



SITREP

"To dissuade and defeat threats
as early and as far from U.S. borders as possible."

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MDP System Architecture Design Process Dr. Tom Huynh, Systems Engineering and Integration

Preventing terrorists from exploiting the world's oceans to attack the United States, its forces, its force projection capability, and other interests is a very serious concern for national leadership. The Maritime Domain Protection Task Force (MDP-TF) at the Naval Postgraduate School (NPS) is engaged in a campus-wide research effort to address this concern.

Systems Engineering Design Integration (SE&I) is one of three primary independent efforts that form the core of this Maritime Domain Protection (MDP) research project. Five full-time NPS faculty members, with many years of systems engineering and project management experience, are committed to conduct SE&I with the collaboration of NPS students from the Navy, Coast Guard, Northern Command, and other MDP project participants.

This multi-year SE&I effort will focus on the delivery of a proposed architecture on which to base future process and technical design.

MDP Architecture Engineering Process

As depicted in Figure 1, the MDP architecture engineering process consists of three main processes executed in an iterative manner: Needs Analysis, Alternative Architecture Definition, and Architecture Ranking and Selection. All boxes in Figure 1 are called processes, and bolded phrases denote names of the processes.

(cont'd on page 2)

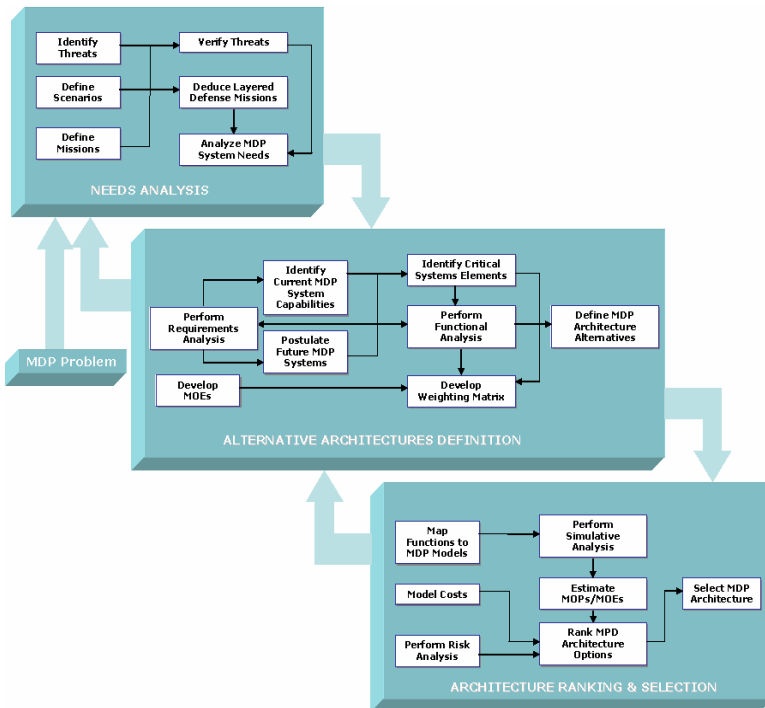


Figure 1. MDP Architecture Engineering Process

U.S. Coast Guard's Maritime Domain Awareness Directorate



A Maritime Domain Awareness Directorate has been established at Coast Guard Headquarters in Washington, D.C. Headed by RADM James Olson, the Directorate is dedicated to developing and implementing Maritime Domain Awareness (MDA) within the Coast Guard and to assisting in furthering the national MDA effort.

The MDA Directorate is organized into three offices: Programs and Architecture; Plans, Policy, and Assessments; and Coordination and Integration.

The Directorate has already collected requirements from Coast Guard operational commands and is currently validating these requirements at the Headquarters level.

In addition, an MDA Concept of Operations is under review and will soon be released. Some of the central tenets of the Coast Guard effort include an integrated system of sensors, both passive and active, cooperative, and non-deniable. This information will be shared on a Common Operational Picture (COP) that will have both a classified and unclassified view and will reach-back to numerous databases. The COP will be available to decision makers at all levels of command, including over fifty Coast Guard command centers located throughout the nation. The COP will also be shared with other services, agencies, and commands.

In addition to coordinating efforts within the Coast Guard and Department of Homeland Security, the new MDA staff has been working closely with NORTHCOM and OPNAV to develop a common understanding of MDA. In support of the Coast Guard's lead role in MDA and the close relationship necessary between the Navy and Coast Guard, the CNO has offered to augment the MDA Directorate with three Navy personnel with programming, intelligence, and planning expertise.

A national MDA summit is scheduled for May 7. The summit will be attended by senior executives from throughout the federal government.

For further information, contact the MDA Directorate at 202-267-6127 or jslotten@comdt.uscg.mil.

Upcoming Events

- April 23** SOCOM Visit
- May 7** National MDA Summit
- May 18** Mini-MDP Symposium: Information exchange with several prominent contractors from Washington, D.C.
- June 15-17** Threat and Vulnerability Assessment Symposium



MDP-TF Members Visit NORTHCOM



Maritime Domain Protection Task Force (MDP-TF) members from NPS recently traveled to Colorado Springs, Colorado, for an information gathering meeting with representatives of NORTHCOM. As the DOD's lead agent in executing DOD's responsibilities for Homeland Defense, NORTHCOM is a key stakeholder in MDP-TF efforts.

The meeting was attended by CAPT Jeff Kline, MDP-TF Lead, Dr. Tom Huynh, Principal Investigator for the Systems Engineering Design Integration

Research Effort, and several other faculty and staff from NPS and NORTHCOM, including officers and analysts from NORTHCOM J2, J3, and J5. All U.S. services, the U.S. Coast Guard, and Canadian allies were represented.

The primary focus of the meeting was to familiarize key NORTHCOM staff members with MDP-TF research efforts, solicit their input on the current system for MDP, and elicit some preliminary views on the general status of MDP.

The meeting provided a valuable opportunity for the discussion of potential problems and successes of the current system and ongoing proposals to modify or restructure C2 in this arena, and to share information on previously completed NORTHCOM efforts, particularly in the area of MD vulnerability and threat analysis.

This meeting was an instrumental first contact with an important stakeholder in the MDP-TF research effort.

SE&I (cont'd from page 1)

Needs Analysis

The MDP problem sets the Needs Analysis process in motion:

- *Identify Threats and Define Scenarios Processes* - Identify threats and scenarios.
- *Define Missions Process* - Defines several MDP missions; requires consultation with the various organizations (known as stakeholders) involved in the defense against terrorists.
- *Verify Threats Process* - Utilizes the results produced by the MDP-TF Threat and Vulnerabilities Assessment research to verify the identified threats for accuracy and reasonableness.
- *Deduce Layered Defense Missions Process* - Based on the scenarios identified by Define Missions, the Deduce Layered Defense Missions Process then defines missions for different layers of defense. Again, consultation with the stakeholders is required for realism.
- *Analyze MDP System Needs Process* - Taking into account the confirmed threats and the missions undertaken by the different layers of defense, this process ascertains what an MDP system must perform to execute the MDP missions.

Architecture Alternatives Definition

The Architecture Alternatives Definition process uses the outputs of the Needs Analysis Process:

- *Perform Requirements Analysis Process* - Translates the MDP needs into MDP system requirements.
- *Perform Functional Analysis Process* - Iteratively refines the MDP system requirements with its outputs.
- *Identify Current MDP System Capabilities Process* - Identifies capabilities of the current MDP system, if it exists, as necessitated by the MDP system requirements. Close collaboration with the stakeholders needs to occur for this process to be effective.
- *Postulate Future MDP Systems Process* - Postulates MDP system elements that need to be developed in the future, based on the existence of any gaps between the current MDP system and the required capabilities.
- *Identify Critical Systems Elements Process* - Upon completion of the previous two processes, the Identify Critical Systems Elements Process establishes critical elements of the desired MDP system.

- *Define MDP Architecture Alternatives Process* - Uses these system elements and the outputs of the Perform Functional Analysis Process to define various MDP architecture options.
- *Develop Weighting Matrix Process* - Uses the MDP critical system elements and the Measures of Effectiveness (MOE) defined by the *Develop MOEs Process* to produce the weights that will go into the Architecture Ranking and Selection Process. Again, close collaboration with the stakeholders is necessary for a robust development of the MOEs and the weighting matrix.

Architecture Ranking and Selection

The *Perform Simulative Analysis Process* now assesses the performance of each of the MDP system architecture alternatives established by the Architecture Alternatives Definition Process. The simulative analysis employs modeling and simulation, which requires modeling of the MDP system functions, facilitated by the *Map Functions to MDP Models Process*. These MDP system functions require appropriate algorithms to be implemented in these MDP models. Also, the simulative analysis will employ various simulations, either in existence here at NPS or elsewhere, or to be developed.

The *Estimate MOPs/MOEs Process*, which processes the outputs of the simulative analysis, provides the estimated Measures of Performance (MOP) and Measures of Effectiveness (MOE).

The *Rank MDP Architecture Options Process* then ranks the various MDP architecture alternatives, using the estimated MOPs and MOEs, the costs produced by the *Model Costs Process*, and the risk factors generated by the *Perform Risk Analysis Process*.

Finally, the *Select MDP Architecture Process* selects the best MDP architecture from the MDP architecture alternatives. Based on the selected MDP system architecture, the implementation phase of the MDP research will design and develop an MDP system.

This system architecture engineering process can be adopted with necessary modifications to determine architectures for any military system.

NPS Systems Engineering and Integration Team

The members of the SE&I team are Drs. Tom Huynh, Orin Marvel, John Osmundson, and Gene Paulo, and Mr. Mark Stevens. Please address questions to Dr. Tom Huynh, at thuynh@nps.edu.