



Educating the M&S Workforce

M&S Body of Knowledge (BOK) & Human Capital Strategy

Dr. Edward Degnan, 407-208-5779

Division Chief M&S Foundations

Air Force Agency for Modeling and Simulation

edward.degnan@afams.af.mil

Patricia Mulligan, 407-208-5713

AF M&S Workforce Manager

Air Force Agency for Modeling and Simulation

patricia.mulligan@afams.af.mil



Original Project Intent

What Problem, Requirement, or M&S Shortfall Underlies This Proposal?

- ***The original problem that was to be addressed?***
 - “The M&S workforce is not equipped with adequate education, processes, practices, tools, technology and resources to support the institutionalization of M&S across the DoD’s mission space.” *Common & Cross Cutting Business Plan*

- ***Directive Documents***
 - Goal 5 of the DoD M&S strategic vision - To develop people that are well trained and employ existing models, simulation, and data to support departmental objectives.
 - Acquisition M&S Master Plan: M&S Education is called for under Objective 5, Shape the Workforce.
 - M&S SC Common and Cross-Cutting Business Plan identified the following Workforce Development Gaps:
 - A DoD **Human Capital Strategy** for M&S to articulate competencies required.
 - Accepted multi-disciplinary M&S **Body of Knowledge (BOK)**.



Original Project Intent

Project Overview Design

Purpose of the M&S Workforce Project

To determine whether the current M&S workforce and management structure or a modification of that structure is required to ensure that M&S technology capabilities are effectively integrated throughout DoD.

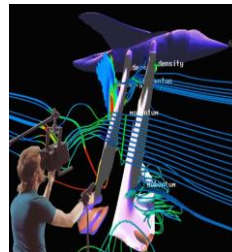
DoD Functional Communities



Planning



Training



Acquisition



Testing



Analysis



Experimentation

Services and Joint Communities



Army



Marines



Navy



Air Force



Joint Organizations

Introduction



The DoD Modeling and Simulation (M&S) workforce comprises at a minimum of 10,000 individuals* which includes military, government civilians, and contractors.

Assuming \$150K cost per individual this represents an expenditure of \$1.5B per year.*

***These numbers are based on previous studies (through surveys and verified during focus group sessions) by the U.S. Army and U.S. Air Force, plus the results from this initiative.**



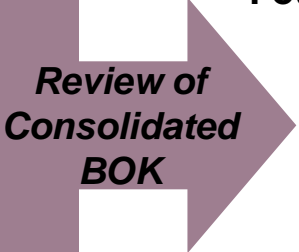
Joint M&S Workforce Development: Joint M&S BOK

Project Overview Design

- Every profession has a Common Body of Knowledge (BOK) that serves as the framework for educating and testing the competencies of those wishing to enter and succeed in the profession.
- M&S BOK is a result of combining several previous initiatives for developing a DoD M&S BOK.



- Joint Organizations
- Army
- Navy
- Air Force
- Marines
- Acquisition
- Training
- Planning
- Testing
- Analysis
- Experimentation



- Initial validation of this BOK, each functional area community and individual Service was requested to identify the knowledge/ skill levels.
- Four areas of M&S usage were examined:
 - **Awareness** – information all persons need to know about M&S
 - **Application** – information needed to perform M&S functions
 - **Management** – information needed to manage M&S programs
 - **Executive** – information senior leadership needs to know about M&S



Joint M&S Workforce Development: Joint M&S BOK

Project Overview Design

- Each functional area community and Service reviewed/validated the consolidated BOK
-
- Each functional and service organization recorded the highest knowledge/skill level needed for each content element.
- 519 knowledge areas were reviewed
- Utilized the Bloom Taxonomy to rate each knowledge/skill level:
 - 1 - **Knowledge**: Recalls data or information
 - 2 - **Comprehension**: Able to understand the meaning of data or information
 - 3 - **Application**: Uses information in new situations; solves problems
 - 4 - **Analysis**: Breaks down information and identifies components
 - 5 - **Synthesis**: Uses old ideas to create new ones
 - 6 - **Evaluation**: Compares and discriminates between ideas
 - 0 - **Does not apply**
- Published as an Appendix in the Human Capital Strategy for the the BOK for four levels of M&S usage (Awareness, Application, Management and Executive)



Project Overview

M&S BOK & Human Capital Strategy

Application

KNOWLEDGE AREA	<i>Application</i>											
<i>Basic Concepts</i>	<i>Army</i>	<i>Navy</i>	<i>AF</i>	<i>Marine</i>	<i>Joint</i>		<i>Acq</i>	<i>Anl</i>	<i>Exp</i>	<i>Plan</i>	<i>T&E</i>	<i>Train</i>
<i>Understand historic perspective of M&S</i>												
Historic Aspect of M&S	3	2	3	7	1		1			2	1	7
<i>DoD/Military Simulations</i>												
Policies and rules	5	3	5	3	3		3			2	7	6
<i>Modeling Concepts</i>												
<i>Model Types</i>												
Model Definition	4	6	4	2	2		3			2	3	6
Model Concept	4	6	4	4	6		3			2	6	6
Physical Models	4	6	4	4	6		3			2	6	6
Mathematical Models	4	6	4	4	6		3			2	6	6
Process Models	4	6	4	4	6		3			2	6	6
Combination Models	4	6	4	3	2		4			2	6	6



Project Overview

M&S BOK & Human Capital Strategy

M&S Management

KNOWLEDGE AREA	Management		Competencies
Basic Concepts			
Understand historic perspective of M&S			
Historic Aspect of M&S	1.33	1	Understand the historic aspects of M&S and common threads that are still valid today
DoD/Military Simulations			
Modeling Concepts			
Model Types			
Model Definition	2.36	2	Know the definition for model
Model Concept	2.69	3	Determine information (and amount) required to develop a model
Physical Models	2.91	3	Define a physical model and apply principles to a given situation
Mathematical Models	2.91	3	Define a mathematical model and apply principles to a given situation
Process Models	2.47	2	Define a process model and provide examples
Combination Models	2.41	2	Define combination models and provide examples

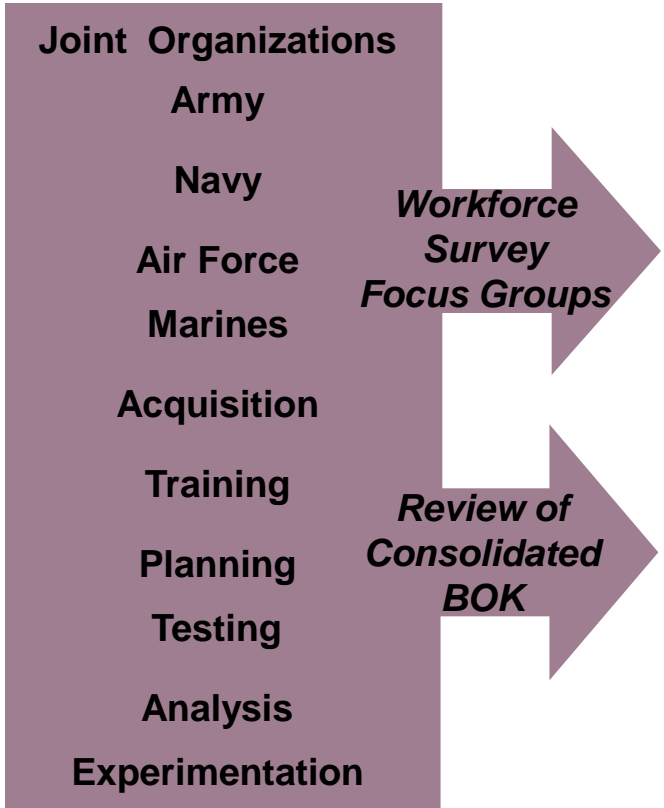


Project Overview

M&S BOK & Human Capital Strategy

Data Collection

- ***Conducted a review of materials, reports, other organizational structures, other M&S Workforce studies and published literature***
- ***Survey elements of DoD through a Trend Analysis Survey and Conduct Focus Group Interviews***

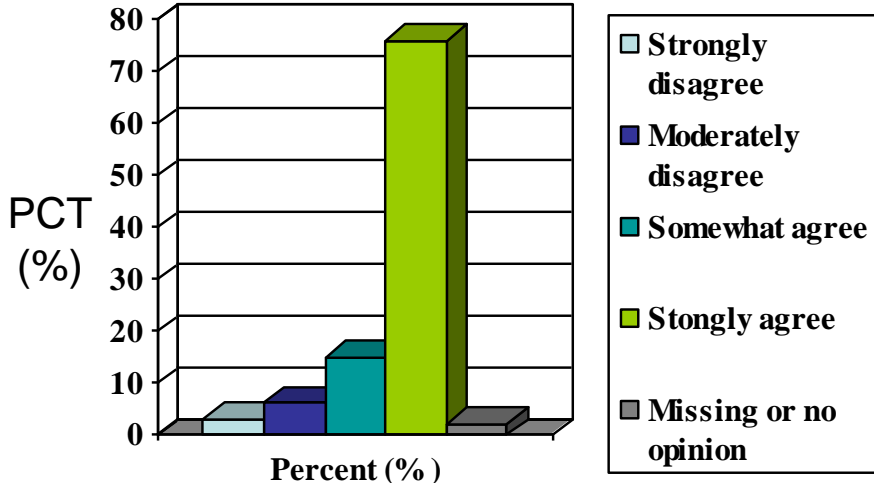


- 1) ***What is meant by an M&S position?***
- 2) ***What **characteristics, competencies, and academic proficiencies** are required of key M&S positions by organizations throughout the DoD?***
- 3) ***Having defined the characteristics, competencies, and academic proficiencies required of key M&S positions what **analytical data is available to support a DoD M&S Human Capital Strategy?*****
 - ***What are the core **M&S requirements** for the various **functional application areas?*****
 - ***What are the **core M&S requirements** for **leaders / managers?*****
 - ***What are the core **M&S requirements** for **executives?*****
- 4) ***What business process would be most effective to identify and track M&S professionals?***

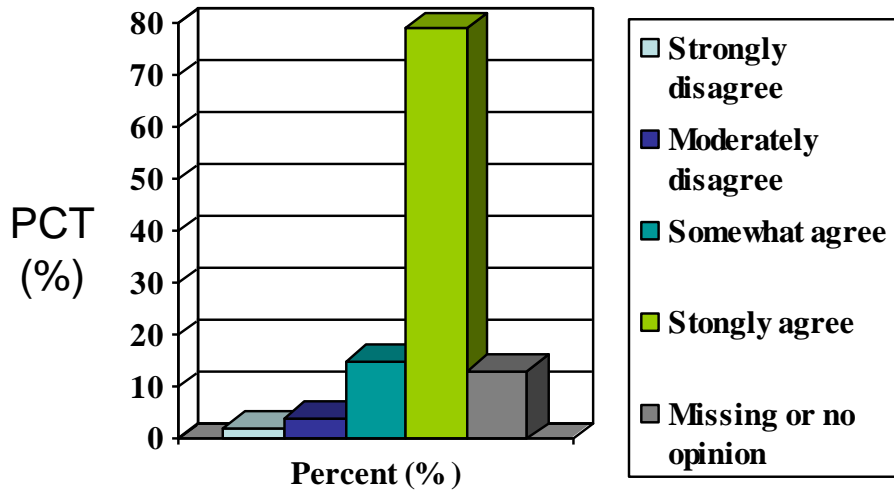


Survey Results

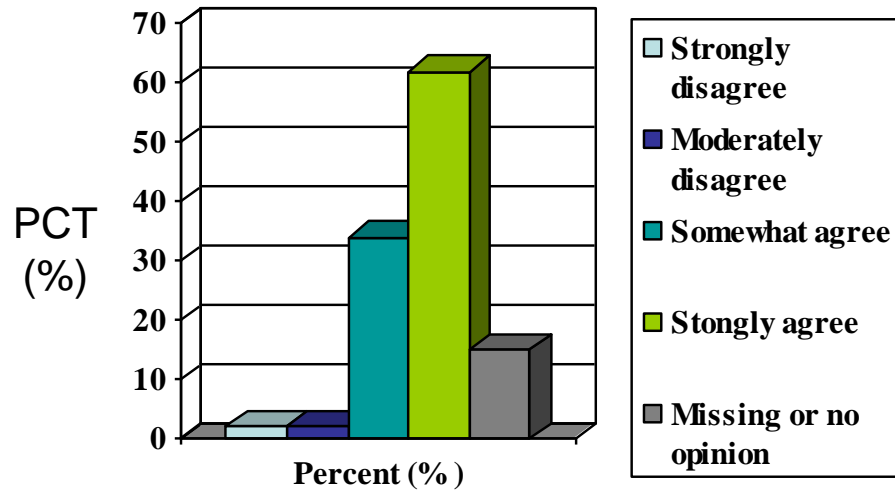
M&S critical for mission success



Org has need of M&S expertise



Org has positions or requirements for specially trained M&S personnel



Data Collection Focus Group Results



- **M&S is critical for mission accomplishment**
 - Qualitative Indicators – 92% of comments emphasizes the critical role of M&S

- **Future M&S requirements will be critical for an organization’s successful mission accomplishment**
 - Qualitative Indicators – 96% of comments view future M&S requirements as critical

- **There are positions and/or associated requirements for specially trained M&S personnel in organizations**
 - Qualitative Indicators – 94% of comments see the need for specially trained M&S personnel

- **Organizations have all of the M&S personnel that are needed**
 - Qualitative Indicators – 84% of comments stated additional M&S personnel are needed

Qualitative results reinforce the quantitative survey results

Data Implications Overview



- **Need an appropriate mix of M&S personnel in organizations**
 - **Officers for Operational Relevance**
 - **GS Civilians for Long Term Continuity**
 - **Contractors are critical but should not be responsible for performing inherently government work**

- **M&S expertise has evolved from professionals in a wide range of job series**
 - **GS-1515 Operations Research Analysis, GS-301 General Management, GS-2210 Computer Specialist; GS 340 Program Management; GS-854 Computer Engineering; etc.**
 - **Promotion/advancement based on job series, not M&S**

- **Contractors**
 - **Each organization has a tendency to view the role of contractors differently**
 - **Unique management competencies are required in dealing with contractors**



Joint M&S Workforce Development: Human Capital Strategy

M&S Challenges

Nine developments within the field of M&S that will have an impact on the DoD M&S workforce

- ***Technical and complex nature of M&S***
 - **M&S tools/applications are technical in nature**
 - **Requires a mix of technical and application skills**
- ***Advances in Technology***
 - **Increased Capabilities**
 - **Rate of Obsolescence**
- ***Need for Digital Systems to Interoperate***
 - **C4I to C4I**
 - **Simulation to Simulation**
 - **C4I to Simulation**
- ***Need for Information Traceability with Documentation***
 - **Historically Lacking**
 - **Process vs. Culture Issue**
- ***Diverse Functionality of M&S Community***
 - **Six different Functional Communities**
 - **Requirements Variations**



Joint M&S Workforce Development: Human Capital Strategy

M&S Challenges

Nine developments within the field of M&S that will have an impact on the DoD M&S workforce

- ***Need for re-use of M&S tools/applications***
 - **Cost of development**
 - **Duplication**
 - **Long-term sustainment costs**
- ***Ongoing changes to DoD environment and missions***
 - **Impact on legacy simulations**
 - **Changes in Mission Set - Warfare vs. other requirements**
 - **Net-centric Operations**
- ***DoD M&S workforce***
 - **M&S “workforce” mix of military, government civilian and contractors**
 - **Most “just happen” into the workforce**
 - **Inherently government work issue**
- ***M&S Skill and Competency Gaps***
 - **Historically new technologies create gaps - Printing Press example**
 - **Secondary effects**
 - **Mix of technical, operational and management level personnel**



Joint M&S Workforce Development: Human Capital Strategy

Modeling and Simulation Human Capital Strategic Goals

Strategic Goal 1: Develop M&S Leadership

Develop leaders to ensure the capabilities that M&S bring to the DoD enhance the ability to execute the department's mission through cooperative and innovative approaches for its investment in and delivery of products, technology, and services.

Objective 1.1 Develop M&S leadership competency framework

Objective 1.2 Assess leadership composition & competencies of current workforce

Objective 1.3 Implement strategies to close competency gaps

Strategic Goal 2: Establish a High-Performing DoD M&S Workforce

Advance M&S to a results-oriented culture that fosters innovation, avoidance of duplication, motivates staff, and sustains a high performing, workforce.

Objective 2.1 Develop and implement strategies to ensure the effectiveness of diversity programs and practices

Objective 2.2 Implement a performance management system that aligns employee performance plans with organizational goals

Objective 2.3 Implement compensation structures that distinguish between levels of performance, recognize contribution and rewards merit



Joint M&S Workforce Development: Human Capital Strategy

Modeling and Simulation Human Capital Strategic Goals

Strategic Goal 3: Institute Recruitment and Retention Practices

Develop effective strategies to recruit and retain a highly skilled and diverse M&S workforce for DoD (including the Services and functional communities) in order to meet the myriad of customer needs and to transform the Department into the Employer of Choice for M&S professionals.

Objective 3.1 Create & implement an M&S workforce recruitment strategy for DoD

Objective 3.2 Implement strategies to retain skilled M&S personnel

Objective 3.3 Become an employer of choice for M&S professionals

Strategic Goal 4: Institutionalize M&S Talent Development/Knowledge Management

Develop, promote, and retain a culture of continuous learning to ensure that the M&S workforce has the knowledge, skills, and abilities to achieve National Security and National Objectives.

Objective 4.1 Develop M&S competency framework

Objective 4.2 Assess competencies of current M&S workforce

Objective 4.3 Implement strategies to close competency gaps

***Objective 4.4 Implement Strategies to preserve M&S organizational
(institutional) knowledge***



Joint M&S Workforce Development: Human Capital Strategy

Modeling and Simulation Human Capital Strategic Goals

Strategic Goal 5: Evaluate Human Capital Effectiveness

Ensure that the management of M&S Human Capital is recognized as a critical component of DoD's mission and that M&S Human Capital strategies, programs, and systems are aligned and measured to effectively achieve DoD goals.

Objective 5.1 Design an M&S organizational structure that allows the right mix of personnel (military, civilian and contractor)

Objective 5.2 Align Human Capital Management strategies with mission, goals, and organizational objectives and integrate into strategic plans, performance plans, and budgets

Objective 5.3 Design an M&S workforce planning framework that aligns with the DoD's strategic plans

Objective 5.4 Implement an accountability system that monitors & measures the results of M&S human capital management policies, programs & activities



Joint M&S Workforce Development: Human Capital Strategy

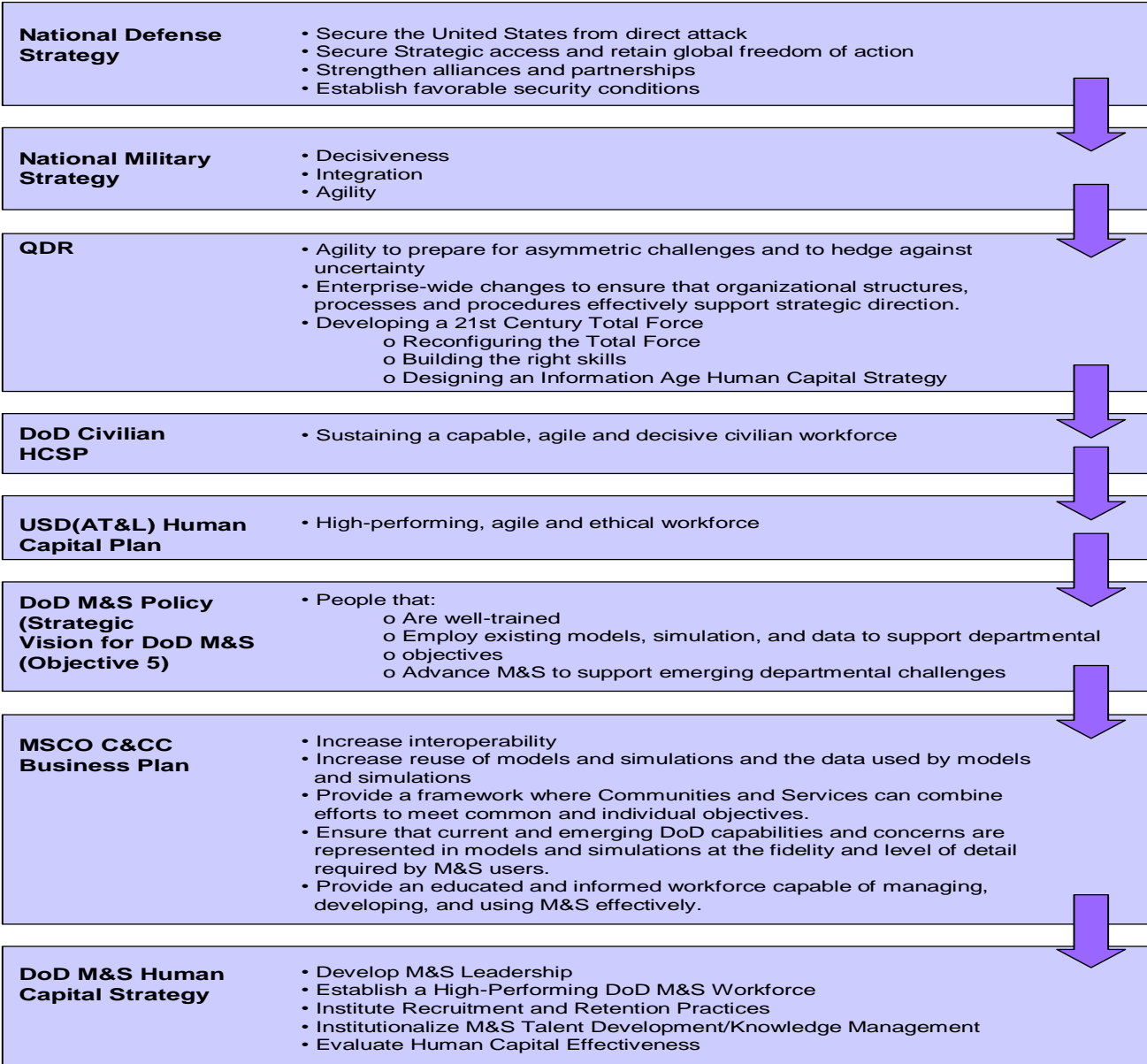
Alignment of Strategic Goals to M&S Challenges

	Strategic Goal 1: Develop M&S Leadership	Strategic Goal 2: Establish a High-Performing DoD M&S Workforce	Strategic Goal 3: Institute Recruitment and Retention Practices	Strategic Goal 4: Institutionalize M&S Talent Development /Knowledge Management	Strategic Goal 5: Evaluate Human Capital Effectiveness
Technical and complex nature of M&S	X	X	X	X	
Advances in Technology		X	X	X	
Need for Digital Systems to Interoperate	X	X		X	
Need for Information Traceability with Documentation	X			X	
Diverse Functionality of M&S Community	X	X	X	X	X
Need for re-use of M&S tools/applications		X	X	X	X
Ongoing changes to DoD environment and missions	X	X		X	
DoD M&S workforce	X	X	X	X	X
M&S Skill and Competency Gaps	X	X	X	X	X



Joint M&S Workforce Development: Human Capital Strategy

Strategic Guidance and Alignment





Prototype Educational Elements for Acquisition / TE

Problem

- **M&S is not realizing its potential for cost savings in DoD**
 - **Customers of M&S do not know how to employ M&S effectively**
 - **Which tools to use, when to use them, how to use them, how to get them.**
 - **Customers of M&S do not understand risk and benefits of using M&S**
- **Education can help drive wider acceptance and better use**



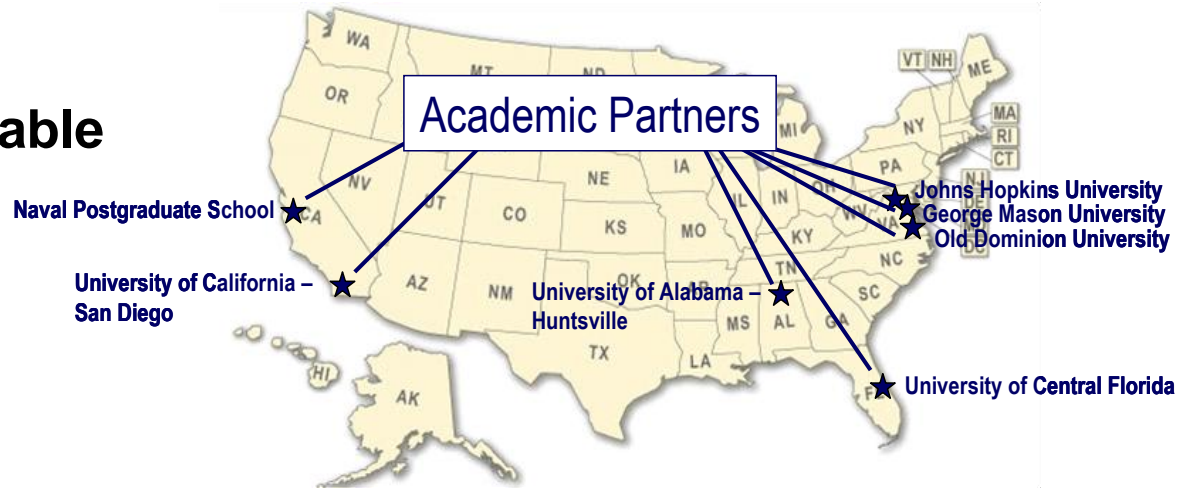
Prototype Educational Elements for Acquisition / TE

The Approach

- **Identify requirements using a wide set of stakeholders for focused initial audience**
- **Survey existing US educational programs to identify gaps**
- **Develop educational offerings to cover gaps using the best US university programs**

- **Make them widely available**

- **Web**
- **DAU CLMs**
- **University Courses**
- **Short courses**
- **Public domain**



- **Track return on investment longitudinally**

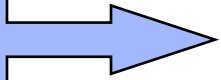


Original Project Intent

Project Overview Design

Consisting of Academic Partners Including:
**George Mason University; John Hopkins University
Applied Physics Lab; Old Dominion University; University
of Alabama at Huntsville; University of Central Florida;
Air Force Institute of Technology; University of
California, San Diego; Stevens Institute; and Texas A&M**

**Stakeholder
Group**



- Joint Organizations**
- Army**
- Navy**
- Air Force**
- Marines**
- Acquisition**
- Training**
- Planning**
- Testing**
- Analysis**
- Experimentation**

***Workforce
Survey
Focus Groups***

***Review of
Consolidated
BOK***

***M&S Human
Capital Strategy***

***M&S Body of
Knowledge***

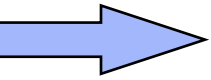




Original Project Intent

Project Overview Design

Stakeholder Group



**Learning Matrix/
Instructional
Content**

***Learning Architecture/
Instructional Framework***

- Army
- Navy
- Air Force
- Marines
- Acquisition
- Training
- Planning
- Testing
- Analysis
- Experimentation

***Workforce
Survey
Focus Groups***

***Review of
Consolidated
BOK***

***M&S Human
Capital Strategy***

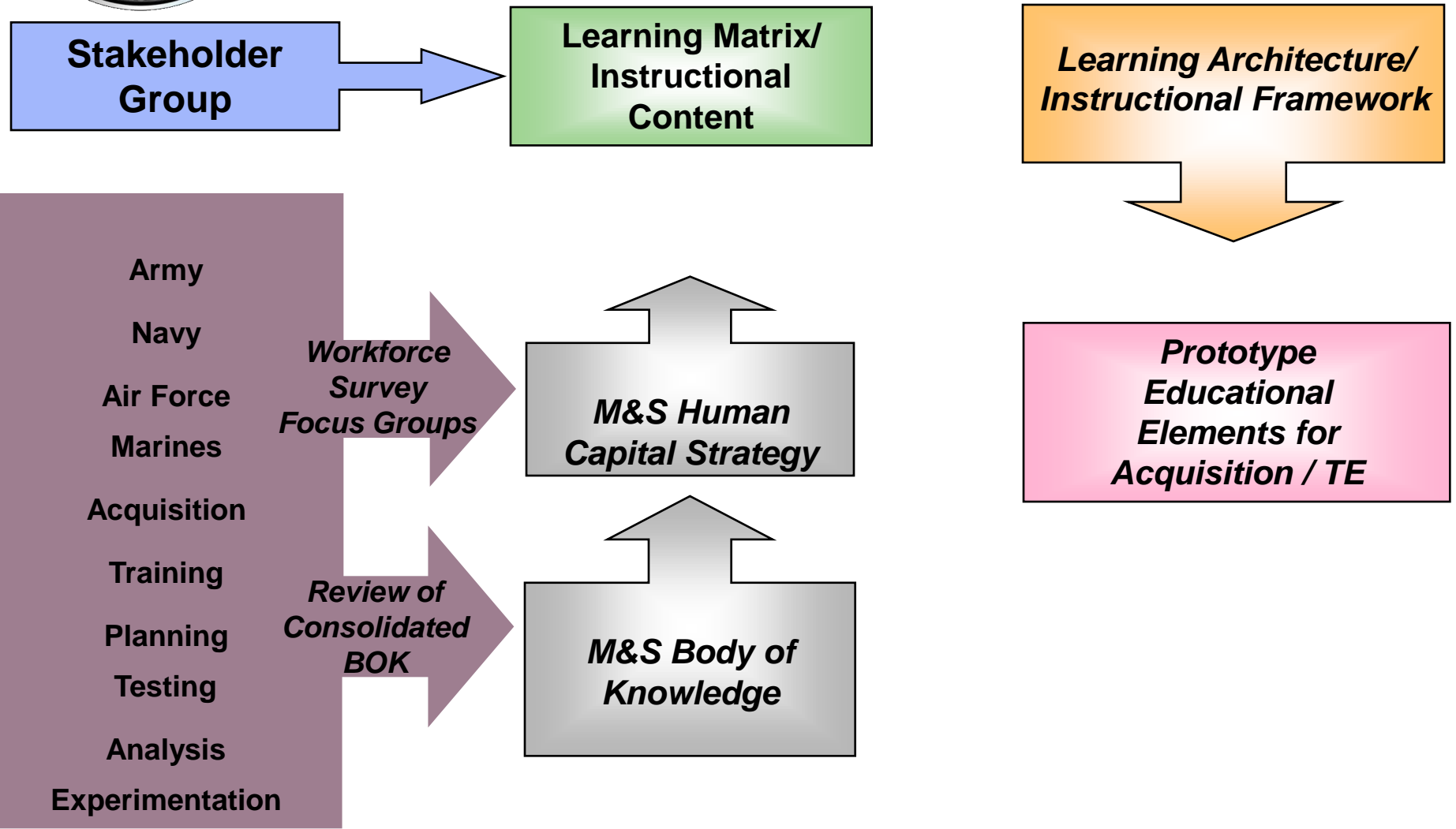
***M&S Body of
Knowledge***





Original Project Intent

Project Overview Design

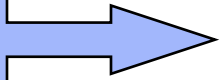




Original Project Intent

Project Overview Design

Stakeholder Group



**Learning Matrix/
Instructional
Content**

***Learning Architecture/
Instructional Framework***



***Prototype
Educational
Elements for
Acquisition / TE***



***Application of
Educational
Elements to Other
Communities and
Services***

- Army
- Navy
- Air Force
- Marines
- Acquisition
- Training
- Planning
- Testing
- Analysis
- Experimentation

***Workforce
Survey
Focus Groups***



***M&S Human
Capital Strategy***

***Review of
Consolidated
BOK***



***M&S Body of
Knowledge***





Prototype Educational Elements for Acquisition / TE

Details

16 Courses planned for development
M&S in the Acquisition Life Cycle, Parts One and Two
M&S Strategy and Support Plans
M&S Requirements and Evaluating M&S Proposals
Contracting for M&S
M&S In Decision Risk Analysis and Mitigation
Best Practices in M&S
M&S Environments
M&S Data Strategies
M&S for Test and Evaluation, Introduction and Advanced
Introduction to Engineering M&S Applications
Physics-based M&S
Basic Engineering Concepts in M&S, parts 1 & 2
Topics in the Application of Engineering M&S

**Courses available
January 2009 at
multiple universities**

Four Certificate programs:

- **M&S Management**
 - Intro to DoD M&S
 - Modeling and Simulation in the Acquisition Life Cycle, Parts 1 & 2
 - Best Practices in M&S
- **M&S Acquisition**
 - M&S Strategy and Support Plans
 - M&S Requirements & Evaluating Proposals
 - Contracting for M&S
 - M&S in Decision Risk Analysis
- **M&S Test and Evaluation**
 - M&S for Test and Evaluation. Introduction and Advanced
 - M&S Environments
 - M&S Data Strategies
- **M&S Engineering Integration**
 - Physics-based M&S
 - Basic Engineering Concepts in M&S, Parts 1 and 2
 - Selected Topics in the Application of Engineering M&S

**Planned NPS
Implementation**

Certificates can be credited toward resident and non-resident NPS degree programs.



Prototype Educational Elements for Acquisition / TE

Current path will result in products that provide the education and training that acquisition and T&E professionals need to use M&S effectively in their jobs.

For more information about this project, please see www.nps.edu/MSAcq, or contact:

Dr. Dave Olwell
Lead Principal Investigator
Chair, Systems Engineering
Department
Naval Postgraduate School
dholwell@nps.edu
(831)656-3583

Ms. Jean Johnson
Project Coordinator
Naval Postgraduate School
jmjohnson@nps.edu
831-656-2956



Questions?