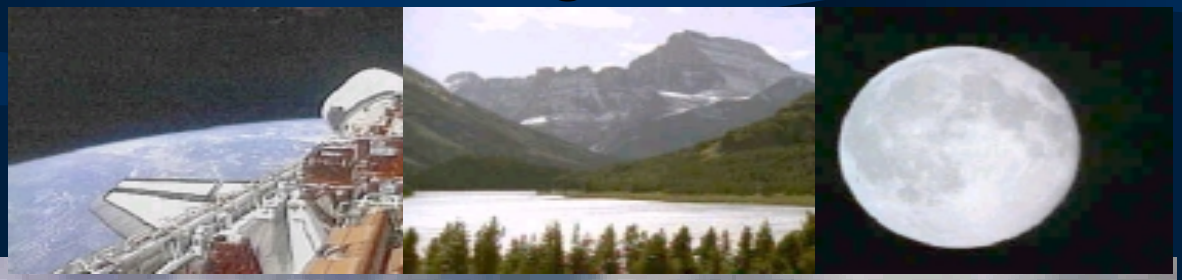
## Block 2

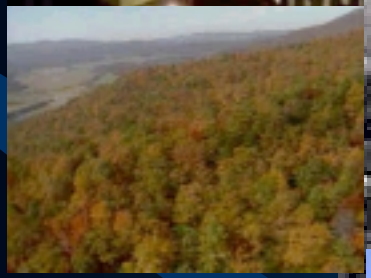
- M&S Functional Areas
- DoD Master Plan
- Common Technical Framework

## Block 3

- Representation
- Common Services
- Information Sources

# What is Modeling and Simulation?

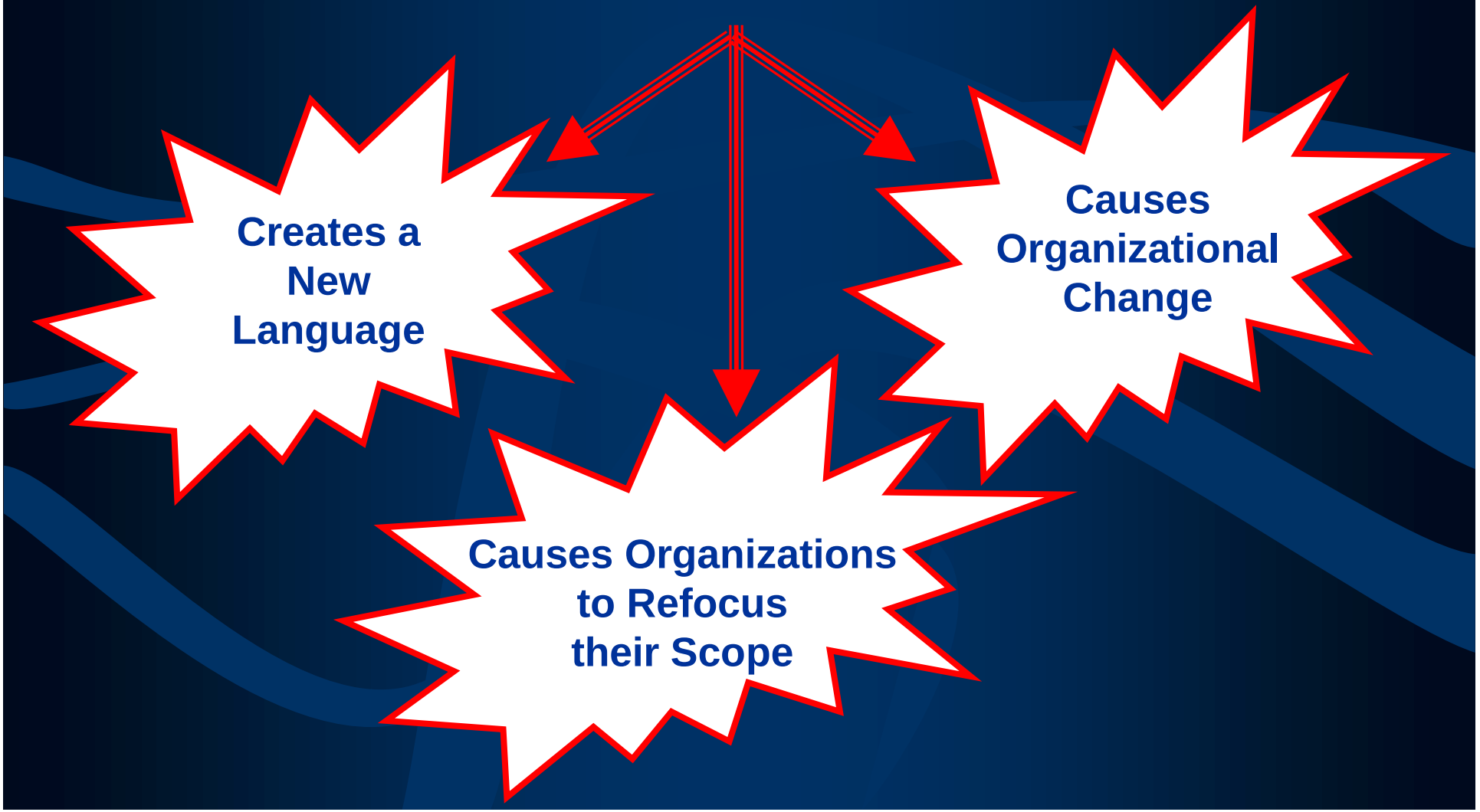




An attempt to imitate real world processes or facilities

**“Modeling and Simulation does not work in isolation. Other technologies and non technology factors are closely integrated and act in conjunction with one another.”**

**Marco Iansiti, Harvard Business School, 1998**



# Creating a New Language

# Definition of a Model

*Model* - "A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process."

DoD M&S GLOSSARY, Jan 98

# Classes of Models

"A ***mathematical model*** is a symbolic model whose properties are expressed in mathematical symbols and relationships."

DoD M&S GLOSSARY, Jan 98

The representation is comprised of procedures (algorithms) and mathematical equations.

# Classes of Models

## *Example of a Mathematical Model*

**STINGER MISSILE CHARACTERISTICS**

| | |
|---|---|
| Type | Supersonic, surface-to-air |
| Diameter | 2.75 inches |
| Length | 58 inches |
| Guidance | Passive infrared homing and modified proportional navigation |
| Range | Excess of 4 kilometers |
| Speed | Mach 2.2 |
| Warhead | High explosive |
| Motor | Rocket, solid propellant, two-stage) |
| Acceleration Rate | 1 Meter per .5 second |

***A = Acceleration Rate***

***S = Speed of projectile***

***S2 = Target Speed***

***D = Distance of Target***

$$R = A + \frac{D}{(D/S + D/S2)}$$

***R = Probability of hit / damage***

# Classes of Models

A ***physical model*** is a model whose physical characteristics resemble the physical characteristics of the system being modeled. DoD M&S GLOSSARY, Jan 98

***Physical models*** are the symbolic forms utilized for simulators.

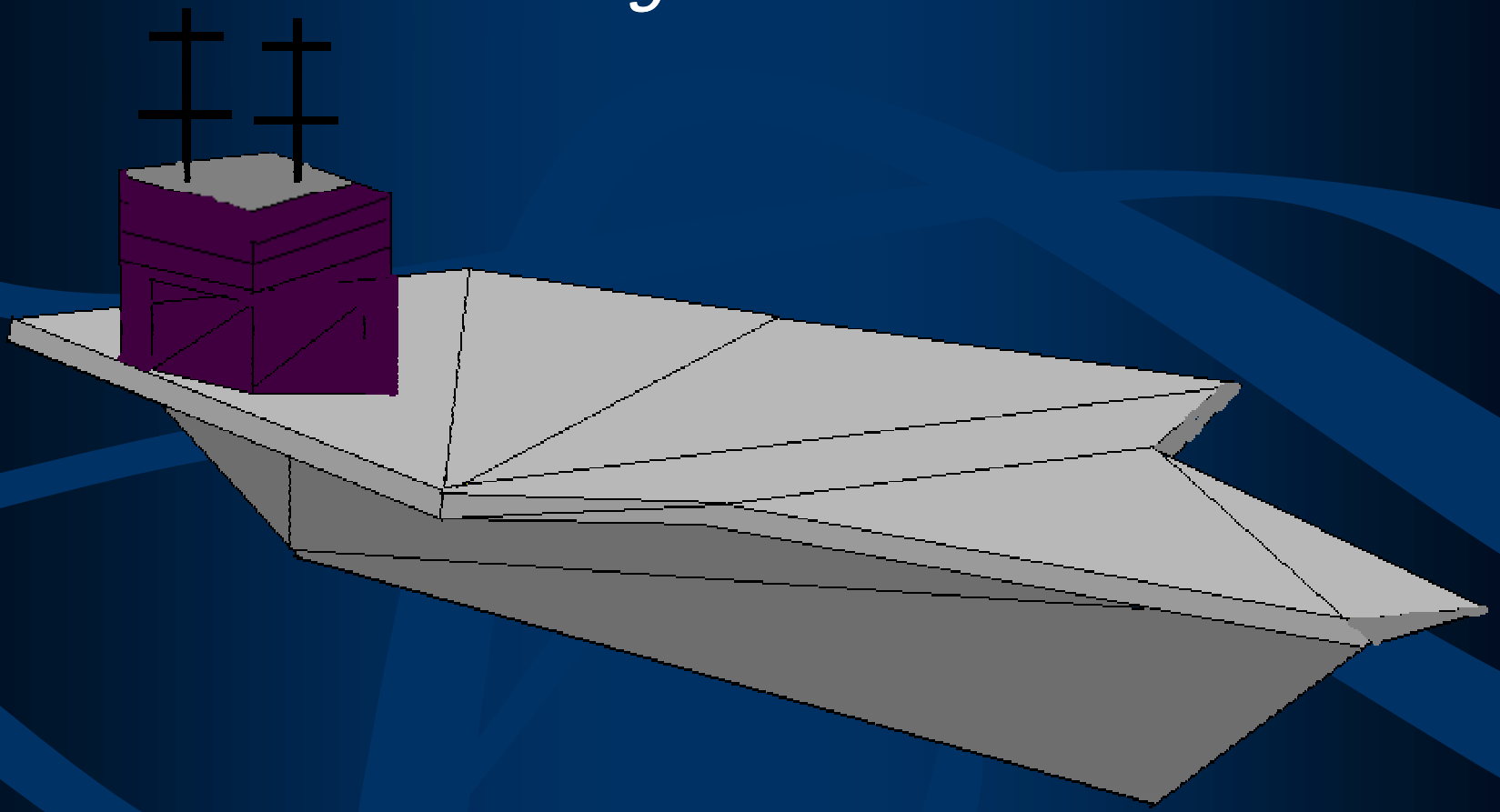
# Concept of Polygons

A *polygon* is a flat plane figure with multiple sides, the basic building block of virtual worlds. The more polygons a computer can display and manipulate per second, the more realistic the virtual world will appear. Humans perceive the equivalent of 80 million polygons at more than 30 frames per second in normal vision.

DoD M&S GLOSSARY, Jan 98

# Concept of Polygons

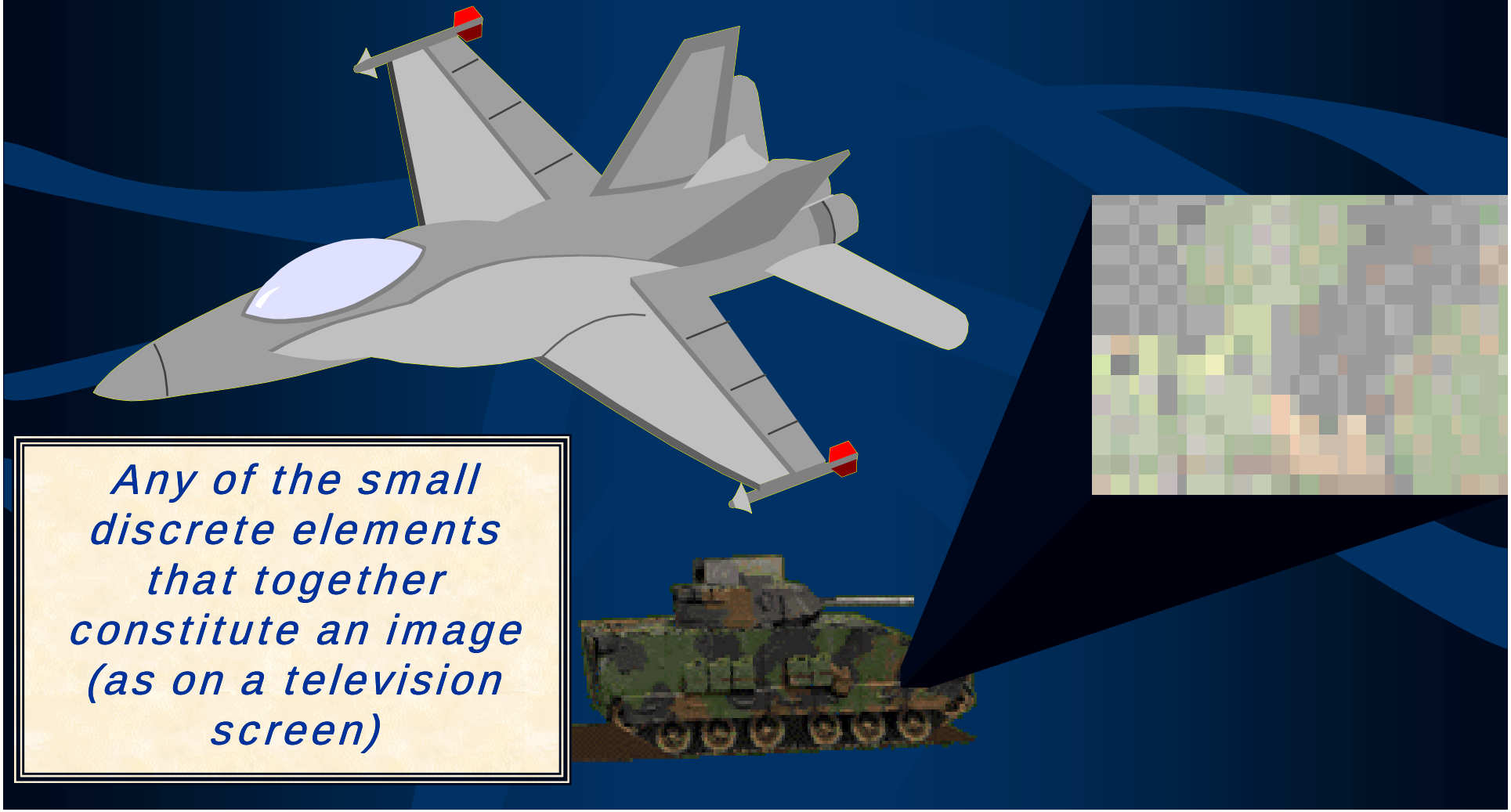
*A closed plane figure bounded by straight lines*



Trade off -- How much is good enough?
> detail = > cost

# Concept of Pixels

A *pixel* is a "picture element," that refers to the smallest visual unit in an image on a computer display. DoD M&S GLOSSARY, Jan 98



*Any of the small discrete elements that together constitute an image (as on a television screen)*

# Classes of Models

***Process Model*** models the processes performed by a system.

DoD M&S GLOSSARY, Jan 98

Process Models allow for the expression of dynamic relationships of a situation expressed by mathematical and logical processes.

# Classes of Models

## *Example of a Process Model*

| *Clear Deck* | *Check Air Craft* | *Fix Catapult* | *Pre-Launch Checks* | *Launch Sequence* | *Launch Air Craft* |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Manpower Time to Do Conditions Equipment | Visual Checks Problems Fix | Hook-up Check Verification | In Aircraft On Deck Tower | Pilot Tasks Deck Tasks Tower Tasks | Pilot Tasks Deck Tasks |
| $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ |

T = Time

$$T_1 + T_2 + T_3 + T_4 + T_5 + T_6 = \text{Time to Launch Aircraft}$$

# What is a Simulation ?

***Simulation*** - A method for implementing a model over time. DoD M&S GLOSSARY, Jan 98

- **Live**
- **Virtual**
- **Constructive**

# Types of Simulation

***Live Simulation -*** A simulation involving real people operating real systems. DoD M&S GLOSSARY, Jan 98

*Live simulations:*

- involve individuals or groups
- may use actual equipment
- may provide a similar area of operations
- may not fully replicate actual activity

# Types of Simulation

## *Example of a Live Simulation*

*May Result in :*

- *Large Resource Expenditure*
- *Safely Hazards*
- *Maneuver Damage*

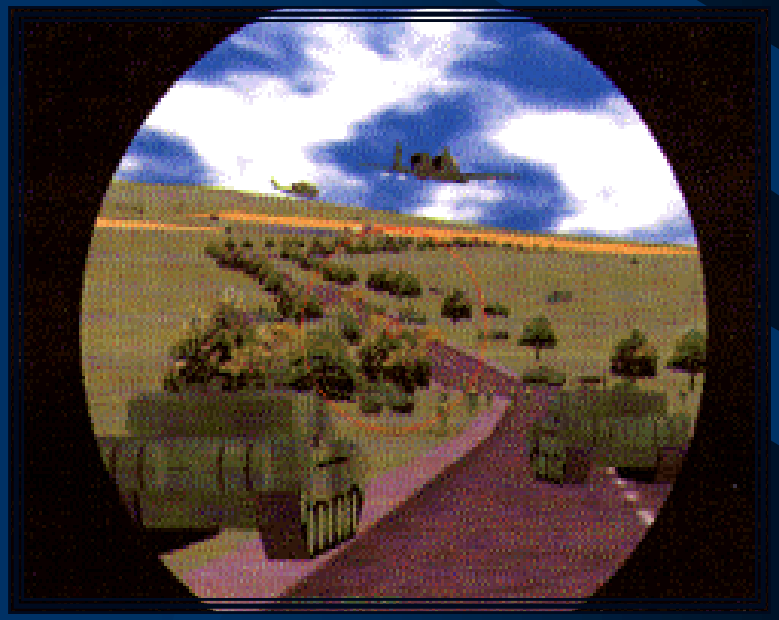
# Types of Simulation

***Virtual Simulation -*** A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a C4I team).

DoD M&S GLOSSARY, Jan 98

# Types of Simulation

## *Example of a Virtual Simulation*



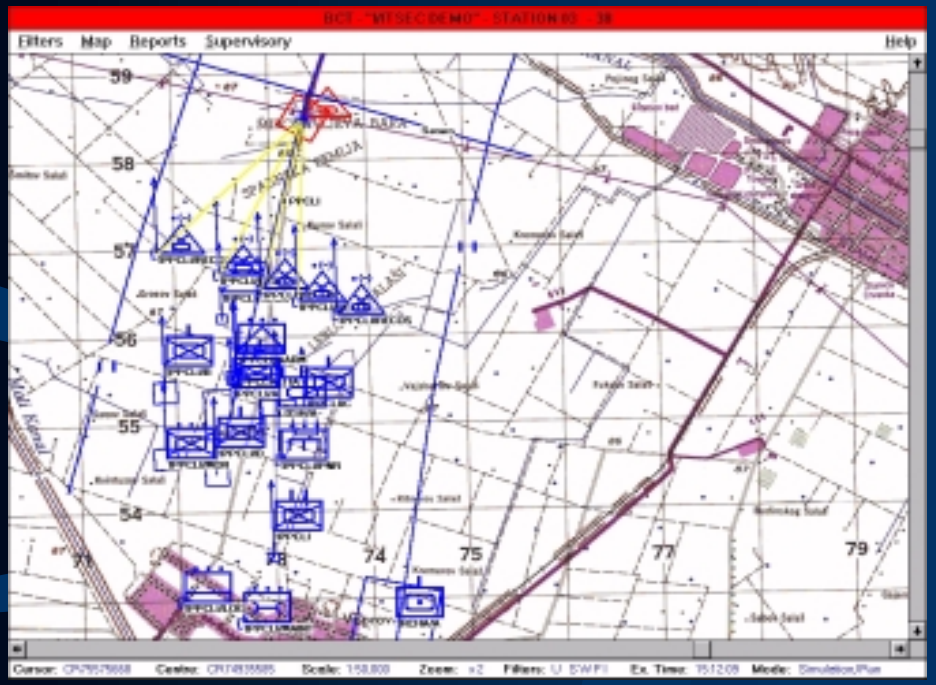
# Types of Simulation

***Constructive Simulation*** - Simulations that involve simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes.

DoD M&S GLOSSARY, Jan 98

# Types of Simulation

## *Example of a Constructive Simulation*



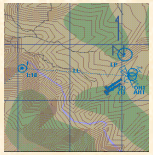

Constructive simulations:
- make measurements
- generate statistics
- perform analysis

Constructive simulations offer the ability to:
- analyze concepts
- predict possible outcomes
- stress large organizations

- Many constructive simulations use a large number of established legacy models.
- Most provide a valuable service, but may not be designed to share information.

# Distributed Simulation (DS)

Connected simulations, sharing information through state-of-the-art communication systems.



Constructive

Live

Virtual

Can be across the world or across the room!

Virtual

Live

Constructive

# Fidelity

***Fidelity :*** The accuracy of the representation when compared to the real world.

DoD M&S GLOSSARY, Jan 98

Vs

A model or simulation is said to have fidelity if it accurately corresponds to or represents the item or experience it was created to emulate.

How does it act?

# Resolution

***Resolution :*** The degree of detail and precision used in the representation of real world aspects in a model or simulation.

DoD M&S GLOSSARY, Jan 98

Vs

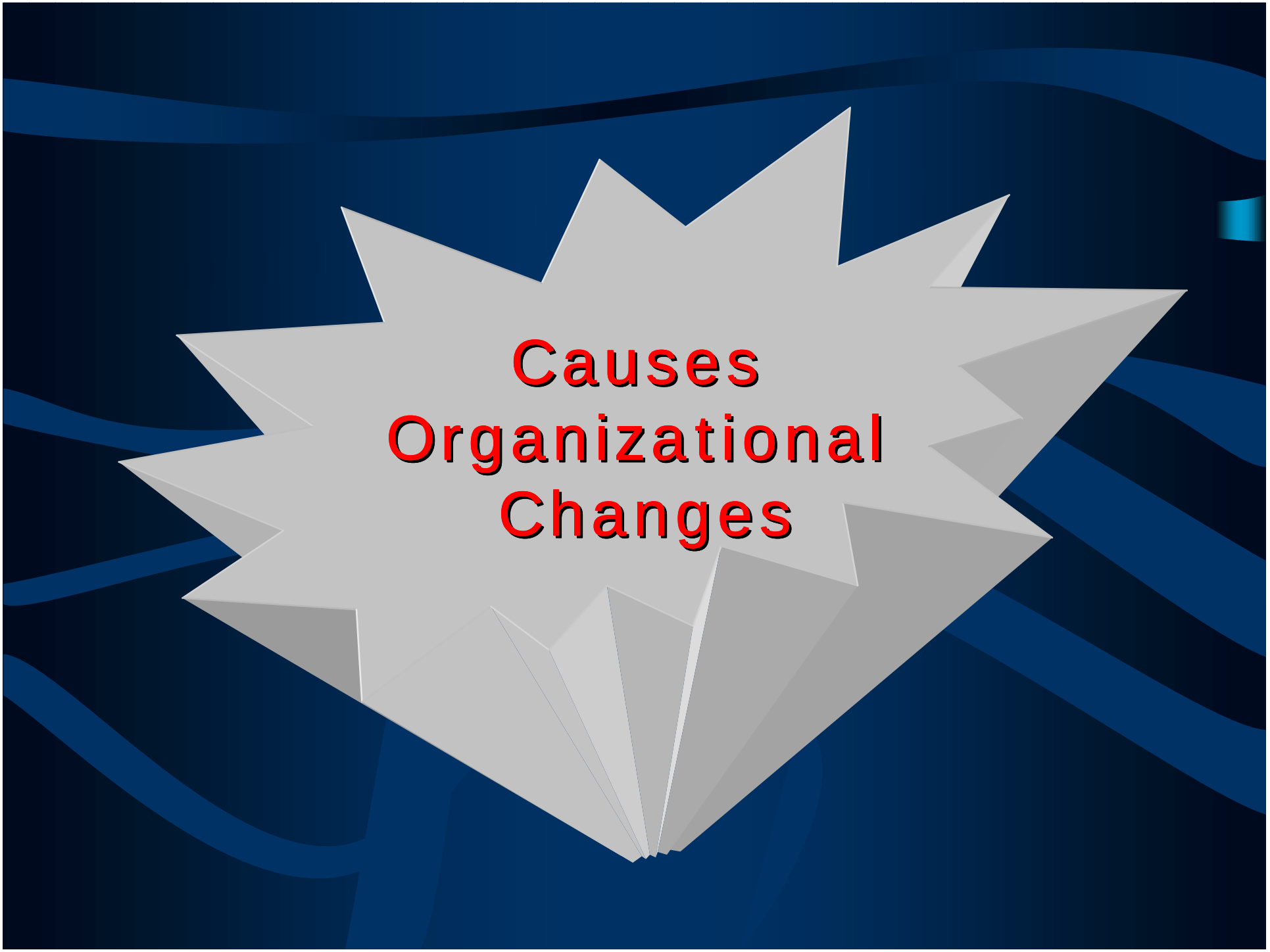
Resolution means the fineness of detail that can be represented or distinguished in an image. How does it look?

# Resolution vs. Fidelity

**Fidelity**

**Resolution**

- **Resolution and Fidelity are not the same**
- **You can have one and not the other**
- **Not necessarily a bad thing**
- **It depends on what you are trying to accomplish**


Causes
Organizational
Changes

# Factors that Effect the Use of M&S in DoD

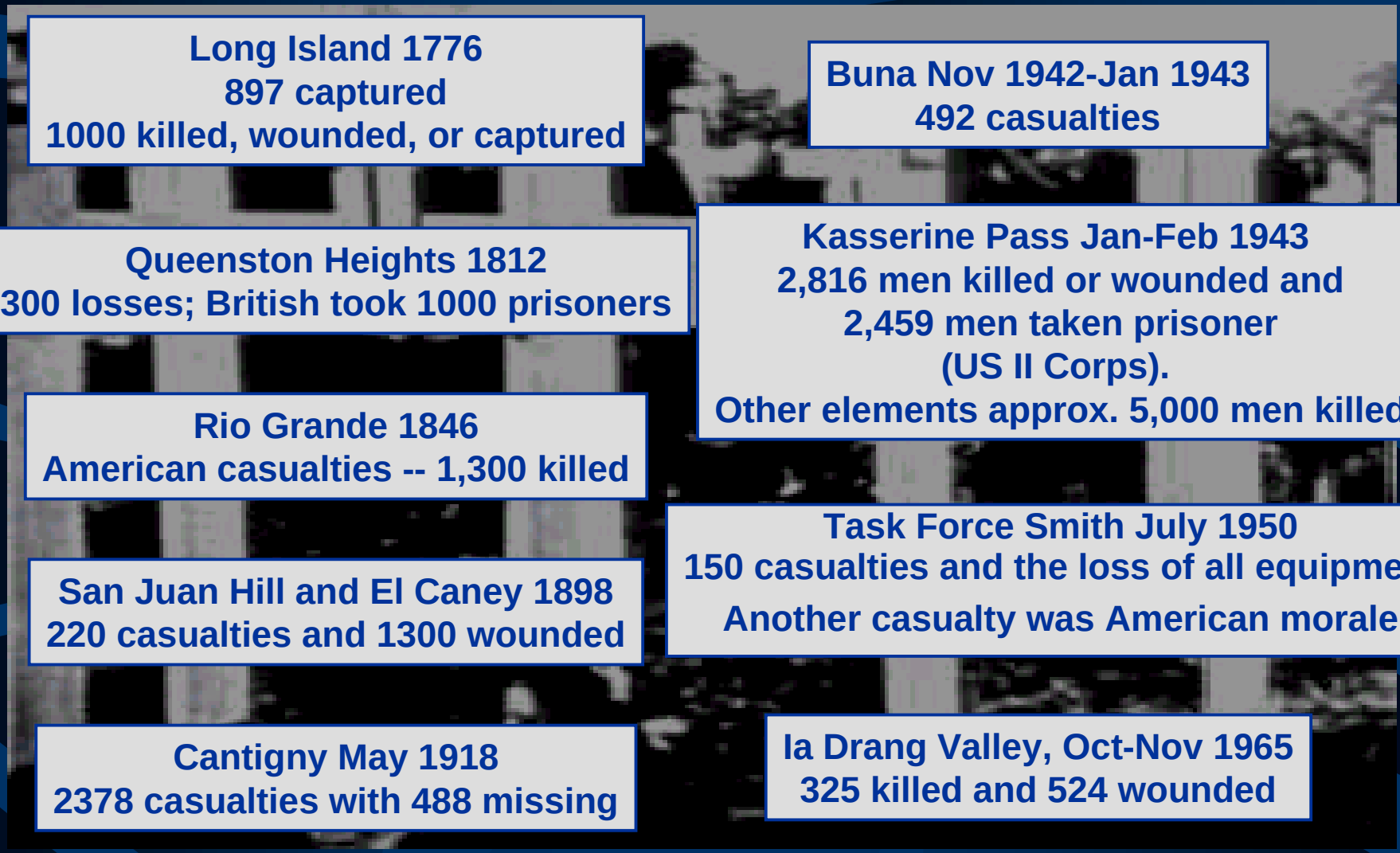
Readiness Concerns

Increased Requirements

Fewer Resources

Greater M&S Availability

# "America's First Battles" By Charles Heller and William Stofft



**Long Island 1776**
**897 captured**
**1000 killed, wounded, or captured**

**Buna Nov 1942-Jan 1943**
**492 casualties**

**Queenston Heights 1812**
**300 losses; British took 1000 prisoners**

**Kasserine Pass Jan-Feb 1943**
**2,816 men killed or wounded and**
**2,459 men taken prisoner**
**(US II Corps).**
**Other elements approx. 5,000 men killed**

**Rio Grande 1846**
**American casualties -- 1,300 killed**

**Task Force Smith July 1950**
**150 casualties and the loss of all equipment**
**Another casualty was American morale**

**San Juan Hill and El Caney 1898**
**220 casualties and 1300 wounded**

**Cantigny May 1918**
**2378 casualties with 488 missing**

**Ia Drang Valley, Oct-Nov 1965**
**325 killed and 524 wounded**

How can we train the warfighting leadership to experience the "first battle" prior to combat?

*A Solution - Through Simulation*

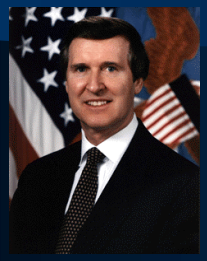
# Initially M&S was Strictly a Service Function In DoD



*The direction and focus of M&S was not always clear!*


# Defense Science Board Concept

*Mission of the Defense Board*:



Advise the Secretary of Defense

Through the Under Secretary of Defense for AT&L

On Scientific And Technical Matters

As they affect the perceived needs of the Department of Defense

- Thirty-two members and seven ex officio members
- Members selected on the basis of their preeminence in:
  - Science
  - Technology and its application to military
  - Operations
  - Research
  - Engineering
  - Manufacturing and Acquisition process

# Objectives

***Management***

- Establish a DoD-Wide Structure to Coordinate Joint M&S Activities and Requirements
- Fix Responsibilities to Ensure Proper M&S Oversight

***Planning***

- Develop a Master Plan
- Furnish Guidance for the Consistent Development of Component M&S Plans

***Policy***

- Implement a DoD M&S Policy Focusing on Interoperability and Standards; Verification, Validation, and Accreditation;
- Development of Common Tools and Methodologies;
- Service Responsibility for M&S of its Forces

***Coordination***

- Promote Coordination Across Programs and Functional Communities
- Establish Means to Facilitate Information Sharing across the M&S Community

***Investment***

- Implement a Long-Range M&S Investment Strategy
- Promote Initiatives to fill Critical Technology Gaps

# DoD Mission for Modeling and Simulation

## *Mission*

To strengthen the use of modeling and simulation in joint education, training and military operations; research and development; test and evaluation; analysis; and production and logistics.

DepSecDef Memorandum, "Modeling and Simulation Management Plan,1991

# DoD M&S Vision

Provide readily-available, operationally-valid environments to:

- train jointly, develop doctrine and tactics, formulate operational plans, and assess war fighting situations
- support technology assessment, system upgrade, prototype and full scale development, and force structuring

DepSecDef Memorandum, "Modeling and Simulation Management Plan,1991

# DoD M&S Vision (cont.)

*Common use* of environments that promotes closer interaction between operations and acquisition communities

- allow maximum utility and flexibility
- by constructing M&S environments from *affordable*, *reusable, interoperable components* through an open system architecture

*Vision revalidated by EXCIMS, Spring 99*

DepSecDef Memorandum, "Modeling and Simulation Management Plan,1991

# Modeling and Simulation Master Plan (MSMP)

*The MSMP is a:*

DoD Plan *under* **Authority USD(A&T)** *and* Coordinated through DoD Components

*The MSMP establishes:*

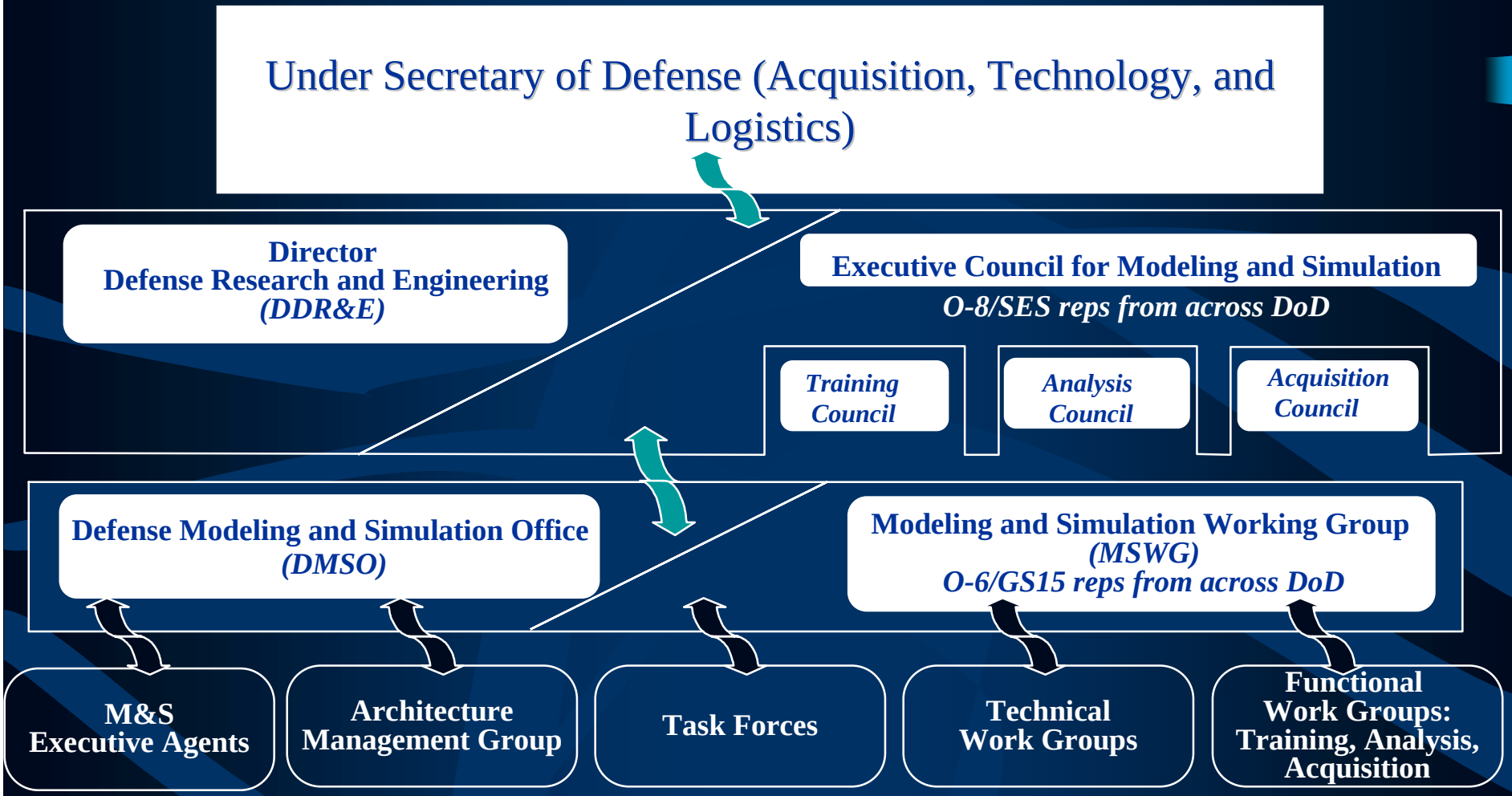
- Short-term Goals and Objectives (Present to 6 Years)
- Long-term Goals and Objectives (Beyond 6 Years)

*The MSMP provides:*

- A Road Map That Delineates the Management, Investment, And Technical Strategies
- Joint and Common Use Applications of M&S
- Assessment Of Current M&S Capabilities

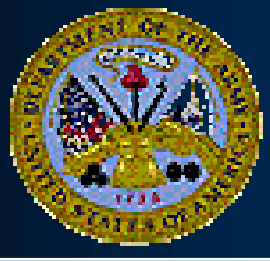
DoD MSMP, Oct 95

# Organization



# Modeling and Simulation Offices

**AMSO**



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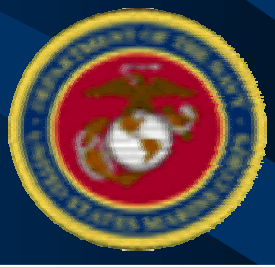
**MCMSMO**



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# Causes Organizations to Focus the Scope of Changes

# M&S Functional Areas

## Training

## Acquisition

## Analysis

# Training Functional Area

Training simulations generally fall into three categories:

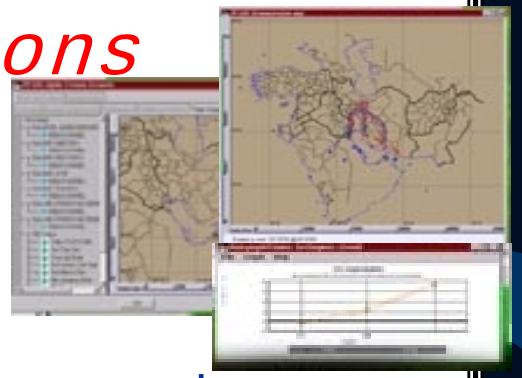
- Exercises
- Education
- Military Operations

Training can be broken down further into two additional categories and subcategories:

- Individual
  - procedural
  - cognitive thinking
  - motor skills
- Collective
  - staff decision making
  - crew skill training
  - maneuver training

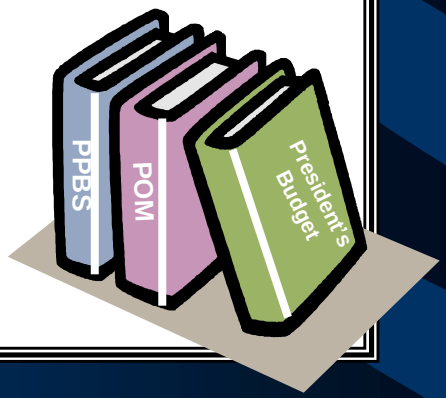
# Analysis Functional Area

## *Analytical Simulations*

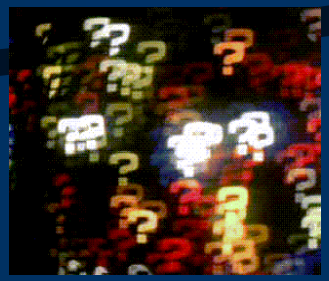


- *Operations support:*
  - Decision-making support for:
    - * current operations
    - * future (tactical and strategic) operations
    - * logistics and administration

- *Assessment:*
  - Two types:
    - * force capability and requirements
    - * combat developments



# What M&S Adds to Analysis



- *Another tool to assist in decision making*
- *Rapidly answer the "What If" questions*
- *Low cost means to test failure*
- *ID logistic constraints*
- *Means of focusing issues*
- *Provides the "missing expert"*
- *Rapid turn around with multiple runs*

# Acquisition Functional Area

*Research & Development:*

- Used for both the *design and development of equipment and weapons systems*
- Used for *"pure" research*

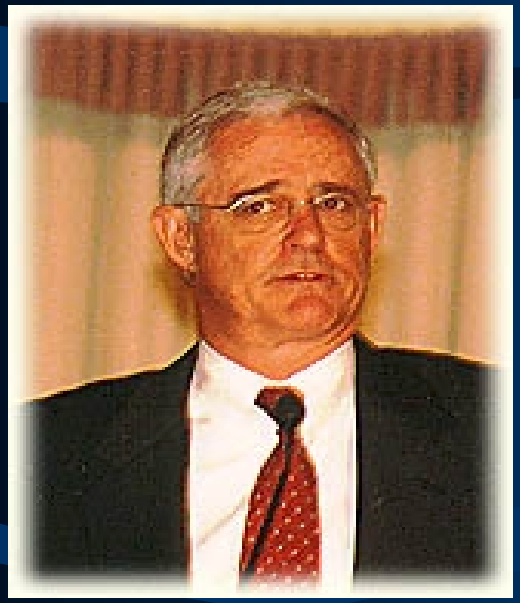
*Test & Evaluation:*

- Augment and complement various stages of *testing in the material acquisition process*
- Provide a representation of certain external factors and situations which cannot be produced in reality
- Augments live testing, does not replace it

*Production & Logistics:*

- Assist in determining *logistics requirements, system productivity assessments, and industrial base appraisals*
- Supports DoD procurement, transportation, and maintenance of personnel, materiel, and facilities.

# Acquisition Functional Area



Dr. Jacques S. Gansler
USD (AT&L)
DMSO Industry Day
6 Jun 1998

"We are committed to *reforming the acquisition system* and recognize that an *essential tool* for accomplishing that reform will be *modeling and simulation.*"

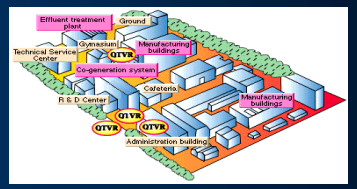
Testing and Evaluation

FAA Crash Analysis

Research and Development

Super Hornet First Flight Test

Production and Logistics




Virtual Factory

# M&S Functional Areas

Analysis

Training

Acquisition

*Some excellent M&S out there. But,*

- Not linked
- Meet localized needs only
- No data exchanged
- Hundreds of models and simulations make it difficult to know what's available

# DoD M&S Programs

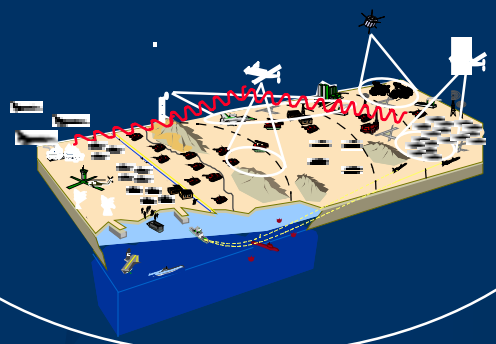
# Joint Simulation System (JSIMS)

**http://www.jsims.mil**

- **Single, distributed, seamlessly integrated constructive simulation environment.**
- **Supports Joint or Service training, rehearsal, and/or education objectives.**

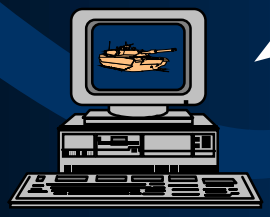
**Live/Range**

**JSIMS Battlespace**



**Live/Real World C²**

**Other Systems**



**JSIMS interacts with separately developed systems via well defined interfaces**

**Virtual Simulators & Stimulators**

# Joint Warfare System (JWARS)

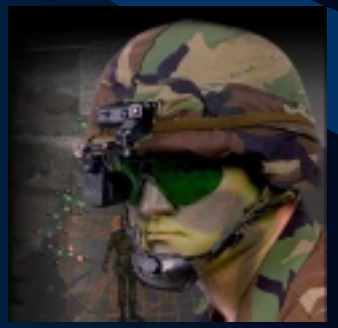
**http://www.dtic.mil/jwars**

- **Constructive simulation of joint theater warfare**
- **Assess current and future operational concepts, to include JV 2010's:**
  **Dominant Maneuver, Precision Engagement, Focused Log, and Full- Dimension Protection**
- **Aids in force assessment; deliberate and crisis action planning; system effectiveness; concept and doctrine development / assessment**

## *PAYOFF*

*FORCE STRUCTURE* *READINESS* *SUSTAINABILITY* *MODERNIZATION*



# Joint Modeling and Simulation System (JMASS)

**http://www.jmass.wpafb.af.mil**


- JMASS is a simulation support environment.
- Collection of well-defined, well-documented interface standards to which a model should be built.
- Includes a tool kit which allows modelers to build representations of real world systems, configure those models, assemble them into simulations, execute those simulations, and process the results.

**JMASS GOALS:**

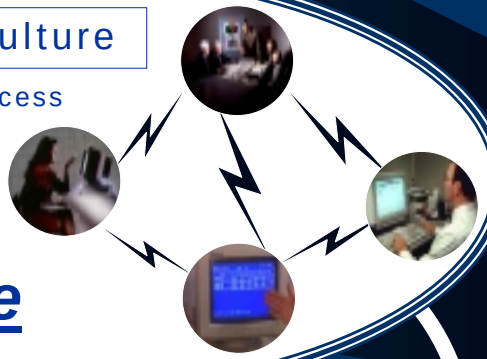
- Standard, consistent, engagement-level M&S tool
- Reduce model development costs
- Improve interoperability
- Analysis focused on results, not the tools
- Scientific and technical foundation for higher-level M&S

# Simulation Based Acquisition (SBA)

http://www.msiac.dmso.mil/sba

## Evolved Acquisition Culture

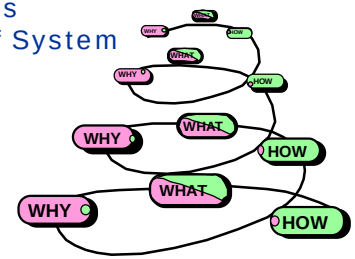
- Enabled Integrated Process Teams
- Changing Roles and Responsibilities



**Culture**

## Iterative Acquisition Process

- Iterative Spiral Process
- Electronic exchange of System Models
- Rapid Evaluation of Multiple Options

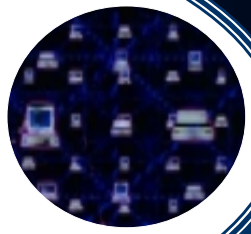



**Process**

Government / Industry

## Integrated Advanced Engineering and Management Enterprise

- Collaborative Distributed Engineering
- Info Repository
- Integrated Design Data Schema



**Environment**

*SBA - Not just M&S support, but a new engineering environment, process, & culture*

Source: SBA Roadmap Presentation, Robin Frost, SIW Spring 99

# Prior to 1990s

Focus was on two areas of the world!

# What we thought would be the result of losing one focus area!

# Reality of Today: Less $ Multi-Threats,

$ $ $ $ $ $ $ $

***2010***

**Chem/Bio Anti-Terrorism Counter Proliferation**

# Messages From The Top

"The path for this is outlined in Joint Vision 2010... blueprint for future military operations, which *combines modern technology* with *new operational concepts* and *organizational structures* designed *to make the most of technological advances*."

William S. Cohen
Secretary of Defense
1998 Annual Report to the President and the Congress.

# Messages From The Top

"*Simulations must be interconnected globally*--*creating a near-real-time interactive simulation super highway* between our forces in every theater. Each CINC must be able to tap into this global network and connect forces worldwide that would be available for theater operations."

GEN Henry H. Shelton
Chairman, Joint Chiefs of Staff
Joint Vision 2010

# Importance of M&S

**Continuing squeeze on DoD resources**

- shrinking, dispersed force structure
- competition for resources limits field exercises
- need to carefully examine every investment

**More demanding operational requirements**

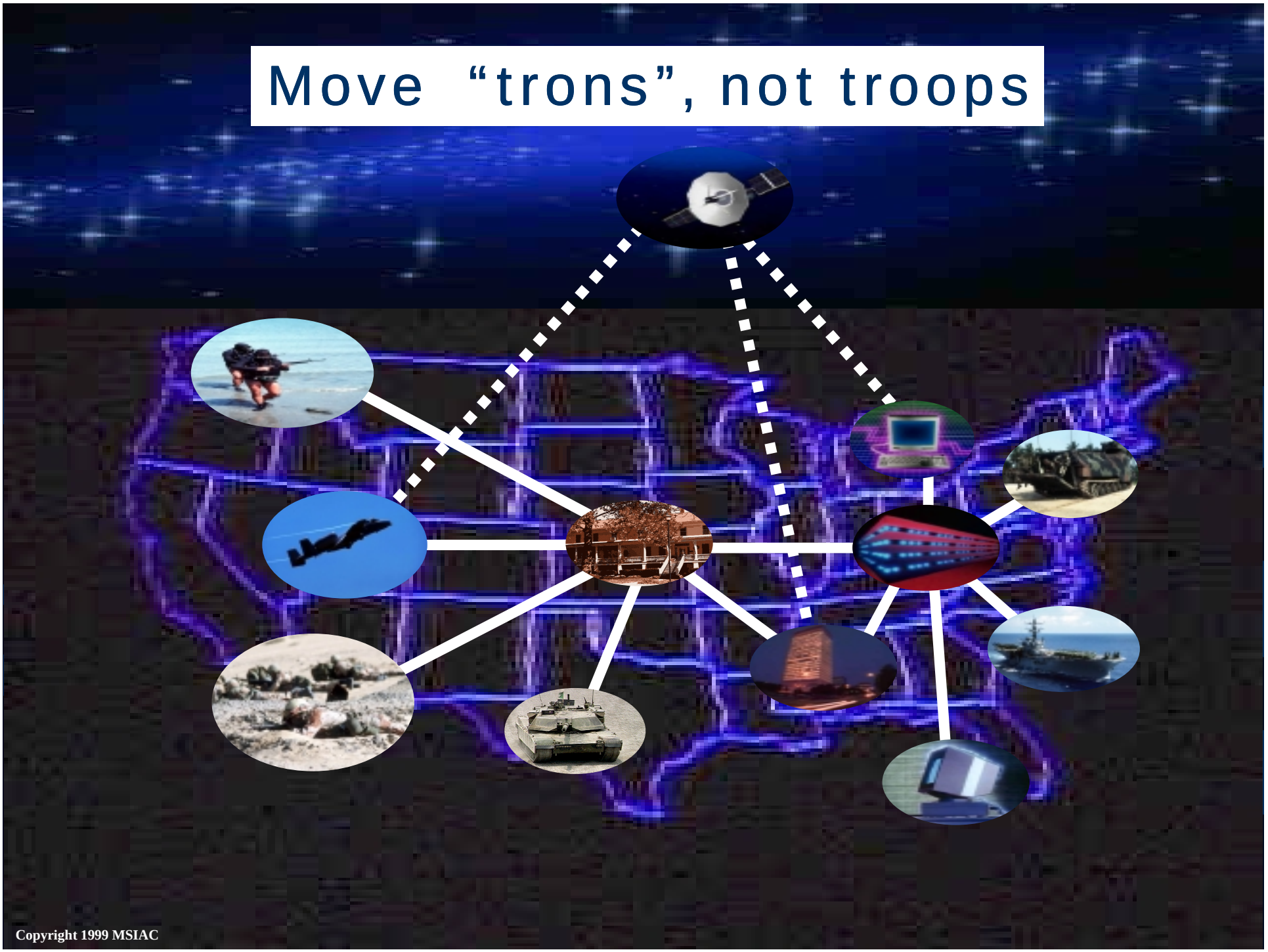
- new complex missions
- expanding mission space
- complexity of systems and plans
- demand for joint/combined training
- security challenges

**Greater technical capability at lower cost**

- communications
- computers
- advanced software technology
- displays/human-machine interfaces
- data storage and management

M&S offers a cost-effective solution

# Move "trons", not troops



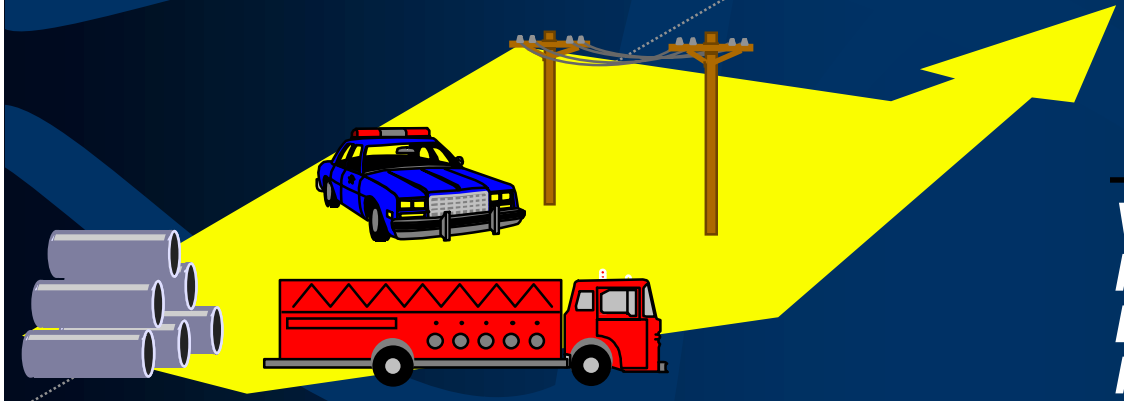
# M&S: An Analogy to City Planning

**Payoffs: Interoperability and reuse = capability and cost-effectiveness**


## Common Technical Framework

*High Level Architecture*
*CMMS (common world view)*
*Data Standards*


**All simulations and live interfaces**



## Common Services

*VV&A policy and procedures*
*Help Desks and Education*
*Environmental databases*
*Resource repositories*
*Communication networks*
*Supporting software/tools*

# DoD M&S Master Plan

***Objective 1***

**Develop a common technical framework for M&S**

***Objective 2***

**Provide timely and authoritative representations of the natural environment**

***Objective 3***

**Provide authoritative representations of systems**

***Objective 4***

**Provide authoritative representations of human behavior**

***Objective 5***

**Establish an M&S infrastructure to meet developer and end-user needs**

***Objective 6***

**Share the benefits of M&S**

DoD 5000.59-P, Modeling and Simulation Master Plan
October 1995

# DoD M&S Master Plan
# Objective 1

***Objective 1***

**Develop a common technical framework for M&S**

***Sub-objectives***

**1-1**
**High-level architecture**

**1-2**
**Conceptual models of the mission space**

**1-3**
**Data standardization**

# DoD M&S Master Plan
# Objective 2

***Objective 2***

**Provide timely and authoritative representations of the natural environment**

***Sub-objectives***

**2-1**
**Terrain**
**2-2**
**Oceans**
**2-3**
**Atmosphere**
**2-4**
**Space**

# DoD M&S Master Plan
# Objective 3

***Objective 3***

**Provide authoritative representations of systems**

# DoD M&S Master Plan
# Objective 4

***Objective 4***

**Provide authoritative representations of human behavior**

***Sub-objectives***

**4-1**
**Individuals**

**4-2**
**Groups and organizations**

# DoD M&S Master Plan
# Objective 5

***Objective 5***

**Establish an M&S infrastructure to meet developer and end-user needs**

***Sub-objectives***

**5-1**
**Field systems**
**5-2**
**VV&A**
**5-3**
**Repositories**
**5-4**
**Communications**
**5-5**
**Coordination Center**

# DoD M&S Master Plan
# Objective 6

***Objective 6***

**Share the benefits of M&S**

***Sub-objectives***

***6-1***

**Quantify impact**

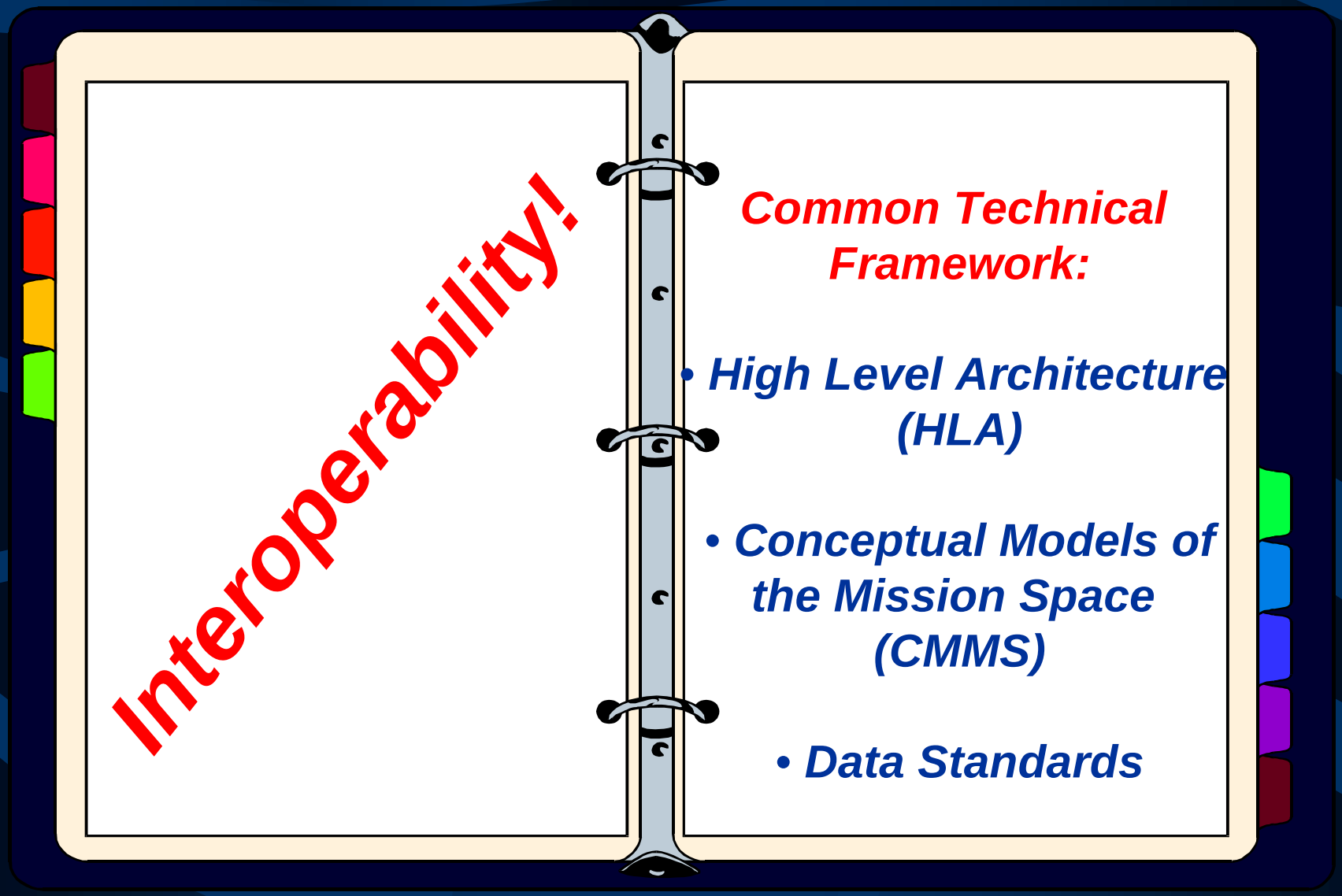
***6-2***

**Education**

***6-3***

**Dual-use**

# Objective 1


Interoperability!
Common Technical Framework:
• High Level Architecture (HLA)
• Conceptual Models of the Mission Space (CMMS)
• Data Standards

# Concept of Interoperability

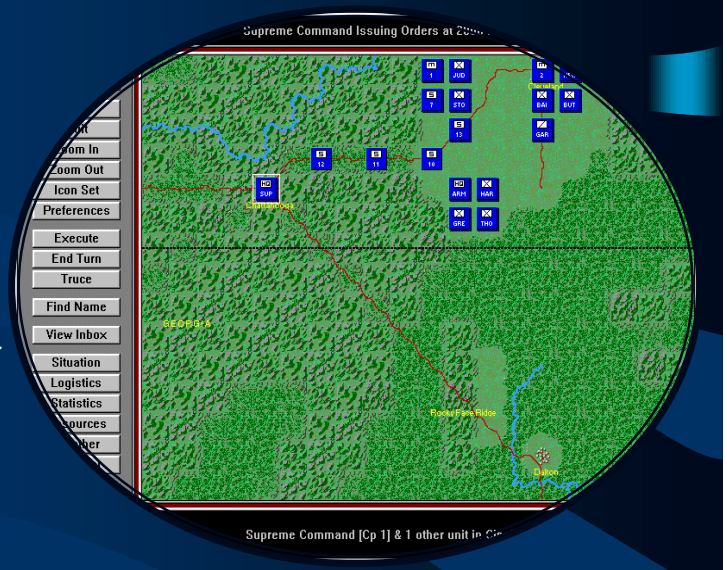
At the most basic level, Interoperability is the ability of two simulations to communicate.

Although more complicated, it is not unlike talking on the telephone, internationally, when both the technology and the language must be compatible.

# Concept of Interoperability

Development teams must comply with standards for interoperability to ensure a simulation will work well on its own and with other simulations

Simulation "B"




Simulation "A"

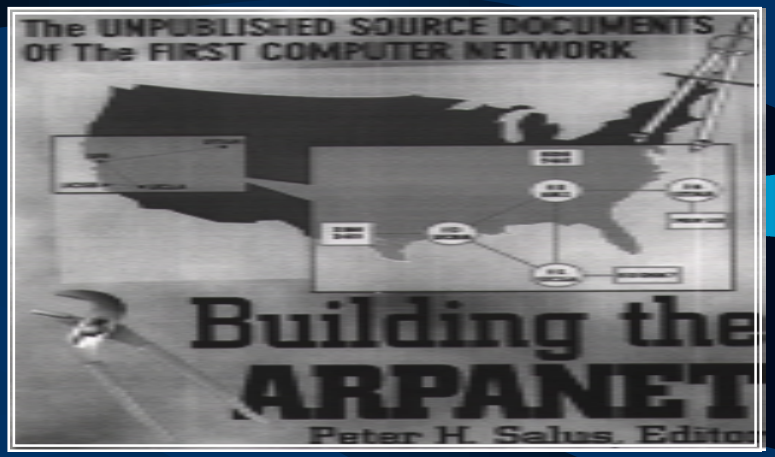
Standards allow different simulations to work together

*M&S Interoperability* is the ability of a model or simulation to provide services to and accept services from other models and simulations, and to use the services so exchanged to enable them to operate effectively together.

DoD M&S GLOSSARY, Jan 98

# History of Interoperability

1971 ARPANET, first distributed INFORMATION network




1982 SIMNET, first networked, virtual SIMULATION environment


Today - CMMS, Data Standards, and HLA

# Distributed Interactive Simulations (DIS)

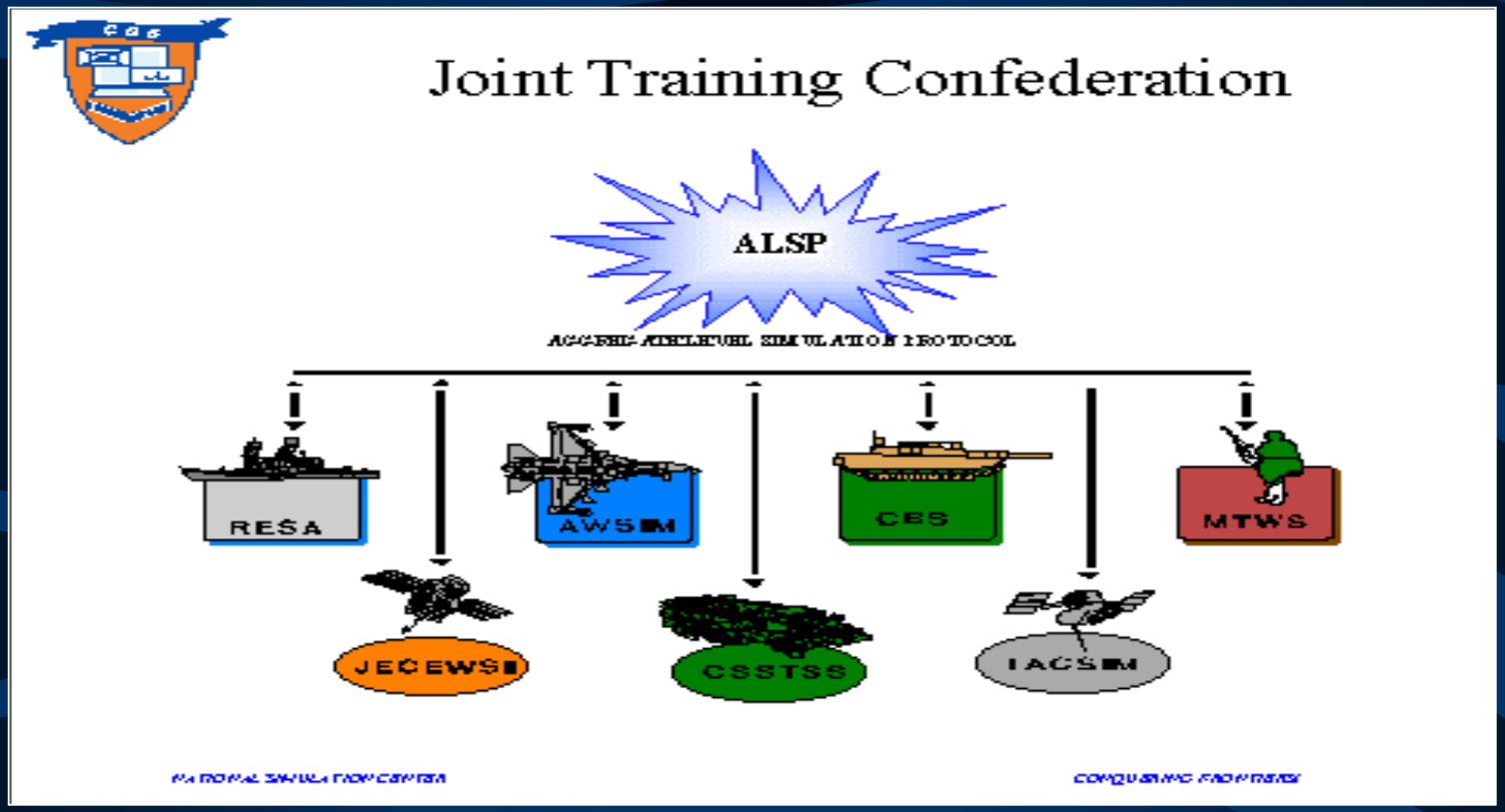
A means of linking simulators and simulations in an interactive environment.

- Transmits information using Protocol Data Units (PDUs). Each PDU contains a header (identification) and body (information).
- Still out there in many DoD legacy simulations and in some allied simulations

*Issues:*

- Runs in real time only
- Uses full broadcast distribution

# Aggregate Level Simulation Protocol (ALSP)




- Connects family of simulations known as the Joint Training Confederation (JTC)

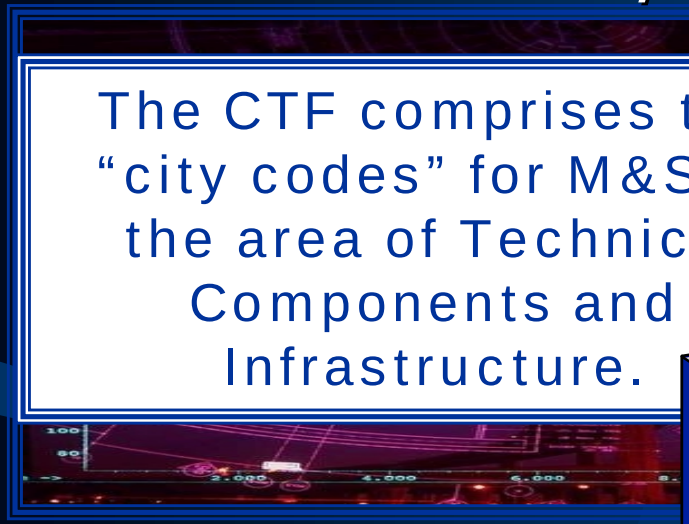
*Issues:*

- Only addresses JTC needs
- Designed for legacy systems

# Interoperability Today - CTF

## *KEY: Interoperability and Reusability*

The CTF comprises the "city codes" for M&S in the area of Technical Components and Infrastructure.




High Level Architecture (HLA)

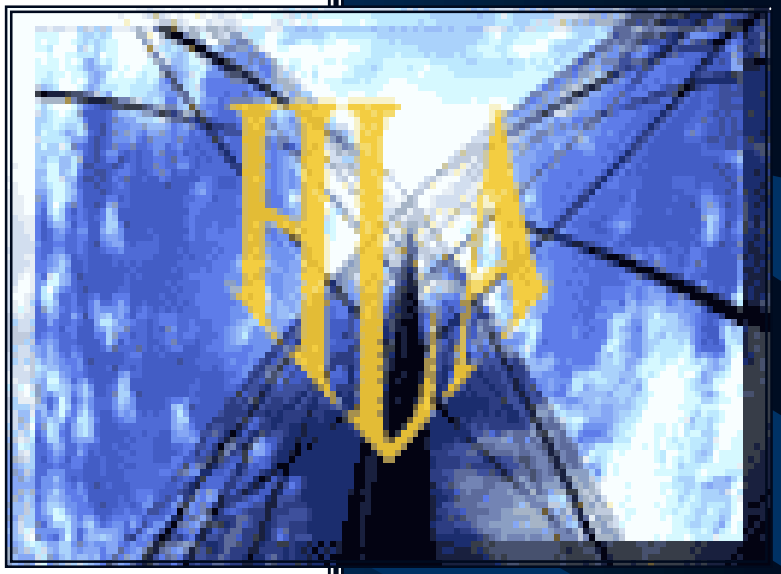
Conceptual Models of Mission Space (CMMS)

Data Standards

# Interoperability Today - HLA

*High Level Architecture (HLA)*

- Supercedes ALSP, DIS
- Mandated by DoD
- Multiple time management schemes
- Selectively passes data
- Accommodates new and legacy simulations
- Supports broad user community

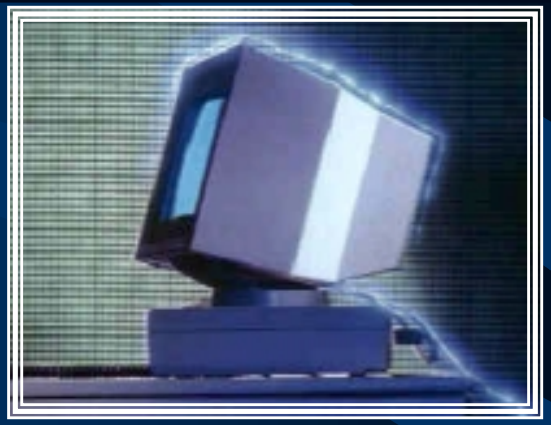


# Interoperability Today - HLA

*HLA is the Cornerstone of CTF*

In Simulations, “Stuff” Is Represented With Information About Characteristics and Processes.

HLA Allows for the Different Simulations to Exchange Objects and their Attributes

This “Stuff” is Known As “Objects and their Attributes”.

# HLA Definitions

*Federate:* one simulation; could represent:

- one platform (e.g., cockpit)
- aggregate (e.g., air traffic flow)

*Federation:* a set of federates, a common object model, and supporting connecting software

*Runtime Infrastructure (RTI):* Provides a set of services which are used by federates to coordinate their operations and data exchange during a runtime execution. RTI is connecting software.

# Interoperability Today - HLA

*Rules*

Designed to achieve interaction. Define relationships among federation components:
- 5 apply to the federation
- 5 apply to the federate

*Object Model Template*

Common framework to specify the form in which simulation elements are described and documented

*Interface Specification*

Software that allows federates to interface through the RTI.

# Interoperability Today - HLA

***DoD Policy: "Under the authority of [DoD Directive 5000.59], and as prescribed by y [the DoD Modeling and Simulation Master Plan], I designate the High Level Architecture as the standard technical architecture for all DoD simulations."***

***HLA supersedes Distributed Interactive Simulation (DIS) and ALSP***

**"No Can" Dates**

**-"No Can Pay"- <u>first day of FY99</u>**

- **no funds for developing/modifying non-HLA-compliant simulations**

**-"No Can Play"- <u>first day of FY01</u>**

- ***Retirement of non-HLA-compliant simulations***
- ***Waivers must be decided on a corporate basis***

***Dr. Paul Kaminski, USD(A&T)***
***10 September 1996***

# Interoperability Today - HLA

## *HLA Policy Reaffirmation*

*" We must foster broad simulation interoperability and reuse if the Department is to cost-effectively harness the potential of simulation to improve DoD operations."*

*" All new simulations will be built in accordance with the HLA. To reap the full benefits of simulation interoperability and reuse in the near term, it is also important to quickly transition our legacy simulations to the HLA, ... I encourage our industry partners to follow suit."*

Dr. J.S. Gansler
USD (AT&L)
7 April 98

# Interoperability Today - HLA

*HLA is Viewed as Part of Broader Standards*

**Government**

**DoD Joint Technical Architecture (JTA)**

(Included, May 98)

**International**

**North Atlantic Treaty Organization (NATO)**

(NATO M&S Master Plan, Nov 98)

**Industry**

**Simulation Interoperability Standards Organization (SISO) for IEEE Standards**

(Draft; In Process)

**Industry**

**Object Management Group (OMG)**

(Adopted, Nov 98)

# Data Standards

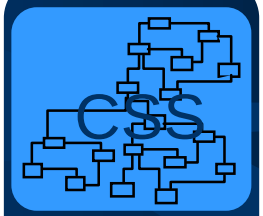
**Knowledge Collection**

PEDIGREE

Component Designated Sources


Publications
Doctrine
Operations
Tactics

Subject Matter Experts




Common Semantics & Syntax

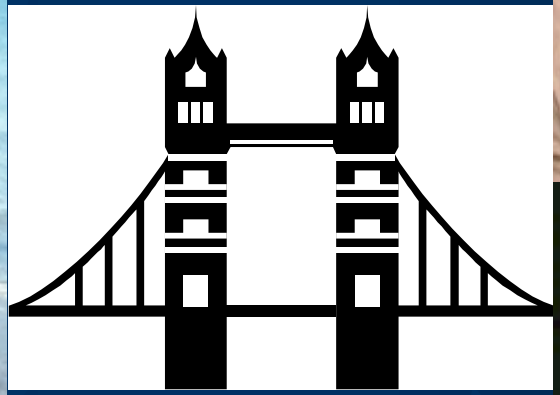

Common Data Interchange Formats

# Conceptual Models of the Mission Space (CMMS)

***CMMS is a bridge between the warfighter and the developer!***

***Conceptual Model***

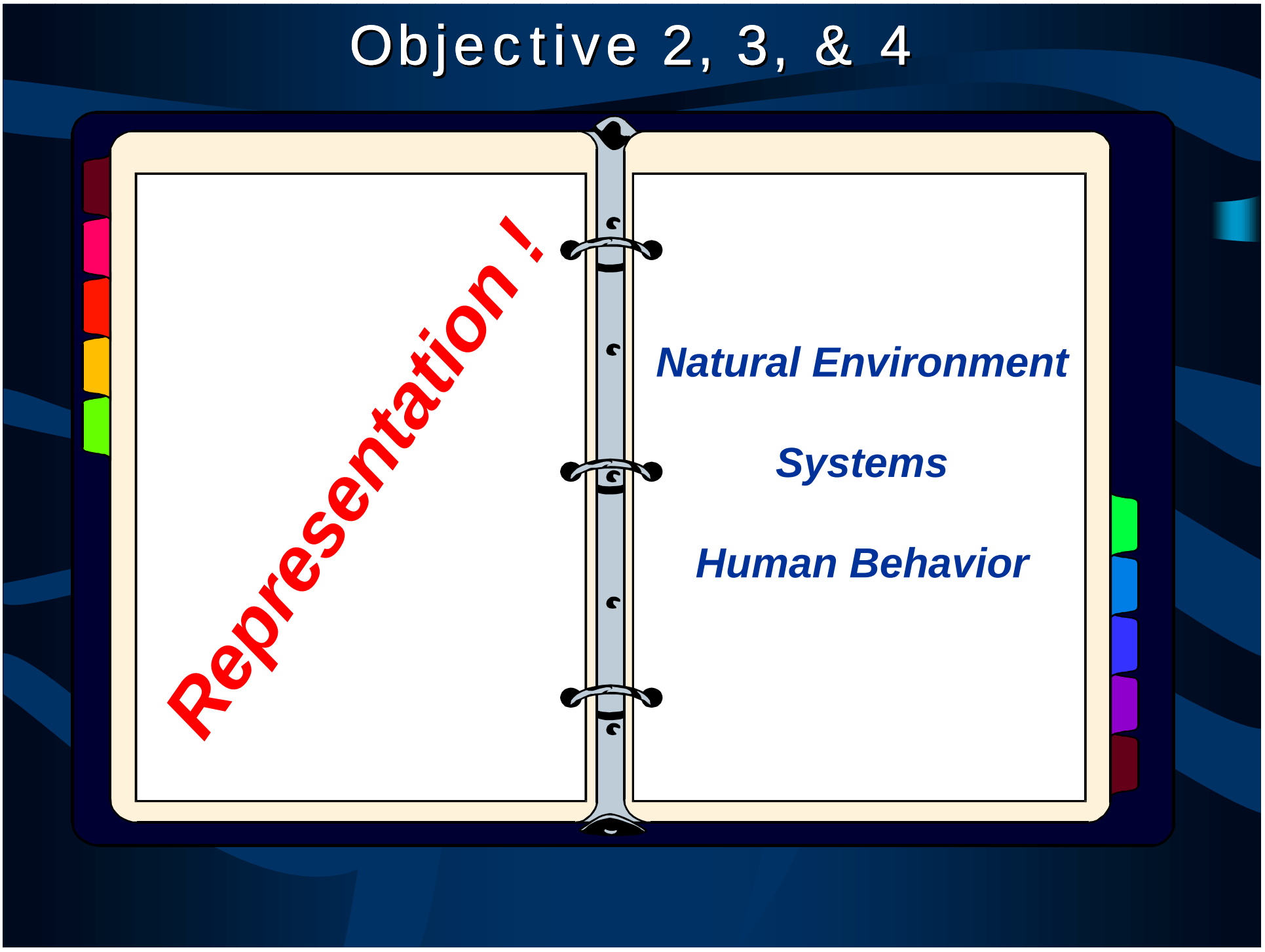
**Front-end analysis to determine warfighter's representation of the real world**



*Functional descriptions of relevant aspects of the real (or projected) world, including:*

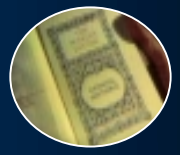
- entities
- processes
- relationships and interactions (including environmental factors)

# Objective 2, 3, & 4



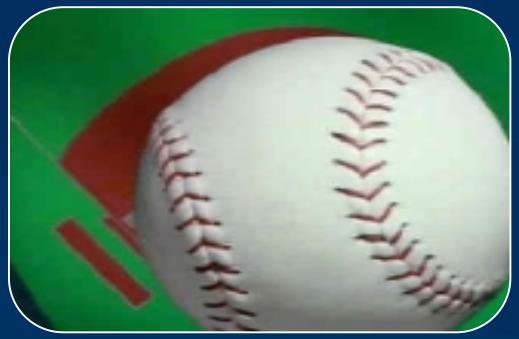
# Representation - What's Involved (Baseball Analogy)

*CTF provides the rulebook!*



**Playing Field**

**Equipment**



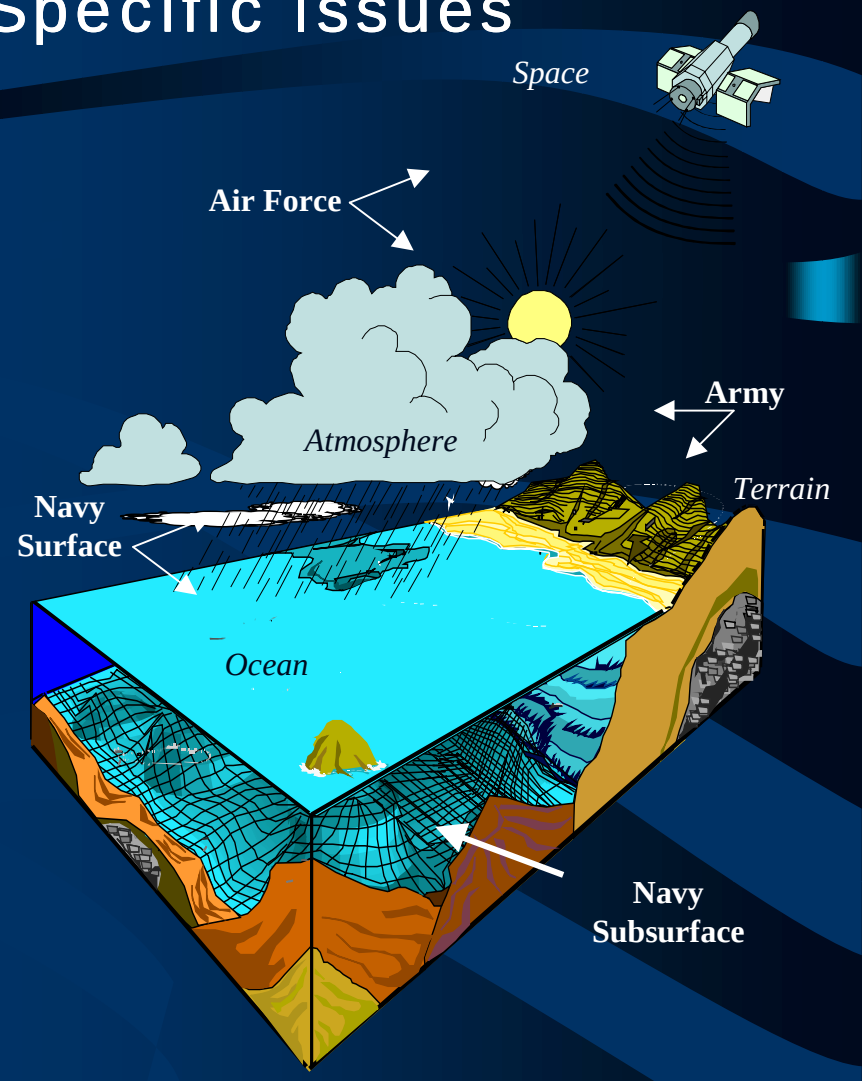
**Players**



# Representation - Specific Issues

## Environment

- Data Collection
  - Information complexity
  - Level of focus
  - Authoritative source
  - Consistency across categories
- Boundaries between areas
  - When does one stop and other start
  - Lack of available information
- Obtaining agreement across simulations
  - Specific needs within & between services
  - Level of detail varies across tasks/objectives
  - Bandwidth vs. realism
- Players interference with environment



# Environmental Executive Agents

*DoD M&S Executive Agent*

- DoD Component
- USD(AT&L) has assigned responsibility and delegated authority
- development and maintenance of a specific area of M&S application
- relevant standards and databases, used by or common to many models and simulations.

DoD M&S GLOSSARY, Jan 98

- Air and Space (USAF): http://msea.afccc.af.mil
- Oceans (Oceanographer of the Navy): www.nrl.navy.mil/OceanEA/index.html
- Terrain (NIMA): www.tmpo.nima.mil

# Systems Representation

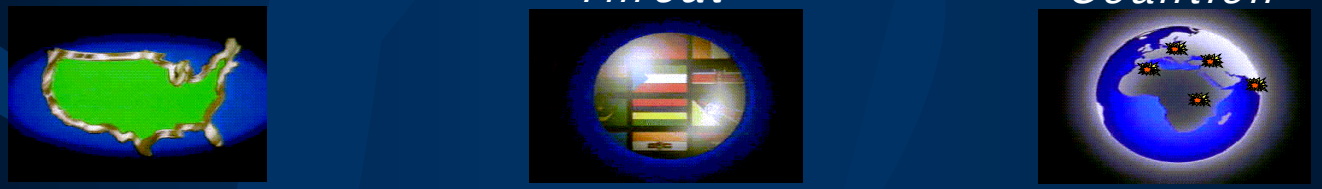
***Initial Categorization - What type of system / element in a simulation***

Units | Weapons | Platforms | Sensors | Life Support | C4I

***Secondary Categorization - Where the system operates***


***Final Categorization - Who controls the system***

U.S. | Threat | Coalition



Non-US Systems M&S Executive Agent:
DIA: www.dia.mil

# Humans & Organizations Representation

Humans and Organizations are represented in four primary areas within M&S:

*Training*

*Systems Analysis*

*Command Decision Aiding*

*System Acquisition*

Individuals ⟷ Teams ⟷ Organizations

*Sensing & Perception*

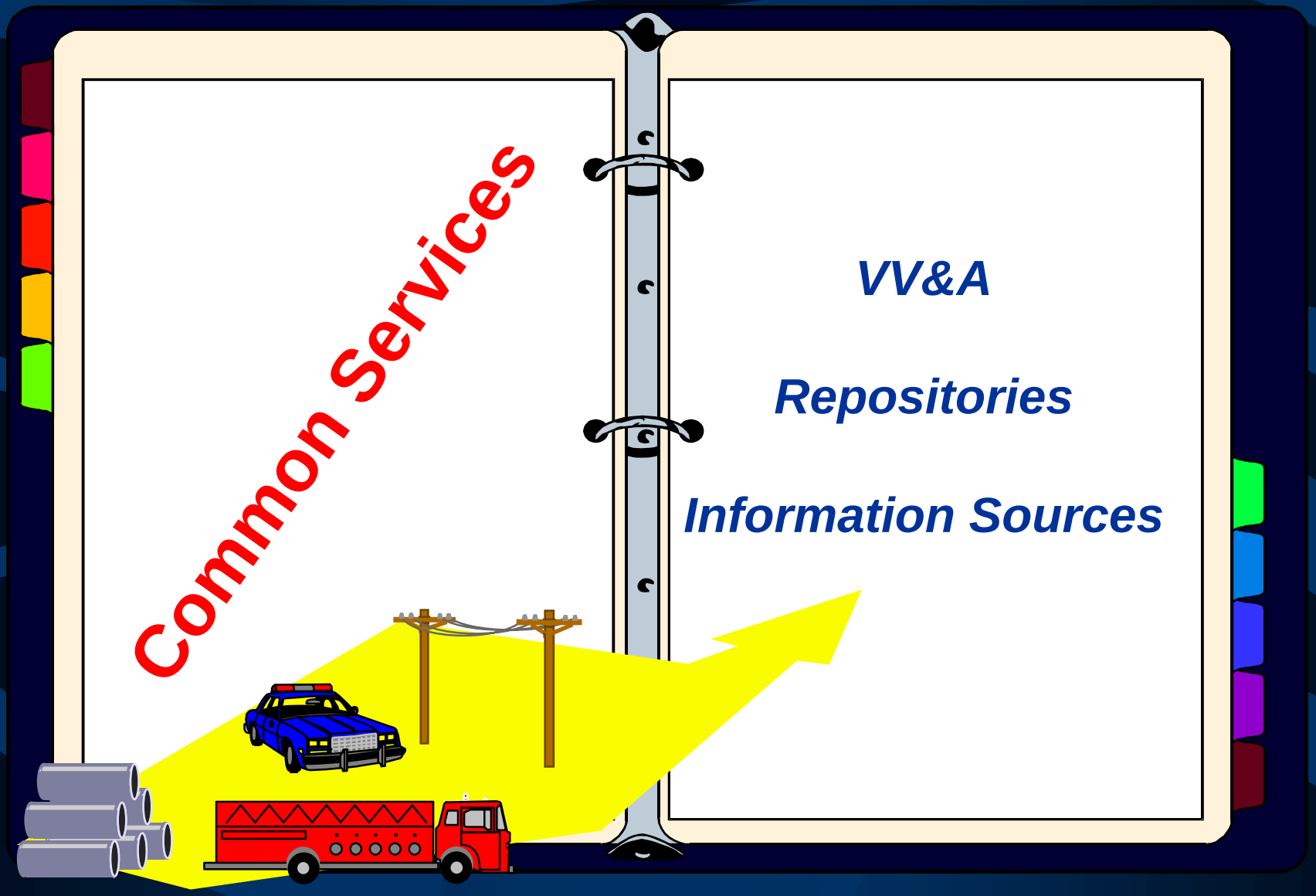

*Physical Movement*

*Information Processing*

*Decision Making*

*Communication & Coordination*

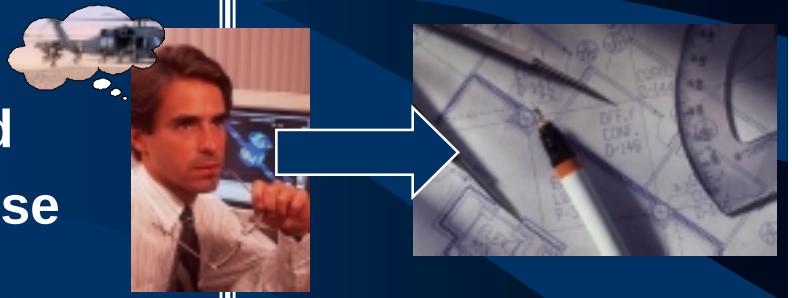
# Objective 5



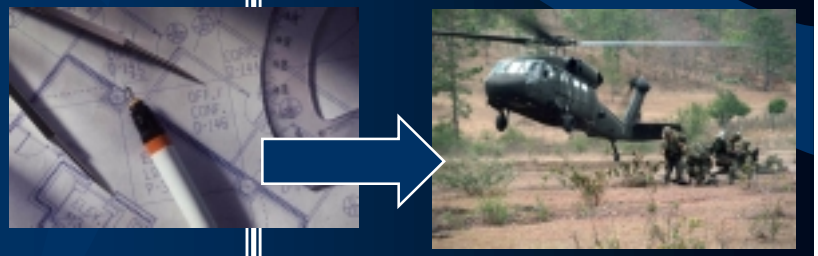
# VV&A and Risk Management

• **ACCREDITATION** Reduces the risk that an inappropriate or unsuitable simulation is selected for use in solving your problem

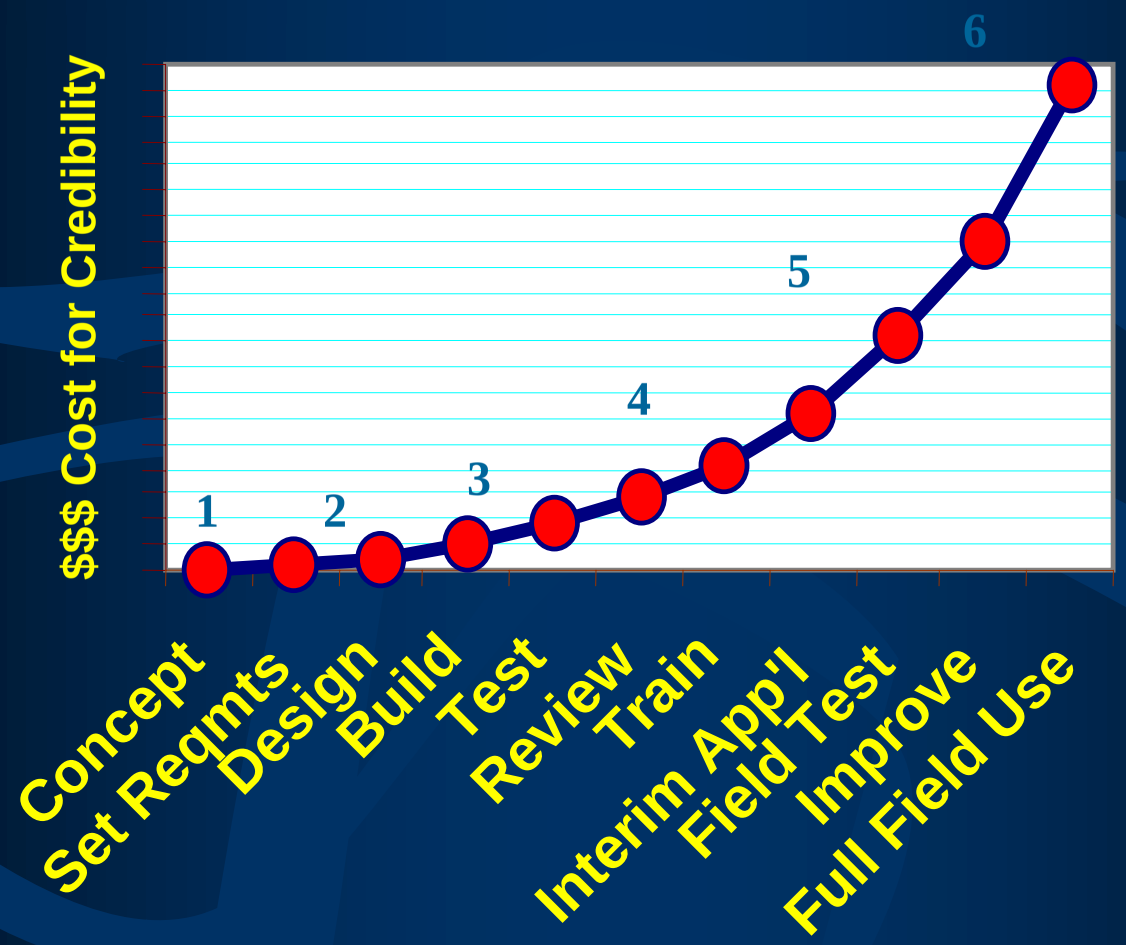

• **VERIFICATION** Reduces the risk that the software you build (or use) has undetected errors in it that are fatal to your intended use
*(Developer: "Did I build it right?")*



• **VALIDATION**
Reduces the risk that simulation outputs won't match the "real world" well enough for you to use them credibly as part of the solution to your problem
*(User: "Did I build the right thing?")*



# VV&A Start Timeline vs. Costs



# Resource Access is Confusing


**Where can I go for help?**

# Modeling and Simulation Information Analysis Center (MSIAC)

msiac
MODELING AND SIMULATION
INFORMATION ANALYSIS CENTER

MSIAC exists to facilitate the use of scientific, technical, and operational support information as it relates to M&S.


Responses

Routine Inquiries

Customer Request

Extended Inquiries

Technical Area Tasks

Help Desk

Responses

Web Site:
http://www.msiac.dmso.mil
SIPRNet:
http://207.85.140.166
1-888-566-7672; msiac@dmso.mil

# M&S Resource Repository (MSRR)

- *A cooperative effort across the Department of Defense M&S community to enable sharing of resources*
- *A distributed network of servers, on both the Internet (unclassified) and SIPRNet (classified), sponsored by DMSO, with central access sustained by the MSIAC*

*The MSRR includes:*

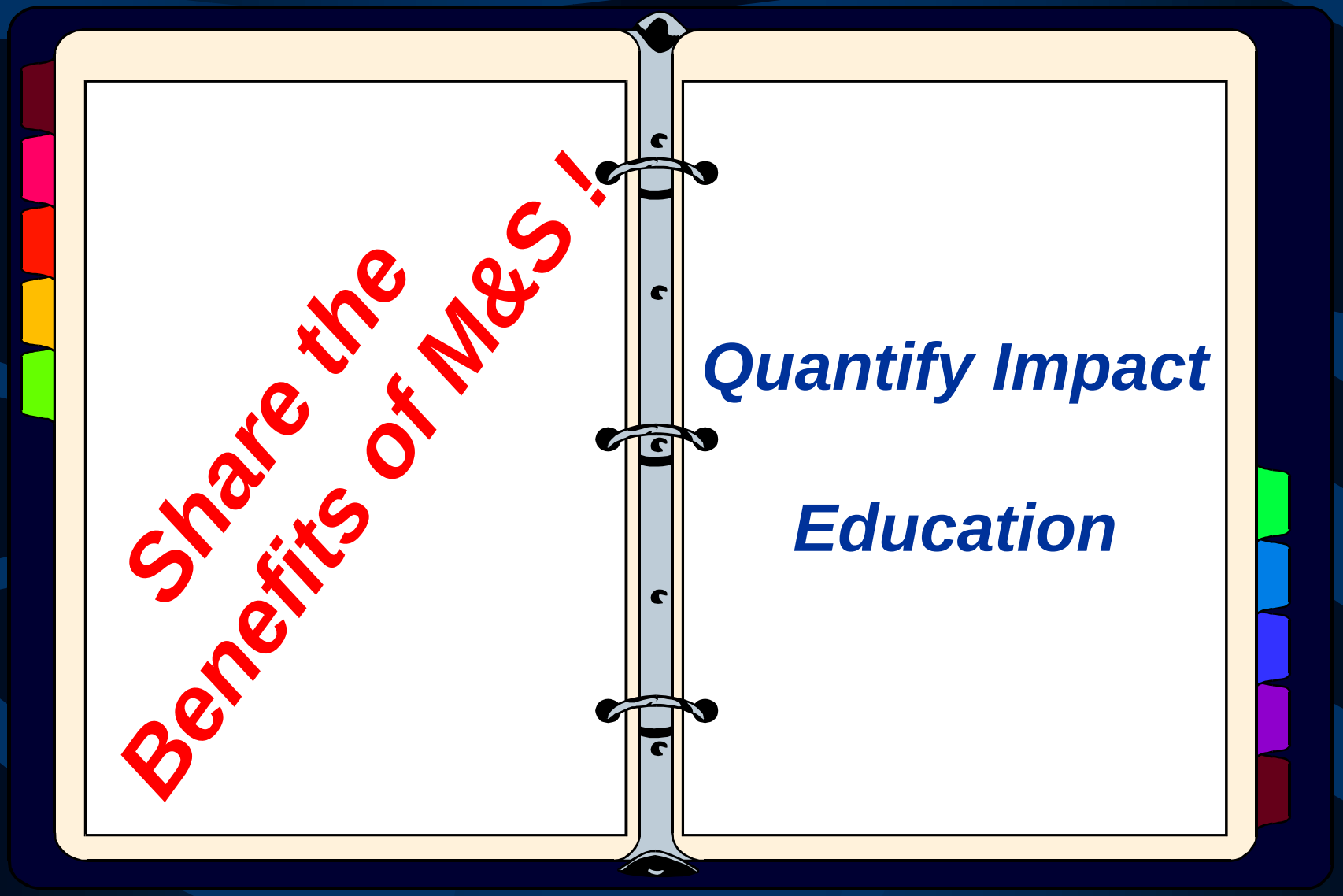
*A central catalog of resources*

*A search engine to index M&S related sites*

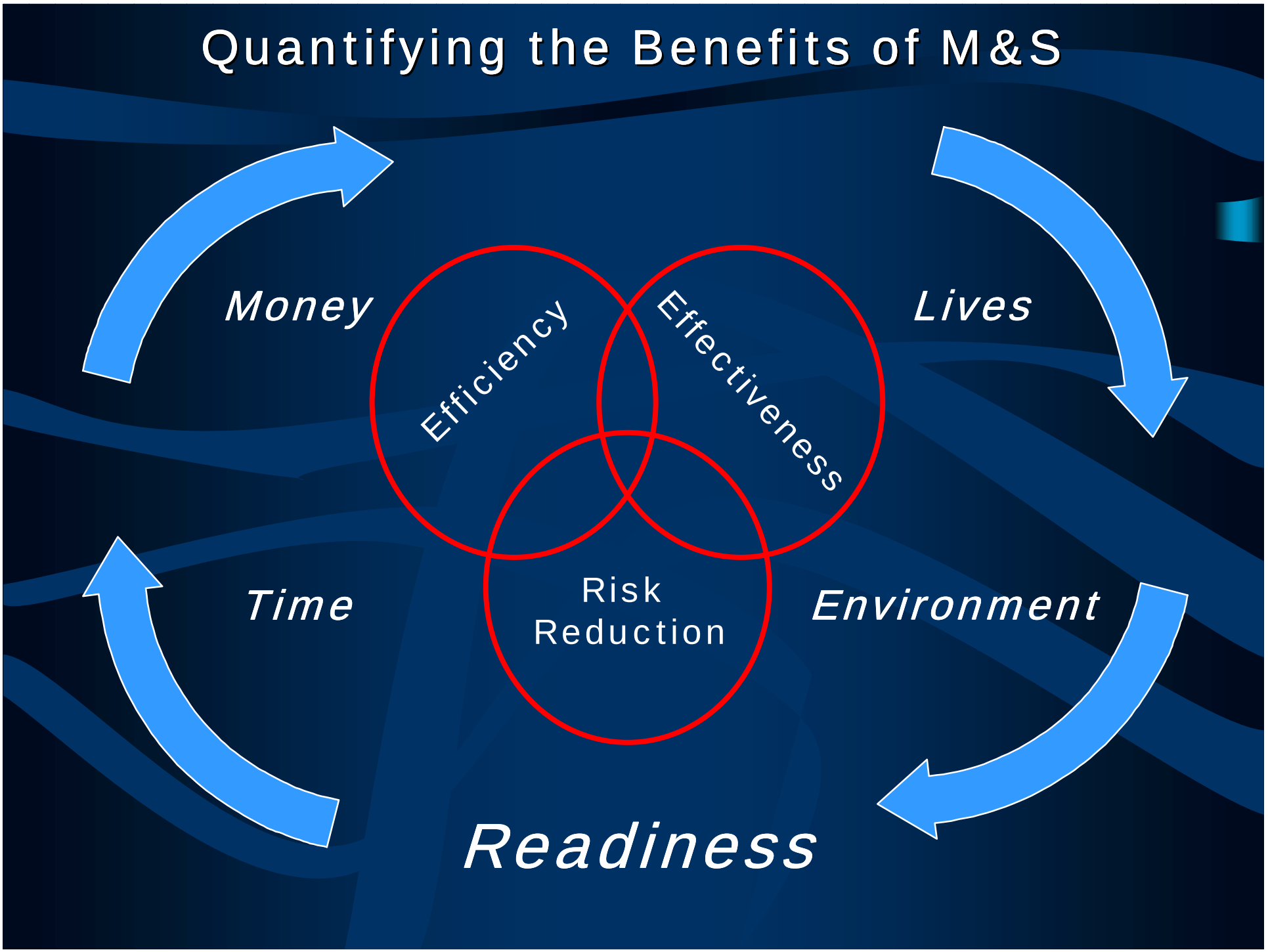
*An administrative and service infrastructure*

*A security system to prevent unauthorized disclosure of resources*

# Objective 6



# Quantifying the Benefits of M&S



Colleges

M&S Demo & Exhibits

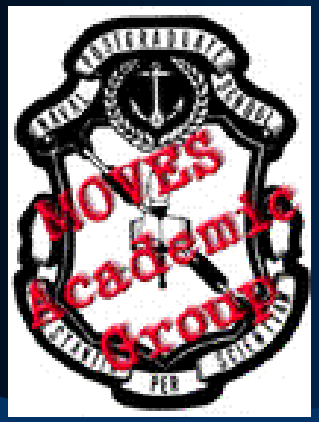

Conferences

# Educating the Community

Military Education

DMSO Education and Training

# Academic institutions focused on M&S




http://www. npsnet.org/~moves/

OLD DOMINION UNIVERSITY

www.odu.edu

UCF

IST

http://www.ucf.edu/

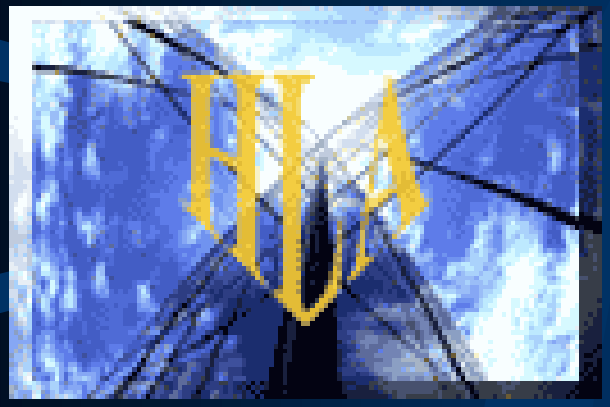
Chico

Today Decides Tomorrow

http://www.ecst.csuchico.edu/~mcleod/courses/

# M&S Courses

- M&S Staff Officer Course (MSSOC)
- Executive Level Orientation (ELO)
- Program Management Office M&S Workshop
- MS 101
- NATO M&S Orientation



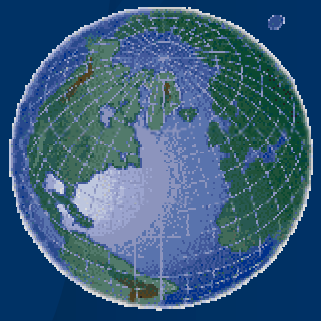

- Regional Comprehensive introduction
- Implementer-level Hands-on training in use of HLA
- CD education materials
- HLA Video

**www.education.dmso.mil**

# Conferences




Check the MSIAC web site “Links” for information on these and other M&S conferences



SISO

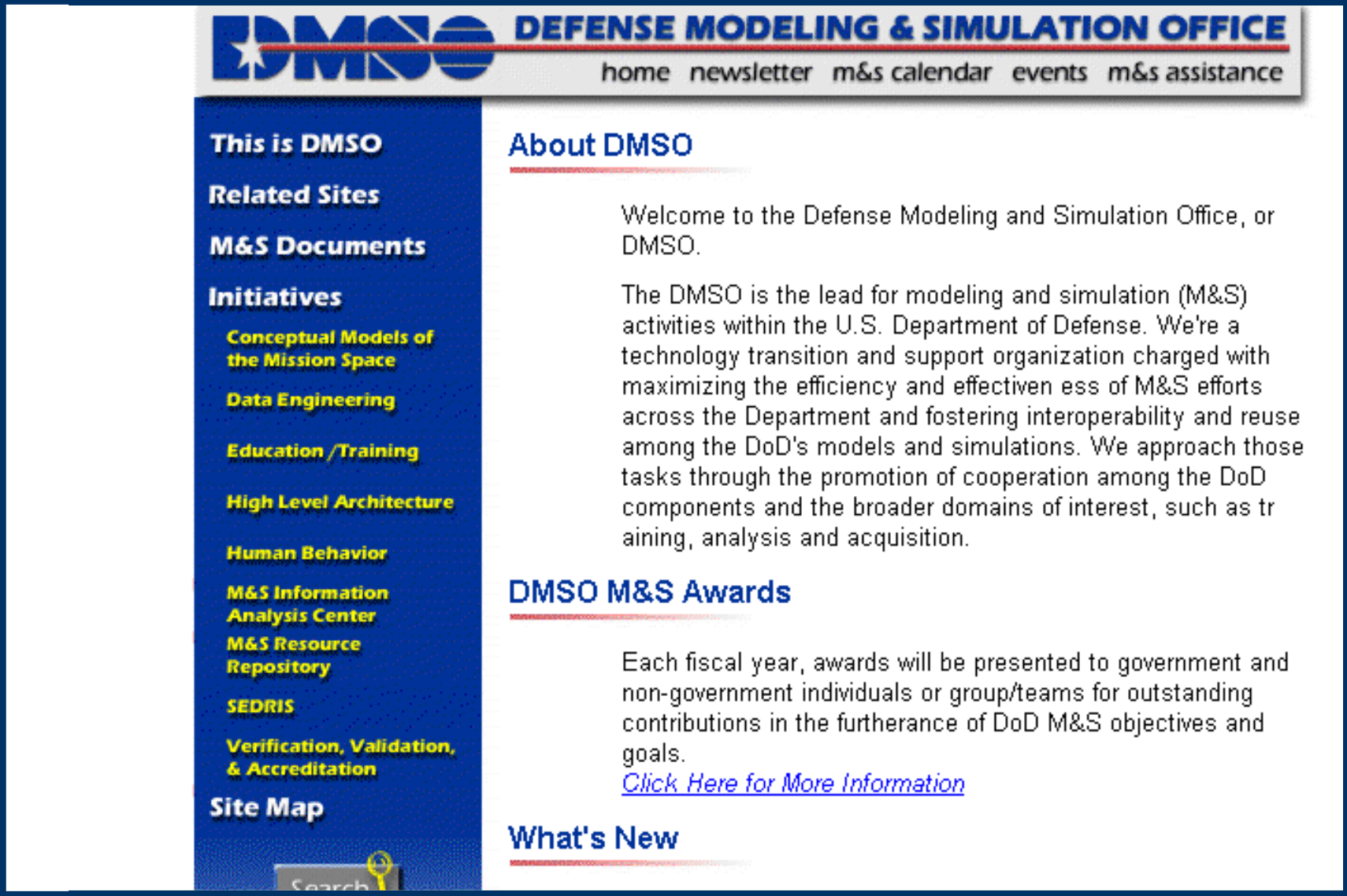
Simulation Interoperability Standards Organization

CALENDAR REFLECTORS SEARCH DOCUMENTS HELP

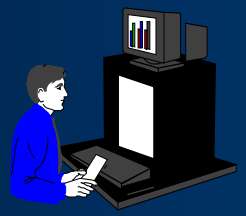
What's New

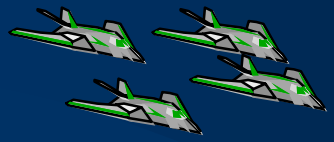
# DMSO Web Site

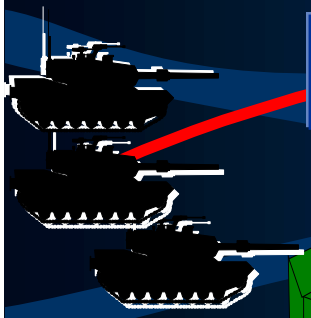
## *www.dmso.mil*



# Interoperability and Reuse !





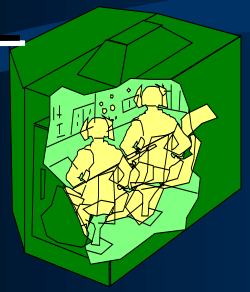


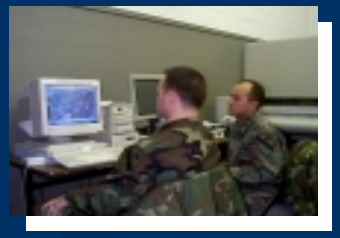
**CTF**

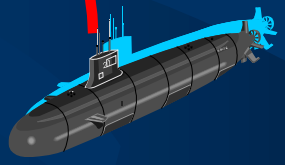
**VV&A**

**Authoritative Representation**

**Info Sources**







**"Sharing the Same Experience"**

# Summary

- DoD mission environment is challenging and changing
  - Constrained resources
  - More and increasingly complex requirements

- Technology is a force multiplier; M&S is a key enabler
  - DoD M&S Master Plan, 1995
  - "City Planning" analogy; Six objectives
    * Common Technical Framework
    * Common Services

**INTEROPERABLE - REUSABLE - AFFORDABLE - CREDIBLE**

*Desired Product --*

*Better Support to Warfighting Forces*