

# **MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY**

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## **USING IT-21 TOOLS TO PROVIDE ASYNCHRONOUS DISTRIBUTED LEARNING (ADL) TO THE FLEET**

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Information superiority is the foundation of Joint Vision 2010 battlefield dominance. Network Centric Warfare, robust infrastructure and information dissemination to dispersed forces are key elements in achieving information superiority. IT-21 is a fleet driven reprioritization of C4I programs to accelerate the transition to a PC-based tactical support warfighting network. Historically, cost and bandwidth have impeded distributed wargaming. Furthermore, when distributed wargames are conducted, they rarely present the scenario tactical picture to an individual using the same C4I systems used in actual warfighting. A solution is to use IT-21 tools to conduct distributed war games that are able to generate Gold formatted messages. The messages will simulate real-time track information into the Global Command and Control System (GCCS). These tracks can then be displayed on the same IT-21 systems used to fight. Such architecture will enable distributed training with units at sea. This capability would also enable collaborative planning at low costs. A proof-of-concept was conducted as an initial step in developing such a capability. The initial proof-of-concept showed the feasibility of the architecture. It demonstrated its use outside the Asynchronous Distance Learning (ADL) context to provide new collaborative capabilities to the Fleet, virtually anywhere in the world.

**DoD KEY TECHNOLOGY AREA:** Other (Distributed Learning)

**KEYWORDS:** Network Centric Warfare, IT-21

## **INFRARED MISSILE AIM-POINT MODELING AND FLARE COUNTERMEASURE EFFECTIVENESS (U)**

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In today's battlefield environment, infrared surface-to-air missiles (IR SAMs) pose a significant threat to modern tactical aircraft. Every effort must be made to more successfully combat such threats through the use of flare countermeasures. The Modeling System for Advanced Investigation of Countermeasures (MOSAIC) is a simulation tool that models countermeasure effectiveness vs. different missile-threat situations. This research first compares the three different aircraft source models used by MOSAIC (area, ellipse, and SPIRITS source models). These source models are compared to each other as well as to actual field test results in order to draw conclusions on model accuracy. Second, the effectiveness of flare

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countermeasures is investigated based on release timing relative to missile aim-point. The aircraft, missile, and countermeasures used in this analysis are the F-15E, the Stinger Basic missile, and the MJU 27 and MJU 8 A/B flares.

**DoD KEY TECHNOLOGY AREAS:** Air Vehicles, Computing and Software, Modeling and Simulation

**KEYWORDS:** MOSAIC, SPIRITS, Infrared Countermeasures (IRCM), Modeling, Simulation, Stinger, F-15E, Aim-point

### **MODELING INFORMATION OPERATIONS (IO): ENGAGEMENT OF THE DECISION-MAKING INFRASTRUCTURE OF CHINA (U)**

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The United States engages China in order to promote regional stability and economic prosperity while attempting to secure China's adherence to international standards. Engagement options such as military exchange programs, port visits, and professional seminars contribute to a dialogue that is aimed at building a lasting relationship that fosters cooperation and confidence between the United States and China. United States Pacific Command (PACOM), a regional unified command, is responsible for conducting military peacetime engagement with China. This thesis investigates the applicability of using the Situational Influence Assessment Module model as a tool for PACOM to plan and assess the value of possible engagement strategies.

**DoD KEY TECHNOLOGY AREAS:** Modeling and Simulation, Other (Information Operations)

**KEYWORDS:** Modeling and Simulation, Information Operations, SIAM, China, Culture, Engagement Planning

### **DEVELOPMENT OF THE BEARTRAP POST MISSION PROCESSING SYSTEM 2000 (S2K) HTML HELP PROJECT**

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This work is part of an ongoing effort to integrate the separate BEARTRAP post mission analysis tools into an application operating in a Microsoft Windows environment. This new integrated system will contain software modules designed to replace the array of diverse processing systems currently being used for BEARTRAP post mission analysis. This thesis develops the HTML Help features to support users of the BEARTRAP Post Mission Processing System 2000 (S2K) software application. This application allows an

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analyst to gather context sensitive HTML Help to support procedural use of the BEARTRAP Post Mission Processing System as well as background information on related fields of study. This document describes the background and development of the HTML Help project with particular emphasis on critical areas fundamental to the HTML Help project development and aspects requiring further research and development.

**DoD KEY TECHNOLOGY AREA:** Computing and Software

**KEYWORDS:** HTML Help, BEARTRAP, S2K

**AUTOMATICALLY GENERATING A DISTRIBUTED 3D BATTLESPACE USING USMTF AND  
XML-MTF AIR TASKING ORDER, EXTENSIBLE MARKUP LANGUAGE (XML) AND  
VIRTUAL REALITY MODELING LANGUAGE (VRML)**

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For the past three decades, the Department of Defense (DoD) has used the U.S. Message Text Format (USMTF) as the primary means to exchange information and to achieve interoperability between joint and coalition forces. To more effectively exchange and share data, the Defense Information Systems Agency (DISA), the lead agency for the USMTF, is actively engaged in extending the USMTF standard with a new data sharing technology called Extensible Markup Language (XML). This work translates and synthesizes Air Tasking Order (ATO) data messages written in XML into a three-dimensional (3D) air attack plan within a virtual environment through the use of the Virtual Reality Modeling Language (VRML).

**DoD KEY TECHNOLOGY AREAS:** Command, Control, and Communications, Modeling and Simulation, Computing and Software

**KEYWORDS:** Extensible Markup Language (XML), Virtual Reality Modeling Language (VRML), Air Tasking Order (ATO), Extensible 3D (X3D), U.S. Message Text Format (USMTF), XML-MTF, and Defense Messaging System

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### SCALABILITY STUDY OF WIRELESS TACTICAL COMMUNICATIONS IN SUPPORT OF A MARINE CORPS EXPEDITIONARY BRIGADE

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This thesis reports the findings of a simulation modeling the communications architecture used during Major System Demonstrations 1 (MSD-1) of the Extended Littoral Battlespace (ELB) Advanced Concept Technology Demonstration (ACTD) and a suitable architecture for a large-scale battlespace. The simulation was accomplished with the use of a leading edge simulation tool, EXTEND™, and the specifications inherent to wireless communications. Specifically, EXTEND was used to replicate the protocols that are inherent within the WaveLAN and VRC-99A systems. A feasible sized architecture was modeled utilizing scaling techniques, which simulated the operation of a Marine Expeditionary Brigade (MEB), covering a 200X200 mile wireless tactical battlespace. This thesis further investigates the validity of a completely wireless tactical network versus the additional use of ground relays. This thesis demonstrates that the wireless tactical battlespace is scalable to satisfy the requirements of a Marine Expeditionary Brigade. Lastly, this thesis demonstrates the effects of an all WaveLAN architecture.

**DoD KEY TECHNOLOGY AREA:** Command, Control, and Communications

**KEYWORDS:** Networks, Tactical Network, Communications, Systems

### THE APPLICATION OF A VIEWPOINTS FRAMEWORK IN THE DEVELOPMENT OF C4I SYSTEMS

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In the development of large distributed systems, both the detection and resolution of inconsistency in policy, requirements, and specifications pose major challenges. The purpose of this thesis is to examine the inconsistencies in policy, requirements, and specifications in the development of information/Joint Command, Control, Communications, Computers, and Intelligence (C4I) systems. In this thesis, we explore the application of a "viewpoints" framework to aid in the development of distributed information systems.

A viewpoints framework methodology that was developed to aid in the development of distributed systems is the Reference Model of Open Distributed Processing (RM-ODP). This thesis is concerned with the application of the five viewpoints of RM-ODP and the translation of policy into requirements and specifications. In this thesis we use the Ballistic Missile Defense (BMD) system as a case study to explain how RM-ODP can be used to develop distributed information systems. We found that identifying inconsistencies regarding interoperability amongst the subsystems of BMD necessitated the use of multiple viewpoints and that firm conclusions could not be made until the system was viewed at the lower levels.

**DoD KEY TECHNOLOGY AREAS:** Command, Control, and Communications, Computing and Software

**KEYWORDS:** Ballistic Missile Defense, C4I, Interoperability, Policy, Reference Model of Open Distributed Processing, , Requirements Engineering, Viewpoints

**REAL-TIME RADAR VIDEO RELAY VIA A COMMERCIAL-OFF-THE-SHELF (COTS)  
WIRELESS LAN**

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Network centric operations in the littorals require an extended horizon radar picture for expanding range of operations and adequate early warning for ship defenses. Ship-based SH-60B Light Airborne Multi-Purpose System (LAMPS) Mark III Helicopters can provide the radar signal data to a surface ship through the multi-purpose AN/SRQ-4 HawkLink. The signal data is then processed at the shipboard HawkLink terminal and converted into display data for the ship's radar. To transmit the actual radar video from the aircraft, a higher bandwidth than the HawkLink system is required. In addition, carriers and amphibious assault ships are not equipped with this system, and it can only be downlinked to one ship at a time.

A Commercial-Off-The-Shelf (COTS) Wireless Local Area Network (WLAN) system can support near real-time radar video transmitted from an airborne platform to multiple surface platforms simultaneously. WLANs can support the high bandwidth necessary to transmit a complete radar picture, and are much more compact and less expensive than the current system. In addition, WLANs can be seamlessly integrated into any ship's network that is interoperable with internet protocols.

**DoD KEY TECHNOLOGY AREA:** Other (Wireless Communications, WLANS, Extension of the Littoral Battlespace (ELB))

**KEYWORDS:** Real-time Radar Relay, Wireless LAN, COTS

**BEGINNER'S USER GUIDE FOR THE MAGTF TACTICAL WARFARE SIMULATION**

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The MAGTF Tactical Warfare Simulator (MTWS) is a multi-sided computer based gaming system, currently in use by the Marine Corps. Marine operations typically involve movement over land, sea, and air, and sustained operations often involve interaction with other services. MTWS's complexity supports the joint warfare nature of Marine operations. This capability and complexity makes it ideally suited for an academic environment, and at the Naval Postgraduate School MTWS introduces students to a current service simulation, reinforces student coursework, and facilitates student research and experimentation. The drawback of a system so complex though not difficult to learn how to use, is that MTWS is not intuitive. While extensive documentation exists to support the system, it is for experienced users of the system. This thesis is tailored toward beginning users, no matter their level of operational experience, and will bridge the gap to the advanced documentation. It provides an overview of the system, explains graphical user interfaces (GUIs), provides instructions on how to develop and utilize units in the simulation, and furnishes reference charts for current U.S. weapon systems.

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**DoD KEY TECHNOLOGY AREAS:** Command, Control, and Communications, Modeling and Simulation, Human Systems Interface

**KEYWORDS:** MAGTF Tactical Warfare Simulator, MTWS, Simulation, Computer Gaming, C4I, Command and Control

### **EXPLOITATION OF WEB TECHNOLOGIES FOR THE JOINT BATTLESPACE INFOSPHERE**

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Today's military command and control (C2) systems provide much information to today's combatants, but because these legacy systems are disjointed, there exists an overload of poorly organized and incomplete data during operations. These systems tend to be "stovepiped," inflexible, difficult to integrate, and hard to use in building a common operational picture. The information exchange model for DoD C2 systems is migrating away from dedicated point-to-point and broadcast systems (information push) toward a model based partly on Internet and World Wide Web technologies (publish and subscribe). The USAF Scientific Advisory Board has created a visionary combat information management concept called the Joint Battlespace Infosphere in response to this movement.

The purpose of this thesis is to identify and evaluate emerging Internet/Web-based technologies that could be employed by the DoD to improve upon existing information exchange services. This survey will examine the strengths and weaknesses of technologies such as client-server architectures, search engines, middleware, intelligent software agents, and multicast delivery tools that could enhance the development of the Joint Battlespace Infosphere.

**DoD KEY TECHNOLOGY AREAS:** Battlespace Environments, Command, Control, and Communications

**KEYWORDS:** Joint Battlespace Infosphere, Command and Control Systems, Global Information Grid, World Wide Web, Internet, Search Engines, Software Agents, Middleware, Multicast Delivery