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THESIS

SCENARIO AUTHORING AND VISUALIZATION FOR ADVANCED GRAPHICAL ENVIRONMENTS (SAVAGE)

by

Shane D. Nicklaus

September 2001

Thesis Advisor:	Don Brutzman
Thesis Co-Advisors:	Curtis Blais
	Dan Boger

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13. ABSTRACT

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The United States and NATO nations use the Land C2 Information Exchange Data Model (LC2IEDM), formally known as the Generic Hub, as a common method for exchanging data between independent systems. As part of the Scenario Authoring and Visualization for Advanced Graphical Environments (SAVAGE) project, this research presents an integrated Web access and 3D visualization strategy for Department of Defense (DOD) tactical messaging and operation orders using the Generic Hub data model and the Extensible Markup Language (XML). A number of alternative yet consistent ways to represent an amphibious operation scenario demonstrate the power, flexibility and scalability of the SAVAGE approach.

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SCENARIO AUTHORING AND VISUALIZATION FOR ADVANCED GRAPHICAL ENVIRONMENTS (SAVAGE)

Shane D. Nicklaus
Major, United States Marine Corps
B.S., University of Southern California, 1991

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September 2001

Author: _____
Shane D. Nicklaus

Approved by: _____
Don Brutzman, Thesis Advisor

_____
Curtis Blais, Thesis Co-Advisor

_____
Dan Boger, Thesis Co-Advisor

_____
Dan Boger, Chair, Information Systems Academic Group

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Today's planning and modeling systems use two-dimensional (2D) representations of the three-dimensional (3D) battlespace. This presents a challenge for planners, commanders, and troops to understand the true nature of the battlespace. This thesis shows how 3D visualization can give both operation planners and executors a better understanding of the battlespace that can augment today's 2D systems. Automatic creation of a 3D model for an amphibious operation allows the planner to view an operation order as a whole, from different perspectives. Recommended changes can be made and their effects immediately known. Warfighters can use the same tools for mission preparation and review.

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I. INTRODUCTION

A. PROBLEM STATEMENT

The Extensible 3D (X3D) and Virtual Reality Modeling Language (VRML) graphics provide a framework for visualizing an amphibious operation in a three-dimensional (3D) battlespace. Work is in progress to convert standard United States Message Text Format (USMTF) documents into Extensible Markup Language-Message Text Format (XML-MTF) documents. Once done, VRML can translate the XML-MTF document one-step further and create an auto generated 3D scene. These 3D visualizations can enhance amphibious operation planning and battlespace awareness.

B. OVERVIEW

Joint Vision 2020 describes ways with which to make our Armed Forces faster, more lethal, and more precise. It describes the significance of information superiority, innovation, interoperability, and precision engagement among other important capabilities. It recognizes that "Information superiority will enhance the capability of the joint force commander to understand the situation, determine the effects desired, select a course of action and the forces to execute it, accurately assess the effects of that action, and reengage as necessary while minimizing collateral damage." (Joint Vision 2020, pg 22) It goes on to say that "The joint force must be able to take advantage of superior information converted to superior knowledge to achieve 'decision superiority'- better decisions arrived at and implemented faster than an opponent can react…." (Joint Vision 2020, pg 8) This thesis aims to present an innovative, interoperable methodology for communicating and visualizing tactical orders that is in the spirit of Joint Vision 2020.

Today's planning and modeling systems use two-dimensional (2D) representations of the three-dimensional (3D) battlespace. This presents a daily challenge for planners, commanders and troops to fully understand the true nature of the battlespace with regards to best ingress/egress routes, areas that offer the best cover and concealment, obstacles that may impede vehicular traffic, and likely enemy strongpoints or ambush points, to name but a few. By creating a 3D model of an amphibious operation, a 2D plan can be further viewed as a whole from many different perspectives. Planners can easily convey this information up and down the chain of command in order to solicit expertise and opinion. Changes can be made and their effects can be viewed and critiqued instantaneously, in context with spatial relationships preserved. The use of 3D is not intended to replace 2D maps and text-based descriptions- rather, 3D is an additional tool needed in combination with current techniques. 3D battlespace visualization may be a key enabler to achieve "decision superiority."

The Virtual Reality Modeling Language (VRML) and its next-generation specification, Extensible 3D (X3D) are Web-based graphics languages for building 3D models. VRML allows user interaction within a scene through viewpoint, movement, and rotation. One of the key features of VRML is it is an ISO standard designed for use over the World Wide Web (WWW). VRML has a rich set of tools for visualizing information. VRML graphics palettes include colors, textures, luminescence, and animations. These features can be combined to represent many different amphibious scenarios. Amphibious vehicles, ships, and troops can all be modeled. Terrain, sea state, and obstacles can be depicted. All of these models can interact and move through the virtual battlespace based on information that the planners will provide.

The US Message Text Format (USMTF) has been used jointly for all operational message traffic since the 1970's. It includes accepted formats for countless message types to include operation orders and associated orders of all types. However, with the ongoing emphasis on development of the Extensible Markup Language (XML), the free-text syntax of USMTF may be reaching an end to its usefulness. The Extensible Markup Language (XML) provides a number of benefits over USMTF and has led the Department of Defense (DoD) to establish an Extensible Markup Language-Message Text Format (XML-MTF) team to focus on the translation of USMTF into XML.

This thesis seeks to translate and synthesize USMTF-based Operation Order data messages written in XML into a 3D amphibious-raid within a virtual battlespace. By combining the power of XML and VRML, the end result will be a 3D world populated with aircraft, ships, amphibious vehicles, and both land and sea terrain. This virtual world permits the viewer to navigate through an amphibious operation in both space and time, and thus to observe the interactions between objects in that world.

C. MOTIVATION

Since World War II, the Marine Corps has made itself known as the premier fighting force capable of accomplishing successful amphibious operations. Iwo Jima, Tarawa, and the Chosin Reservoir landing are but a few reminders of the importance that amphibious operations have played in our nations history. While these operations were eventually successful, they came at the great cost of thousands of men's lives. Were a 3D tool, such as this thesis introduces, available to commanders at the time these operations were executed, perhaps a profound impact may have been made on many life-or-death decisions. An approach such as this can't change the past, but it can have a positive impact on the future. Not only can this technique help Marines, sailors, soldiers, and

airmen to train for the future, it can help both the military and the general public learn and possibly understand the crucial decisions and actions of the American Military, past and present.

D. OBJECTIVES

This thesis demonstrates and evaluates the functionality of a 3D amphibious operation visualization using Extensible 3D (X3D) and the Virtual Reality Modeling Language (VRML). The objective is to determine how 3D visualization can give both operation planners and executors a better understanding of the battlespace than is currently available solely using today's 2D systems. To accomplish this objective, USMTF documents must first be translated into XML documents, and then the relevant data transformed into VRML/X3D objects. End-to-end construction of an exemplar amphibious-raid has guided the design and development presented here.

E. ORGANIZATION OF THESIS

Chapter II reviews background and related information on amphibious operations, US Message Text Format (USMTF), Extensible Markup Language-Message Text Format (XML-MTF), Combat 21, and operation and air tasking orders. Chapter III describes the amphibious-raid scenario and introduces operation order design and content. It also introduces the scenario exemplar operation orders and discusses potential limitations. Chapter IV provides insight into the NATO Land Command and Control Information Exchange Data Model (LC2IEDM). Chapter V discusses the importance of using a Web-based approach and the Extensible Markup Language (XML). The XML schemas for the operation orders and ongoing efforts to further Web based technologies are also presented. Chapter VI describes the scenario and visualization techniques upon which the virtual amphibious-raid is based. Chapter VII discusses scenario-authoring

methodologies, assumptions and limitations, and presents the results of the virtual amphibious-raid. Chapter VIII summarizes the conclusions and recommendations for future work of this thesis. The appendices present the exemplar operation orders, schemas, stylesheet, and scripted raid code.

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II. BACKGROUND AND RELATED WORK

A. INTRODUCTION

This chapter reviews concepts that are at the root for understanding Marine Corps amphibious operations. Subject matter includes amphibious operations background, Operation and Air Tasking Orders, and the US Message Text Format (USMTF).

B. AMPHIBIOUS OPERATION

1. Definition

An amphibious operation is,

> …an attack launched from the sea by naval and landing forces, embarked in ships or craft involving a landing on a hostile shore. ***(Joint Publication 1-02)***

It is important to note here that the attack must be launched from the sea, and that the landing be made on a hostile shore. Without these two elements, there is no amphibious operation.

2. Types of Operations

There are four types of amphibious operations that Marines may be called upon to perform. These include the *amphibious assault*, *amphibious-raid*, *amphibious demonstration*, and *amphibious withdrawal*.

An *amphibious assault* is the principal type of amphibious operation. It is usually long in duration and seeks to establish large landing forces on a hostile shore. An *amphibious-raid* is similar to an assault, except that it is generally short in duration and has a planned withdrawal. Raids may be used for reconnaissance, diversions, evacuations, or as a means to quickly inflict loss or damage on the enemy, to name a few.

An *amphibious demonstration* seeks to deceive the enemy with a show of force, and hopes to cause him to adopt an unfavorable course of action. There is not an actual landing during a demonstration. At a predetermined turn-away point, the forces will turn around with the hope that the desired effect has been accomplished. Finally, an *amphibious withdrawal* is usually made at the end of an operation or when it is strategically or tactically determined to be a necessity. It is not predetermined, and is one of the more difficult types of operation. ***(AWS Ex Ops Course, Vol. 1, pg. 2-16 –2-17)***

3. Marine Air Ground Task Force (MAGTF)

There are three basic and one special MAGTF types in the Marine Corps. Each type consists of a command element (CE), ground combat element (GCE), air combat element (ACE), and a combat service support element (CSSE).

a. Marine Expeditionary Force (MEF)

The MEF is the principal warfighting MAGTF. It can conduct amphibious operations as well as sustained operations ashore. It typically deploys with supplies that are geared to last 60 days. In addition to the CE, the MEF is comprised of a a reinforced division (GCE), a Marine aircraft wing (ACE), and a force service support group (FSSG) which serves as the CSSE.

b. Marine Expeditionary Unit (MEU)

A MEU is usually deployed at sea in an amphibious ready group (ARG), and takes along supplies aimed at sustaining it for 15 days of continuous operations should it be called to do so. The MEU serves as a forward presence or projection of power, and can provide immediate response to a crisis or contingency through its capability of rapid deployment. The MEU acts as an advance force for a larger MAGTF to follow if the duration of the operation exceeds 15 days. In addition to the CE, the

MEU is comprised of a reinforced infantry battalion (GCE), a reinforced medium helicopter squadron (ACE), and a MEU service support group (MSSG) which serves as the CSSE.

c. Marine Expeditionary Unit Special Operations Capable (MEU(SOC))

MEU(SOC) is a certification that all MEUs attempt to obtain prior to deployment. A series of special operations capable exercises (SOCEX) are conducted in which the MEU demonstrates the ability to conduct varied special operations such as non-combatant evacuation operations (NEOs), hostage rescue, demolition operations, and civic action operations to name a few. MEU(SOC) composition is similar to that of a MEU except that it is augmented with specialized personnel and equipment.

d. Special Purpose MAGTF (SPMAGTF)

SPMAGTFs are configured to accomplish a specific mission when one of the other MAGTF types is inappropriate or too large to employ. They can be organized, trained and equipped to conduct a variety of operations. In addition to the CE, the SPMAGTF is normally comprised of at least a platoon-sized element (GCE), and a task organized ACE and CSSE. ***(AWS Ex Ops Course, Vol. 1, pg. 1D-8 and 9)***

C. AMPHIBIOUS PLANNING DOCUMENTS

1. Operation Order (OPORD)

The Operation Order (OPORD) is a directive issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. (DoD Definition). OPORDs are written at all levels of command by all military services. One high-level OPORD can in turn generate numerous like OPORDs down to the unit-level. The format is generally the same, with detail increasing as the

order reaches the lowest unit. Operation orders are discussed in more detail in Chapter III.

2. Air Tasking Order (ATO)

The Air Tasking Order (ATO) is used to task and disseminate information to units regarding projected sorties, capabilities, and specific missions. It commonly provides instructions regarding call signs, targets, aircraft type/number, controlling agencies, and other general information.

Automatically generating an Air Tasking Order and visualizing it in 3D was the subject of Mark Murray and Jason Quigley's thesis, "Automatically Generating A Distributed 3D Battlespace Using USMTF and XML-MTF Air Tasking Order, Extensible Markup Language (XML) and Virtual Reality Modeling Language (VRML)", June 2000 at the Naval Postgraduate School. The proof-of-concept demonstration in that effort provided the basis for this work.

D. US MESSAGE TEXT FORMAT (USMTF)

The US Message Text Format (USMTF) is the joint standard for message-based information exchange. It facilitates communications efficiency for joint and combined forces by standardizing message formats, data elements, and information exchange procedures. (www-usmtf.itsi.disa.mil)

USMTF is a government proprietary message standard for sharing structured information (Edwards, 1999, slide 4). It has the advantage of having approval from all DoD agencies and US allies. USMTF represents a large collection of Information Exchange Requirements that provide a standard vocabulary, are platform independent

and man readable. Additionally, joint and international configuration-management processes support USMTF. (Edwards, 1999, slide 6)

While USMTF is still being used throughout the DoD, it has many limitations and some believe it is coming to the end of its useful life. With the proliferation of the Extensible Markup Language (XML) and the shortcomings of USMTF, there is a strong push in the DoD to develop a new standard called Extensible Markup Language-Message Text Format.

1. Extensible Markup Language-Message Text Format (XML-MTF)

USMTF has several downsides that make it less appealing as technology continues to advance. For one, USMTF is a military proprietary piece of software. This forces the government to upkeep and upgrade all aspects of USMTF, precluding any commercial-off-the-shelf (COTS) support. It also requires the government to hire system developers who will have to learn and adopt USMTF standards in order to engineer interfaces. Because government-off-the-shelf (GOTS) tools are expensive and lag far behind the competitive COTS market, USMTF is becoming a high-priced dinosaur. (Edwards, 1999, slide 7)

Another shortcoming to USMTF is its formatting rules. It was developed in the early 1970's for AUTODIN transport and teletype presentation; therefore, USMTF format is limited to display only teletype characters (capital letters and numbers). (Edwards, 1999, slide 7) Given the vast number of fonts, formats, and the addition of multi-media available in today's presentations, USMTF is somewhat archaic.

Finally, USMTF can only send messages, not metadata. Metadata can be defined as data about data. That is, it contains a description or information on the data being sent.

Metadata provides powerful utility in that individual consumers can search, filter, organize, or otherwise manipulate data in such a way as to provide meaning that is in line with personal or organizational guidelines.

In order to try and overcome many of these limitations, an initiative called the Extensible Markup Language-Message Text Format (XML-MTF) was launched. In May of 1999, the XML-MTF Development Team was formed to attempt replacing standard USMTF with XML formatted messages. The team's charter was to develop an XML-MTF specification and software tools that transform messages between USMTF and XML-MTF standards. This approach has numerous advantages. XML gives users the ability to manipulate data in any way they see fit, as it includes metadata. Interoperability issues can be overcome because XML is easily exchanged between systems. These systems can, in turn, transform the data using an Extensible Stylesheet Language (XSL) into any format necessary. Additionally, since XML is an open Web standard, USMTF won't be tied to a government proprietary standard any longer. This will allow XML-MTF to keep pace with technology as well as have a learned group of commercial technicians available, who won't have to overcome a steep learning curve whenever XML-MTF changes or updates need to be made.

According to the J6I, "…this powerful combination of military and industry standards, called XML-MTF, is expected to drastically improve the warfighter's ability to find, retrieve, process and exchange tremendous amounts of information easily across system, organizational and format boundaries…." (Edwards, 1999, slide 10)

E. COMBINED ARMS ANALYSIS TOOL FOR THE 21ST CENTURY (COMBAT XXI)

The Combined Arms Analysis Tool for the 21st Century (COMBAT XXI) is a non-interactive, high-resolution analytical combat simulation system being developed by the US Army and US Marine Corps. The COMBAT XXI model incorporates both land and amphibious warfare capabilities, and is designed to evaluate operations at the brigade level and below. Among its goals are interoperability with other models and systems, plus alleviation of the difficulties that legacy systems experience in the scenario-development process. (Goerger, 2001)

COMBAT XXI adopted an open standard called the High Level Architecture-Dynamic Scenario Builder (HLA-DSB) to handle the problem of portability. This standard prescribes a basic format for scenario files, and uses the Extensible Markup Language (XML) as the storage and interchange media. (Goerger, 2001) By using XML, COMBAT XXI will reap the same benefits as those of XML-MTF.

F. SUMMARY

This chapter covered concepts and technologies inherent to understanding amphibious operations. An amphibious operation is an attack that must be launched from the sea against a hostile shore. The four types of amphibious operations are: amphibious assault, amphibious-raid, amphibious demonstration, and amphibious withdrawal. A Marine Air Ground Task Force (MAGTF) is responsible for executing an amphibious operation and varies in size and structure depending on the type and duration of the operation. The Marine Expeditionary Force (MEF) is the principal warfighting MAGTF while the Marine Expeditionary Unit Special Operations Capable (MEU(SOC)) is the primary forward presence.

The Operation Order, which includes the Air Tasking Order, is the formal and primary means of effecting the coordinated execution of an operation. These orders are currently written using the United States Message Text Format (USMTF), but are currently being rewritten using the Extensible Markup Language (XML). The resulting Extensible Markup Language-Message Text Format (XML-MTF) is expected to provide more robust and interoperable data that is more valuable to the end users. The Combined Arms Analysis Tool for the 21st Century (COMBAT XXI) is a non-interactive, high-resolution analytical combat simulation system that incorporates land and amphibious warfare capabilities. Like many tools currently being developed, COMBAT XXI seeks to leverage the robust benefits of XML. Together, these technologies can lead to an integrated "system of systems" wherein interoperability issues between services and countries are non-existent.

III. OPERATION ORDERS AND TACTICAL MESSAGING

A. INTRODUCTION

This chapter focuses on the amphibious invasion scenario and the operation orders that accompany it. It describes the elements of an operation order and further discuss the methodology and limitations of the operation order as it is applied to the amphibious scenario. Finally, it examines Public Beta Release 1.02 of the MTF2XML converter.

B. AMPHIBIOUS INVASION DESCRIPTION

This section presents an imaginary exemplar scenario: Continued fighting in Koala between Snake National Forces and Apean Separatists has resulted in the displacement of thousands of Koalan non-combatants. The non-combatants have attempted to flee towards the Apean and Monkey borders which has caused heightened tensions along the Apean/Koalan border. To support peacekeeping operations along the border, a forward-operations base is required in Ape. While the Apean Government supports establishment of the airfield, the likely reaction of the civilian population is unknown.

Combined Joint Task Force Blue has assembled off the shore of "Red Beach" in preparation for an amphibious-raid (Figure 3.1). Marine Forces will disembark Amphibious Ready Group (ARG) shipping using Advanced Amphibious Assault Vehicles (AAAVs) under cover of darkness to storm "Red Beach" and proceed inland to secure the airfield (Figure 3.2). Marine AH-1Z Super Cobras will provide cover and support for raiding forces. A destroyer squadron will steam offshore in order to defend

the ARG and provide fire support for the raid. In addition to surface fleet support, one submarine is in the area of operation (AOR) in a direct-support role.

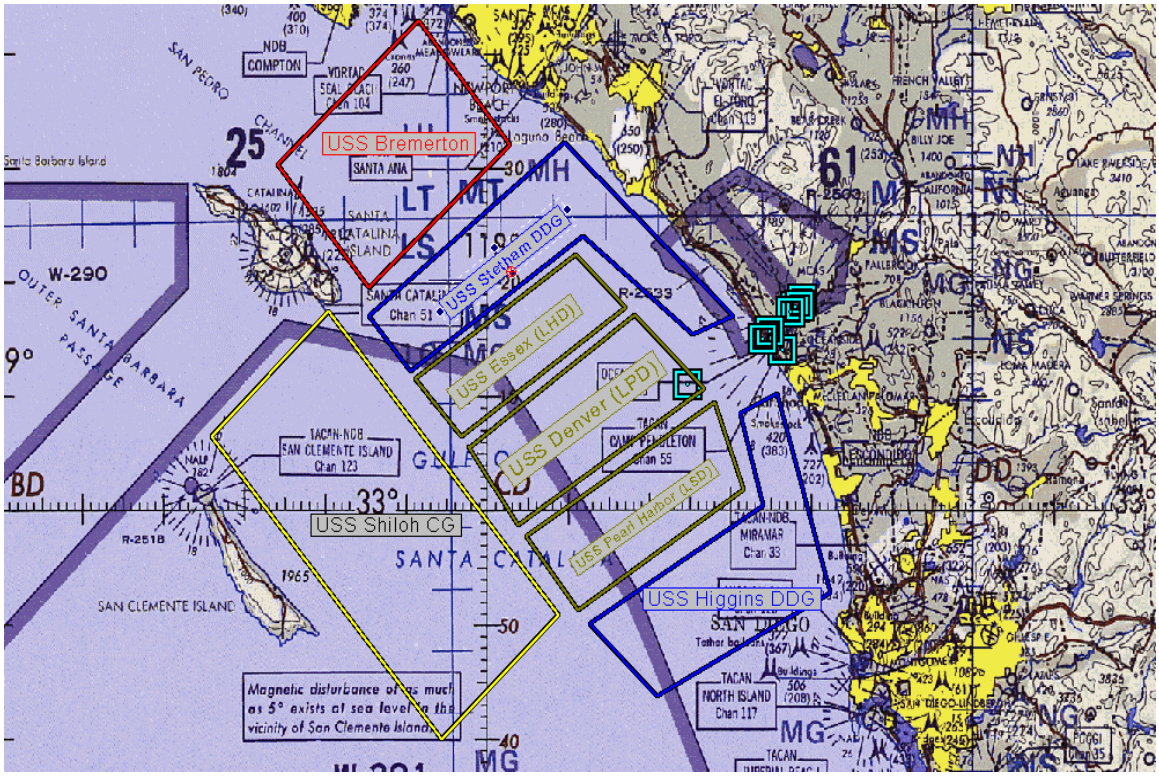

Figure 3.1 Naval Ships Assembled off the Shore of "Red Beach"

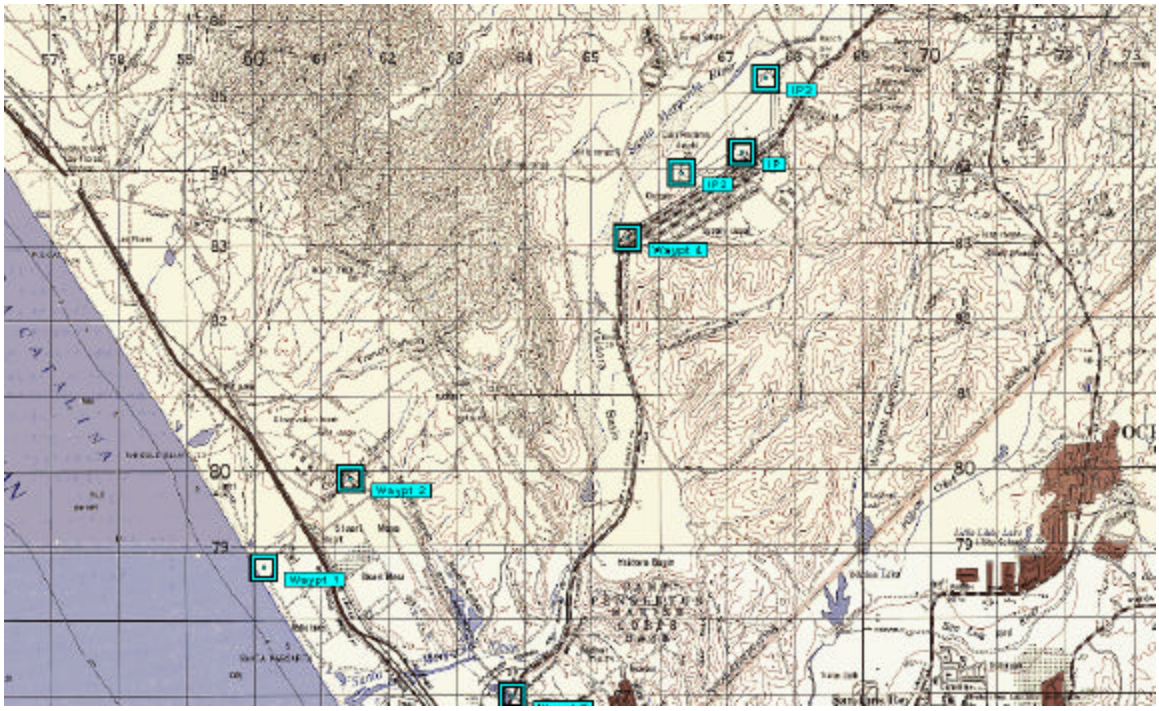

Figure 3.2 AAAV Route to Airfield Represented As Waypoints

Once Marine Forces have secured the airfield, they will remain in position until Army Apache helicopters arrive and assume control (Figure 3.3). At that time, all Marine Forces will return to ARG shipping for completion of the mission.

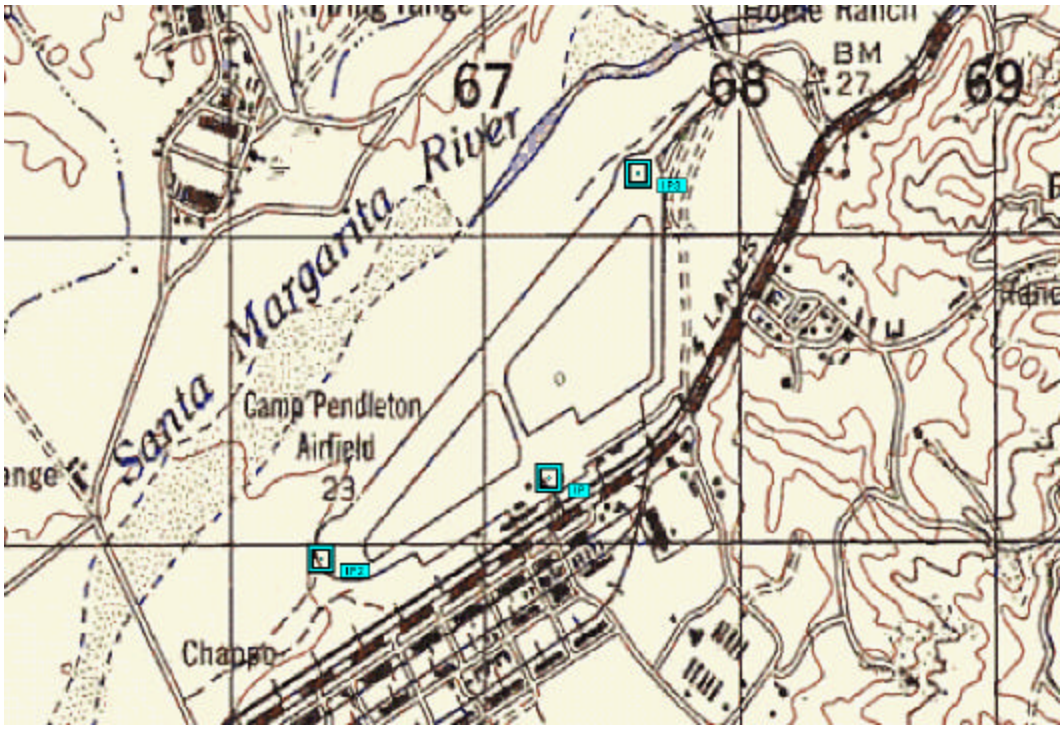

Figure 3.3 Marine Security Positions at Camp Pendleton Airfield

C. OPERATION ORDER DRAFTING AND DESIGN

In order to capture all of the pieces of the amphibious-raid above, it is necessary to put the information together in a meaningful format. The operation order is the format of choice. As noted in Chapter II, an operation order is a directive issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. While the operation order is the primary directive, some information may be put in other meaningful formats that are referenced in the order. These documents may consist of annexes, standard operating procedures (SOPs), operation overlays, or other orders.

All operation orders have guidelines that are followed when they are written. "Guidelines" is a key word here because, while all operation orders follow the same format, the style they are written in, information that is included or omitted, and the amount of detail may be vastly different from one order to the next. That said, all operation orders have a heading, a body and an ending that consist of similar information. The Amphibious Warfare School provides an in-depth look at operation order writing and contents online. There is a self-paced text entitled Operation Plans and Orders that can be accessed via the following link: http://www.mcu.usmc.mil/aws/selfpacedText The next pages focus on each of the sections and provide a brief description of the information they contain.

1. Heading

Heading data contains basic routing information. It is used to handle the administrative details of the order. It generally includes the message classification; who the message is from; who the message is to; the date/time group (DTG); a message reference number; the title of the order; references referred to in the order; and the time zone that will apply during the execution of the order.

2. Body

The body of the operation order contains the meat of the information needed to execute the mission. There are five paragraphs within the body of the order that are further broken down into standard subparagraphs.

a. Situation

This paragraph is made up entirely of information that is designed to provide the framework for the operation. It is divided into six subparagraphs: 1) General,

2) Battlespace, 3) Enemy Forces, 4) Friendly Forces, 5) Attachments and Detachments, and 6) Legal Considerations.

(1) General. Used to describe the political and military environments that may set the conditions for execution of the mission. It is often omitted in OPORDS.

(2) Battlespace. Used to describe the higher commander's area of operations and the command's area of interest and operations.

(3) Enemy Forces. Used to describe enemy information that may have an effect on mission accomplishment. This information may be alluded to in an annex or other document. If it is included in this paragraph, information is given in the following order: 1) Composition, Location, Disposition, and Movements, 2) Capabilities, 3) Enemy Courses of Action (most likely and most dangerous),

(4) Friendly Forces. Used to describe friendly forces that may have a bearing on the outcome of the operation. This may include the location, mission, and intent of higher, adjacent or supporting forces.

(5) Attachments and Detachments. Used to describe non-organic units that have been attached to, or organic units that have been detached from, the headquarters that are issuing the order. Often this will read "None."

(6) Legal Considerations. Used to describe only significant conditions on which the OPORD is based. This paragraph is routinely omitted.

b. Mission

This paragraph is used to give a succinct account of the WHO, WHAT, WHERE, WHEN, and WHY of an operation in order to have enough information for coordination and compliance. It does not describe the HOW.

c. Execution

This paragraph is probably the most important of the entire operation order. It describes HOW the mission will be accomplished. It contains six subparagraphs: 1) Commander's Intent, 2) Concept of Operations, 3) Tasks, 4) Reserves, 5) Commander's Critical Information Requirements (CCIR), and 6) Coordinating Instructions.

(1) Commander's Intent. Used to describe the commander's personal articulation of the purpose of the operation. It is extremely important because, in the event of unforeseen circumstances, the intent will guide subordinates to use proper judgment and initiative to deviate from the plan, yet remain consistent with the objectives of the commander.

(2) Concept of Operations. This is a summary statement of HOW the commander wants the operation to unfold. In some cases, the Concept of Operations may refer to other documents, or be an entire appendix of its own.

(3) Tasks. Used to assign tasks to subordinate elements. This paragraph is where each element is told what its specific mission is with regards to accomplishing the overall mission. Assignments are given to ground elements, aviation elements, and service support elements, in that order.

(4) Reserve. Used to assign the mission of the reserve forces.

(5) Commander's Critical Information Requirements (CCIR). Used to describe both friendly and enemy information that the commander considers critical for situational awareness and future planning.

(6) Coordinating Instructions. Used to "send home" information that is applicable to everyone affected by the order. Information may include, but is not limited to, D-day, H-hour, L-Hour, and coordinates for beach landing sites, helicopter landing zones, and amphibious task force objectives.

d. Administration and Logistics

This paragraph describes personnel and logistical information important to the conduct of the operation. It contains seven subparagraphs that are described in the following order: 1) Personnel, 2) Logistics, 3) Public Affairs, 4) Civil Affairs, 5) Meteorological and Oceanographic Services, 6) Geospatial Information and Services, and 7) Medical Services. Each of these subparagraphs may be referenced to a SOP, or more

commonly, its appropriate annex. At the tactical level, subparagraphs 1 and 3-7 are routinely omitted.

(1) Personnel. Used to give instructions on timely and accurate strength and accountability reporting procedures.

(2) Logistics. Used to describe how logistics support such as transportation, resupply, maintenance, and general engineering will be conducted.

(3) Public Affairs. Used to give instructions on how to deal with questions from the local media.

(4) Civil Affairs. Used to give instructions on how to handle issues such as requests for political asylum or temporary refuge.

(5) Meteorological and Oceanographic Services. Used to describe weather, tide, and other environmental factors that may have an impact on operations. Also discusses how this information will be updated.

(6) Geospatial Information and Services. Used to describe the use and update of satellite imagery.

(7) Medical Services. Used to describe the locations of hospitals and battalion aid stations, their hours and services offered, and to give instructions on medevac procedures. Anything medically related may go here, but will most

likely be in a separate annex or covered in a separate CSSE order.

e. Command and Signal

This is the last paragraph in an operation order, and is used to provide instructions on the proper establishment and maintenance of command and signal. It is subdivided into four paragraphs: 1) Command Relationships, 2) Command Posts and Headquarters, 3) Succession to Command, and 4) Signal.

(1) Command Relationships. Generally used in a large or complex operation in order to easily ascertain "who is who" with regards to command interaction. Is routinely omitted or referenced to its appropriate annex.

(2) Command Posts and Headquarters. Used to give command post locations of the orders issuing unit and those of subordinate and higher units when known or desired.

(3) Succession to Command. Used to describe who will take over command should the current commander become incapacitated for any reason. This list needs to be deep enough to ensure there is never a question as to who is in command if there needs to be numerous successions.

(4) Signal. Used to describe the use and meaning of electronic communications, pyrotechnics, and other communication means.

3. Ending

Ending data is really just a continuation of administrative information such as contained in the Heading. It generally contains the message classification, and may contain an authentication, list of annexes used, and a request for acknowledgement.

D. OPERATION ORDER METHODOLOGY

There were two overarching goals in writing the exemplar operation orders for this thesis. The first is that the operation be joint. The orders needed to contain elements of Marine Corps, Navy and Army missions (at a minimum) in order to show that operation order visualization can work for all services. The second goal was that the operation had to be realistic. Not only did the "story" have to seem real, but the tactics, players and equipment needed to make sense as well. To make this happen, an operational scenario considered for Operation Noble Anvil/Allied Force was used and "rewritten" to take place off of Camp Pendleton's "Red Beach" using surface and sub-surface ships from the West Coast and Hawaii. Amphibious tactics and doctrine were drawn from experience and from the Amphibious Warfare School Non-Resident Program textbooks.

Appendices B through F contain the operation orders drafted for this scenario. Appendix B is the top-level joint order. Appendix C is a lower-level operations annex. Appendices D through F are varying versions of the unit-level (specifically GCE) orders. These orders were written with enough detail and structure to fulfill the intent of this thesis. Some of the less-pertinent guidelines mentioned earlier have not been adhered to, and much superfluous information has been omitted or is incomplete in order to focus on operation order tactical details critical for visualization. As this thesis seeks to visualize

an amphibious-raid, its focus is on the unit-level operation order (Appendices D through F). Therefore some of the coordinates for AORs, FSAs and NFAs in the joint order and operation annex do not correspond to the AOR the scenario encompasses. These coordinates are provided as "filler" and have no bearing on the outcome of this thesis.

The following paragraphs briefly discuss the methodology for the unit-level order, and the clarifying simplifications that were taken to refine it along the way. The methodology is summarized in Appendix H. This summary also introduces the Generic Hub (GH), which is discussed in detail in Chapter IV.

1. Unit Operation Order as a Word Document

While USMTF is the DoD standard for sending messages, it is an extremely common practice (at least in the Marine Corps, and conjecturally in other services) to write orders as a Word document and distribute copies (paper or e-mail) to the appropriate recipients. This is why the "first draft" of the unit order is provided as a Word document.

Figure 3.4 is the TASKS section of the order (the complete order can be found in Appendix D). This portion communicates enough detail for tasked units to understand the commander's intent and be able to write five paragraph orders of their own that further describe the tasks of the individual components (platoon, squad, fire team, etc.). It also demonstrates the desire to keep the initial assault small and simple. It is not an oversight that an entire reinforced platoon is not likely to fit into a single Advanced Amphibious Assault Vehicle (AAAV). This was an intentional inaccuracy in order to keep the amount of AAAVs to be visualized at a minimum. As the ability to visualize

more complex scenarios and the number of available models grows, future work should expand upon this scenario and add more realistic levels of detail.

```
B.   TASKS
      1. 1ST PLAT(REIN), CO A
             i.  A H-HOUR (1500Z), CONDUCT AN AAAV ASSAULT ACROSS RED
                 BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.
            ii.  YOU ARE THE RECONNAISSANCE ELEMENT AND WILL LOAD IN
                 AAAV 1.
           iii.  ONCE YOU REACH THE BLS, YOU WILL FOLLOW IN TRACE OF 2ND
                 AND 3RD PLATOONS WHILE DRIVING TO ATF OBJECTIVE A.
            iv.  UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH
                 PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG673842
             v.  BE PREPARED TO ASSIST WITH THE TURNOVER TO TF APACHE.
      2. 2ND PLAT(REIN), CO A
             i.  AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND
                 CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.
            ii.  YOU ARE THE COMMAND ELEMENT AND WILL LOAD IN AAAV 2.
           iii.  ONCE YOU REACH THE BLS, YOU WILL FOLLOW IN TRACE OF 3RD
                 PLATOON WHILE DRIVING TO ATF OBJECTIVE A.
            iv.  UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH
                 PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG664839.
             v.  BE PREPARED TO ASSIST WITH THE TURNOVER TO TF APACHE.
      3. 3RD PLAT(REIN), CO A
             i.  AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND
                 CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.
            ii.  YOU ARE THE SECURITY ELEMENT AND WILL LOAD IN AAAV 3.
           iii.  UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH
                 PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG676853.
```

Figure 3.4 Unit Operation Order TASKS Section excerpted from Appendix D

2. USMTF "Enhanced" Order

The next step in automatically generating a 3D visualization of the operation order was to reformat the Word document into the United States Message Text Format. This was necessary in order to run the XML2MTF tool on the order to get it into an XML format. This was a relatively easy step, but it became very apparent that there was not enough tactical information provided. In order for the AAAVs to move in a virtual world, they would have to have some idea of where to go, when to go, and when to stop. While the traditional operation order would not get to this level of detail (except perhaps in an annex or landing plan), it was concluded that it was necessary to add information to

the order. After adding the new information and running it through the XML2MTF tool, it became evident that the tool did not distinguish this information from the rest of the general text. Knowing this, liberties were taken with the structure of the TASKS section of the order to make defining tags and writing an XML schema easier. XML schemas are discussed in Chapter V. Figure 3.5 emonstrates some of the clarifying changes that were made (the complete order can be found in Appendix E).

Most notably, an Organization section and a Timeline and Movement section were added. In the Organization section, each AAAV was given a call sign for easier identification. The original tasks given to each platoon were modified to read "per guidance in section 6 of this order." Section 6, which is the Timeline and Movement section, then became the heart of the order with regards to important data required for the 3D visualization. It now contains all the necessary data that the AAAVs need to move. Start times and locations, end times and locations, waypoints, and actions at the objective are given for each phase of the assault (insertion, infiltration, maneuvers at the objective, and exfil). Currently, for sake of simplicity, all AAAV movement is tied to the lead vehicle with the exception of movement at the objective. In other words, the lead AAAV dictates the movement of the other AAAVs while moving from ship-to-shore, and to and from the airfield. In order to give each AAAV autonomous movement, additional coordinates must be given for each vehicle in every phase of the assault.

Finally, all coordinates are given in terms of Lat/Long because they are universal and don't change. To depict land coordinates by grid numbers, the type and version of the map being used must be specified, and the conversion program would have to know

how to do the translation. This feature is very important and may possibly be added by writing a script for it, however, Lat/Long suffices for purposes of this thesis.

```
B. TASKS
  1. ORGANIZATION

      1. AAAV1

        A. CALL SIGN - BLUE DEVIL

  4. 3RD PLAT(REIN), CO A

    A. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND
CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6
OF THIS ORDER.

  6. TIMELINE AND MOVEMENT

    A. DEPART SHIP AT H-HOUR (INSERTION)

      1. START TIME: 041500ZJUL01

      2. START LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN

      3. END TIME: 041800ZJUL01

      4. END LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN

    B. TRANSIT TO OBJECTIVE AREA (INFIL)

      1. START TIME:041801ZJUL01

      2. START LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN

      3. WAYPOINTS:

            A. LAT N33DEG15.538MIN LONG W117DEG24.875MIN

            B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN

            C. LAT N33DEG17.274MIN LONG W117DEG22.241MIN

      4. END TIME: 042100ZJUL01

      5. END LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN
```

Figure 3.5 USMTF “Enhanced” Operation Order Demonstrating Changes in the TASKS Section excerpted from Appendix E

Table 3.1 summarizes the changes that were made to the enhanced order. The '(new)' under the Sub-paragraph heading signifies and additional sub-paragraph with supplementary information.

Section	Sub-paragraph	Additional Information
Tasks	Organization (new)	Call signs for each AAAV
	Platoon Assignments	Modified original verbiage to include reference to sub-paragraph 6 of the order
	Timeline and Movement (new)	Insertion- start/end times and start/end locations Infil- start/end times and start/end locations as well as a series of waypoints Actions at the Objective- start/end times and location of each AAAV Exfil- start/end times and start/end locations as well as a series of waypoints Extraction- start/end times and start/end locations

Table 3.1 Summary of Changes to the USMTF "Enhanced" Operation Order

3. XML-MTF Order

Once the unit-level order was in the USMTF system, it was possible to run the XML2MTF conversion tool on it. Figure 3.6 demonstrates that the tool did a good job of "pulling out" administrative information such as the exercise name and the originator of the order. However, Figure 3.7 shows that the tool takes the GENTEXT data and lumps it all together. It is evident that the information is part of the EXECUTION section of the order, but the data within the section is very ambiguous and not very useful. Because of this, an XML schema that can semantically capture this data had to be developed. The XML schema is discussed further in Chapter V. The complete XML-MTF order can be found in Appendix F.

```
<?xml version="1.0"?>
-<order>
 -<exercise_identification setid="EXER">
  <exercise_nickname>XMLO1</exercise_nickname>
  </exercise_identification>
 -<message_identification setid="MSGID">

<message_text_format_identifier>ORDER</message_text_format_identifier>
   <originator>BLT ONE SLANT FOUR</originator>
  </message_identification>
 -<type_of_order setid="ORDTYP">
   <type_of_plan_order>TASKORD</type_of_plan_order>
   <order_originator_and_or_number/>
  </type_of_order>
 -<time_zone setid="TIMEZONE">
   <time_zone_zulu>Z</time_zone_zulu>
  </time_zone>
```

Figure 3.6 XML-MTF Operation Order Showing Capture of Administrative Information excerpted from Appendix F

```
-<general_text_information setid="GENTEXT">
   <gentext_text_indicator>EXECUTION</gentext_text_indicator>
   <free_text xml:space="preserve"> …B. TASKS 1. ORGANIZATION A.
    AAAV COMPANY 1. AAAV1 A. CALL SIGN - BLUE DEVIL 2. AAAV 2 A.
    CALL SIGN – NITTANY LION 3. AAAV 3 A. CALL SIGN – HUSKY 2. 1ST
    PLAT(REIN), CO A AT H-HOUR (1500Z), CONDUCT AN AAAV ASSAULT
    ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A
    PER GUIDANCE IN SECTION 6 OF THIS ORDER. PER GUIDANCE IN
    SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF
    APACHE ASSUMES CONTROL OF THE AIRFIELD. C. YOU ARE THE
    RECONNAISSANCE ELEMENT AND WILL LOAD IN AAAV 1. 3. 2ND
    PLAT(REIN), CO A A. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS
    RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER
    GUIDANCE IN SECTION 6 OF THIS ORDER. B. PER GUIDANCE IN
    SECTION 6 OF THIS ORDER,WITHDRAW TO ARG SHIPPING AFTER TF
    APACHE ASSUMES CONTROL OF THE AIRFIELD. C. YOU ARE THE COMMAND
    ELEMENT AND WILL LOAD IN AAAV 2. 4. 3RD PLAT(REIN), CO A A. AT
    H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE
    INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF
    THIS ORDER. B. PER GUIDANCE IN SECTION 6 OF THIS ORDER,
    WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF
    THE AIRFIELD. C. YOU ARE THE SECURITY ELEMENT AND WILL LOAD IN
    AAAV 3. 5. BLT RESERVE: CO B A. AT H-HOUR, YOU ARE ON
    IMMEDIATE ALERT AND WILL BE PREPARED TO ASSUME THE MISSION OF
    THE MAIN EFFORT. 6. TIMELINE AND MOVEMENT A. DEPART SHIP AT H-
    HOUR (INSERTION) 1. START TIME: 041500ZJUL01 2. START
    LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN 3. END TIME:
    041800ZJUL01 4. END LOCATION: LAT N33DEG14.9MIN LONG
    W117DEG25.7MIN B. TRANSIT TO OBJECTIVE AREA (INFIL) 1. START
    TIME:041801ZJUL01 2. START LOCATION: LAT N33DEG14.9MIN LONG
    W117DEG25.7MIN 3. WAYPOINTS: A. LAT N33DEG15.538MIN LONG
    W117DEG24.875MIN B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN
    C. LAT N33DEG17.274MIN LONG W117DEG22.241MIN 4. END TIME:
    042100ZJUL01 5. END LOCATION: LAT N33DEG17.MIN…  </free_text>
 </general_text_information>
```


Figure 3.7 XML-MTF Operation Order Showing GENTEXT Data in Unusable Format excerpted from Appendix F

E. OPERATION ORDER LIMITATIONS

While the benefits of being able to compose an operation order and visualize the plan are enormous, there are many limitations to using operation orders for this purpose. This section addresses some of the problems that need to be overcome in order to make widespread use of a tool like this.

1. Inconsistent Applications

When it comes to writing orders, there are inconsistent applications regarding their use both across and within the military services. One service's operation order may be another's warning order, which may be yet another's fragmentary order. Each can contain similar information, but is written differently and varies in the level of detail. It is up to individuals to decide what type of order to write. Additionally, guidelines for writing orders are often misinterpreted or misunderstood. One order may omit key information that the next order includes. No automatic completeness checks are currently available. There is no "hard and fast" doctrine regarding what must be included in an order. Guidelines are subject to the interpretation of the individual, which results in many like orders with individual styles that make them very different. While this is not a showstopper, until there are XML DTDs or schemas for every possible type of order, visualization capabilities are going to rely on everyone using a standard operation order with identical types of information.

2. Acronyms

Personnel in the armed services know what it is like to live in an ARE (acronym rich environment)! There are likely as many acronyms as there are hours in a year, and many have multiple meanings (including acronyms in an acronym!). It is very difficult to define a tagset that understands an acronym in a way that can be useful if they are used haphazardly. While it is not likely that the use of acronyms will ever end, their usefulness in an operation order is questionable. Overuse of acronyms that are not understood by an XML DTD/schema, or (even more distressing) the recipient of the order can render a visualization tool ineffective.

3. Inconsistent Semantics

The armed services pride themselves on being unique from one branch to the next. Oftentimes, the same philosophy holds true with individual units or specialties in the same service. What this valuable uniqueness also tends to encourage is a lot of different terms or meanings (semantics) for the same thing. For instance, the Marine Corps wears "cammies" while the Army wears "BDUs". While a Sergeant in the Marine Corps is just that, the term is used very loosely in the Army. An E-3 isn't the same thing in any of the services. So how does one go about defining XML tags when there are so many differences? One way would be to have different tags for each service. In this way, service unique definitions would not be an issue. However, what terminology needs to be used on a joint order, or during an allied or coalition exercise? One possible solution to jargon incompatibilities is the Land Command and Control Information Exchange Data Model (LC2IEDM). This database model has been accepted by the United States and NATO, and is discussed at length in Chapter IV.

4. Applicability

Another limitation with regards to the written operation order is that it is not used consistently at all levels in the chain of command. Often times written orders come from high commands and get disseminated through the lower echelons in numerous ways. It is not unheard of (and probably a common practice) for the amphibious-raid scenario presented in this thesis to not be written as an operation order at all but rather covered in a confirmation brief. Squad leaders might scribble partial five-paragraph orders on the main course box of the Meal Ready to Eat (MRE), or fire team leaders may simply give a verbal order. Formal written orders take time that many people aren't willing to give or don't have. Getting everyone to write a formal order in order to visualize the outcome

may be a daunting and unattainable task. Nevertheless, for nontrivial operations, clarity and accountability are essential.

5. Document References

Operation orders are often just the skeleton in larger bodies of information. As mentioned before, countless other documents may be referenced in an operation order. Other orders, operation overlays, and SOPs often contain core information that is needed in order to visualize the plan. Appendix G lists twenty-six (26) different annexes that may be referenced. A joint or coalition order can have myriad possible references that may be in several languages. In order to capture the information from each of these documents, there would have to be a DTD or schema for each one, the DTD or schema would have to be updated or changed every time a given document was altered, and the XML translation tool would have to be able to parse and differentiate between all the possible documents that may have been referenced. For this reason, it may be necessary for operation orders to become more verbose in order to cut down on the number of referenced documents. This is a shift from the common thinking of brevity versus verbosity, but it will prove useful in the long run if clarity is improved.

F. EXTENSIBLE MARKUP LANGUAGE-MESSAGE TEXT FORMAT (XML-MTF)

The United States Message Text Format (USMTF) has long been the tactical messaging tool of choice for the Department of Defense. As the Extensible Markup Language (XML) continues to proliferate and gain momentum in the commercial sector, many of its proponents have questioned the usefulness of the USMTF system. An XML-MTF Development Team was given the task of converting orders from the USMTF

format to an XML-MTF format. While work is ongoing, a tool has been developed that takes a common USMTF message and converts it into an XML-MTF message.

1. Public Beta Release 1.02 of MTF2XML Converter

In July of 2000, UnixPros of Eatontown, New Jersey, released version 1.01 of the MTF2XML converter. This tool takes an MTF message input and creates an XML message output. It follows the mapping standard set forth in the XML-MTF Mapping Public Working Draft that was created by the XML-MTF Development Team in March of 2000. It is a Java-based program so it can run on various platforms without having to recompile. The tool is only guaranteed to work on Windows NT (other platforms have yet to be tested, however, the message in Appendix F was generated using Windows 2000), and messages should be viewed with Microsoft Internet Explorer 5.0 or higher. (Public Beta Release 1.02 of MTF2XML Converter, Readme.TXT file, July 2000)

G. SUMMARY

The amphibious invasion scenario for this thesis encompasses a joint exercise with coordinated Army, Navy, and Marine Corps participation. While operation orders were written for the entire scenario, the focus of this paper is strictly on the amphibious-raid and the unit-level orders that correspond to it.

Operation orders are directives issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. There are guidelines on how to write these orders that are often interpreted in many ways. All orders contain a heading, body and ending. The body of the order is the most important and is made up of five paragraphs: 1) Situation, 2) Mission, 3) Execution, 4), Administration and Logistics, and 5) Command and Signal. Each of these paragraphs are

comprised of numerous subparagraphs which contain or make reference to information critical to the execution of the mission. The Execution paragraph is of great importance as it conveys the Commander's Intent, Concept of Operations, and the Tasks for the mission.

In writing these exemplar orders, there were two main goals. First, the orders had to be joint. Second, the orders had to be realistic. In order to create an order that would lend itself to proper tag definitions and provide information necessary for proper visualization, an "enhanced" order was created that included timelines and coordinates for AAAV movements. While it was possible to alter this exemplar order for purposes of research, many limitations on the use of operation orders exist. They are used inconsistently across and within the military services, acronyms are used without remorse, semantics are not consistent, and countless documents may be referenced from which data retrieval must be attempted. Once an order is written and put in the USMTF structure, the MTF2XML Converter takes the MTF input and outputs an XML message. This is a significant first step in attaining a commonly defined message format that is interoperable across systems.

IV. MODELING AMPHIBIOUS PLANNING AND OPERATIONS USING THE NATO LAND COMMAND AND CONTROL INFORMATION EXCHANGE MODEL (LC2IEDM)

A. INTRODUCTION

Future warfare will increasingly rely on ad hoc coalition environments with disparate communication and information technology systems. These systems will need to provide functionality and interoperability in order to facilitate the exchange of data between Joint US and Coalition international forces. Prior to the start of any operation, Coalition partners must review and agree on communications standards to abide by. NATO is currently trying to overcome this recurring problem by evaluating a common data-interchange specification called the Land C2 Information Exchange Model (LC2IEDM). The Naval Undersea Warfare Command (NUWC) and the Institute for Defense Analysis (IDA) are working with the Naval Postgraduate School (NPS) to extend this primarily land-oriented model to incorporate Naval and maritime representations. This chapter briefly introduces the LC2IEDM data model and evaluates its suitability for representing amphibious planning and operations.

A previous version of portions of this chapter was presented in an earlier thesis. (Hunsberger, 2001)

B. DATA INTERCHANGE

As individuals and groups progress along the "knowledge pyramid" from data to knowledge, they work to attain increasingly higher levels of understanding. Systems that are interconnected need structured formats for passing information. Structured methodologies allow one system to pass specific information to another, with the

expectation that the other system can correctly represent it. A command-and-control example might be a Marine Corps system passing a structured message 'Squadron of F/A-18s at the air base' and having an Army system represent the information correctly.

Data models are used by systems to provide format and message structure. By outlining a format and structure, the data model provides the basis for any system to be able to send on data that any other system can understand. This information exchange model does not specify the way data must be represented or stored on a specific system. It only specifies what and how information must be exchanged between different systems. This significantly reduces the number of parameters that must be specified and gives system implementers freedom to extend the specifications to meet their needs.

The NATO C3 Technical Architecture (NC3TA) Interoperability Reference Model describes four levels for classifying a system's interoperability. They are:

> **Degree 1: Unstructured Data Exchange**. Involves the exchange of human-interpretable unstructured data such as the free text found in operational estimates, analysis and papers.
>
> **Degree 2: Structured Data Exchange**. Involves the exchange of human-interpretable structured data intended for manual and/or automated handling, but requires manual compilation, receipt and/or message dispatch.
>
> **Degree 3: Seamless Sharing of Data**. Involves the automated sharing of data amongst systems based on a common exchange model.
>
> **Degree 4: Seamless Sharing of Information**. An extension of Degree 3 to the universal interpretation of information through data processing based on cooperating applications. (NC3TA, 2000)

The LC2IEDM effectively lays the foundation for Degree 3 Interoperability. (NATO, 2000) Designers can further create systems that can seamlessly share data by adhering to the model.

C. GENERIC HUB

The Land C2 Information Exchange Data Model (LC2IEDM) is formally known as the Generic Hub (GH). The name is derived from the understanding that information exchange requirements (IERs) will change over time, therefore a flexible ***generic*** model that can serve as a basis or ***hub*** for new systems is needed. NATO's information requirement is to define only information to be exchanged versus modeling all the information that might normally be mandatory for a national system. Therefore the intent of the GH is to clearly specify the minimum set of data to be exchanged. However, since the model is both flexible and generic, nations may compatibly expand their own data structures or extend the model to fit their needs. (NATO, 2000)

The primary goal of the Generic Hub model is to serve as a common information-exchange data model. NATO's automated information-exchange plan requires a common specification and a common structure for information to be exchanged. The model provides the basis for sharable structured information. It defines standard elements of information (e.g. vehicle AAAV, and Location Grid 543789) and can also capture relationships between the information (e.g. AAAV is located at Grid 543789). "As a minimum, the NATO nations wish to have the GH Data Model preserve the meaning and relationships of the information exchanged and thereby attain the interoperability associated with NATO Level 5 of System Interconnection (automated

exchange of data, with user-imposed constraints, between C2IS databases)." (NATO, 2000)

Land Combat Operations serve as the common core of the Generic Hub. Functional areas are referred to as "subfunctional" areas of the core. These subfunctional areas can be viewed as spokes extending from the hub as shown in Figure 4.1. With the Generic Hub serving as the basis for the subfunctional area models, data common across all the areas is viewed and structured in a standard way. (NATO, 2000)

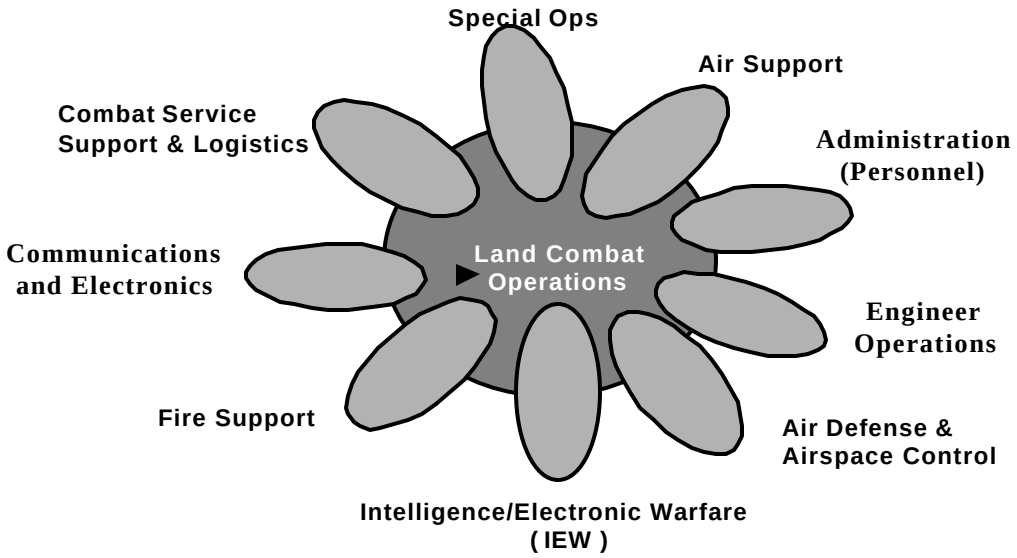

Figure 4.1 Hub and Its Relationship to Subfunctional Areas (NATO, 2000)

D. LAND C2 INFORMATION EXCHANGE DATA MODEL (LC2IEDM) DATA SPECIFICATION

The Land C2 Information Exchange Data Model (LC2IEDM) (formally known as the Generic Hub) structure is meant to be generic and include all land, sea and air operations. It seeks to define the information that is relevant to the generic battlespace and also the information that has meaning within several of the functional areas. The model describes objects of interest including forces, equipment, weather, terrain features,

and facilities. The data model also includes information about the relationship between objects. In order to maintain a common understanding of all content in the model, use of free text (i.e. unstructured data) is discouraged. (NATO, 2000)

The data model has five key and five secondary independent entities. The key entities specify information that directly addresses the battlespace and include OBJECT-ITEM, OBJECT-TYPE, CAPABILITY, LOCATION, and ACTION. The OBJECT-ITEM entity is an individual object that has some military significance. Examples are a specific person such as a commanding general or a specific geographic feature such as a river. The OBJECT-TYPE entity is an individually identified class of objects with some military significance. This might be a type of facility (airfield or mess hall), a type of person (rank or position), or a type of feature (fire support area). The CAPABILITY entity denotes the ability to perform a mission or function. The LOCATION entity is a position within a specific frame of reference. Finally, the ACTION entity is an activity or a description of how an activity will take place. Example ACTIONs include operation orders, fire missions and logistic requests.

The five secondary entities include CANDIDATE-TARGET-LIST, CONTEXT, REFERENCE, REPORTING-DATA, and RULE-OF-ENGAGEMENT. These entities provide information that does not directly address the battlespace. For instance, the REPORTING-DATA entity captures metadata from the other entities relevant to command and control, and the CONTEXT entity is used to group data from other entities without having to create new information.

The use of these ten (10) entities, and the relationships between them, allows for the full specification of a battlespace situation that can be transmitted between coalition systems to convey sharable information.

E. AMPHIBIOUS MODELING USING LC2IEDM

It is worth emphasizing that the Generic Hub (GH) is physically nothing more than an extensive database governed by a NATO-wide acceptance of common definitions for the data that is input. As such, all modeling using the GH is dependent on the entity relationships established in the database. The GH alone cannot generate an XML document, nor will it unilaterally fabricate a 3D virtual world. The XML schema discussed in the next chapter shows how information from the GH can be represented using XML, and the stylesheet example shows how to covert one XML document to another.

The following figures demonstrate different levels of entity-relationship diagrams. Each entity can be specified to the most discriminating level of detail if desired. This is important in that the user defines the preferred level of detail they wish to model. Figure 4.2 is a very simple diagram showing the relationships between the five key entities.

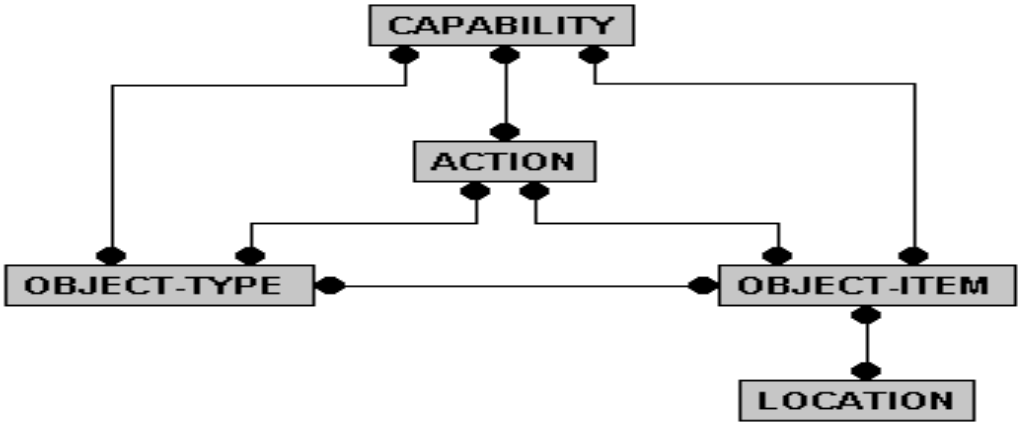

Figure 4.2 Key Entities of the Generic Hub Data Model (NATO, 2000)

Figure 4.3 expands the level of detail to include most of the secondary entities. This is still a very high-level view of the model but it begins to illustrate the added complexity and sophistication available.

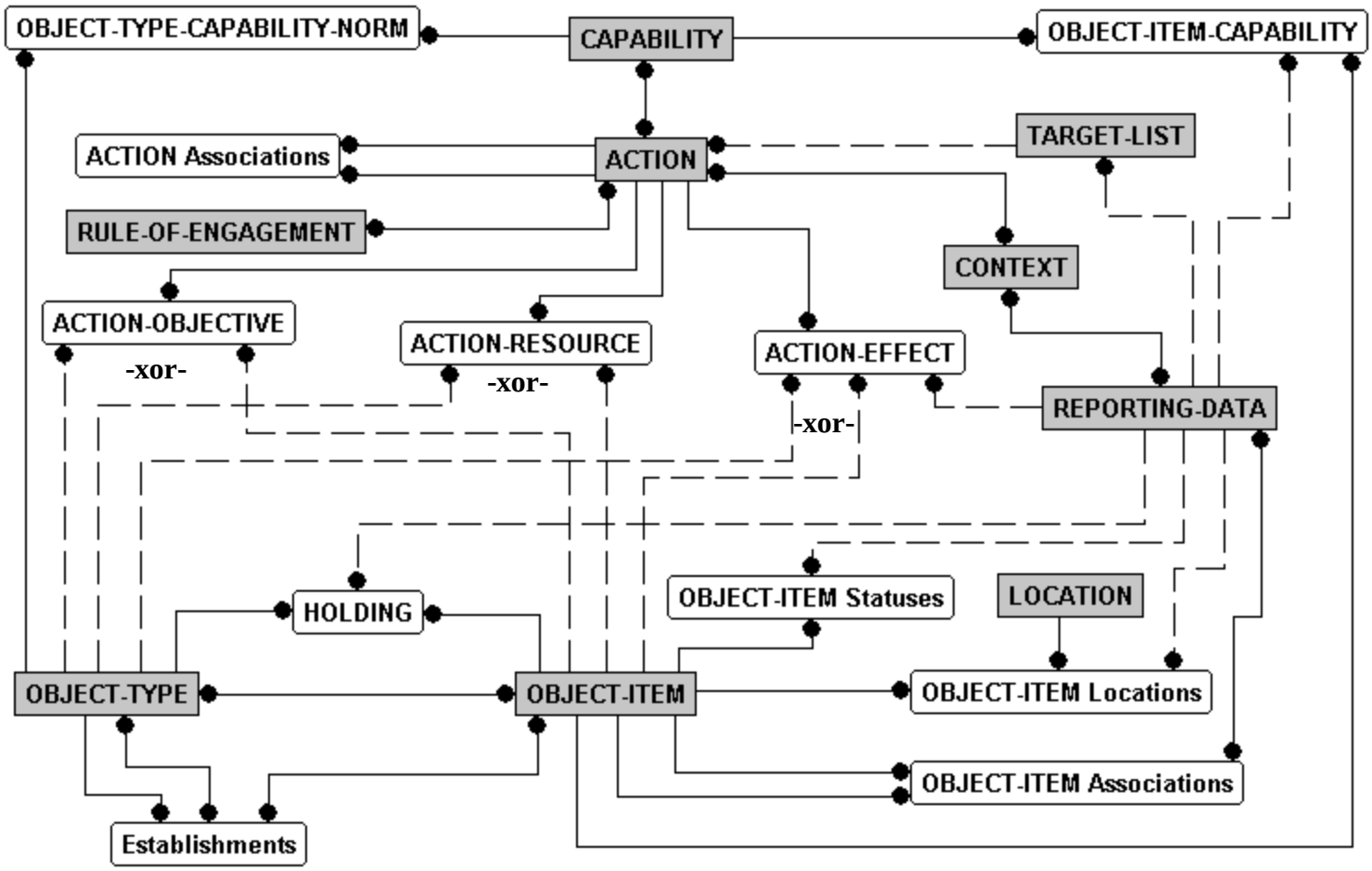

Figure 4.3 High-level View of the Generic Hub Model (Chaum, 2001)

Figure 4.4 takes the ACTION entity and breaks it out into an even finer level of detail. Figure 4.4 is the foundation for demonstrating how the amphibious-raid scenario can be modeled, since it illustrates the relationships between OBJECT-ITEM and OBJECT-TYPE to ACTION. The demonstration example provided later focuses on the

objective of securing the Camp Pendleton Airfield and utilizes the mapping structure illustrated in Figure 4.4.

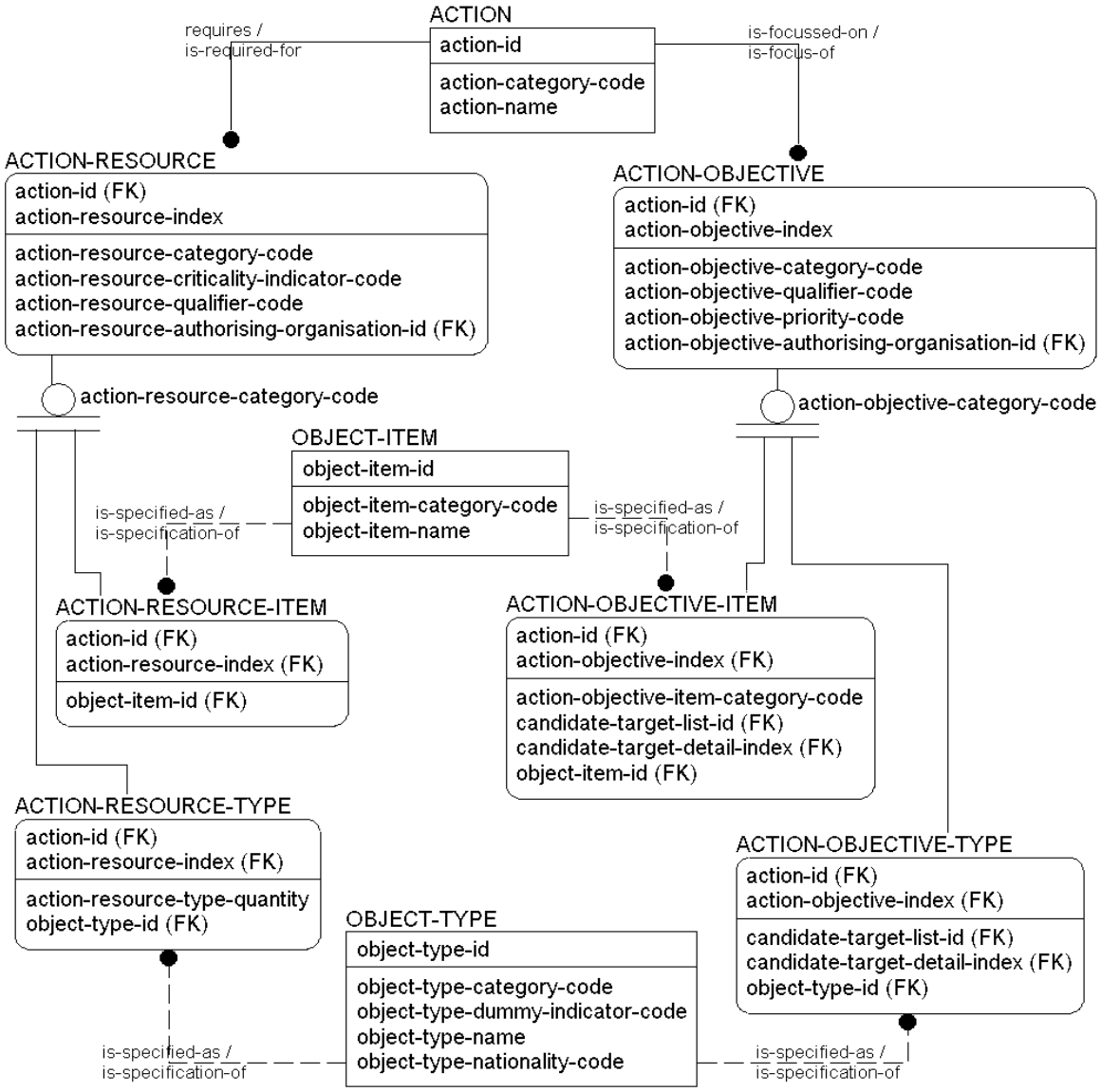

Figure 4.4 ACTION, ACTION-RESOURCE, and ACTION-OBJECTIVE Structure (NATO, 2000)

For this example all “battlefield objects” are specified as instances of OBJECT-ITEM (Loaiza, 2001). In this case, Alpha Company and the Camp Pendleton Airfield are

the OBJECT-ITEMs. Additionally, all activities in the battlefield are represented as instances of ACTION (Loaiza, 2001). In the exemplar scenario, Alpha Company was tasked with securing the Airfield, so the ACTION is given the value "secure". The NATO agreed-upon definition" in the LC2IEDM specification for "secure is:

> In an operational context, to gain possession of a position of terrain feature, with or without force, and to make such disposition as will prevent, as far as possible, its destruction or loss by enemy action. (NATO, 2000)

The other entities are described in the following tables. Each table captures details from e-mail correspondence with Francisco Loaiza.

Table 4.1 expresses the way the WHO-WHAT dyad (who is responsible for what action) is represented:

(a) ACTION

action-id	action-category-code	action-name
1101	OP	Secure

(b) ACTION-RESOURCE

action-id	action-resource-index	action-resource-category-code
1101	1	ObjectItem

(c) ACTION-RESOURCE-ITEM

action-id	action-resource-index	object-item-id
1101	1	11

(d) OBJECT-ITEM

object-item-id	object-item-category-code	object-item-name
11	OR	Alpha Company

Table.4.1 ACTION-RESOURCE Example Expressed using Generic Hub Notation, derived from (NATO, 2000) ID values are keys representing specific objects or items in the given scenario.

What Table 4.1 actually says is that the instance of OBJECT-ITEM with id=11 (Alpha Company) is the resource for effectuating the instance of ACTION with id=1101 (Secure). (Loaiza, 2001) Plainly stated, Alpha Company will secure something.

Table 4.2 expresses the way the WHAT-TO_WHOM dyad (for what/whom is the action intended) is represented. The ACTION table is omitted, as it has not changed from Table 4.1:

(a) ACTION-OBJECTIVE

action-id	action-objective-index	action-objective-category-code
1101	1	ObjectItem

(b) ACTION-OBJECTIVE-ITEM

action-item	action-objective-index	object-item-id
1101	1	17

(c) OBJECT-ITEM

object-item-id	object-item-category-code	object-item-name
17	FE	Camp Pendleton Airfield

Table 4.2 ACTION-OBJECTIVE Example Expressed using Generic Hub Notation, From (NATO, 2000)

What Table 4.1 communicates is that the instance of OBJECT-ITEM with id=17 (Camp Pendleton Airfield), is the recipient of the instance ACTION id=1101 (Secure). In other words, Camp Pendleton Airfield is “secured”. (Loaiza, 2001)

As expressed in the entity-relationship diagram in Figure 4.4, Tables 4.1 and 4.2 are not independent of each other. When both “halves” are put together, the model states that Alpha Company is the resource that carries out the action “secure” against the objective of Camp Pendleton Airfield.

It is evident that more data must be recorded and many additional relationships developed to complete even the simple amphibious- raid model. One can then surmise that the magnitude of complexity for a large-scale joint operation would increase exponentially. Nevertheless, once information has been recorded in the database, there is no need to re-enter the data again. Moreover, because the data input is defined in terms that the US and NATO have agreed on, the information can be shared from one service or country to another.

F. LC2IEDM AND XML-MTF

By now it should be apparent that the Generic Hub (GH) and XML-MTF models are very complementary. XML-MTF provides a set of tags that capture all of the message header and ending administrative information, as well as each section within the operation order. While it further breaks the operation order down into Situation, Mission, Execution, etc., it typically consolidates all of the content (GENTEXT) into a large, unusable single tag. On the other hand, the GH schema (when complete) can provide semantic tags that fully capture and structure the content of the operation order. More importantly, US and NATO forces have agreed upon these semantic terms, making them compatible for coalition use. When used together, each process can leverage off the strengths of the other without having to duplicate the effort of creating tags that have already been defined.

G. SUMMARY

The Land C2 Information Exchange Data Model (LC2IEDM) (formally known as the Generic Hub (GH)) increases the effectiveness and efficiency of dissimilar systems that require data exchange. The data model supports information interchange by standardizing the measures in which the data is exchanged. The model is generic in order

to offer the flexibility necessary to permit the creation of a full range of battlespace representations over a wide spectrum of military operations.

The Generic Hub (GH) is an extensive database that depends on the arrangment of potentially large sets of entity-relationships to complete a model. The example of securing the Camp Pendleton Airfield demonstrated some of the relationships that are created between entities. It is up to the author to determine the level of detail desired when creating an order or plan. The more data desired, the more complex the structure of the model for the order of plan becomes. However, once information has been recorded in the database, there is no need to reenter the data again. Also, because the data entered is defined in terms that have been agreed upon, the information can be shared from one service or country to another.

Finally, the LC2IEDM and XML-MTF schemas are complementary to one another. The XML-MTF tags essentially capture the administrative information and message format while the LC2IEDM tags capture the content (GENTEXT) of the message. By using the two together, they can leverage each other's strengths and eliminate the need to duplicate the effort of recreating semantic tags that have already been defined.

V. WEB ACCESS AND XML

A. INTRODUCTION

The chapter discusses reasons for using the World Wide Web as a medium to distribute and utilize the visualization tool. It also introduces the Extensible Markup Language (XML) and the schemas and stylesheet that are being generated for the amphibious-raid scenario. It concludes by describing several current efforts that are underway within the DoD and commercial sectors that are also committed to the Web and XML.

B. WHY USE A WEB APPROACH?

The phrase "Web3D content" refers to 3D graphics rendered via a web browser, such as a 3D plugin operating inside Microsoft Internet Explorer or Netscape Communicator. 3D content needs to be as easy to access and view as 2D text and graphics in a Hypertext Markup Language (HTML) document using the browser. This distinction is important if scalability, ubiquity, and "ease of use" are to be attained. (Blais, 2001)

3D content must be accessible via networked browsers in order to grow and interconnect without bounds. This is different from the separate-program installation methodology required by most standalone or large-scale multi-player online games. For commercial reasons (i.e., billing for services), most large-scale commercial online games are separate customized applications that only allow authenticated users to join and depart shared virtual environments. In return, such distributed applications provide state management and communications among the host servers and other players. The

application further provides specialized (usually proprietary) graphics rendering that can only utilize 3D content which is uniquely prepared for that application. While this is an effective business model for online gaming, it is not a very scalable or robust approach for long-term military and scientific applications that must steadily grow and improve (and perhaps even interoperate). That is why it is important to use open scalable nonproprietary Web-based 3D graphics technologies that are available today. (Blais, 2001)

C. EXTENSIBLE MARKUP LANGUAGE (XML)

This section gives an overview of the Extensible Markup Language and further discuss specific aspects of the language that impact the research of this thesis.

1. Overview

The Extensible Markup Language (XML) was designed to provide the simplicity of the Hypertext Markup Language (HTML) and the information exchange benefits of the Standard Generalized Markup Language (SGML). It became a World Wide Web Consortium (W3C) specification in February 1998. XML was created to enable richly structured documents to be employed on the Web; in other words, it is a markup language for documents containing structured data. Two major benefits of XML are that it is free and platform independent.

With HTML, tag semantics and tag sets are fixed. XML does not specify semantics or tags. Therefore, XML semantics and tags are user defined. The examples in Figure 5.1 demonstrate how HTML describes the format of a document whereas XML describes the structure and semantics. It is clear that the XML tag has been defined in a manner that is descriptive and human readable. The tag describes the data encapsulated

within it. The product of data describing data is referred to as metadata. This is an extremely powerful and valuable function of XML. The <p> tag pair in the HTML document denotes a paragraph. This construct is primarily for presentation purposes and does not provide any useful semantic information. One note of concern worth mentioning is that because XML tags are user-defined, there are many equally valid ways to express the same data using different terms and structures. The uncoordinated addition of tagsets will reduce data interoperability rather than improve it. (Crawford, 2001)

A. HTML EXAMPLE

```
<html>

<head>

<title>Department Heads</title>

</head>

<body>

<p>CO: Col Stargazer</p>
<p>XO: LtCol Imnext</p>
<p>S-1: CWO3 Lostit</p>
<p>S-2: Capt Knowit</p>
<p>S-3: Capt Writingit</p>
<p>S-4: Maj Outofit</p>
<p>S-6: Maj Rebootit</p>

</body>
</html>
```

B. XML EXAMPLE

```
<ROSTER>
   <TITLE>Department Heads</TITLE>
   <COMMANDING_OFFICER>CO: Col Stargazer</COMMANDING_OFFICER>
   <EXECUTIVE_OFFICER>XO: LtCol Imnext</EXECUTIVE_OFFICER>
   <ADMINISTRATION_OFFICER>S-1: CWO3 Lostit</ADMINISTRATION_OFFICER>
   <INTELLIGENCE_OFFICER>S-2: Capt Knowit</INTELLIGENCE_OFFICER>
   <TRAINING_OFFICER>S-3: Capt Writingit</TRAINING_OFFICER>
   <SUPPLY_OFFICER>S-4: Maj Outofit</SUPPLY_OFFICER>
   <COMMUNICATIONS_OFFICER>S-6: Maj Rebootit</COMMUNICATIONS_OFFICER>
</ROSTER>
```

Figure 5.1 A. HTML Example for Presentation B. Corresponding XML Example for Content Semantics

2. XML Components

While there are many components and rules for creating a proper XML document, only those that have a direct effect on this thesis are discussed. There are countless numbers of XML books, Web pages, magazines, presentations and other resources available for readers who desire more information on the subject. A good starting point is the World Wide Web Consortium (W3C) home page at http://www.w3.org.

a. Elements and Attributes

Elements and attributes are the fundamental nodes used to create XML documents. Elements consist of a start and end tag, and are characteristically given descriptive names to denote meaning. In Figure 5.1, `<SUPPLY_OFFICER>S-4: Maj Outofit</SUPPLY_OFFICER>` is the element <*SUPPLY_OFFICER*> containing the data "*S-4: Maj Outofit*". Tag names must begin with a letter, underscore or colon. Follow on characters can be letters, numbers, etc., but cannot contain whitespace. As noted earlier, it is easy to depict the same data using different tag names. Because XML parsers are case sensitive, the element <SUPPLY_OFFICER> is not the same as <Supply_Officer> or <supply_officer>, but (to humans at least) all three versions clearly describe the same data.

Attributes enable an author to define extra information about an element. Values given to attributes are strings that must be delimited by quotation marks. An example of an attribute is <Service branch="USMC"> where <*Service*> is the element with the attribute *branch* having the value "*USMC*". There are arguments for and against the use of attributes. Arguments against include the inability of attributes to specify

structure, and their tendency to inhibit document readability when they are used in excess. Arguments for include attributes usefulness in describing the unique properties of an object and therefore increase the metadata provided. In any case, a good rule of thumb is to use an attribute for simple, unstructured "secondary" information that is unique and cannot be separated from the concept of the element.

b. XML Schema

An XML Schema formally specifies a coherent set of definitions for elements and attributes. Within the schema definition are declarations of which elements, attributes etc. are legal within a document, and also the locations where they are legal. (Goldfarb, 2001) In other words, the schema specifies the content and structure of an XML document. If a document does not conform to the XML specification it is not valid.

The XML Schema is a W3C recommendation that was created to improve deficiencies of the Document Type Definition (DTD). DTDs also specify the content and structure of an XML document, but DTD document schemas are not written in XML and only support character data. XML schemas make up for these deficiencies while providing other new capabilities that make it more robust and powerful than a DTD. Some of the extensive additional capabilities that schemas provide include:

- New built-in data types such as integers and dates;
- User-defined data types can be created to put additional constraints on built-in data types;
- Any non-negative whole number can be used to specify the number of child element occurrences (formerly just zero, one, and infinity were allowed)
- Schema constructs can be imported from existing schemas, and;

- A process called *refinement* enables elements to inherit content and attributes from other elements. (Bird, 1999)

c. Extensible Stylesheet Language (XSL)

The Extensible Stylesheet Language (XSL) is a W3C specification for applying standard formatting to XML documents. It is made up of two standards: format and transformation. The formatting standard defines the semantics of formatting in the form of a catalog of formatting objects. The transformation standard has evolved into a language that is autonomously useful for transforming one XML document to another. It is known as Extensible Stylesheet Language for Transformations (XSLT). XSL is the link between abstract data required for computer processing and the formatted rendition essential for human readability. XSLT transforms a document from an abstraction to a rendition. (Goldfarb, 2001) By using multiple XSL stylesheets, a single message can be formatted for text, HTML, printing, or e-mail.

D. XML SCHEMAS FOR THE AMPHIBIOUS-RAID

As discussed before, the XML-MTF operation order is insufficient in the way it handles the GENTEXT information. In order to filter out the essential data from the TASK sections, it is necessary to create and define another set of XML tags. Furthermore, these tags need to be compliant with the Generic Hub (GH) in order to benefit from the coalition database. The XML schema in Appendix I defines the critical information that is needed for proper 3D visualization of the order. It leverages all of the tags from the XML-MTF DTD that give the order it's structure, but it contains additional elements and attributes specifically designed to capture the data from the TASKS section of the order. An ORGANIZATION element was created to represent the MEU, BLT, Company and Platoon. This element is given the attribute NAME to allow each

ORGANIZTION element to be described as 15th MEU or Alpha Company. Each ORGANIZATION element may be nested in another element to form a hierarchical "parent-child" structure. This enables Alpha Company to be an element of the BLT, or 1st Platoon to be an element of Alpha Company. Other elements were added to define tags in the TIMELINE AND MOVEMENT section of the order. These elements map to the data added to the USMTF "Enhanced" Order in Appendix E. In other words, elements were created for INSERTION, INFILTRATION, WAYPOINT, etc. To account for movement times, an attribute group named START TIME was created with attributes that comprise a date time group (DTG). Another attribute group named LOCATION was created to facilitate defining locations. Attributes in this group include LAT/LONG coordinates, GH associated id numbers (used to establish entity relationships as discussed in the previous chapter), and Names. While the schema is still a "work in progress", it is practically acceptable in its present state. Appendix J is an XML operation order that has been generated using the new schema. This order should be compared with the order in Appendix F to get a full appreciation of what the XML schema can do.

In order for the operation order in Appendix J to interoperate with the Generic Hub, another XML schema defines semantic tags that attempt to embrace all possible elements incorporated in the database. This schema is robust in that it works for any document or order that may utilize the element tags, not just operation orders. Segments of this schema is located in Appendix K. Appendix L contains parts of a GH compliant operation order that follows the rules of the GH schema. This order is what the order in Appendix J must transform into to be compliant with the database. An XSL stylesheet (discussed in the next section) is needed to make that happen. Once the order is

amenable to the GH schema, data is entered into the database by means of a Visual Basic script.

E. XML-MTF TO GENERIC HUB USING XSL

In order for the operation order in Appendix J to become the operation order in Appendix L, and thereby compliant with the GH, an XSL stylesheet is applied to change its format. Specifically, XSLT is used to transform one XML document into another. Once this link is complete, an extremely important chain reaction can occur. Operation orders can be produced with the improved XML-MTF schema, transformed into orders compliant with the GH schema and read into the database. However, this is not a "one-way" feed. Once autogeneration of the 3D scene is functional, the GH database will be able to feed and update the information in the scene; in other words the data flow and transformation works both ways. This concept is made clearer in Appendix H.

F. RELATED EFFORTS

1. Semantic Web

The Semantic Web strives to make the Web useful not only for communication between humans, but also to allow machines to participate and help. Its goal is to allow robots and other automated tools to interpret information on the Web. (Semantic Web Activity Statement, 2001) "The Semantic Web will bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users." It is not a separate Web but rather an extension of the current one. (Berners-Lee, May 2001)

The Semantic Web will leverage two existing technologies and add a third component to round out its development. The existing technologies are XML and the Resource Description Framework (RDF). The RDF is an application of XML and is used

to put data into the Web in a form that can be processed by machines using a common data model and data schemas that can be interpreted by machines. (Semantic Web Activity Statement, 2001) The final component is an ontology, which is a document or file that formally defines the relations among terms. Software agents using this component will be able to discover common meanings for terms across multiple databases. (Berners-Lee, 2001)

2. Task Force Web (TFW)

Task Force Web is an initiative sponsored by the Department of the Navy Chief Information Officer (DON CIO). It seeks to Web-enable the Navy's applications, and uses XML as a key element in its architecture. Building on current Navy-Marine Corps Internet (NMCI) and IT-21 infrastructures, TFW is to have at least 50 applications Web-ready by 1 November 2001, and all applications ready by 2004. (TFW, 2001). X3D, XML-based Generic Hub and XML-MTF are all excellent candidates to become TFW exemplar systems.

3. Geography Markup Language (GML)

The Geography Markup Language is an XML-based language for encoding geographic information. It is intended to enable the transport and storage of geographic information to include properties and geometry of geographic features. A product of the Open Geographic Information Systems (OpenGIS) Consortium, GML should make an impact on the ability of organizations to share geographic information with one another, and to enable linked geographic datasets. GML is intended to describe the geography of entities in the real world, not the visualization of geographic features. As such, GML looks to transform its XML encoded features into XML encoded graphics elements such as VRML. (Johnson, 1999)

G. SUMMARY

3D content must be accessible via networked browsers in order to grow and interconnect without bound. 3D content needs to be as easy to access and view as 2D text and graphics in a Hypertext Markup Language (HTML) document using a browser in order to attain scalability, ubiquity, and "ease of use".

The Extensible Markup Language (XML) was created to enable richly structured documents to be employed on the Web. It was designed to provide the simplicity of the Hypertext Markup Language (HTML) and the information exchange benefits of the Standard Generalized Markup Language (SGML). As a World Wide Web Consortium (W3C) specification, XML is a free and platform independent language. It allows users to define their own tags, and therefore their own metadata (i.e. data describing data) that makes the original structured information more useful and readable to humans.

The XML schemas and stylesheet for the amphibious-raid are presented in this chapter. One schema extends the XML-MTF DTD by defining elements that extract data from the GENTEXT portions of the operation order. The other schema defines possible elements incorporated in the GH database. The stylesheet transforms one XML document to another XML document that is compliant with the GH database. Generally speaking, an XML schema is a catalog of definitions for elements and attributes. The schema specifies the content and structure of an XML document. The Extensible Stylesheet Language (XSL) is utilized for applying standard formatting to XML documents. By using multiple XSL stylesheets, a single message can be formatted for plain text, HTML, printing or e-mail.

There are numerous efforts within the Department of Defense and in the commercial sector that are simultaneously leveraging the benefits of XML and the Web. The Semantic Web, Task Force Web, and the Geography Markup Language are just a few examples. As XML progresses and XML tools become more robust, it is clear that XML will become essential for most information systems.

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VI. 3D GRAPHICS AND VISUALIZATION

A. INTRODUCTION

This chapter describes concepts that are fundamental for understanding how complex three-dimensional (3D) worlds are created. It discusses the Virtual Reality Modeling Language (VRML), DIS-Java-VRML and Extensible 3D (X3D).

B. 3D MODELING AND VISUALIZATION TECHNIQUES

1. Virtual Reality Modeling Language (VRML)

The Virtual Reality Modeling Language (VRML) is a Web-based graphics language for building 3D models. VRML allows user interaction within a scene through viewpoint, movement, and rotation. One of the key features of VRML is it is an ISO standard designed for use over the World Wide Web.

VRML worlds are created using a scene-graph structure. Scene graphs are simply a hierarchical decomposition of components that will be rendered in a scene. Scene graphs are comprised of various groups of nodes, which together form a virtual world. These nodes are responsible for displaying shapes, interaction, and movement through the world. VRML worlds can be viewed with any VRML-capable browser such as Cosmo Player or Cortona, which can be downloaded at no cost from the internet and support both Internet Explorer and Netscape as plug-ins.

There are numerous examples of 3D images and objects available on the Web. These examples demonstrate how groups of nodes are used to create complex 3D objects and virtual worlds. The following list is an excellent reference for 3D examples:

- Naval Postgraduate School VRML Course examples are available at http://www.web3D.org/TaskGroups/x3d/translation/examples/toc.html

- VRML Sourcebook examples at http://www.web3D.org/TaskGroups/x3d/translation/examples/Vrml2.0Sourcebook/toc.html
- VRML/X3D Conformance examples at http://www.web3D.org/TaskGroups/x3d/translation/examples/Conformance/toc.html
- Scenario Authoring and Visualization for Advanced Graphical Environments (Savage) project at http://web.nps.navy.mil/~brutzman/Savage/toc.html

a. Visual Nodes

Visual nodes are the foundation for generating 3D virtual worlds. The `Shape` node is the node in which the form and appearance of a 3D object are defined. The `Shape` node consists of four primitive shapes: Box, Cylinder, Cone, Sphere. Each shape can be manipulated by changing field values such as the radius of a sphere or the height and width of a box. In addition to manipulating the shapes, each shape has an `Appearance` node in which material and texture fields can be changed. The `Material` node allows the user to choose colors, shininess, transparency, and how bright or dull the color will be. The `Texture` node allows the user to apply a 2D texture (such as brick or water) to a 3D object to increase realism. In addition to changing the appearance and texture of a shape, other nodes are available that allow the user to translate, rotate, size, and orient the shape within the scene graph.

Shape nodes are not limited to the primitive geometries mentioned above. Advanced geometries exist that allow the user to create more complex objects and closely approximate smooth surfaces and terrain. These nodes include (but are not limited to) `IndexedFaceSet`, `Extrusion`, and `Elevation Grid`. Figures 6.1 and 6.2 demonstrate how complex objects can be built using a variety of visual nodes.

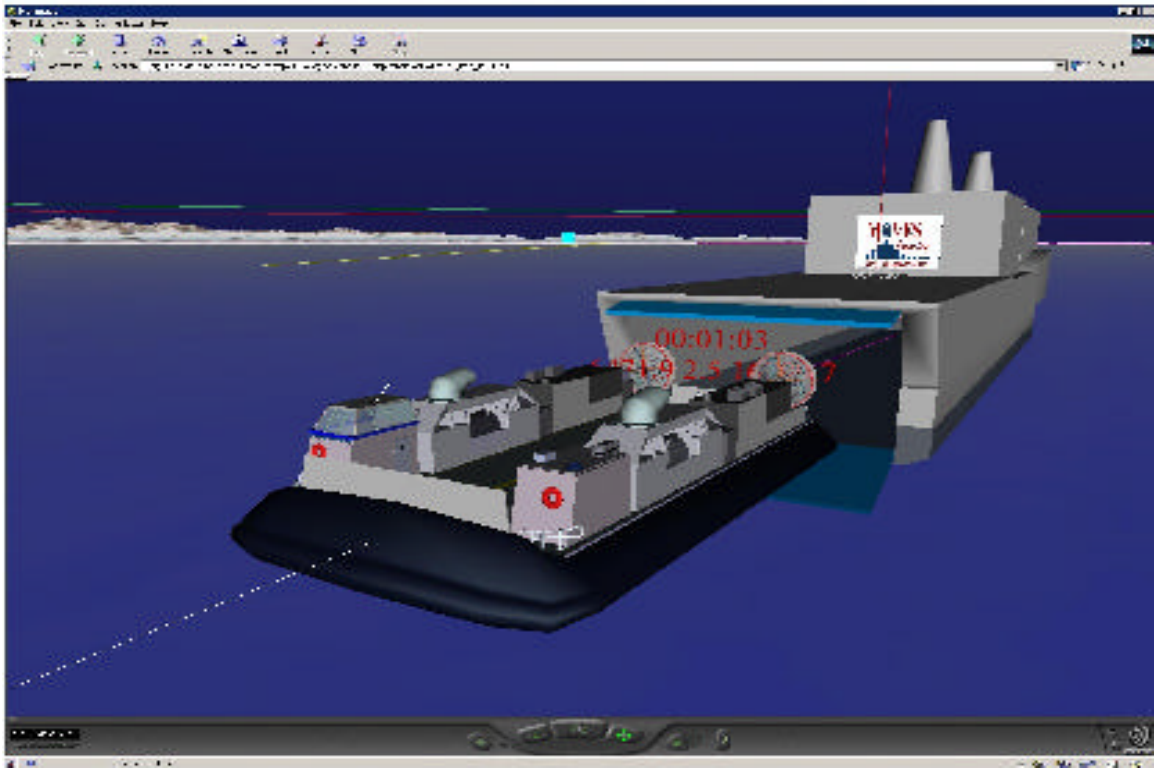

Figure 6.1 Landing Craft Air Cushioned (LCAC) Exiting the Well Deck of a San Antonio Class LPD-17

Figure 6.2 AH-1Z Super Cobra Patrolling “Red Beach” at Camp Pendleton

b. Grouping Nodes

Grouping nodes are used to band other nodes into a common entity, and then treat and manipulate that entity as a whole. The Group node is the most basic of these nodes, and simply serves as a container for children nodes. More powerful is the Transform node, which allows a builder to manipulate an entity's size, position, and orientation within its own coordinate system. This node allows large parts of a virtual world to be manipulated at one time.

c. Viewing Nodes

Viewing nodes are used to set up predefined "camera" viewpoints within a virtual world. A `Viewpoint` node is used to predefine a position and orientation that automatically takes a viewer to that location when first entering the world. Additional viewpoints can be defined that enable the viewer to easily navigate to predetermined areas throughout the world. These viewpoints can be selected randomly from a simple Graphical User Interface (GUI) list, or visited in order by simply using the Page Down key on the keyboard. Viewpoints are very important when trying to navigate through large, complex virtual worlds. Predetermined viewpoints do not, however, disable a viewers ability to self navigate through a virtual world. Another viewing node is the `NavigationInfo` node. This node determines how a viewer navigates through a world. This node can be set to let a user walk, fly, or examine the world around them.

d. Animation Nodes

Once a 3D world is populated with objects, it is usually desirable to make it come alive. In order to animate an object in a 3D world, VRML needs a clock, interpolator and a route. A clock can be created using the `TimeSensor` node which provides features for starting, stopping and controlling how quickly the animation plays.

The `PositionInterpolator` and `OrientationInterpolator` nodes describe the changes that occur during an animation. Using a technique called keyframe animation, a position or rotation is specified for only a few, key fractional times. The VRML interpolator nodes use these key fractional times and values as a rough sketch of the animation and fill in the values between those specified as needed. As the animation progresses, new positions and orientations are selected and output. (Ames, 1997)

In order to make animations work, a circuit must be created between nodes to exchange the information that will ultimately make things move. In order to do this, VRML uses `ROUTE` descriptions. A `ROUTE` can take an output from a `TimeSensor` node and "wire" it into an input field of an interpolator node. Another `ROUTE` is used to "wire" the interpolator node's output into an input field of a `Transform` node. Once the circuit is complete, the `TimeSensor` node's clock can be started. Events flow from the `TimeSensor` node to the interpolator, and from there to the `Transform` node, causing the node's coordinate system to translate, rotate, and scale as the animation plays back. (Ames, 1997)

e. Sensor Nodes

Sensors are the primary means of providing interaction in a virtual world. VRML sensors are activated when a cursor, mouse arrow, or other pointing device is moved over or clicked on an object. When the viewer clicks on an object with an attached sensor, the sensor outputs events that can be routed into other nodes to start animations (Ames, 1997). The main sensor nodes are: `TouchSensor`, `PlaneSensor`, `SphereSensor`, and `CylinderSensor`. The nodes all act

similarly, but the latter three provide the additional capability of selectively moving objects within the world.

f. Script Node

The `Script` node is used when native VRML animation features are insufficient. This node is used to integrate programs using Java or JavaScript (EcmaScript), and can be very powerful in creating more complex animations or calculations in the scene graph.

g. PROTO and EXTERNPROTO Definitions

A `PROTO` (prototype) and `EXTERNPROTO` (external prototype) are used to create and define a new node type. A `PROTO` is usually a combination of many other nodes that have been grouped together to make a complex object that may be useful or necessary to reuse. For instance, a helicopter may be defined as a `PROTO` so as not to have to recreate it to be used at a later time. As complex `PROTOS` become common, it is useful to maintain them in your own external library. An `EXTERNPROTO` declaration is a reduced version of a `PROTO`. The `EXTERNPROTO` specifies a URL that points to an external file containing the `PROTO` (Ames, 1997). This provides for efficient network storage, accessibility and reuse. The corresponding X3D nomenclature for these constructs is `ProtoDeclare`, `ExternprotoDeclare` and `ProtoInstance`.

2. GeoVRML

GeoVRML 1.0 is an extension of the Virtual Reality Modeling Language (VRML) that allows for accurate rendering of geographic data. While this thesis does not make use of GeoVRML in its current state, it is important to discuss as it has tremendous utility for follow-on work.

GeoVRML 1.0 is a "Recommended Practice" of the Web3D Consortium. It is open source and freely downloadable to the public at www.geovrml.org. GeoVRML 1.0 provides a suite of solutions for representing and visualizing geographic data. It provides the following list of high-level capabilities:

1. **Coordinate Systems** - GeoVRML provides the ability to embed latitude/longitude or UTM coordinates directly into a VRML file and have the browser transparently fuse these into a global context for visualization. GeoVRML 1.0 supports 3 coordinate systems, 21 ellipsoids, and 1 geoid.
2. **Precision** - VRML97 provides only single-precision floating point values. This is insufficient to represent data on a planetary scale down to around 10 m resolution or beyond. GeoVRML provides solutions to extend this precision and enable sub-millimeter positional accuracies.
3. **Scalability** - GeoVRML provides various scalability features to manage the streaming of large, multi-resolution models over the Web.
4. **Metadata** - GeoVRML provides the ability to specify a generic subset of metadata describing geographic objects, including the ability to link to a full metadata description.
5. **Animation** - The ability to interpolate within the supported geographic coordinate systems is provided so that animations can be defined with respect to key points on the surface of the planet.
6. **Introspection** - Functionality is provided to be able to query a GeoVRML scene and discover the geographic coordinate of any georeferenced point.
7. **Navigation** - GeoVRML 1.0 provides some basic support for navigation schemes that are specific to geographic applications. Specifically, the issue of elevation scaled velocity is addressed.

GeoVrml 1.0 is a suite of ten nodes designed to enhance virtual worlds by making them geographically accurate. Table 6.1 is an overview of the nodes. Following the table are more complete definitions for nodes that have significant military application.

Node Name	Description
GeoCoordinate	Build geometry using geographic coordinates
GeoElevationGrid	Define a height field using geographic coordinates
GeoInline	Inline a file with control over when to load and unload the data
GeoLocation	Georeference a vanilla VRML model onto the surface of the earth
GeoLOD	Level of detail management for multi-resolution terrains
GeoMetadata	Include a generic subset of metadata about the geographic data
GeoOrigin	Specify a local coordinate system for increased precision
GeoPositionInterpolator	Animate objects within a geographic coordinate system
GeoTouchSensor	Return the geographic coordinate of the object being pointer to
GeoViewpoint	Specify viewpoints using geographic coordinates

Table 6.1. Nodes Covered by GeoVRML 1.0 Recommended Practice. (Iverson, 2000)

a. GeoElevationGrid

The `GeoElevationGrid` node lets users specify a grid of elevations within a geographic coordinate system. These are then transparently transformed into a geocentric, curved-earth representation. A height field can be created by simply specifying all coordinates in terms of latitude, longitude, and elevation. (Iverson, 2000) This allows for 3D visualization of fingers, draws, mountains, cliffs, and other heightened terrain important for the military planner. It would help in mapping routes, possible enemy strongpoints, and helicopter landing zones to name a few.

b. GeoLocation

The `GeoLocation` node provides the ability to georeference any standard VRML model. That is, to take an ordinary VRML model and specify its absolute location on the surface of the earth. (Iverson, 2000) This would allow military

planners the ability to place ships, landing craft, tanks, squads, artillery and other assets at precise locations in the virtual battlespace.

c. GeoOrigin

The `GeoOrigin` node defines an absolute geographic location and an implicit local coordinate frame against which geometry is referenced. This node is used to translate from geographical coordinates into a local Cartesian coordinate system that can be managed by a VRML browser. (Iverson, 2000)

d. GeoPositionInterpolator

The `GeoPositionInterpolator` node provides an interpolator capability where key values are specified in geographic coordinates and the interpolation is performed within the specified coordinate system. (Iverson, 2000) The `GeoPositionInterpolator` works much like the `PositionInterpolator` node in VRML. Animation is achieved by routing `TimeSensor` information to the `GeoPositionInterpolator`, and from the interpolator to the `GeoLocation` node. For example, an AAAV can be moved from its initial location across the water and onto a beach landing site, stopping and starting as necessary based on `TimeSensor` inputs. Using this combination of nodes on many ships, landing craft, aircraft, and personnel would give the planners the ability to watch an entire amphibious operation unfold in 3D.

e. GeoViewpoint

The `GeoViewpoint` node allows users to specify a viewpoint in terms of a geographic coordinate. This node can be used wherever a standard Viewpoint node can be used. A `GeoViewpoint` and Viewpoint node can be combined in the same file.

(Iverson, 2000) The `GeoViewpoint` is very valuable in that it allows the user to easily navigate through vast complex virtual worlds. Because the viewpoint is in terms of a geographic coordinate, planners can choose viewpoints that will help them see the virtual battlefield from specific locations on key pieces of terrain. For example, if consideration is being given to move troops up a draw, a viewpoint could be set at the crest of a finger looking down into the draw in order to get an enemy perspective. The outcome may be to change courses of action or plan a new route. This is invaluable for land and air assets alike.

3. DIS-Java-VRML

> The Institute of Electrical and Electronic Engineers (IEEE) Distributed Interactive Simulation (DIS) Protocol is used to communicate state information (such as position, orientation, velocities and accelerations) among entities participating in a shared network environment. Java is a portable networked programming language that can interoperate on any computer that includes a Web-browser. The Virtual Reality Modeling Language (VRML) enables platform-independent interactive three-dimensional (3D) graphics across the Internet, and can be used to compose sophisticated 3D virtual environments. (Brutzman, 2001)

The DIS-Java-VRML Working Group is developing a free open-source software library that allows DIS and VRML to interoperate by implementing Java code. Its goal is to provide libraries and examples that allow scene developers to build networked 3D worlds that are portable, pervasive, scalable and viewable on any computer with a browser and network connection. (Brutzman, 2001)

C. EXTENSIBLE 3D (X3D)

The next-generation specification for VRML is the Extensible 3D (X3D) standard (Brutzman, 2001). X3D is a scene graph and text-based encoding designed to overcome several limitations of the VRML standard. X3D includes an Extensible Markup Language

(XML) encoding to express identical VRML geometry and behavior structures. X3D is thus a standardized XML tagset for describing the VRML 200x standard for Web-compatible 3D content. Such content is not static but dynamic, driven by a rich set of interpolators, sensor nodes, scripts, and behaviors. (Blais, 2001)

X3D/VRML 200x is capable of compatibly using all legacy VRML 97 content. X3D provides new interoperability with other relevant standards including MPEG-4 and an entire family of XML-based languages. X3D further addresses several shortcomings of VRML 97, provides tighter media integration, improved visual quality through advanced-rendering nodes, and enables a component-based approach. (Blais, 2001)

Using the X3D-Edit authoring tool, developers can create valid scene graphs with little trouble. The tool is simple enough that even novice 3D developers can create virtual worlds with relative ease. When generating a scene, the X3D-Edit software limits the developer to only see allowable choices. Only valid nodes can be selected, eliminating guesswork and potential errors. X3D-Edit utilizes IBM's Xeena XML editor configured to work with the X3D document type definition (DTD). Documents are translated into VRML using the Extensible Stylesheet Language (XSL), and a browser is automatically launched for convenient debugging. (Brutzman, 2001) Figure 6.3 shows a screen shot of the X3D Edit tool.

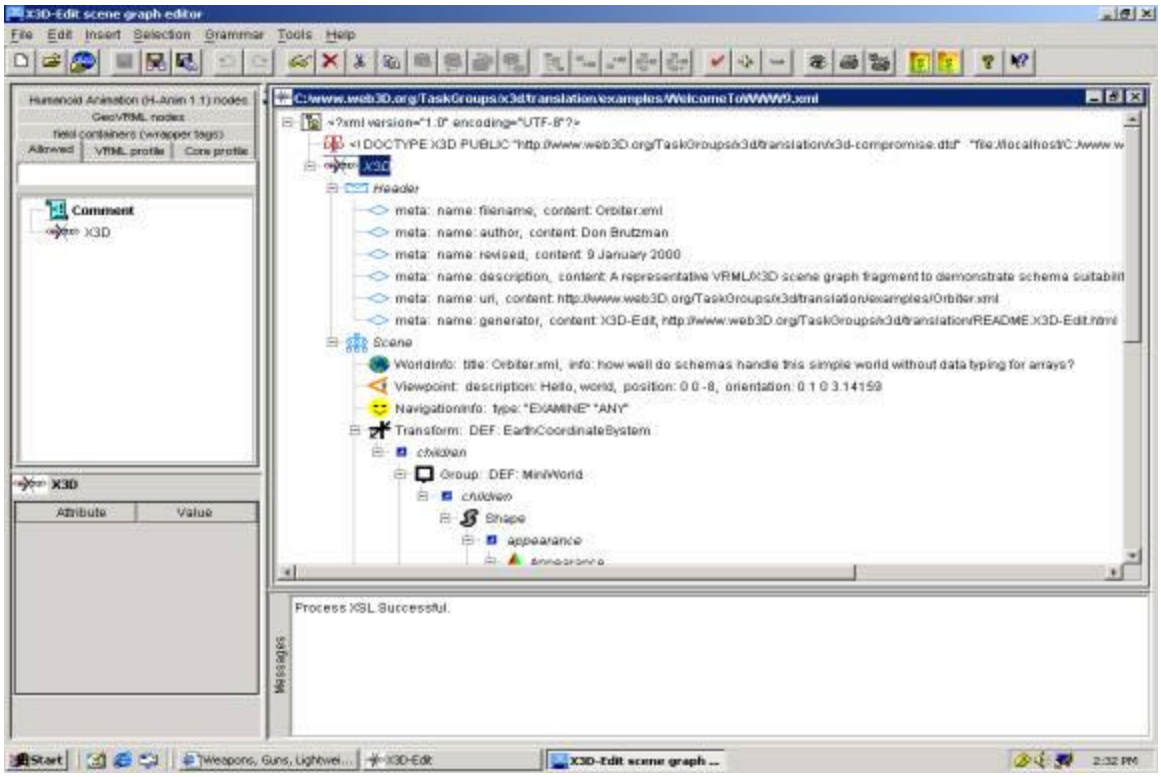

Figure 6.3 Screen Capture of the X3D Edit Tool

D. SUMMARY

The Virtual Reality Modeling Language (VRML) is a Web-based graphics language for building 3D models. VRML allows user interaction within a scene through viewpoint, movement, and rotation. VRML worlds are created using scene graphs that are comprised of various groups of nodes. These nodes are responsible for displaying shapes, interaction, and movement through the virtual world. GeoVRML 1.0 is an extension of VRML that allows for accurate rendering of geographic data. While not used in this thesis, it will be extremely useful to military planners and should be followed closely as it becomes more robust. Extensible 3D (X3D) is the next-generation specification for VRML. It was designed to overcome some of the limitations of the

original VRML specification and incorporates the use of the Extensible Markup Language (XML). These technologies provide a scalable Web-based approach to networked 3D graphics that is suitable for generation and distribution of large-scale virtual environments.

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VII. EXPERIMENTAL RESULTS

A. INTRODUCTION

This chapter describes how the concept of how to represent and visualize the amphibious-raid scenario is implemented and demonstrated. It concludes with a number of different yet equivalent methods for describing and presenting such tactical scenarios.

B. SCENARIO AUTHORING

1. Motivation

The Director of Training and Education Command at the Marine Corps Combat Development Command (MCCDC) in Quantico, Virginia wanted to develop a tool that could "bring the basic concepts of amphibious operations to the masses". Believing in the power a tool like this could deliver to the Marine Corps, and having recently been exposed to VRML and, to a lesser degree, XML, it was clear that the foundation for creating this tool was already available. Armed with the knowledge that this could be done, it was decided that an amphibious-raid scenario of limited complexity was an excellent starting point to begin modeling some of the "basics of amphibious operations."

2. Methodology

In order to author and visualize an amphibious-raid, it was decided that a filmmaker approach would be taken. Drawing on prior experience and using the Amphibious Warfare School Non-resident Program Expeditionary Operations Course as a resource, a realistic and tactically correct scenario was outlined. From the outline, storyboards were drawn to correspond to the "scenes" that were needed to convey an accurate and believable visualization of the scenario.

Having storyboarded the entire scenario, a trip was made to “Red Beach” at Camp Pendleton, California to observe an amphibious capabilities exercise (CAPEX). This was an invaluable visit because it provided the opportunity to take photographs of the terrain, aircraft, landing craft, and ships that needed to develop into 3D models for the scenario. Furthermore, the luxury of observing a live-action operation enabled the storyboard vision to be refined and take on a new life of its own.

While 3D models were being generated, each storyboard was coupled with an actual photo that was consistent with the “theme” it conveyed. The next step was providing a text description for each storyboard/photo pair that put into words what was actually happening in each scene. This permitted scenes to have deeper meaning given that each set of pictures was complemented with background and tactical information.

As models became available, the visualization of the amphibious-raid started to take shape. Lacking an adequate XML DTD or schema that allowed for the conversion of operation orders into automatically generated 3D worlds, a scripted version of the raid was created (see Appendix N). For each text description/storyboard/photo set, an analogous screen capture was added from the virtual raid. This added a new level of depth in visualizing how everything fit together.

Lastly, the operation orders were written as discussed previously in Chapter III. The amphibious-raid and corresponding unit-level orders were focused on because modeling and translating orders for the entire joint scenario would have been attempting too much too soon. Once written, the order added yet another level of depth in seeing how everything tied together.

3. Tactical Assumptions for the Amphibious Raid Scenario

In order to keep the scenario realistic, yet simple enough to model, some assumptions had to be made. These tactical assumptions are not meant to be realistic in all cases, but are sensible limitations for a generic example without loss of generality.

The amphibious-raid takes place during twilight hours on a calm sea (sea-state is 0-1 (flat)) where the wind is less than 10 knots. Helicopters have been conducting routine patrols for a number of days prior to the raid. Since the enemy is used to hearing the helicopters, there is no suspicion when they are heard while actually providing cover noise for the raid. The raid is on a hostile beach, but is generally clear of enemy troops or fortifications. This allows for the entire raid force to land in one wave.

The next few ideas are notional, but important in understanding some of the decisions made for the scenario. Developmental systems such as the San Antonio class LPD-17 and the AAAV are assumed to have been fielded and fully employed. An ATO has already been written for the Super Cobras- a new ATO was not written for this scenario because the Quigley/Murray thesis handled this subject sufficiently and there was no need to repeat their work. Finally, each AAAV holds a reinforced Marine platoon.

4. Tactical Limitations

In order to keep the virtual raid as simple as possible, a number of limitations were placed on the scenario: 1) The amount of vehicles were kept to a minimum and don't fundamentally reflect a realistic battlefield picture (more AAAVs would have to be added to truly carry a reinforced company of Marines from ship-to-shore), 2) There is no enemy contact or enemy obstacles while in transit to, or while crossing the beach landing

site (BLS), 3) There are no avatars representing individual Marines, rather they are considered to be represented by the AAAV.

In order to keep coding simple while manually scripting the scene, the AAAVs were made to move as one entity instead of individually (movement at the airfield is the only exception). Because they are bound together, individual movements 1100m and 500m from the BLS are precluded. Instead, the AAAVs go directly from ship to shore.

C. EXEMPLAR TACTICAL SCENARIO

This section gives visual insight into the methodology described earlier. It demonstrates how the text description, storyboard, photo, and 3D screen shot all work in parallel to describe the exact same scene. Operation orders are not included here, as they have been discussed at length throughout this thesis.

1. Scene 10: Beach Landing Site (BLS)

Location

- Red Beach, Camp Pendleton California

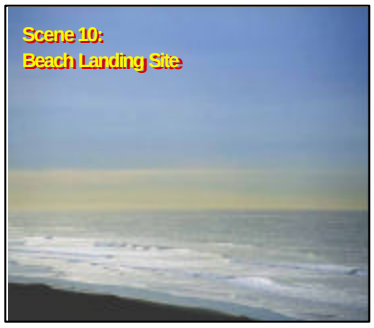
Description

- Beach landing site on a hostile shore
- Morning hours of twilight

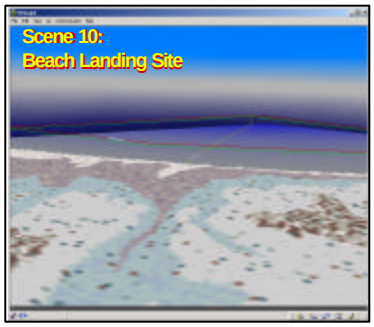
Purpose

- Establish initial viewpoint from objective

Storyboard



Photo



3D Screen Shot

2. Scene 20: Helicopter Sortie

Location

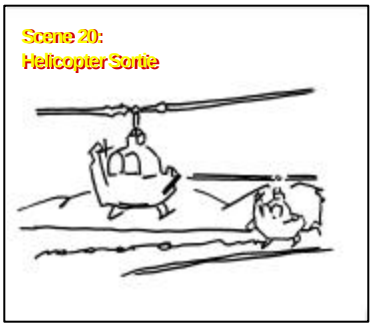
- Flight deck of the LPD-17

Description

- AH-1Z Super Cobra helicopters prepare for takeoff

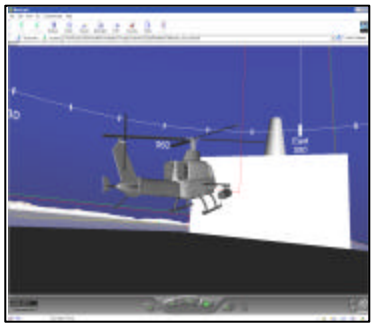
Purpose

- Provide cover noise for the incoming raid force



Storyboard

Photo



3D Screen Shot

3. Scene 30: AAAVs Exit LPD Well Deck

Location

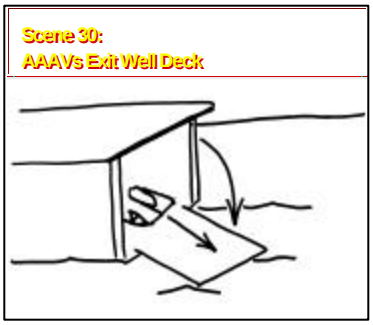
- Insertion point from well deck of San Antonio class LPD-17

Description

- Three AAAVs get underway

Purpose

- Each AAAV has one squad of Marines
- Squads: command, recon/security and covering elements
- These squads comprise the raid force



Storyboard

Photo

3D Screen Shot

4. Scene 40: Helicopters on Patrol

Location

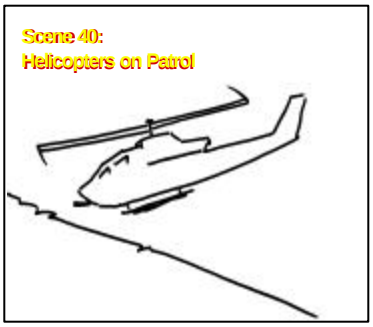
- Flying over the Pacific Ocean and Red Beach

Description

- AH-1Z Super Cobra helicopters fly a regularly scheduled reconnaissance route

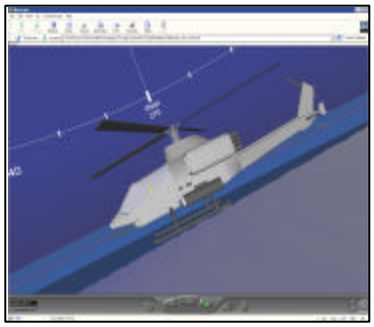
Purpose

- Provide cover noise for the incoming raid force



Storyboard

Photo



3D Screen Shot

5. Scene 50: AAAVs 1100m from Beach Landing Site

Location

- Control point 1100m from beach landing site

Description

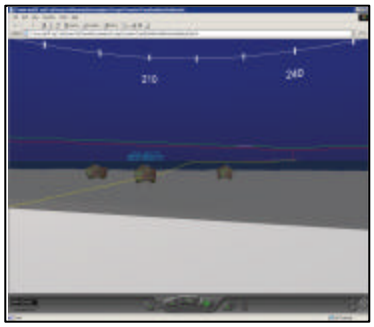
- Raid force moves from a wedge to an on line formation

Purpose

- Ensure everything is still a “go” before raid force proceeds

Storyboard

Photo



3D Screen Shot

6. Scene 60: Recon Element Advances

Location

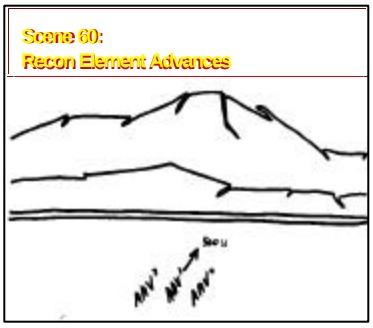
- Control point 1100m from beach landing site

Description

- Recon/security AAAV travels to the Line of Departure (500 m from the beach landing site)

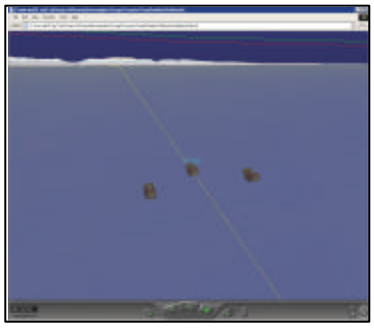
Purpose

- Insert scout swimmers for reconnaissance of surf and beach
- Command and covering elements wait at their current location



Storyboard

Photo



3D Screen Shot

7. Scene 70: Scout-Swimmers

Location

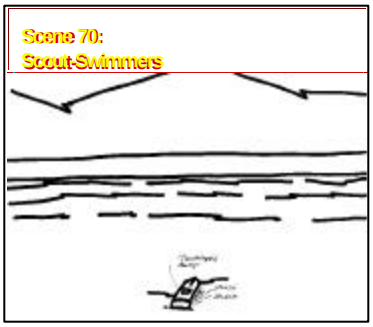
- Line of Departure 500m from the beach landing site

Description

- Team of six to eight scout-swimmers from the recon/security element enter the water

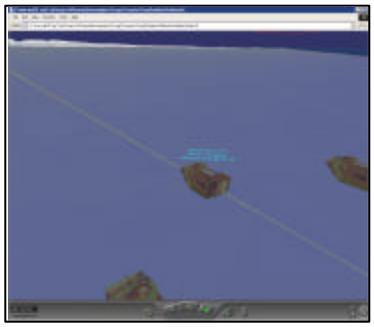
Purpose

- Ensure that beach landing site and water approaches are clear of hazards



Storyboard

Photo



3D Screen Shot

8. Scene 80: Recon Complete

Location

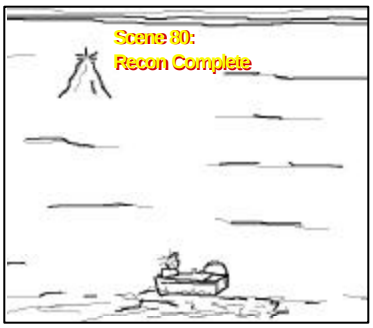
- Line of Departure 500m from the beach landing site

Description

- Scout-swimmers signal the raid force to land using a green directional chemlight (only visible to the raid force still at sea)

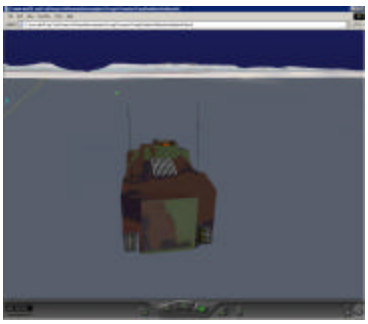
Purpose

- This is the planned signal that recon is complete and it is OK to land



Storyboard

Photo



3D Screen Shot

9. Scene 90: Raid Force Regroups at Line of Departure

Location

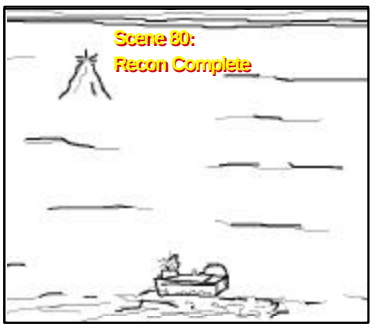
- Line of Departure (LOD) 500m from the beach landing site

Description

- Command and covering elements join the recon/security element at LOD

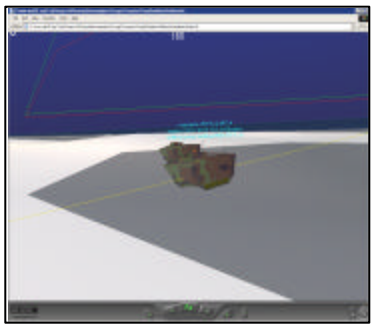
Purpose

- Raid force will cross Line of Departure together
- Raid force will cross surf zone on line in one wave



Storyboard

Photo



3D Screen Shot

10. Scene 100: Beach Landing Site

Location:

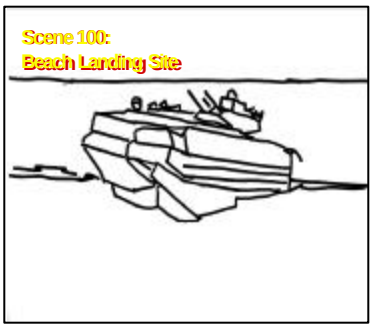
- Red Beach, Camp Pendleton California

Description:

- Raid force crosses surf zone and lands at beach landing site

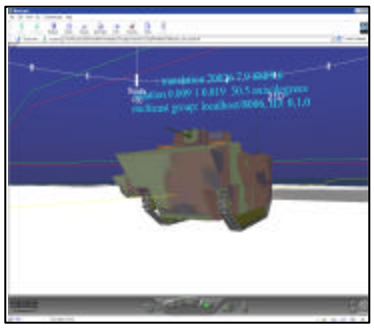
Purpose:

- Raid force reaches the beach landing site
- Drive inland to disembark the Marines
- Marine squads carry out the rest of the mission



Storyboard

Photo



3D Screen Shot

D. SUMMARY

This chapter describes the methodology used to arrive at the end goal of generating the 3D amphibious-raid. In order to keep the scenario realistic, yet remain simple at the same time, a number of assumptions and limitations are imposed. In order to validate the use of future platforms such as the San Antonio class LPD and the AAAV, it was assumed that both platforms are fielded and in use throughout the fleet. Further limitations to ensure scenario simplicity include lack of enemy contact, no representation of individual Marines, and minimal overall numbers of AAAVs, ships and helicopters. In order to get a visual perception of the methodology used, the chapter concludes with a demonstration of how the text description, storyboard, photo and 3D screen shot all work in parallel to embody the exact same tactical scene.

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VIII. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This chapter presents conclusions drawn from the authoring and visualization work completed by this thesis. Recommendations for future work that benefit or add value to the research of this thesis are also presented.

B. CONCLUSIONS

Automatic generation of an operation order into a 3D virtual battlespace capable of displaying an amphibious-raid is feasible. The storyboarding technique is an effective way to generate a rich scenario and capture the elements that are considered vital to battlespace visualization. While the final step of automatic scene generation did not come to fruition for this thesis due to the need to complete a more robust XML schema than was available from the MTF2XML Converter, the Mark Murray and Jason Quigley thesis has shown that it can be done. It can't be stressed enough that XML is the "glue" that makes this all possible. With the operation order format tags that the MTF2XML Converter provides, the Generic Hub schema that defines consistent semantic tags for the usable information within the GENTEXT sections of the order, and a stylesheet that translates this information into VRML, only the number of 3D models available bound the visualization possibilities. While work is still necessary, this tool will prove invaluable in operations planning efforts.

C. RECOMMENDATIONS FOR FUTURE WORK

1. Standardized Operation Orders

While it can be said that operation orders are currently standardized, based on the limitations of operation orders discussed in Chapter III, I would argue that they are not

truly standardized. In order to have one schema or document type definition to define tag sets that are valid across all services (and within services), required information, terms, and acronyms are going to have to be common for everyone. Ultimately, this would need to extend to annexes, SOPs, and other materials that may be referenced. While the Generic Hub is just a database, the concepts it employs should be enforced with regards to writing operation orders. Whereas the Generic Hub data definitions are agreed upon by the US and NATO, the US military should develop an agreed upon standard for writing operation orders, conceivably using Generic Hub terminology.

2. Autogeneration of the Amphibious-raid in 3D

It is important to continue to work on an XML schema and XSL stylesheet that automatically generates a 3D visualization of the amphibious-raid scenario. While the work is close to completion, it isn't there yet. Continued work and collaboration with the XML-MTF Development Team, Naval Undersea Warfare Command, and Institute for Defense Analysis will ensure a robust schema is created that combines elements of USMTF and the Generic Hub. Once the current scenario can be autogenerated in 3D, it can be extended in functionality and complexity.

3. Expand Scenario

Once it is shown that the simple amphibious assault can be automatically translated from an operation order to a 3D virtual world, it is time to expand the scenario. In order to add the joint aspect of the current scenario and increase the complexity of the amphibious-raid, 3D models need to be created to include additional ships, tanks, bulldozers, aircraft, motor transportation assets, weapons systems, individual weapons, artillery, and realistic humanoids. It is essential to demonstrate the visualization of

complex scenarios in 3D, as this is what will most likely to be useful to warfighters using the tool.

4. Expand Functionality of the Tool

The amount of useful functionality that could be added to a tool as powerful as this is endless. Capabilities should be added which allow the user to control, record, and playback the animation as one can do with a video cassette recorder (VCR). The ability to toggle between the 3D world and a 2D map overlay would be useful for planners and commanders to see the "big picture" in one snapshot. A graphical user interface (GUI) that facilitates ease of authoring a scene would be a great value in decreasing the time to learn how to use the tool and the time to compose an order. This GUI could permit the author to drag and drop entities right where they are wanted on the battlefield; it could provide drop down menus for the addition of waypoints, calls for fire, force definitions, operation timelines, and specific pieces of 3D terrain. In time this tool should be coupled with current modeling and simulation systems to capitalize on their data. For instance, the Marine Corps' MAGTF Tactical Warfare Simulation (MTWS) system already has a repository of scenarios that have been previously authored. If 3D scenes could be generated directly from the MTWS system, the need to create the same scenario again would be negated.

5. Dynamic 3D Terrain Generation

An underlying factor to the entire visualization of any virtual battlefield is the terrain. While Digital Terrain Elevation Data (DTED) and other 2D sources of terrain representations are available for most of the world, 3D data is not. A tool is needed which automatically generates 3D terrain from anywhere in the world by simply providing coordinate (grid, lat/long, etc.) input. The terrain developed for this scenario

was built using the Virtual Reality Toolbox. This tool, developed by Humusoft (www.humusoft.com), works with the MATLAB program (www.mathworks.com) to generate complex 3D shapes from equations. While a tool of this caliber may have utilities for the 3D battlespace, it is not intuitive enough to be used to create realistic 3D terrain. More emphasis and research needs to be given to GeoVRML to bring the capability of autogenerating 3D terrain from anywhere in the world to fruition.

APPENDIX A. ABBREVIATIONS

2D	Two-Dimensional
3D	Three-Dimensional
AAAV	Advanced Amphibious Assault Vehicle
ACE	Air Combat Element
AOR	Area of Responsibility
ARG	Amphibious Ready Group
ATO	Air Tasking Order
BDU	Battle Dress Uniform
BLT	Battalion Landing Team
CAPEX	Capabilities Exercise
CCIR	Commander's Critical Information Requirements
CIO	Chief Information Officer
COMBAT XXI	Combined Arms Analysis Tool for the 21st Century
COTS	Commercial off the Shelf
CSSE	Combat Service Support Element
DIS	Distributed Interactive Simulation
DoD	Department of Defense
DON	Department of the Navy
DSB	Dynamic Scenario Builder
DTD	Document Type Definition
DTED	Digital Terrain Elevation Data
DTG	Date Time Group
FSA	Fire Support Area
FSSG	Force Service Support Group
GCE	Ground Combat Element
GeoLOD	Geographic Level of Detail
GH	Generic Hub
GIS	Geographic Information Systems
GML	Geography Markup Language
GUI	Graphical User Interface
HLA	High Level Architecture
HTML	Hypertext Markup Language
IDA	Institute for Defense Analysis
IEEE	Institute of Electrical and Electronic Engineers
IER	Information Exchange Requirements
LC2IEDM	Land Command and Control Information Exchange Data Model
LCAC	Landing Craft Air Cushioned
LOD	Line of Departure
LPD	Landing Platform Dock

MAGTF	Marine Air Ground Task Force
MCCDC	Marine Corps Combat Development Command
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MEU(SOC)	Marine Expeditionary Unit(Special Operation Capable)
MSSG	MEU Service Support Group
MTWS	MAGTF Tactical Warfare Simulation
NATO	North Atlantic Treaty Organization
NEO	Non-combatant Evacuation Operation
NFA	No Fire Area
NMCI	Navy-Marine Corps Internet
NPS	Naval Postgraduate School
NUWC	Naval Undersea Warfare Command
OPORD	Operation Order
RDF	Resource Description Framework
SAVAGE	Scenario Authoring and Visualization for Advanced Graphical Environments
SGML	Standard Generalized Markup Language
SOCEX	Special Operation Capabilities Exercise
SOP	Standard Operating Procedure
SPMAGTF	Special MAGTF
TF	Task Force
TFW	Task Force Web
US	United States
USMC	United States Marine Corps
USMTF	United States Message Text Format
VCR	Video Cassette Recorder
VRML	Virtual Reality Modeling Language
W3C	World Wide Web Consortium
WARNORD	Warning Order
WWW	World Wide Web
X3D	Extensible 3D
XML	Extensible Markup Language
XML-MTF	XML-Message Text Format
XSL	Extensible Stylesheet Language
XSLT	XSL Transformations

APPENDIX B. JOINT-LEVEL OPERATION ORDER

A. INTRODUCTION

This appendix is the joint-level operation order for the amphibious-raid written as a Word document. It is supplied as a typical initial reference from which the unit operation order is built. It is intended that future expansions of the scenario modeling effort build from this order. This order is not complete, nor have AOR coordinates been updated to reflect the working scenario since it was not important to do so in support of this thesis. Nevertheless, this operation order contains sufficiently detailed information to fully model an exemplar amphibious-raid.

B. JOINT LEVEL OPERATION ORDER

```
FM CJTF BLUE
TO
COMTHIRDFLT N3
CTF ONE SEVEN FIVE
CTF ONE SEVEN SIX
CTF ONE SEVEN SEVEN
CTF ONE SEVEN EIGHT
COMDESRON TWO ONE
MSSG ONE FIVE
ZEN/BLT ONE SLANT FOUR
ZEN/HMM ONE SIX SIX
USS SHILOH
USS STETHEM
USS HIGGINS
USS BREMERTON
COT USS ESSEX
COT USS DENVER
COT USS PEARL HARBOR

INFO
BT
UNCLAS //N03500//
EXER/XML01//
MSGID/GENADMIN//
SUBJ/OPERATIONS ORDER FOR AMPHIBIOUS-RAID//
EXERCISE EXERCISE EXERCISE//
REF/AWARNORD/JCS/011000Z JAN 01//
AMPN/REF A IS JCS WARNORD TO CONDUCT AMPHIB RAID//
NARR/ //
RMKS/
TIME ZONE: ZULU
```

REFERENCE: (A) MAP: COMBAT TRAINING CHART, CAMP JOSEPH H. PENDLETON, DMAHTC SERIES V795, EDITION 1975, 1:50,000

(B) MAP: DIGITAL TERRAIN ELEVATION DATA (DTED) LEVEL 1. SERIES: TCD, ITEM DTED 128, EDITION: 005

(C) MAP: ARC DIGITIZED RASTER GRAPHICS, SERIES: ARC8, STOCK NO. ARC8 809055, EDITION:1.

OPERATION ORDER 1-01 (EXERCISE XML01 AMPHIBIOUS-RAID)

BASIC ORDER

1. SITUATION.

A. GENERAL. CONTINUED FIGHTING IN KOALA BETWEEN SNAKE NATIONAL FORCES AND APEAN SEPARATISTS HAS RESULTED IN THE DISPLACEMENT OF THOUSANDS OF KOALAN NON-COMBATANTS. THE NON-COMBANTANTS HAVE ATTEMPTED TO FLEE TOWARDS THE APEAN AND MONKEY BORDERS. THIS HAS CAUSED HEIGHTENED TENSIONS ALONG THE APEAN/KOALAN BORDER. TO SUPPORT PEACEKEEPING OPERATIONS ALONG THE BORDER, A FORWARD OPERATING BASE IS REQUIRED IN APE. WHILE THE APEAN GOVERNMENT SUPPORTS ESTABLISHMENT OF THE AIRFIELD THE REACTION OF THE CIVILIAN POPULATION IS UNKNOWN AND STATE POLICE/MILITARY CAPABILITIES ARE LIMITED. IT IS THEREFORE NECESSARY TO SECURE THE AIRFIELD PRIOR TO STAGING AIRCRAFT.

B. BATTLESPACE.

(1) JOINT OPERATIONS AREA/HIGHER COMMANDER'S AREA OF OPERATIONS: (GIVE BOX WHICH INCLUDES AREA)

(2) AREA OF INTEREST. APE LITTORAL AREA.

(3) AREA OF OPERATION

i. N33DEG 20.00MIN/W118DEG 00.00MIN

ii. N33DEG 00.00MIN/W117DEG 40.00MIN

iii. N33DEG 10.00MIN/W117DEG 00.00MIN

iv. N33DEG 36.00MIN/W117DEG 00.00MIN

C. ENEMY FORCES. OPPOSING FORCES CONSIST OF LOCAL ETHNIC GROUPS SYMPATHETIC TO SNAKE OBJECTIVES, ISLAMIC FUNDAMENTAL TERRORIST ORGANIZATIONS AND DISGRUNTLED STUDENTS AND WORKERS. THE MORE VIOLENT FORCES ARE EQUIPPED WITH AK-47'S AND EXPLOSIVES. THE LESS ORGANIZED GROUPS ARE EQUIPPED WITH CLUBS AND KNIVES. MOST OF THESE GROUPS HAVE TACTICAL AND CELLULAR COMMUNICATIONS EQUIPMENT AND A STRONG MESSENGER SYSTEM. MULTIPLE INTEL SOURCES INDICATE THAT THE POPULATION IS CONCENTRATED TO THE SOUTH IN THE CITY OF CARLSDAD.

D. FRIENDLY FORCES.

(1) HIGHER.

1. MISSION. O/O CTF 176 CONDUCTS AN AMPHIBIOUS-RAID INTO THE COUNTRY OF APE TO SECURE THE APE AIRFIELD AND PROVIDE SECURITY FOR FOLLOW ON AIR COMBAT ELEMENTS.

a. INTENT.

i. PURPOSE/METHOD. THE PURPOSE OF THIS OPERATION IS TO SECURE THE APE AIRFIELD IOT ESTABLISH A FORWARD OPERATING BASE. THIS WILL BE ACCOMPLISHED BY AN AMPHIBIOUS-RAID FROM ARG SHIPPING.

ii. ENDSTATE. THE ENDSTATE OF THE OPERATION IS TO HAVE BLUE FORCES IN CONTROL OF THE AIRFIELD AND MEU FORCES RETURNED SAFELY TO ARG SHIPPING.

(2) ADJACENT. NONE
(3) SUPPORTING.
(A) TACON TO CJTF BLUE
(1) USS SHILOH
(2) USS STETHEM
(3) USS HIGGINS
(B) ATTACHMENTS AND DETACHMENTS. NONE
(C) ASSUMPTIONS. OMITTED.
(D) LEGAL CONSIDERATIONS.
(4) RULES OF ENGAGEMENT. REFER TO ANNEX C

2. MISSION. IAW REF A, CJTF BLUE CONDUCTS A LIMITED AMPHIBIOUS-RAID INTO THE COUNTRY OF APE IOT SECURE APE AIRFIELDIN VIC OF N33DEG 18.00MIN LAT/ W117DEG 21.00MIN LONG AND MAINTAIN AIRFIELD SECURITY UNTIL RELIEVED BY CTF 175 (TF APACHE).

3. EXECUTION.

A. COMMANDER'S INTENT.
1. PURPOSE. THE PURPOSE OF THIS OPERATION IS TO SECURE THE AIRFIELD IOT ESTABLISH THE AIRFIELD AS A FORWARD OPERATING BASE TO SUPPORT PEACEKEEPING EFFORTS ALONG THE APEAN/KOALAN BORDER.
2. METHOD. CJTF BLUE WILL CONDUCT A LIMITED AMPHIBIOUS-RAID TO CONTROL THE AIRFIELD. ENVIRONMENT IS ASSUMED TO BE PERMISSIVE. ONCE AIRFIELD IS SECURED AND TURNED OVER TO FOLLOW ON FORCES CJTF BLUE WILL REEMBARK ARG SHIPPING AND BE PREPARED TO RESPOND TO ANY FURTHER TASKING.
3. ENDSTATE. ATF OBJECTIVE A SECURED AND CONTROLLED BY CTF 175. MEUFORCES REEMBARKED ABOARD ARG SHIPPING.

B. CONCEPT OF OPERATIONS.
1. SCHEME OF MANEUVER.
i. PHASE I. PRE-ASSAULT OPERATIONS (D-2 TO D-DAY). CTF 176 CONDUCTS AERIAL RECONNAISSANCE WITH COBRA HELOS IOT DEVELOP THE SITUATION AND PROVIDE BLS ON D-DAY FOR SURFACE ASSAULT FORCES.
1. ENDSTATE. POSITIVE ID OF BLS AND OPPOSING FORCES.
ii. PHASE II. ASSAULT (D-DAY TO D+1). AT H-HR ON D-DAY, CTF 176 CONDUCTS AN AAAV RAID SUPPORTED BY HELIBORNE RECON ELEMENTS ACROSS DESIGNATED BEACHES. AAAV CONDUCTS VEHICLE PATROL TO AIRFIELD SUPPORTED BY HELOS. GCE SECURES AIRFIELD.
1. ENDSTATE. AIRFIELD SECURED, CONTROL OF AIRFIELD ESTABLISHED. ACE REMAINS AFLOAT.
iii. PHASE III. FOLLOW ON FORCES OPERATIONS (D+1 TO COMPLETION). CTF 176 MAINTAINS AIRFIELD SECURE, RECEIVES CTF 175 AIRCRAFT.
1. ENDSTATE. SUCCESSFUL RECEIPT OF CTF 175AIRCRAFT AND PERSONNEL.
iv. PHASE IV. WITHDRAWAL. CTF 176 CONDUCTS AMPHIBIOUS WITHDRAWAL FROM AIRFIELD ACROSS THE BEACH TO ARG SHIPPING.
1. ENDSTATE. ALL FORCES RECOVERED ABOARD ARG SHIPPING.
2. FIRE SUPPORT PLAN. REFER TO ANNEX C (OPERATIONS).

C. TASKS
a. COMMAND ELEMENT R&S. NONE
b. FCE. NONE

c. GCE.

i. PHASE I. PRE-ASSAULT OPERATIONS

1. SUPPORTING EFFORT

ii. PHASE II. ASSAULT OPERATIONS

1. MAIN EFFORT
2. ON D-DAY AT H-HOUR, CONDUCT AN AMPHIBIOUS-RAID OVER DESIGNATED BEACHES.
3. SEIZE ATF OBJECTIVE A
4. MAINTAIN SECURITY

iii. PHASE III. FOFO

1. SUPPORTING EFFORT
2. CONDUCT SECURITY OPERATIONS
3. RECEIVE CTF 175

iv. PHASE IV. WITHDRAWAL

1. O/O, RECOVER ABOARD ARG SHIPPING

d. ACE

i. PHASE I. PRE-ASSAULT OPERATIONS

1. MAIN EFFORT
2. PROVIDE VISUAL RECONNAISSANCE
3. IDENTIFY BLS AND PRIMARY INGRESS/EGRESS ROUTES

ii. PHASE II. ASSAULT OPERATIONS

1. SUPPORTING EFFORT
2. PROVIDE RWCAS RAID SUPPORT FOR MAIN EFFORT
3. PROVIDE C2 SUPPORT FOR COMM RELAY WITH THE MAIN EFFORT
4. PROVIDE R&S SUPPORT FOR GCE DURING INGRESS TO ATF OBJECTIVE A

iii. PHASE III. FOFO

1. SUPPORTING EFFORT
2. PROVIDE ON-CALL CAS AND R&S SUPPORT

iv. PHASE IV. WITHDRAWAL

1. PROVIDE RWCAS AND VEHICLE ESCORT IN SUPPORT OF THE AMPHIBIOUS WITHDRAWAL
2. PROVIDE ASSAULT SUPPORT IN SUPPORT OF THE AMPHIBIOIUS WITHDRAWAL

e. CSSE

i. PHASE I. PRE-ASSAULT OPERATIONS

1. SUPPORTING EFFORT
2. CONDUCT MAINTENANCE ON MEU ASSETS AS REQUIRED
3. PROVIDE SEA BASED SUSTAINMENT TO THE MAIN EFFORT AS REQUIRED
4. ASSUME REAR AREA COMMANDER

ii. PHASE II. ASSAULT OPERATIONS

1. SUPPORTING EFFORT
2. ESTABLISH AND CONDUCT LFSP OPERATIONS AT DESIGNATED RAID BEACHES

iii. PHASE III. FOFO

1. MAIN EFFORT
2. CONTINUE TO CONDUCT LFSP OPERATIONS AT DESIGNATED RAID BEACHES
3. FORM A MCSS DETACHMENT AND PROVIDE SUSTAINMENT TO SUPPORTING EFFORTS AS REQUIRED
4. ACCEPT TACON OF GCE SECURITY FORCES

5. BPT MOVE ELEMENTS OF THE SUPPORTING EFFORTS AS REQUIRED
6. BPT PROVIDE MAINTENANCE CONTACT TEAMS IN SUPPORT OF THE MAIN EFFORT

iv. PHASE IV. WITHDRAWAL

1. CONDUCT LFSP AT DESIGNATED BEACH FOR AMPHIBIOUS WITHDRAWAL OF FORCES.
2. ON ORDER, RECOVER ABOARD ARG SHIPPING

D. RESERVE. GCE WILL MAINTAIN A MOBILE RESERVE ON SHIP

E. COMMANDERS CRITICAL INFORMATION REQUIREMENTS

a. PIR

i. TO KNOW THE SIZE, LOCATION, AND DISPOSITION OF HOSTILE FACTIONS IVO THE BLS, INGRESS/EGRESS ROUTES AND AIRFIELD

ii. TO KNOW ANY OBSTRUCTIONS OR OBSTACLES IVO RAID BEACHES/HLZS.

b. FFIR

i. REPORT WHEN A UNIT SUSTAINS CASUALITIES IN PERSONNEL OR MAJOR END ITEMS

ii. REPORT IF ACE READINESS DROPS BELOW 75 %

c. EEFI

i. CONCEAL THE COMM PLAN

ii. CONCEAL THE SCHEME OF MANUEVER

iii. CONCEAL HLZ’S AND ROUTES TO THE OBJECTIVE AREA

iv. CONCEAL AIR/SURFACE INGRESS/EGRESS ROUTES

v. CONCEAL H-HOUR AND D-DAY

vi. FORCE/COMMAND STRUCTURE RELATIONSHIPS

vii. ROE

F. COORDINATING INSTRUCTION

a. D-DAY 04JUL01
b. H-HOUR=1500Z
c. L-HOUR=ON CALL
d. RED BEACH LOCATION (11SMG572830)
e. OBJECTIVE A: APE AIRFIELD (CAMP PENDLETON) (11SMG670845)

4. **ADMINSTRATION AND LOGISTICS**

A. PERSONNEL OMITTED

B. LOGISTICS SEE CSSE OPORDER

C. PUBLIC AFFAIRS OMITTED

D. CIVIL AFFAIRS

a. REQUESTS FOR POLITICAL ASYLUM WILL NOT BE GRANTED

E. METEOROLOGICAL AND OCEANOGRAPHIC SERVICES METOC UPDATES WILL BE PROVIDED DAILY

F. GEOSPATIAL INFORMATION AND SERVICES OMITTED

G. MEDICAL SERVICES SEE CSSE OPORDER

5. **COMMAND AND SIGNAL**

A. COMMAND RELATIONSHIPS

B. COMMAND POSTS AND HEADQUARTERS

C. SUCCESSION TO COMMAND

D. SIGNAL. REFER TO OPTASK COMMS MESSAGE.//

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#1234
NNNN

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APPENDIX C. ANNEX C FOR AMPHIBIOUS-RAID

A. INTRODUCTION

This is Annex C to the joint operation order. It is intended to show that much information comes from sources outside the physical operation order. It may be used as a tool for future modeling and scenario development related to the efforts of this thesis. This annex is not complete, nor have FSA and NFA coordinates been updated to reflect the working scenario, as it was not important to do so in support of this thesis. Nevertheless, sufficient detail is included to accurately model an exemplar amphibious-raid along with supporting ship and aircraft operations.

B. ANNEX C

```
FM CTF ONE SEVEN SIX
TO MSSG ONE FIVE
ZEN/BLT ONE SLANT FOUR
ZEN/HMM ONE SIX SIX
INFO CJTF BLUE
COMTHIRDFLT N3
COMDESRON TWO ONE
CTF ONE SEVEN FIVE
CTF ONE SEVEN SEVEN
CTF ONE SEVEN EIGHT
USS SHILOH
USS STETHEM
USS HIGGINS
USS BREMERTON
COT USS ESSEX
COT USS DENVER
COT USS PEARL HARBOR
BT
UNCLAS //N03500//
EXER/XML01//
MSGID/GENADMIN//
SUBJ/OPERATIONS ANNEX FOR AMPHIBIOUS-RAID//
EXERCISE EXERCISE EXERCISE//
REF/A/WARNORD/CJTF BLUE/011000Z JAN 01//
AMPN/REF A IS CJTF BLUE WARNORD TO CONDUCT AMPHIB RAID//
NARR/
RMKS/
TIME ZONE: ZULU
REFERENCE:  (A) MAP: COMBAT TRAINING CHART, CAMP JOSEPH H.
PENDLETON, DMAHTC SERIES V795, EDITION 1975, 1:50,000
       (B) OPERATION ORDER 1-01 (EXERCISE XML01 AMPHIBIOUS-RAID)
```

ANNEX C TO OPERATION ORDER 1-01 (EXERCISE XML01 AMPHIBIOUS-RAID) OPERATIONS

1. **GENERAL**. THIS ANNEX PROVIDES GUIDANCE FOR THE CONDUCT OF OPERATIONS.

A. SITUATION. REFER TO THE BASIC ORDER.

B. MISSION. REFER TO THE BASIC ORDER.

C. AREA OF OPERATIONS. REFER TO THE BASIC ORDER.

2. **CONCEPT OF OPERATIONS**. REFER TO THE BASIC ORDER.

3. **CONDUCT OF OPERATIONS**.

A. AVIATION OPERATIONS.

a. ATO PUBLISHED DAILY BY JFACC **(**CCDG-3**)** VIA CLASSIFIED MESSAGE TRAFFIC

b. ACO PUBLISHED DTG 021640Z DEC 00 VIA UNCLASS MESSAGE TRAFFIC.

c. ATTACK AVIATION PLANNING GUIDANCE FOR D-DAY.

i. RWCAS: 1430Z – 2030Z 2 X AH-1Z ON STATION. THESE AIRCRAFT WILL PROVIDE LANDING SUPPORT AND COMMUNICATIONS SUPPORT FOR THE GCE TO THE BLS. FURTHER R&S SUPPORT WILL BE PROVIDED TO GCE DURING INGRESS TO OBJECTIVE A.

d. ATTACK AVIATION PLANNING GUIDANCE FOR D+1.

i. RWCAS:

1. AT 2300Z, ONE SIMCAS SECTION AH-1Z ASSUMES 15M ALERT, ONE SIMCAS SECTION AH-1Z ASSUMES 60M ALERT. SUBMIT JTARS FOR SUPPORT.

2. AT 0030Z, IF ALERT AIRCRAFT HAVE NOT BEEN TASKED, ONE SECTION AH-1Z LAUNCHES AND IS ON STATION FROM 0030Z TO 0200Z. SAME SECTION THEN RTB. ADDITIONALLY, ONE SECTION AH-1Z ASSUMES 15M ALERT. SUBMIT JTARS FOR SUPPORT.

3. AT 0200Z, IF ALERT AIRCRAFT HAVE NOT BEEN TASKED, ONE SECTION AH-1Z LAUNCHES AND IS ON STATION FROM 0200Z TO 0330Z. SAME SECTION THEN RTB.

4. AT 0330Z, IF ALERT AIRCRAFT ARE NOT TASKED, AIRCRAFT REMAIN ON BOAT AVAILABLE FOR TASKING.

e. ALL OTHER AVIATION OPERATIONS ARE PER THE BASIC ORDER AND CO, HMM ONE SIX SIX OPERATION ORDER.

B. MARITIME PREPOSITIONING FORCE OPERATIONS.

C. INFORMATION OPERATIONS, COMMAND AND CONTROL WARFARE.

a. FRIENDLY COMMAND AND CONTROL WARFARE READINESS. STRICT “NO CLUTTER” USES OF ALL ARG/MEU NETS IS CRITICAL. CELLULAR PHONES, UNSECURED NETS, POTS LINES AND SAILOR PHONES WILL NOT BE USED AT ANY TIME DURING THIS OPERATION.

D. COUNTERINSURGENCY. OMITTED.

E. NUCLEAR OPERATIONS. OMITTED.

F. NBC DEFENSE OPERATIONS. OMITTED.

G. SPECIAL OPERATIONS. OMITTED.

H. TACTICAL RECOVERY OF AIRCRAFT AND PERSONNEL. REFER TO THE BASIC ORDER.

I. RULES OF ENGAGEMENT.

a. CJCS STANDING AND USPACOM SUPPLEMENTAL ROE APPLY.

b. OFFENSIVE MILITARY OPERATIONS ARE AUTHORIZED IN ATF OBJECTIVE A AGAINST ANY FORCES OPPOSING SEIZURE OF THESE OBJECTIVES.

c. ENTRY INTO THE FOREIGN LAND TERRITORY, INTERNAL WATERS, AND AIRSPACE OF APE IS AUTHORIZED.

d. CTF 176 IS DELEGATED AUTHORITY TO EXERCISE NATIONAL SELF DEFENSE.

e. USE OF RIOT CONTROL AGENTS (RCA), SPECIFICALLY CS GAS AND PEPPER SPRAY ONLY, IS AUTHORIZED TO CONTROL NONCOMBATANT INDIVIDUALS AND GROUPS AS RIOT AND CROWD CONTROL AS NECESSARY.

J. RECONNAISSANCE. REFER TO R&S CONOPS AND CONFIRMATION BRIEFS.

K. AIR BASE OPERABILITY. OMITTED.

L. COMBAT CAMERA. OMITTED.

M. NONCOMBATANT EVACUATION OPERATIONS. REFER TO THE BASIC ORDER.

N. ESCAPE AND EVASION OPERATIONS. REFER TO R&S CONOPS AND CONFIRMATION BRIEFS.

O. COUNTERATTACK. OMITTED.

P. EXPLOSIVE ORDNANCE DISPOSAL. OMITTED.

Q. AMPHIBIOUS OPERATIONS. REFER TO CTF 176 OPTASK AMPHIB FOR AMPHIBIOUS-RAID XML01 DTG 101700Z NOV 00 ISSUED VIA CLASSIFIED MESSAGE TRAFFIC AND TO THE LANDING PLAN FOR THIS OPERATION.

R. FORCE PROTECTION. REFER TO THE BASIC ORDER.

S. REAR AREA OPERATIONS. PER CSSE OPERATION ORDER.

T. FIRE SUPPORT.

a. ASSETS

(1) ARTILLERY BATTERY WILL BE EMPLOYED IN A NON LETHAL CAPACITY DURING THIS OPERATION

(2) R/W CAS: 2 X AH-1Z

(3) USS STETHEM, 2 X 5″54.

b. AIR SUPPORT. REFER TO PARAGRAPH 3.A OF THIS ANNEX.

c. ARTILLERY SUPPORT. OMITTED

d. NAVAL SURFACE FIRE SUPPORT. USS STETHEM WILL TRANSIT TO FSA 1 IMMEDIATELY PRIOR TO H-HOUR AND WILL BE ON-STATION FOR THE DURATION OF OPERATIONS ASHORE.

e. FIRE SUPPORT COORDINATION.

(1) METHOD. INITIALLY, THE SACC WILL ACT AS THE PRINCIPLE FIRE SUPPORT COORDINATION CENTER FOR THE AREA OF OPERATIONS. AS SOON AS THE GCE FSCC IS ABLE TO CONDUCT FIRE SUPPORT COORDINATION IN ZONE, RESPONSIBILITY FOR FIRE SUPPORT COORDINATION IN ZONE WILL BE PHASED ASHORE. AFATDS WILL BE THE PRIMARY MEANS OF REQUESTING AND COORDINATING SURFACE FIRE SUPPORT THROUGHOUT THE OPERATION. INITIALLY, ALL DIGITAL CALLS FOR FIRE WILL ROUTE THROUGH THE SACC TO THE FIRING UNITS. ROUTING OF CALLS FOR FIRE WILL TRANSITION TO THE GCE FSCC ONCE IT IS CAPABLE OF PROCESSING MISSIONS. ANY VOICE CALLS FOR FIRE WILL ROUTE DIRECTLY TO THE FIRING UNIT. THE GCE WILL MONITOR, CLEAR AND DECONFLICT VOICE FIRE REQUESTS IF ABLE. IF THE GCE IS UNABLE, REQUESTS FOR CLEARANCE WILL BE ROUTED TO THE SACC VIA THE LF FSC 2 VOICE NET. WHENEVER POSSIBLE, AND IN THE ABSENCE OF COMMUNICATIONS WITH HIGHER AGENCIES, FIRE SUPPORT COORDINATION WILL BE CONDUCTED AT THE LOWEST POSSIBLE LEVEL.

(2) FIRE SUPPORT COORDINATION MEASURES AND GEOMETRY.

1. FSA ONE.

11S MG463916
11S MG521844
11S MG491821
11S MG434853

2. FSA TWO.

11S MG568784
11S MG636697
11S MG607675
11S MG537762

3. ZONES OF ACTION. REFER TO APPENDIX 18 (OPERATIONS OVERLAY).

4. NFA’S. ALL NFA'S ARE VALID AS OF 032000Z JAN 01. ALL NFA'S AROUND OP'S ARE 250M RADIUS.

(a) NFA1 11SMG489008 SS2
(b) NFA2 11SMG489969 SS3
(c) NFA3 11SMG585867 SS1
(d) NFA4 11SMG631850 BLT3
(e) NFA5 11SMG626750 BLT2
(f) NFA6 11SMG570828 NSWTU

5. AIRSPACE COORDINATION MEASURES. REFER TO AIR CONTROL ORDER OR APPENDIX 18.

f. ATTACK GUIDANCE. PUBLISHED VIA SEPCOR.

g. FIRE SUPPORT COMMUNICATIONS. THE SACC WILL MONITOR THE FOLLOWING NETS.

(1) NAVAL GUNFIRE GROUND SPOT.
(2) TAR HR
(3) LF FSC 2. PRIMARY VOICE FSC NET AND COF BACKUP.
(4) LF FSC 3. PRIMARY DIGITAL AFATDS NET.
(5) TAD NETS AS APPLICABLE.

U. COUNTER MECHANIZED PLAN. OMITTED.
V. BREACHING PLAN. OMITTED.
W. OBSTACLE PLAN. OMITTED.

4. **OPERATIONAL CONSTRAINTS**. OMITTED.

5. **COMMAND AND SIGNAL**.

A. COMMAND. REFER TO THE BASIC ORDER
B. SIGNAL. REFER TO OPTASK COMMS MSG FOR XML01.//

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APPENDIX D. UNIT OPERATION ORDER

A. INTRODUCTION

This appendix is the unit-level operation order for the amphibious-raid written as a word document. It is the focus order from which follow on orders were modified for purposes of this thesis. Future additions and expansions of this order to increase complexity at the unit-level can build on this order. This order contains enough information to understand the scenario and support the goals of this thesis.

B. UNIT OPERATION ORDER

```
FM BLT ONE SLANT FOUR
TO COMPANY ALPHA
COMPANY BRAVO
INFO CJTF BLUE
CTF ONE SEVEN SIX
CTF ONE SEVEN FIVE
CTF ONE SEVEN SEVEN
CTF ONE SEVEN EIGHT
COMTHIRDFLT N3
COMDESRON TWO ONE
MSSG FIFTEEN
ZEN/HMM ONE SIX SIX
USS SHILOH
USS STETHEM
USS HIGGINS
USS BREMERTON
COT USS ESSEX
COT USS DENVER
COT USS PEARLHARBOR
BT
UNCLAS//N03500//
EXER/XML01//
MSGID/GENADMIN//
SUBJ/MEU OPERATIONS ANNEX FOR AMPHIBIOUS-RAID//
EXERCISE EXERCISE EXERCISE//
REF/A/OPORD/CJTF BLUE/010100Z JAN 01

AMPN/REF A IS CJTF BLUE OPORD TO CONDUCT AMPHIB RAID
NARR/THIS IS MEU OPERATIONS ANNEX IN SUPPORT OF
XML01//
RMKS/
TIME ZONE:  ZULU
REFERENCE:(A) MAP: COMBAT TRAINING CHART, CAMP JOSEPH H.
PENDLETON, DMAHTC SERIES V795, EDITION 1975,1:50,000
(B) MAP: DIGITAL TERRAIN ELEVATION DATA (DTED) LEVEL 1. SERIES:
TCD, ITEM DTED 128, EDITION: 005
(C) MAP: ARC DIGITIZED RASTER GRAPHICS, SERIES: ARC8, STOCK NO.
ARC8 809055, EDITION: 1.
```

(D) OPERATION ORDER 1-01 (EXERCISE XML01 AMPHIBIOUS-RAID)
(E) ANNEX C TO OPERATION ORDER 1-01 (EXERCISE XML01 AMPHIBIOUS-RAID)
(F) BATTALION ORDER P3000 (COMBAT SOP)

1. **SITUATION**.
   A. GENERAL. REFER TO BASIC ORDER.
   B. ENEMY FORCES. REFER TO BASIC ORDER.
   C. FRIENDLY FORCES. REFER TO BASIC ORDER
   D. ATTACHMENTS AND DETACHMENTS. ANNEX A (TASK ORGANIZATION)

2. **MISSION**. AT H-HOUR, BLT 1/4 CONDUCTS AN AAAV RAID ACROSS RED BEACH AND PROCEEDS INLAND TO SEIZE ATF OBJECTIVE A. ONCE SEIZED, MAINTAIN SECURITY OF OBJECTIVE UNTIL RELIEVED BY TF APACHE.

3. **EXECUTION.**
   A. COMMANDER'S INTENT AND CONCEPT OF OPERATIONS.
      1. BATTALION COMMANDERS INTENT. CURRENTLY THERE IS MINIMAL THREAT IN OUR ZONE. HOWEVER, MY CONCERN LIES IN THE FACT THAT CIVILIAN REACTION IS UNCERTAIN AND THERE ARE GREAT NUMBERS OF THEM NEARBY. AS WE ARE DEALING WITH A CIVILIAN GROUP, I SEE THEIR VULNERABILITY AS RESPONSIVENESS AND LACK OF TRAINING. I INTEND TO EXPLOIT THIS BY LANDING EARLY IN THE MORNING AN MOVING TO THE OBJECTIVE QUICKLY BEFORE THE GENERAL POPULACE IS AWAKE.
      2. ENDSTATE. I SEE OUR ENDSTATE AS ATF OBJECTIVE A SECURED & IN CONTROL OF CTF 175 (TF APACHE).
      3. CONCEPT OF OPERATIONS. AT H-HOUR, BLT 1/4 CONDUCTS AN AMPHIBIOUS-RAID TO SEIZE ATF OBJECTIVE A. THREE REINFORCED PLATOONS FROM COMPANY A WILL CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND PROCEED INLAND VIA PREDETERMINED ROUTE TO SEIZE ATF OBJECTIVE A. COMPANY A WILL SECURE THE OBJECTIVE AND REMAIN UNTIL RELIEVED BY TF APACHE. COMPANY B IS THE RESERVE. COMPANY A IS THE MAIN EFFORT AND WILL HAVE PRIORITY OF FIRES FOR THE DURATION OF THE OPERATION.

   B. TASKS
      1. 1ST PLAT(REIN), CO A
      i. AT H-HOUR (1500Z), CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.
      ii. YOU ARE THE RECONNAISSANCE ELEMENT AND WILL LOAD IN AAAV 1.
      iii. ONCE YOU REACH THE BLS, YOU WILL FOLLOW IN TRACE OF 2ND AND 3RD PLATOONS WHILE DRIVING TO ATF OBJECTIVE A.
      iv. UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG673842
      v. BE PREPARED TO ASSIST WITH THE TURNOVER TO TF APACHE.

      2. 2ND PLAT(REIN), CO A
      i. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.
      ii. YOU ARE THE COMMAND ELEMENT AND WILL LOAD IN AAAV 2.

iii. ONCE YOU REACH THE BLS, YOU WILL FOLLOW IN TRACE OF 3RD PLATOON WHILE DRIVING TO ATF OBJECTIVE A.

iv. UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG664839.

v. BE PREPARED TO ASSIST WITH THE TURNOVER TO TF APACHE.

3. 3RD PLAT(REIN), CO A

i. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A.

ii. YOU ARE THE SECURITY ELEMENT AND WILL LOAD IN AAAV 3.

iii. UPON CONSOLIDATION ON ATF OBJECTIVE A, ESTABLISH PERIMETER SECURITY IN THE VICINITY OF GRID 11SMG676853.

iv. BE PREPARED TO ASSIST WITH THE TURNOVER TO TF APACHE.

4. BLT RESERVE: CO B

i. AT H-HOUR, YOU ARE ON IMMEDIATE ALERT AND WILL BE PREPARED TO ASSUME THE MISSION OF THE MAIN EFFORT.

C. COORDINATING INSTRUCTIONS

1. D-DAY 04JUL01
2. H-HOUR=1500Z
3. L-HOUR=ON CALL
4. RED BEACH LOCATION (11SMG572830)
5. ATF OBJECTIVE A: APE AIRFIELD (CAMP PENDLETON) (11SMG670845)
6. REPORT INCREASED CIVIL UNREST.

4. ADMINISTRATION AND LOGISTICS

A. REFER TO ANNEX D (LOGISTICS).

B. PRESCRIBED LOAD PER REF D.

5. COMMAND AND SIGNAL

A. SIGNAL. REFER TO REF D.//

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APPENDIX E. USMTF "ENHANCED" ORDER

A. INTRODUCTION

This appendix contains the same operation order as in Appendix D, but it has been entered into USMTF and "enhanced" to include pertinent amplifying information (displayed in bold text). This information includes call signs, and an entire section on "Timeline and Movement" which includes a number of important times, actions and coordinates that are not normally included in the "basic" operation order. In order to add this additional information, normal operation order writing criteria were slightly modified.

B. USMTF ORDER

```
UNCLAS

EXER/XMLO1//

MSGID/ORDER/BLT ONE SLANT FOUR//

ORDTYP/TASKORD/-//

TIMEZONE/Z//

ORDREF/WARNORD/CJTF BLUE                                ..-
//

GENTEXT/SITUATION/
      A. GENERAL. REFER TO BASIC ORDER
      B. ENEMY FORCES. REFER TO BASIC ORDER
      C. FRIENDLY FORCES. REFER TO BASIC ORDER
      D. ATTACHMENTS AND DETACHMENTS. ANNEX A (TASK
ORGANIZATION)//
GENTEXT/MISSION/AT H-HOUR, BLT 1/4 CONDUCTS AN AAAV RAID ACROSS
RED BEACH AND PROCEEDS INLAND TO SEIZE ATF OBJECTIVE A. ONCE
SEIZED, MAINTAIN SECURITY OF OBJECTIVE UNTIL RELIEVED BY TF
APACHE.//
GENTEXT/EXECUTION/A. COMMANDER'S INTENT AND CONCEPT OF
OPERATIONS.
      1. BATTALION COMMANDERS INTENT. CURRENTLY THERE IS MINIMAL
THREAT IN OUR ZONE. HOWEVER, MY CONCERN LIES IN THE FACT THAT
CIVILIAN REACTION IS UNCERTAIN AND THERE ARE GREAT NUMBERS OF
THEM NEARBY. AS WE ARE DEALING WITH A CIVILIAN GROUP, I SEE THEIR
```

VULNERABILITY AS RESPONSIVENESS AND LACK OF TRAINING. I INTEND TO EXPLOIT THIS BY LANDING EARLY IN THE MORNING AND MOVING TO THE OBJECTIVE QUICKLY BEFORE THE GENERAL POPULOUS IS AWAKE.

2. ENDSTATE. I SEE OUR ENDSTATE AS ATF OBJECTIVE A SECURED & IN CONTROL OF CTF 175 (TF APACHE).

3. CONCEPT OF OPERATIONS. AT H-HOUR, BLT 1/4 CONDUCTS AN AMPHIBIOUS-RAID TO SEIZE ATF OBJECTIVE A. THREE REINFORCED PLATOONS FROM COMPANY A WILL CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND PROCEED INLAND VIA PREDETERMINED ROUTE TO SEIZE ATF OBJECTIVE A. COMPANY A WILL SECURE THE OBJECTIVE AND REMAIN UNTIL RELIEVED BY TF APACHE. COMPANY B IS THE RESERVE. COMPANY A IS THE MAIN EFFORT AND WILL HAVE PRIORITY OF FIRES FOR THE DURATION OF THE OPERATION.

B. TASKS

1. ORGANIZATION

A. AAAV COMPANY

1. AAAV1

A. CALL SIGN - BLUE DEVIL

2. AAAV 2

A. CALL SIGN - NITTANY LION

3. AAAV 3

A. CALL SIGN - HUSKY

2. 1ST PLAT(REIN), CO A

A. AT H-HOUR (1500Z), CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF THIS ORDER.

B. PER GUIDANCE IN SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF THE AIRFIELD.

C. YOU ARE THE RECONNAISSANCE ELEMENT AND WILL LOAD IN AAAV 1.

3. 2ND PLAT(REIN), CO A

A. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF THIS ORDER.

B. PER GUIDANCE IN SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF THE AIRFIELD.

C. YOU ARE THE COMMAND ELEMENT AND WILL LOAD IN AAAV 2.

4. 3RD PLAT(REIN), CO A

A. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF THIS ORDER.

B. PER GUIDANCE IN SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF THE AIRFIELD.

C. YOU ARE THE SECURITY ELEMENT AND WILL LOAD IN AAAV 3.

5. BLT RESERVE: CO B

A. AT H-HOUR, YOU ARE ON IMMEDIATE ALERT AND WILL BE PREPARED TO ASSUME THE MISSION OF THE MAIN EFFORT.

6. TIMELINE AND MOVEMENT

A. DEPART SHIP AT H-HOUR (INSERTION)

1. START TIME: 041500ZJUL01

2. START LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN

3. END TIME: 041800ZJUL01

4. END LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN

B. TRANSIT TO OBJECTIVE AREA (INFIL)

1. START TIME:041801ZJUL01

2. START LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN

3. WAYPOINTS:

A. LAT N33DEG15.538MIN LONG W117DEG24.875MIN
B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN
C. LAT N33DEG17.274MIN LONG W117DEG22.241MIN
4. END TIME: 042100ZJUL01
5. END LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN
C. ACTIONS AT OBJECTIVE
A. START TIME: 042101ZJUL01
B. END TIME: 050300ZJUL01
1. AAAV1
A. LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN
B. ROLE: C2 AND SECURITY
2. AAAV2
A. LOCATION: LAT N33DEG17.744MIN LONG W117DEG21.722MIN
B. ROLE: SECURITY
3. AAAV3
A. LOCATION: LAT N33DEG18.419MIN LONG W117DEG20.919MIN
B. ROLE: SECURITY
D. EXFIL
1. START TIME: 050301ZJUL01
2. START LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN
3. WAYPOINTS:
A. LAT N33DEG17.274MIN LONG W117DEG22.241MIN
B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN
C. LAT N33DEG15.538MIN LONG W117DEG24.875MIN
4. END TIME: 050500ZJUL01
5. END LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN
E. EXTRACTION
1. START TIME: 050501ZJUL01
2. START LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN
3. END TIME: 050701ZJUL01
4. END LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN
C. COORDINATING INSTRUCTIONS
1. D-DAY 04JUL01
2. H-HOUR=1500Z
3. L-HOUR=ON CALL
4. RED BEACH LOCATION (11SMG572830)
5. ATF OBJECTIVE A: APE AIRFIELD (CAMP PENDLETON) (11SMG670845)
6. REPORT INCREASED CIVIL UNREST.//
GENTEXT/AUTHENTICATION/MG PULLER
OFFICIAL:
(ORIGINAL SIGNED)
DAILY OPSOFF//
ANNEXES/ANXNO:C/OPERATION ANNEX//
AKNLDG/YES//

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APPENDIX F. XML-MTF ORDER

A. INTRODUCTION

This appendix takes the previous USMTF order and runs it through a MTF2XML conversion tool. The outcome is a converted USMTF to XML-MTF message. By looking at the GENTEXT sections, it is apparent that there are insufficient tags to capture any useful information since each section is lumped into a gigantic element tag. This is why it is important to continue to develop XML schemas that identify and capture the critical information.

B. XML-MTF ORDER


```
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- <order>
  - <exercise_identification setid="EXER">
      <exercise_nickname>XMLO1</exercise_nickname>
    </exercise_identification>
  - <message_identification setid="MSGID">

        <message_text_format_identifier>ORDER</message_text_form
        at_identifier>
        <originator>BLT ONE SLANT FOUR</originator>
    </message_identification>
  - <type_of_order setid="ORDTYP">
      <type_of_plan_order>TASKORD</type_of_plan_order>
      <order_originator_and_or_number />
    </type_of_order>
  - <time_zone setid="TIMEZONE">
      <time_zone_zulu>Z</time_zone_zulu>
    </time_zone>
  - <order_reference setid="ORDREF">
      <type_of_plan_order>WARNORD</type_of_plan_order>
    - <order_originator_and_or_number>
        <military_command_authority>CJTF
          BLUE</military_command_authority>
        <two_character_space_filler>..</two_character_space_filler>
        <operation_order_number>-</operation_order_number>
      </order_originator_and_or_number>
    </order_reference>
  - <general_text_information setid="GENTEXT">
      <gentext_text_indicator>SITUATION</gentext_text_indicator>
```

```
    <free_text xml:space="preserve">A. GENERAL. REFER TO
      BASIC ORDER B. ENEMY FORCES. REFER TO BASIC ORDER
      C. FRIENDLY FORCES. REFER TO BASIC ORDER D.
      ATTACHMENTS AND DETACHMENTS. ANNEX A (TASK
      ORGANIZATION) </free_text >
  </general_text_information>
- <general_text_information setid="GENTEXT">
    <gentext_text_indicator>MISSION</gentext_text_indicator>
    <free_text xml:space="preserve">AT H-HOUR, BLT 1/4
      CONDUCTS AN AAAV RAID ACROSS RED BEACH AND
      PROCEEDS INLAND TO SEIZE ATF OBJECTIVE A. ONCE
      SEIZED, MAINTAIN SECURITY OF OBJECTIVE UNTIL
      RELIEVED BY TF APACHE.</free_text >
  </general_text_information>
- <general_text_information setid="GENTEXT">
    <gentext_text_indicator>EXECUTION</gentext_text_indicator>
    <free_text xml:space="preserve">A. COMMANDER'S INTENT
      AND CONCEPT OF OPERATIONS. 1. BATTALION
      COMMANDERS INTENT. CURRENTLY THERE IS MINIMAL
      THREAT IN OUR ZONE. HOWEVER, MY CONCERN LIES IN
      THE FACT THAT CIVILIAN REACTION IS UNCERTAIN AND
      THERE ARE GREAT NUMBERS OF THEM NEARBY. AS WE
      ARE DEALING WITH A CIVILIAN GROUP, I SEE THEIR
      VULNERABILITY AS RESPONSIVENESS AND LACK OF
      TRAINING. I INTEND TO EXPLOIT THIS BY LANDING
      EARLY IN THE MORNING AN MOVING TO THE OBJECTIVE
      QUICKLY BEFORE THE GENERAL POPULACE IS AWAKE. 2.
      ENDSTATE. I SEE OUR ENDSTATE AS ATF OBJECTIVE A
      SECURED & IN CONTROL OF CTF 175 (TF APACHE). 3.
      CONCEPT OF OPERATIONS. AT H-HOUR, BLT 1/4
      CONDUCTS AN AMPHIBIOUS-RAID TO SEIZE ATF
      OBJECTIVE A. THREE REINFORCED PLATOONS FROM
      COMPANY A WILL CONDUCT AN AAAV ASSAULT ACROSS
      RED BEACH AND PROCEED INLAND VIA PREDETERMINED
      ROUTE TO SEIZE ATF OBJECTIVE A. COMPANY A WILL
      SECURE THE OBJECTIVE AND REMAIN UNTIL RELIEVED BY
      TF APACHE. COMPANY B IS THE RESERVE. COMPANY A IS
      THE MAIN EFFORT AND WILL HAVE PRIORITY OF FIRES
      FOR THE DURATION OF THE OPERATION. B. TASKS 1.
      ORGANIZATION A. AAAV COMPANY 1. AAAV1 A. CALL
      SIGN - BLUE DEVIL 2. AAAV 2 A. CALL SIGN - NITTANY
      LION 3. AAAV 3 A. CALL SIGN - HUSKY 2. 1ST PLAT(REIN),
      CO A A. AT H-HOUR (1500Z), CONDUCT AN AAAV ASSAULT
      ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE
      ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF THIS
      ORDER. B. PER GUIDANCE IN SECTION 6 OF THIS ORDER,
      WITHDRAW TO ARG SHIPPING AFTER TF APACHE
      ASSUMES CONTROL OF THE AIRFIELD. C. YOU ARE THE
      RECONNAISSANCE ELEMENT AND WILL LOAD IN AAAV 1.
      3. 2ND PLAT(REIN), CO A A. AT H-HOUR, CONDUCT AN
      AAAV ASSAULT ACROSS RED BEACH AND CONTINUE
      INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN
```

SECTION 6 OF THIS ORDER. B. PER GUIDANCE IN SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF THE AIRFIELD. C. YOU ARE THE COMMAND ELEMENT AND WILL LOAD IN AAAV 2. 4. 3RD PLAT(REIN), CO A A. AT H-HOUR, CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND CONTINUE INLAND TO SEIZE ATF OBJECTIVE A PER GUIDANCE IN SECTION 6 OF THIS ORDER. B. PER GUIDANCE IN SECTION 6 OF THIS ORDER, WITHDRAW TO ARG SHIPPING AFTER TF APACHE ASSUMES CONTROL OF THE AIRFIELD. C. YOU ARE THE SECURITY ELEMENT AND WILL LOAD IN AAAV 3. 5. BLT RESERVE: CO B A. AT H-HOUR, YOU ARE ON IMMEDIATE ALERT AND WILL BE PREPARED TO ASSUME THE MISSION OF THE MAIN EFFORT. 6. TIMELINE AND MOVEMENT A. DEPART SHIP AT H-HOUR (INSERTION) 1. START TIME: 041500ZJUL01 2. START LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN 3. END TIME: 041800ZJUL01 4. END LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN B. TRANSIT TO OBJECTIVE AREA (INFIL) 1. START TIME:041801ZJUL01 2. START LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN 3. WAYPOINTS: A. LAT N33DEG15.538MIN LONG W117DEG24.875MIN B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN C. LAT N33DEG17.274MIN LONG W117DEG22.241MIN 4. END TIME: 042100ZJUL01 5. END LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN C. ACTIONS AT OBJECTIVE A. START TIME: 042101ZJUL01 B. END TIME: 050300ZJUL01 1. AAAV1 A. LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN B. ROLE: C2 AND SECURITY 2. AAAV2 A. LOCATION: LAT N33DEG17.744MIN LONG W117DEG21.722MIN B. ROLE: SECURITY 3. AAAV3 A. LOCATION: LAT N33DEG18.419MIN LONG W117DEG20.919MIN B. ROLE: SECURITY D. EXFIL 1. START TIME: 050301ZJUL01 2. START LOCATION: LAT N33DEG17.885MIN LONG W117DEG21.144MIN 3. WAYPOINTS: A. LAT N33DEG17.274MIN LONG W117DEG22.241MIN B. LAT N33DEG13.976MIN LONG W117DEG23.328MIN C. LAT N33DEG15.538MIN LONG W117DEG24.875MIN 4. END TIME: 050500ZJUL01 5. END LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN E. EXTRACTION 1. START TIME: 050501ZJUL01 2. START LOCATION: LAT N33DEG14.9MIN LONG W117DEG25.7MIN 3. END TIME: 050701ZJUL01 4. END LOCATION: LAT N33DEG11.00MIN LONG W117DEG35.00MIN C. COORDINATING INSTRUCTIONS 1. D-DAY 04JUL01 2. H-HOUR=1500Z 3. L-HOUR=ON CALL 4. RED BEACH LOCATION (11SMG572830) 5. ATF OBJECTIVE A: APE AIRFIELD (CAMP PENDLETON) (11SMG670845) 6. REPORT INCREASED CIVIL UNREST. </free_text >
</general_text_information>
- <general_text_information setid="GENTEXT">

```
        <gentext_text_indicator>AUTHENTICATION</gentext_text_in
        dicator>
      <free_text xml:space="preserve">MG PULLER OFFICIAL:
        (ORIGINAL SIGNED) DAILY OPSOFF</free_text >
    </general_text_information>
  - <annex_information setid="ANNEXES">
      <annex_number>C</annex_number>
      <annex_name >OPERATION ANNEX</annex_name >
    </annex_information>
  - <acknowledgement_requirement setid="AKNLDG">

        <acknowledgement_requirement_indicator>YES</acknowledge
        ment_requirement_indicator>
    </acknowledgement_requirement >
</order>
```

APPENDIX G. OPERATION ORDER ANNEXES

A. INTRODUCTION

This appendix lists the number and types of annexes that can be referenced in an operation order. The sheer number and amount of information contained in these annexes add to the complexity of "grabbing" the necessary data from them. References may also be made to operation overlays, other orders, and SOPs which compound the complexity even further.

B. LIST OF ANNEXES

A - Task Organization
B - Intelligence
C - Operations
D - Logistics/Combat Service Support
E - Personnel
F - Public Affairs
G - Civil Affairs
H – Meteorological and Oceanographic Operations
J - Command Relationships
K – Combat Information Systems
L – Environmental Considerations
M – Geospatial Information and Services
N – Space Operations
P – Host Nation Support
Q – Medical Services
S – Special Technical Operations
U – Information Management
W – Aviation Operations
X – Execution Checklist
Z – Distribution

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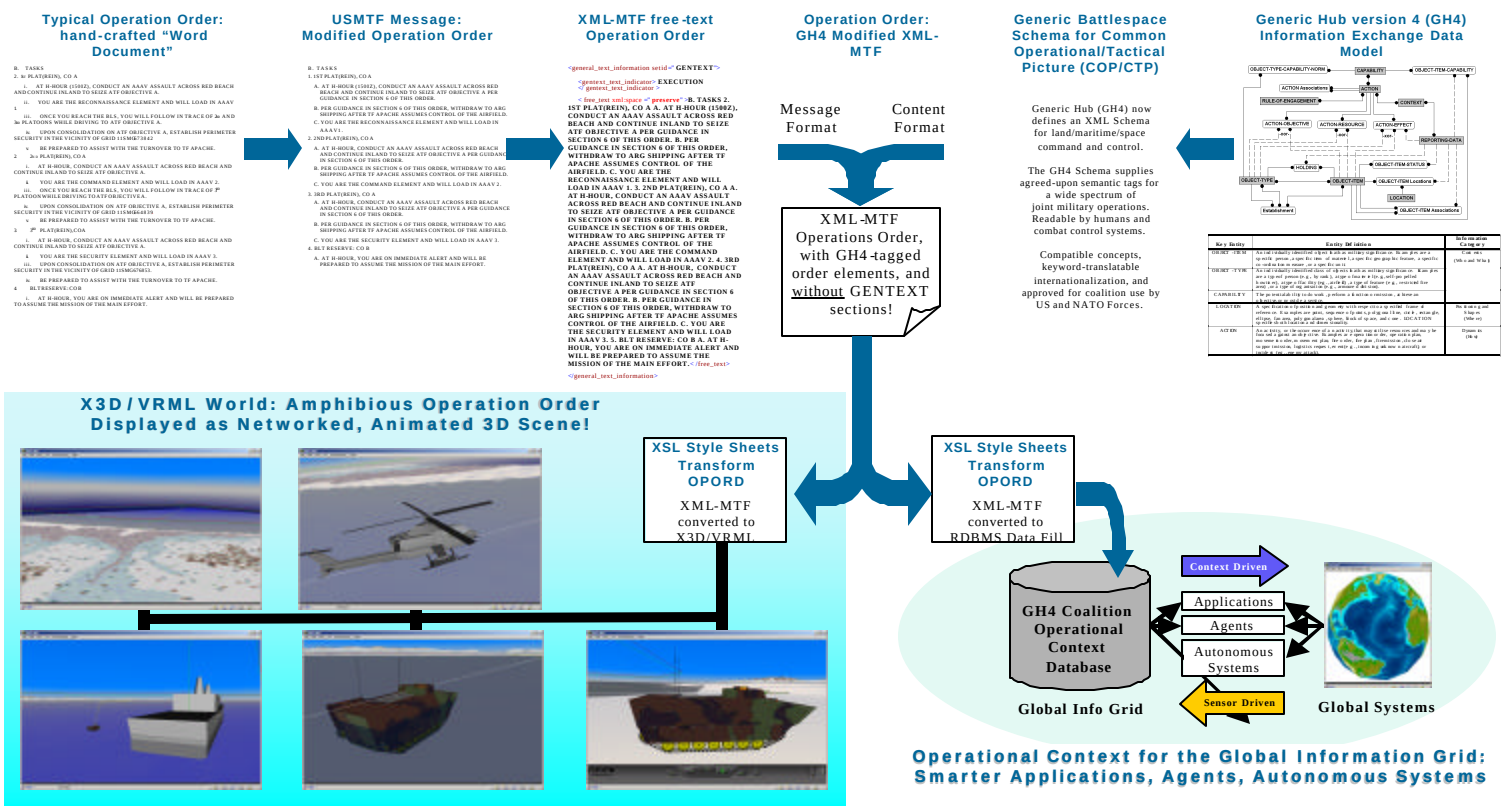
APPENDIX H. OPERATION ORDER TO 3D METHODOLOGY



Points of Contact: Erik Chaum NUWC *ChaumE@npt.nuwc.navy.mil* - Francisco Loaiza IDA *FLoaiza@ida.org* - Eugene Simaitis IDA *GSimaiti@ida.org* - Don Brutzman, Shane Nicklaus, Doug Horner NPS *brutzman@nps.navy.mil*
13 September 2001

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APPENDIX I. OPERATION ORDER SCHEMA

A. INTRODUCTION

This XML schema defines the critical information required for proper 3D visualization of the order. It leverages all of the tags from the XML-MTF DTD that give the order it's structure, but it contains additional elements and attributes specifically designed to capture the data from the TASKS section of the order. This schema is authored by Doug Horner of the Naval Postgraduate School and is still a work in progress.

B. XML SCHEMA

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XML Spy v4.0 U beta 3.1 build Aug 27 2001 (http://www.xmlspy.com) by Doug Horner (Naval Postgraduate School) -->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
<!-- Filename: OperationOrder.xsd
     Author: Doug Horner
     Created: 01AUG01
     Revised: 22SEP01
      Description: Schema for USMTF 2002 Order message. The purpose of the project is to be able to create a VRML scene from a USMTF message. This schema is the tagset that includes all of the "Order" message fields and then adds additional tags so that an XML document can "capture" the information in the USMTF GENTEXT Execution section of the Order formatted message and use a XSL stylesheet to convert that to VRML. This message format conforms to an exemplar USMC OPORDER message generated for KB01 exercise. -->
<xsd:element name="Order">
<xsd:annotation>
<xsd:documentation>Root Element</xsd:documentation>
</xsd:annotation>
<xsd:complexType>
```

```
<xsd:sequence>
<xsd:element name="ExerciseIdentification" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="ExerciseNickname">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="56"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="ExerciseMessageAdditionalIdentifier" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="16"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="EXER"/>
<xsd:attributeGroup ref="startTime"/>
<xsd:attributeGroup ref="endTime"/>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="actionIdNumber" type="xsd:anySimpleType" use="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="OperationIdentificationData" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="OperationCodeword">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
```

```
<xsd:maxLength value="32"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="PlanOriginatorAndNumber" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="5"/>
<xsd:maxLength value="36"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="OptionNickname" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="23"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="SecondaryOptionNickname" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="23"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="OPER"/>
<xsd:attribute name="operationDescription" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attributeGroup ref="startTime"/>
<xsd:attributeGroup ref="endTime"/>
```

```
<xsd:attribute name ="name " type ="xsd:anySimpleType" use ="optional"/ >
<xsd:attribute name ="actionIdNumber" type ="xsd:anySimpleType" use ="optional"/ >
</xsd:complexType >
</xsd:element >
<xsd:element name ="MessageIdentification">
<xsd:complexType >
<xsd:sequence >
<xsd:element name ="MessageTextFormatIdentifier">
<xsd:simpleType >
<xsd:restriction base ="xsd:string">
<xsd:minLength value ="2"/ >
<xsd:maxLength value ="20"/ >
</xsd:restriction >
</xsd:simpleType >
</xsd:element >
<xsd:element name ="Originator">
<xsd:simpleType >
<xsd:restriction base ="xsd:string">
<xsd:minLength value ="1"/ >
<xsd:maxLength value ="30"/ >
</xsd:restriction >
</xsd:simpleType >
</xsd:element >
<xsd:element name ="MessageSerialNumber" minOccurs ="0">
<xsd:complexType >
<xsd:simpleContent >
<xsd:extension base ="xsd:integer">
<xsd:attribute name ="referenceIdNumber" type ="xsd:anySimpleType" use ="required"/ >
</xsd:extension >
</xsd:simpleContent >
</xsd:complexType >
</xsd:element >
<xsd:element name ="MonthName " minOccurs ="0">
<xsd:simpleType >
<xsd:restriction base ="xsd:string">
```

```
<xsd:length value="3"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="MessageClassification" type="xsd:anySimpleType"/>
<xsd:element name="MessageFormat" type="xsd:anySimpleType"/>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="MSGID"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="Reference" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="SerialLetter">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:length value="1"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="TypeOfReferenceRef">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="2"/>
<xsd:maxLength value="20"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="Originator">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="30"/>
</xsd:restriction>
</xsd:simpleType>
```

```
</xsd:element>
<xsd:element name="DateAndOrTimeOfReferenceRef" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="6"/>
<xsd:maxLength value="15"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="SerialNumberOfReference" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="10"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="SpecialNotation" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:length value="5"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="ReferenceFieldGroup">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="SicCodeOrFilingNumberRef" minOccurs="0"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="REF"/>
</xsd:complexType>
</xsd:element>
```

```
<xsd:element name="Amplification" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="FreeText" minOccurs="0"/>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="AMPN"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="NarrativeInformation" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="FreeText" minOccurs="0"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="TypeOfOrder">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="TypeOfPlanOrder">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="3"/>
<xsd:maxLength value="16"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="OrderOriginatorAndOrNumber" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="0"/>
<xsd:maxLength value="59"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
```

```
<xsd:attribute name ="setid" type ="xsd:string" use ="required" fixed ="ORDTYP"/>
</xsd:complexType>
</xsd:element>
<xsd:element name ="MapDataInformation" minOccurs ="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name ="MapOrChartSeriesDesignator">
<xsd:simpleType>
<xsd:restriction base ="xsd:string">
<xsd:minLength value ="3"/>
<xsd:maxLength value ="16"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name ="MapOrChartSuffixNumber" minOccurs ="0">
<xsd:simpleType>
<xsd:restriction base ="xsd:integer">
<xsd:totalDigits value ="2"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name ="MapDataInformationFieldGroup" minOccurs ="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name ="MapOrChartSheetNumber" minOccurs ="0">
<xsd:simpleType>
<xsd:restriction base ="xsd:string">
<xsd:minLength value ="1"/>
<xsd:maxLength value ="14"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name ="MapOrChartEditionNumber" minOccurs ="0">
<xsd:simpleType>
<xsd:restriction base ="xsd:string">
```

```
<xsd:minLength value="1"/>
<xsd:maxLength value="6"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="GeodeticDatum" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="2"/>
<xsd:maxLength value="5"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="MAP"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="TimeZone">
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:string">
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="TIMEZONE"/>
<xsd:attribute name="timeZoneZulu" type="xsd:string" use="required"/>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="OrderReference" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="TypeOfPlanOrder">
<xsd:simpleType>
```

```
<xsd:restriction base="xsd:string">
<xsd:minLength value="3"/>
<xsd:maxLength value="16"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="OrderOriginatorAndOrNumber">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="MilitaryCommandAuthority">
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:string">
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="required"/>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="TwoCharacterSpaceFiller"/>
<xsd:element name="OperationOrderNumber" type="xsd:string"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="ORDREF"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="HeadingForSegmentsOfAMessage" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="HeadingInformation">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="61"/>
```

```
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="HEADING"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="MilitaryUnitIdentificationAndLocation_information" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="ColumnDefinition"/>
<xsd:element name="MilitaryUnitIdentificationAndLocationInformationFieldGroup"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="GeneralTextInformation" minOccurs="0" maxOccurs="unbounded">
<xsd:complexType>
<xsd:complexContent>
<xsd:extension base="GeneralTextInformationType">
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="DesignatedHour" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="HourName">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="8"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
```

```
<xsd:element name="ActionIndicator">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="3"/>
<xsd:maxLength value="6"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="DayTimeGroup" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:length value="6"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="HOURIS"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="AnnexInformation" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="AnnexName">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="2"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="AnnexNumber">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="20"/>
```

```
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="required" fixed="ANNEXES"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="AcknowledgeRequirement">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="AcknowledgementRequirementIndicator">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="2"/>
<xsd:maxLength value="3"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="AcknowledgementRequirementFieldGroup" type="xsd:string" minOccurs="0"/>
</xsd:sequence>
<xsd:attribute name="setid" type="xsd:string" use="optional" fixed="AKNLDG"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="Remarks" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="FreeText"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="MessageDowngradingOrDeclassification_data" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="SourceForClassificationDecl">
<xsd:simpleType>
```

```
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="55"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="ReasonForClassification" minOccurs="0">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:length value="3"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="MessageDowngradingOrDeclassificationDataFieldGroup">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="DowngradeInstructionsDateDecl">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:minLength value="1"/>
<xsd:maxLength value="38"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="DowngradingOrDeclassificationExemptionCode">
<xsd:simpleType>
<xsd:restriction base="xsd:string">
<xsd:length value="2"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
```

```
</xsd:complexType>
</xsd:element>
<!--THE EXER SET PROVIDES THE DESIGNATED CODE NAME OR NICKNAME, IF THE MESSAGE SUPPORTS AN EXERCISE. -->
<!--THE OPER SET PROVIDES THE DESIGNATED CODE NAME OR NICKNAME, IF THE MESSAGE SUPPORTS AN OPERATION.-->
<!--THE MSGID SET PROVIDES THE MESSAGE  IDENTIFICATION AND ORIGINATOR.-->
<!--THE REF SET PROVIDES BOTH USMTF AND NON-USMTF REFERENCES..-->
<!--THE ORDTYP SET SPECIFIES THE TYPE OF FIVE PARAGRAPH ORDER BEING SENT..-->
<!--THE MAP SET PROVIDES THE MAP REFERENCES FOR THE ORDER MESSAGE.-->
<!--THE TIMEZONE SET DESIGNATES ZULU TIME AS THE REFERENCE FOR THE ORDER MESSAGE..-->
<!--THE ORDREF SET SPECIFIES THE TYPE AND DESIGNATION (NUMBER OR LETTER) OF THE BASIC ORDER ADDRESSED BY THIS MESSAGE..-->
<!--THE HEADING/TASK ORGANIZATION SET INTRODUCES THE SECTION FOR ADDRESSING TASK UNITS -->
<!--THE HOURIS SET PROVIDES THE DESIGNATED  HOUR FOR THE ORDER.-->
<!--THE ANNEXES SET PROVIDES A LISTING FOR ALL APPROPRIATE ANNEXES TO THE ORDER.-->
<!--THE AKNLDG SET PROVIDES OPERATOR ACKNOWLEDGEMENT AND NOT COMMUNICATIONS CENTER ACKNOWLEDGEMENT.-->
<!--THE DECL SET PROVIDES DECLASSIFICATION OR DOWNGRADING INSTRUCTIONS, IF THE MESSAGE IS CLASSIFIED.-->
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<!-- There are normally 5 General Text Information fields, they are SITUATION | MISSION | EXECUTION | ADMIN AND LOG | COMMAND AND CONTROL -->
<xsd:complexType name="GeneralTextInformationType">
<xsd:annotation>
<xsd:documentation>GENTEXT sections of the Order message</xsd:documentation>
</xsd:annotation>
<xsd:sequence>
<xsd:element name="GentextTextIndicator" id="EXECUTION" minOccurs="0">
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:string">
<xsd:attribute name="contextId" type="xsd:anySimpleType" use="optional"/>
```

```
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="FreeText" type="xsd:string" minOccurs="0"/>
<xsd:element name="CdrsIntentAndConceptOfOperations" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="BattalionCdrIntent"/>
<xsd:element name="EndState"/>
<xsd:element name="ConceptOfOperations"/>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="Tasks" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="Organization" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="MarineExpeditionaryUnit" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="BattalionLandingTeam" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="Company" minOccurs="0" maxOccurs="3">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="Platoon" minOccurs="0" maxOccurs="3">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="Squad" minOccurs="0" maxOccurs="2">
<xsd:complexType>
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="required"/>
```

```
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="name " type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="callSign" type ="xsd:anySimpleType" use ="optional"/ >
</xsd:complexType >
</xsd:element >
</xsd:sequence>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="name " type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="callSign" type ="xsd:anySimpleType" use ="optional"/ >
</xsd:complexType >
</xsd:element >
</xsd:sequence>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="name "/ >
<xsd:attribute name ="callSign" type ="xsd:anySimpleType" use ="optional"/ >
</xsd:complexType >
</xsd:element >
</xsd:sequence>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="required"/ >
<xsd:attribute name ="name "/ >
</xsd:complexType >
</xsd:element >
</xsd:sequence>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="optional"/ >
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="optional"/ >
<xsd:attribute name ="name " type ="xsd:anySimpleType" use ="required"/ >
</xsd:complexType >
</xsd:element >
</xsd:sequence>
</xsd:complexType >
</xsd:element >
<xsd:element name ="ExecutionTimelineAndMovement " minOccurs ="0" >
```

```
<xsd:complexType>
<xsd:sequence>
<xsd:element name="Insertion" maxOccurs="3">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
<xsd:attributeGroup ref="location"/>
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="objectTypeIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="actionDescription" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="actionIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="candidateTargetDetailIndexNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="action" type="xsd:anySimpleType" use="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="Infiltration" minOccurs="0" maxOccurs="3">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
<xsd:attributeGroup ref="location"/>
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="objectTypeIdNumber" type="xsd:anySimpleType" use="required"/>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="actionDescription" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="actionIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="candidateTargetDetailIndexNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="action" type="xsd:anySimpleType" use="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="ActionsAtTheObjective" maxOccurs="3">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
<xsd:attributeGroup ref="location"/>
<xsd:attribute name="objectItemIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="objectTypeIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
```

```
<xsd:attribute name ="actionDescription" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="actionIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="candidateTargetDetailIndexNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="action" type ="xsd:anySimpleType" use ="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name ="Exfil" minOccurs ="0" maxOccurs ="3">
<xsd:complexType>
<xsd:attributeGroup ref ="startTime"/>
<xsd:attributeGroup ref ="location"/>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="name" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="actionDescription" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="actionIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="candidateTargetDetailIndexNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="action" type ="xsd:anySimpleType" use ="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name ="Extraction" maxOccurs ="3">
<xsd:complexType>
<xsd:attributeGroup ref ="startTime"/>
<xsd:attributeGroup ref ="location"/>
<xsd:attribute name ="objectItemIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="objectTypeIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="name" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="actionDescription" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="actionIdNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="candidateTargetDetailIndexNumber" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="action" type ="xsd:anySimpleType" use ="optional"/>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
```

```
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="CoordinatingInstructions" minOccurs="0">
<xsd:complexType>
<xsd:sequence>
<xsd:element name="DDay" minOccurs="0">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="HHour" minOccurs="0">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="LHour" minOccurs="0">
<xsd:complexType>
<xsd:attributeGroup ref="startTime"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="MissionObjectiveLocation" minOccurs="0">
<xsd:complexType>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attributeGroup ref="location"/>
<xsd:attribute name="targetIdNumber" type="xsd:anySimpleType" use="optional"/>
</xsd:complexType>
</xsd:element>
<xsd:element name="BeachLandingSite" minOccurs="0">
<xsd:complexType>
<xsd:attribute name="name" type="xsd:anySimpleType" use="optional"/>
<xsd:attributeGroup ref="location"/>
</xsd:complexType>
</xsd:element>
</xsd:sequence>
```

```
</xsd:complexType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>
<xsd:attributeGroup name="startTime">
<xsd:attribute name="day" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="time" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="timeZone" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="month" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="year" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="julianDate" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="startTimeInSecondsPerDay" type="xsd:anySimpleType" use="optional"/>
</xsd:attributeGroup>
<xsd:attributeGroup name="location">
<xsd:attributeGroup ref="latitudeLongitude"/>
<xsd:attributeGroup ref="UTM"/>
<xsd:attribute name="locationIdNumber" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="featureLocationIndexNumber" type="xsd:anySimpleType" use="optional"/>
</xsd:attributeGroup>
<xsd:attributeGroup name="latitudeLongitude">
<xsd:attribute name="latitude" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="longitude" type="xsd:anySimpleType" use="optional"/>
</xsd:attributeGroup>
<xsd:attributeGroup name="UTM">
<xsd:attribute name="utmGridZoneColumn" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utmGridZoneRow" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm100000MeterSquareColumn" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm100000MeterSquareRow" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm10MeterEasting" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm10MeterNorthing" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm100MeterEasting" type="xsd:anySimpleType" use="optional"/>
<xsd:attribute name="utm100MeterNorthing" type="xsd:anySimpleType" use="optional"/>
</xsd:attributeGroup>
<xsd:attribute name="name"/>
<xsd:attribute name="objectItemIdNumber"/>
```

```
<xsd:attribute name ="objectTypeIdNumber"/>
<xsd:attribute name ="callSign" type ="xsd:anySimpleType"/>
<xsd:attribute name ="candidateTargetDetailIndexNumber" type ="xsd:anySimpleType"/>
<xsd:attributeGroup name ="endTime ">
<xsd:attribute name ="day" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="time " type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="timeZone" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="month" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="year" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="julianDate" type ="xsd:anySimpleType" use ="optional"/>
<xsd:attribute name ="endTimeInSecondsPerDay" type ="xsd:anySimpleType" use ="optional"/>
</xsd:attributeGroup>
</xsd:schema >
```

APPENDIX J. XML-MTF OPERATION ORDER USING NEW SCHEMA

A. INTRODUCTION

This Appendix applies the XML-MTF operation order in Appendix F to the improved schema. Whereas the GENTEXT in the original message is lumped together as a single tag, GENTEXT data in this message is extracted, making it useful for visualization. This message will continue to evolve until the schema in Appendix I is completed.

B. OPERATION ORDER

```
<?xml version="1.0" encoding="UTF-8" ?>
- <!--
 edited with XML Spy v4.0 U beta 3.1 build Aug 27 2001 (http://www.xmlspy.com) by Doug Horner (Naval Postgraduate School)
  -->
<?xml-stylesheet type="text/xsl" href="C:\Program Files\Altova\XML Spy Suite\XML2XMLconversion.xsl"?>
- <Order xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="C:\Program Files\Altova\XML Spy Suite\ModOperationOrder.xsd">
  - <ExerciseIdentification setid="EXER" name="Amphibious Raid on Camp Pendleton"
        actionIdNumber="9999900000">
        <ExerciseNickname>XML01</ExerciseNickname>
      </ExerciseIdentification>
  - <MessageIdentification setid="MSGID">
        <MessageTextFormatIdentifier>ORDER</MessageTextFormatIdentifier>
        <Originator>JTF 167</Originator>
        <MessageSerialNumber referenceIdNumber="5250001">129005</MessageSerialNumber>
        <MessageClassification>UNCLASSIFIED</MessageClassification>
        <MessageFormat>USMTF</MessageFormat>
      </MessageIdentification>
```

```
- <TypeOfOrder setid="ORDTYP">
    <TypeOfPlanOrder>OPORD</TypeOfPlanOrder>
    <OrderOriginatorAndOrNumber />
  </TypeOfOrder>
  <TimeZone setid="TIMEZONE" timeZoneZulu="Z" />
- <OrderReference setid="ORDREF">
    <TypeOfPlanOrder>OPORD</TypeOfPlanOrder>
  - <OrderOriginatorAndOrNumber>
      <MilitaryCommandAuthority
        objectItemIdNumber="555550014">USPACCOM</MilitaryCommandAuthority>
      <TwoCharacterSpaceFiller>..</TwoCharacterSpaceFiller>
      <OperationOrderNumber>A101</OperationOrderNumber>
    </OrderOriginatorAndOrNumber>
  </OrderReference>
- <HeadingForSegmentsOfAMessage setid="HEADING">
    <HeadingInformation>TASK ORGANIZATION</HeadingInformation>
  </HeadingForSegmentsOfAMessage>
- <GeneralTextInformation>
    <GentextTextIndicator contextId="92220001">SITUATION</GentextTextIndicator>
    <FreeText >A. GENERAL. REFER TO BASIC ORDER B. ENEMY FORCES. REFER TO BASIC ORDER C.
      FRIENDLY FORCES. REFER TO BASIC ORDER D. ATTACHMENTS AND DETACHMENTS. ANNEX A
      (TASK ORGANIZATION) </FreeText >
  </GeneralTextInformation>
- <GeneralTextInformation>
    <GentextTextIndicator contextId="92220002">MISSION</GentextTextIndicator>
    <FreeText >AT H-HOUR, BLT 1/4 CONDUCTS AN AAAV RAID ACROSS RED BEACH AND PROCEEDS
      INLAND TO SEIZE ATF OBJECTIVE A. ONCE SEIZED, MAINTAIN SECURITY OF OBJECTIVE UNTIL
      RELIEVED BY TF APACHE.</FreeText >
  </GeneralTextInformation>
- <GeneralTextInformation>
    <GentextTextIndicator contextId="92220003">EXECUTION</GentextTextIndicator>
    <FreeText />
  - <CdrsIntentAndConceptOfOperations>
```

```
    <BattalionCdrIntent>1. BATTALION COMMANDERS INTENT. CURRENTLY THERE IS MINIMAL
      THREAT IN OUR ZONE. HOWEVER, MY CONCERN LIES IN THE FACT THAT CIVILIAN
      REACTION IS UNCERTAIN AND THERE ARE GREAT NUMBERS OF THEM NEARBY. AS WE ARE
      DEALING WITH A CIVILIAN GROUP, I SEE THEIR VULNERABILITY AS RESPONSIVENESS AND
      LACK OF TRAINING. I INTEND TO EXPLOIT THIS BY LANDING EARLY IN THE MORNING AND
      MOVING TO THE OBJECTIVE QUICKLY BEFORE THE GENERAL POPULACE IS
      AWAKE.</BattalionCdrIntent>
    <EndState>2. ENDSTATE. I SEE OUR ENDSTATE AS ATF OBJECTIVE A SECURED AND IN
      CONTROL OF CTF 175.</EndState>
    <ConceptOfOperations>3. CONCEPT OF OPERATIONS. AT H-HOUR, BLT 1/4 CONDUCTS AN
      AMPHIBIOUS RAID TO SEIZE ATF OBJECTIVE A. THREE REINFORCED PLATOONS FROM
      COMPANY A WILL CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND PROCEED INLAND
      VIA PREDETERMINED ROUTE TO SEIZE ATF OBJECTIVE A. COMPANY A WILL SECURE THE
      OBJECTIVE AND REMAIN UNTIL RELIEVED BY TF APACHE. COMPANY B IS THE RESERVE.
      COMPANY A IS THE MAIN EFFORT AND WILL HAVE PRIORITY OF FIRES FOR THE DURATION
      OF THE OPERATION.</ConceptOfOperations>
  </CdrsIntentAndConceptOfOperations>
- <Tasks>
  - <Organization>
    - <MarineExpeditionaryUnit name="15TH MEU" objectItemIdNumber="555550001"
        objectTypeIdNumber="777770001">
      - <BattalionLandingTeam name="BLT1/4" objectItemIdNumber="555550002"
          objectTypeIdNumber="777770002">
        - <Company name="INFANTRY CO" objectItemIdNumber="555550003"
            objectTypeIdNumber="777770003">
            <Platoon name="1ST PLT(REIN)" objectItemIdNumber="555550004"
              objectTypeIdNumber="777770004" />
            <Platoon name="2ND PLT(REIN)" objectItemIdNumber="555550005"
              objectTypeIdNumber="777770004" />
            <Platoon name="3RD PLT(REIN)" objectItemIdNumber="555550006"
              objectTypeIdNumber="777770004" />
          </Company>
        - <Company name="AAAV CO" objectItemIdNumber="555550007"
            objectTypeIdNumber="777770003">
```

```
        <Platoon name="AAAV1" objectItemIdNumber="555550008"
          objectTypeIdNumber="777770004" />
        <Platoon name="AAAV2" objectItemIdNumber="555550009"
          objectTypeIdNumber="777770004" />
        <Platoon name="AAAV3" objectItemIdNumber="555550010"
          objectTypeIdNumber="777770004" />
      </Company>
    </BattalionLandingTeam>
  </MarineExpeditionaryUnit>
</Organization>
- <ExecutionTimelineAndMovement>
  <Insertion name="Primary Insertion Point" objectItemIdNumber="555550010"
    objectTypeIdNumber="777770010" latitude="N33 11.00" longitude="W117 35.00" day="01"
    time="1500" timeZone="Z" month="JAN" year="2001" julianDate="36519"
    startTimeInSecondsPerDay="54000" locationIdNumber="88880001"
    featureLocationIndexNumber="111110001" actionDescription="Insert AAAV Company from
    the LHD" actionIdNumber="999990001" candidateTargetDetailIndexNumber="1000001"
    action="INSERT" />
  <Infiltration name="Primary Infil Route" objectItemIdNumber="555550011"
    objectTypeIdNumber="777770011" latitude="N33 14.9" longitude="W117 25.7" day="01"
    time="1800" timeZone="Z" month="JAN" year="2001" julianDate="36519"
    startTimeInSecondsPerDay="54000" locationIdNumber="88880002"
    featureLocationIndexNumber="111110002" actionDescription="Secure the BLS, proceed to
    the AF" actionIdNumber="999990002" candidateTargetDetailIndexNumber="1000002"
    action="INFILT" />
  <ActionsAtTheObjective name="Camp Pendleton Airfield" objectItemIdNumber="555550012"
    objectTypeIdNumber="7777700012" latitude="N33 17.88" longitude="W117 21.44"
    day="01" time="2100" timeZone="Z" month="JAN" year="2001" julianDate="36519"
    startTimeInSecondsPerDay="54000" locationIdNumber="88880003"
    featureLocationIndexNumber="111110003" actionDescription="Secure Camp Pendleton AF"
    actionIdNumber="999990003" candidateTargetDetailIndexNumber="1000003"
    action="SECURE" />
  <Exfil name="Primary Exfil Route" objectItemIdNumber="555550013"
    objectTypeIdNumber="777770013" latitude="N33 17.88" longitude="W117 21.44" day="02"
```

```
        time="0300" timeZone="Z" month="JAN" year="2001" julianDate="36519"
        startTimeInSecondsPerDay="54000" locationIdNumber="88880004"
        featureLocationIndexNumber="111110004" actionDescription="Return from the Airfield to
        the LHD" actionIdNumber="999990004" candidateTargetDetailIndexNumber="1000004"
        action="EXFILT" />
      <Extraction name="Primary Extraction Point" objectItemIdNumber="555550014"
        objectTypeIdNumber="777770014" latitude="N33 17.88" longitude="W117 21.44" day="02"
        time="0700" timeZone="Z" month="JAN" year="2001" julianDate="36519"
        startTimeInSecondsPerDay="54000" locationIdNumber="88880005"
        featureLocationIndexNumber="111110005" actionDescription="Extract AAAV Company and
        return to LHD" actionIdNumber="999990005" candidateTargetDetailIndexNumber="1000005"
        action="EXTRCT" />
    </ExecutionTimelineAndMovement>
  </Tasks>
- <CoordinatingInstructions>
    <DDay day="01" month="JAN" year="2001" />
    <HHour time="1500" timeZone="Z" />
    <LHour time="1800" timeZone="Z" />
    <MissionObjectiveLocation name="APE AIRFIELD (CAMP PENDLETON)" latitude="N33 17.88"
      longitude="W117 21.44" targetIdNumber="6566" />
    <BeachLandingSite name="Beach Landing Site" latitude="N33 14.9" longitude="W117 25.7" />
  </CoordinatingInstructions>
</GeneralTextInformation>
- <GeneralTextInformation>
    <GentextTextIndicator contextId="92220004">ADMIN AND LOG</GentextTextIndicator>
    <FreeText>REFER TO BASIC ORDER</FreeText>
</GeneralTextInformation>
- <GeneralTextInformation>
    <GentextTextIndicator contextId="92220005">COMMAND AND CONTROL</GentextTextIndicator>
    <FreeText>REFER TO OPTASK COMMS</FreeText>
</GeneralTextInformation>
- <AcknowledgeRequirement>
    <AcknowledgementRequirementIndicator>YES</AcknowledgementRequirementIndicator>
```

```
  </AcknowledgeRequirement >
</Order>
```

APPENDIX K. GENERIC HUB SCHEMA

A. INTRODUCTION

The Generic Hub (GH) XML schema defines semantic tags that attempt to embrace all possible elements incorporated in the database. This schema is robust in that it works for any document or order that may utilize the element tags, not just operation orders. This schema is needed in order to create documents that are compliant and interoperable with the GH database. Franciso Loaiza and Eugene Simaitis from the Institute for Defense Analysis created this schema. As this order is in excess of 160 pages, it is not included it its entirety. Sufficient tags are depicted order to convey enough information to obtain a reasonable appreciation of its contents.

B. GENERIC HUB SCHEMA

```
<?xml version="1.0" encoding="UTF-8" ?>
- <!--
 edited with XML Spy v4.0 U beta 3 build Aug 24 2001 (http://www.xmlspy.com) by FRANCISCO L LOAIZA (SED)
  -->
- <!--
W3C Schema generated by XML Spy v4.0 U beta 3 build Aug 24 2001 (http://www.xmlspy.com)
  -->
- <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
  - <xsd:element name="AbsolutePoint">
    - <xsd:complexType>
      - <xsd:sequence>
          <xsd:element ref="AbsolutePoint.longitudeCoordinate" />
          <xsd:element ref="AbsolutePoint.latitudeCoordinate" />
          <xsd:element ref="AbsolutePoint.elevationCategoryCode" />
          <xsd:element ref="AbsolutePoint.id" />
```

```
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="AbsolutePoint.elevationCategoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="EAP" />
        <xsd:enumeration value="LOC" />
        <xsd:enumeration value="NOS" />
        <xsd:enumeration value="SEA" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  <xsd:element name="AbsolutePoint.id" type="xsd:long" />
  <xsd:element name="AbsolutePoint.latitudeCoordinate" type="xsd:decimal" />
  <xsd:element name="AbsolutePoint.longitudeCoordinate" type="xsd:decimal" />
- <xsd:element name="AbsolutePointTable">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="AbsolutePoint" maxOccurs="unbounded" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="Action">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="Action.id" />
        <xsd:element ref="Action.name" />
        <xsd:element ref="Action.categoryCode" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
```

```
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="Action.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="ACTEV" />
        <xsd:enumeration value="ACTTA" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  <xsd:element name="Action.id" type="xsd:long" />
  <xsd:element name="Action.name" type="xsd:string" />
- <xsd:element name="ActionAircraftEmployment">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="ActionAircraftEmployment.terminalAttackDirectionAngle" />
        <xsd:element ref="ActionAircraftEmployment.inflightReportRequirementIndicatorCode" />
        <xsd:element ref="ActionAircraftEmployment.egressDirectionAngle" />
        <xsd:element ref="ActionAircraftEmployment.approachOffsetCode" />
        <xsd:element ref="ActionResource.index" />
        <xsd:element ref="Action.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="ActionAircraftEmployment.approachOffsetCode">
  - <xsd:simpleType>
  - <!—break in schema…..-->
- <xsd:element name="ActionEffect.descriptionCode">
```

```
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="BURN" />
        <xsd:enumeration value="CAPTUR" />
        <xsd:enumeration value="CONS" />
        <xsd:enumeration value="DEST" />
        <xsd:enumeration value="FKIL" />
        <xsd:enumeration value="FLIG" />
        <xsd:enumeration value="IDNT" />
        <xsd:enumeration value="ILLUMN" />
        <xsd:enumeration value="KILL" />
  - <!—break in schema…..-->
- <xsd:element name="ActionEvent.subcategoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
    - <!—break in schema, following actions are not sequential or all-inclusive…..-->
        <xsd:enumeration value="ATTACK" />
        <xsd:enumeration value="DEFEAT" />
        <xsd:enumeration value="DEFEND" />
        <xsd:enumeration value="DEFLCT" />
        <xsd:enumeration value="DELAY" />
        <xsd:enumeration value="DEMO" />
        <xsd:enumeration value="DENY" />
        <xsd:enumeration value="DEPLOY" />
        <xsd:enumeration value="SECURE" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
- <!—break in schema…..-->
- <xsd:element name="ActionObjectiveItem">
  - <xsd:complexType>
    - <xsd:sequence>
```

```
            <xsd:element ref="ActionObjectiveItem.categoryCode" />
            <xsd:element ref="ActionObjective.index" />
            <xsd:element ref="Action.id" />
            <xsd:element ref="ObjectItem.id" />
            <xsd:element ref="CandidateTargetList.id" />
            <xsd:element ref="CandidateTargetDetail.index" />
            <xsd:element ref="updateSequenceNumber" minOccurs="0" />
            <xsd:element ref="ownerId" minOccurs="0" />
        </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <!—break in schema…..-->
- <xsd:element name="ActionResource">
  - <xsd:complexType>
    - <xsd:sequence>
            <xsd:element ref="ActionResource.index" />
            <xsd:element ref="ActionResource.qualifierCode" />
            <xsd:element ref="ActionResource.criticalityIndicatorCode" />
            <xsd:element ref="ActionResource.categoryCode" />
            <xsd:element ref="Action.id" />
            <xsd:element ref="AuthorisingOrganisation.id" />
            <xsd:element ref="updateSequenceNumber" minOccurs="0" />
            <xsd:element ref="ownerId" minOccurs="0" />
        </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="ActionResource.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
            <xsd:enumeration value="RI" />
            <xsd:enumeration value="RT" />
            <xsd:enumeration value="" />
        </xsd:restriction>
```

```
    </xsd:simpleType>
  </xsd:element>
- <!—break in schema…..-->
</xsd:element>
  <xsd:element name="ActionTask.estimatedDuration" type="xsd:decimal" />
  <xsd:element name="ActionTask.id" type="xsd:long" />
  <xsd:element name="ActionTask.maximumDuration" type="xsd:decimal" />
  <xsd:element name="ActionTask.minimumDuration" type="xsd:decimal" />
  <xsd:element name="ActionTask.plannedEndDate" type="xsd:int" />
  <xsd:element name="ActionTask.plannedEndTime" type="xsd:int" />
  <xsd:element name="ActionTask.plannedStartDate" type="xsd:int" />
  <xsd:element name="ActionTask.plannedStartTime" type="xsd:int" />
- <xsd:element name="ActionTask.priorityCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="1" />
        <xsd:enumeration value="2" />
        <xsd:enumeration value="3" />
        <xsd:enumeration value="4" />
        <xsd:enumeration value="5" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
- <xsd:element name="ActionTask.startPrecisionCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="DAY" />
        <xsd:enumeration value="HR" />
        <xsd:enumeration value="MIN" />
        <xsd:enumeration value="MON" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="SEC" />
```

```
            <xsd:enumeration value="WEK" />
            <xsd:enumeration value="YEA" />
            <xsd:enumeration value="" />
          </xsd:restriction>
        </xsd:simpleType>
    - <!—break in schema…..-->
  - <xsd:element name="CandidateTargetList">
    - <xsd:complexType>
      - <xsd:sequence>
            <xsd:element ref="CandidateTargetList.id" />
            <xsd:element ref="CandidateTargetList.name" />
            <xsd:element ref="ReportingData.id" />
            <xsd:element ref="updateSequenceNumber" minOccurs="0" />
            <xsd:element ref="ownerId" minOccurs="0" />
          </xsd:sequence>
        </xsd:complexType>
    </xsd:element
    - <!—break in schema…..-->
  - <xsd:element name="ConsumableMaterielType">
    - <xsd:complexType>
      - <xsd:sequence>
            <xsd:element ref="ConsumableMaterielType.perishabilityIndicatorCode" />
            <xsd:element ref="ConsumableMaterielType.issuingWeightQuantity" />
            <xsd:element ref="ConsumableMaterielType.issuingWidthDimension" />
    <xsd:element
  - <!—break in schema…..-->
  - <xsd:element name="ConsumableMaterielType.categoryCode">
    - <xsd:simpleType>
      - <xsd:restriction base="xsd:string">
            <xsd:enumeration value="AMM" />
            <xsd:enumeration value="CLO" />
            <xsd:enumeration value="CON" />
```

```
        <xsd:enumeration value="FOO" />
  <xsd:enumeration value="MED" />
- <!—break in schema…..-->
- <xsd:element name="Convoy">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="Convoy.packetSizeQuantity" />
        <xsd:element ref="Convoy.packetGapDimension" />
        <xsd:element ref="Convoy.nightVehicleGapDimension" />
        <xsd:element ref="Convoy.nightSpeedRate" />
        <xsd:element ref="Convoy.haltDuration" />
        <xsd:element ref="Convoy.dayVehicleGapDimension" />
        <xsd:element ref="Convoy.daySpeedRate" />
        <xsd:element ref="Convoy.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <!—break in schema…..-->
</xsd:element>
  <xsd:element name="EquipmentType.id" type="xsd:long" />
  <xsd:element name="EquipmentType.loadedWeightQuantity" type="xsd:decimal" />
  <xsd:element name="EquipmentType.maximumHeightDimension" type="xsd:decimal" />
  <xsd:element name="EquipmentType.maximumLengthDimension" type="xsd:decimal" />
  <xsd:element name="EquipmentType.maximumWidthDimension" type="xsd:decimal" />
- <xsd:element
- <!—break in schema…..-->
- <xsd:element name="FacilityStatus.operationalStatusQualifierCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="DENY" />
```

```
        <xsd:enumeration value="DESTR" />
        <xsd:enumeration value="HVYDAM" />
        <xsd:enumeration value="LGTDAM" />
        <xsd:enumeration value="LST" />
        <xsd:enumeration value="LVR" />
        <xsd:enumeration value="MODDAM" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="UNCNST" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  - <!—break in schema…..-->
- <xsd:element name="GeographicFeatureStatus.surfaceConditionCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="DUST" />
        <xsd:enumeration value="FLODNG" />
        <xsd:enumeration value="GRASS" />
        <xsd:enumeration value="ICE" />
        <xsd:enumeration value="MARSH" />
        <xsd:enumeration value="NOS" />
        <xsd:enumeration value="SAND" />
        <xsd:enumeration value="SCRUB" />
        <xsd:enumeration value="SNOW" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  - <!—break in schema…..-->
- <xsd:element name="Light.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="CIVIL" />
```

```
        <xsd:enumeration value="DARK" />
        <xsd:enumeration value="DAY" />
        <xsd:enumeration value="MOON" />
        <xsd:enumeration value="NAUTIC" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    - <!—break in schema…..-->
- <xsd:element name="Location">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="Location.id" />
        <xsd:element ref="Location.categoryCode" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
    - <!—break in schema…..-->
- <xsd:element name="MaterielType">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="MaterielType.stockNumberText" />
        <xsd:element ref="MaterielType.categoryCode" />
        <xsd:element ref="MaterielType.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
    - <!—break in schema…..-->
- <xsd:element name="Minefield">
  - <xsd:complexType>
    - <xsd:sequence>
```

```
        <xsd:element ref="Minefield.purposeCode" />
        <xsd:element ref="Minefield.persistenceCode" />
        <xsd:element ref="Minefield.patternCode" />
        <xsd:element ref="Minefield.mineSpacingDimension" />
        <xsd:element ref="Minefield.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
    - <!—break in schema…..-->
- <xsd:element name="ObjectItem">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="ObjectItem.id" />
        <xsd:element ref="ObjectItem.name" />
        <xsd:element ref="ObjectItem.categoryCode" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <xsd:element name="ObjectItem.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="FA" />
        <xsd:enumeration value="FE" />
        <xsd:enumeration value="MA" />
        <xsd:enumeration value="OR" />
        <xsd:enumeration value="PE" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
```

```
    - <!—break in schema…..-->
- <xsd:element name ="OrganisationOrganisationAssociation.subcategoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="ADMIN" />
        <xsd:enumeration value="ALTFOR" />
        <xsd:enumeration value="ASGND" />
        <xsd:enumeration value="ATPRCL" />
        <xsd:enumeration value="ATTACH" />
        <xsd:enumeration value="CAPT" />
        <xsd:enumeration value="COMD" />
        <xsd:enumeration value="DIRSUP" />
        <xsd:enumeration value="FORCE" />
    - <!—break in schema…..-->
- <xsd:element name ="Person">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="Person.religionCode" />
        <xsd:element ref="Person.genderCode" />
        <xsd:element ref="Person.bloodTypeCode" />
        <xsd:element ref="Person.birthDate" />
        <xsd:element ref="Person.alternateIdentificationText" />
        <xsd:element ref="Person.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name="Person.alternateIdentificationText" type="xsd:string" />
  <xsd:element name="Person.birthDate" type="xsd:int" />
- <xsd:element name="Person.bloodTypeCode">
  - <xsd:simpleType>
```

```
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="A+" />
        <xsd:enumeration value="A-" />
        <xsd:enumeration value="AB+" />
        <xsd:enumeration value="AB-" />
        <xsd:enumeration value="B+" />
        <xsd:enumeration value="B-" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="O+" />
        <xsd:enumeration value="O-" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
- <xsd:element name="Person.genderCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="F" />
        <xsd:enumeration value="M" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  <xsd:element name="Person.id" type="xsd:long" />
- <xsd:element name="Person.religionCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="ATH" />
        <xsd:enumeration value="BUD" />
        <xsd:enumeration value="GRC" />
        <xsd:enumeration value="HIN" />
        <xsd:enumeration value="JUD" />
```

```
            <xsd:enumeration value="MUSLIM" />
            <xsd:enumeration value="NKN" />
            <xsd:enumeration value="NON" />
            <xsd:enumeration value="ORT" />
            <xsd:enumeration value="PRO" />
            <xsd:enumeration value="ROM" />
            <xsd:enumeration value="" />
          </xsd:restriction>
        </xsd:simpleType>
      </xsd:element>
        - <!—break in schema…..-->
    - <xsd:element name="Precipitation.categoryCode">
      - <xsd:simpleType>
        - <xsd:restriction base="xsd:string">
            <xsd:enumeration value="DRZLE" />
            <xsd:enumeration value="FDRZLE" />
            <xsd:enumeration value="FRAIN" />
            <xsd:enumeration value="HAIL" />
            <xsd:enumeration value="ICECRY" />
            <xsd:enumeration value="ICEPLT" />
            <xsd:enumeration value="NPR" />
            <xsd:enumeration value="RAIN" />
            <xsd:enumeration value="RAINSR" />
            <xsd:enumeration value="SLEET" />
            <xsd:enumeration value="SNOW" />
            <xsd:enumeration value="SNWGRN" />
            <xsd:enumeration value="SNWSHR" />
            <xsd:enumeration value="" />
          </xsd:restriction>
        </xsd:simpleType>
        - <!—break in schema…..-->
    - <xsd:element name="Reference.transmittalTypeCode">
```

```
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="COUMSG" />
        <xsd:enumeration value="EMLMSG" />
        <xsd:enumeration value="FAXMSG" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="NOS" />
        <xsd:enumeration value="PHNMSG" />
        <xsd:enumeration value="RADMSG" />
        <xsd:enumeration value="SFXMSG" />
        <xsd:enumeration value="TELEX" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType
  - <!—break in schema…..-->
- <xsd:element name ="Route.mobilityCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="FOOT" />
        <xsd:enumeration value="NKN" />
        <xsd:enumeration value="TRACK" />
        <xsd:enumeration value="WHEEL" />
        <xsd:enumeration value="WHTR" />
        <xsd:enumeration value="" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  - <!—break in schema…..-->
- <xsd:element name ="RuleOfEngagement">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="RuleOfEngagement.id" />
```

```
            <xsd:element ref="RuleOfEngagement.descriptionText" />
            <xsd:element ref="RuleOfEngagement.name" />
            <xsd:element ref="updateSequenceNumber" minOccurs="0" />
            <xsd:element ref="ownerId" minOccurs="0" />
        </xsd:sequence>
    </xsd:complexType>
  - <!—break in schema…..-->
- <xsd:element name="SurveillanceCapability.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
            <xsd:enumeration value="COM" />
            <xsd:enumeration value="ELC" />
            <xsd:enumeration value="HUM" />
            <xsd:enumeration value="IMG" />
            <xsd:enumeration value="NKN" />
            <xsd:enumeration value="NOS" />
            <xsd:enumeration value="SIG" />
            <xsd:enumeration value="" />
        </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  - <!—break in schema…..-->
- <xsd:element name="TargetMarking">
  - <xsd:complexType>
    - <xsd:sequence>
            <xsd:element ref="TargetMarking.startTime" />
            <xsd:element ref="TargetMarking.startDate" />
            <xsd:element ref="TargetMarking.methodCode" />
            <xsd:element ref="ActionObjective.index" />
            <xsd:element ref="Action.id" />
            <xsd:element ref="UsingOrganisation.id" />
            <xsd:element ref="updateSequenceNumber" minOccurs="0" />
```

```
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
- <!—break in schema…..-->
- <xsd:element name="UnitType">
  - <xsd:complexType>
    - <xsd:sequence>
        <xsd:element ref="UnitType.sizeCode" />
        <xsd:element ref="UnitType.serviceCode" />
        <xsd:element ref="UnitType.mobilityCode" />
        <xsd:element ref="UnitType.categoryCode" />
        <xsd:element ref="UnitType.id" />
        <xsd:element ref="PrincipalEquipmentType.id" />
        <xsd:element ref="updateSequenceNumber" minOccurs="0" />
        <xsd:element ref="ownerId" minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
- <!—break in schema…..-->
- <xsd:element name="Visibility.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
        <xsd:enumeration value="DSTSND" />
        <xsd:enumeration value="BLWSNW" />
        <xsd:enumeration value="DSTDVL" />
        <xsd:enumeration value="DSTSTR" />
        <xsd:enumeration value="FOG" />
        <xsd:enumeration value="FRZFOG" />
        <xsd:enumeration value="HAZE" />
        <xsd:enumeration value="SNDSTR" />
        <xsd:enumeration value="SMOKE" />
        <xsd:enumeration value="NKN" />
```

```
            <xsd:enumeration value="" />
          </xsd:restriction>
        </xsd:simpleType>
- <!—break in schema…..-->
- <xsd:element name="Wind.categoryCode">
  - <xsd:simpleType>
    - <xsd:restriction base="xsd:string">
            <xsd:enumeration value="CONST" />
            <xsd:enumeration value="GUST" />
            <xsd:enumeration value="NKN" />
            <xsd:enumeration value="SQUAL" />
            <xsd:enumeration value="TRBLEX" />
            <xsd:enumeration value="TRBLLI" />
            <xsd:enumeration value="TRBLMO" />
            <xsd:enumeration value="TRBLSE" />
            <xsd:enumeration value="VRB" />
            <xsd:enumeration value="" />
          </xsd:restriction>
        </xsd:simpleType>
  </xsd:element>
  <xsd:element name="Wind.directionAngle" type="xsd:decimal" />
  <xsd:element name="Wind.id" type="xsd:long" />
  <xsd:element name="Wind.speedRate" type="xsd:decimal" />
- <xsd:element name="WindTable">
  - <xsd:complexType>
    - <xsd:sequence>
            <xsd:element ref="Wind" maxOccurs="unbounded" />
          </xsd:sequence>
        </xsd:complexType>
  </xsd:element>
  <xsd:element name="ownerId" type="xsd:long" />
  <xsd:element name="updateSequenceNumber" type="xsd:long" />
</xsd:schema>
```

APPENDIX L. GENERIC HUB COMPLIANT OPERATION ORDER

A. INTRODUCTION

This is a fraction of a GH compliant order that follows the rules of the GH schema. As this order is in excess of 142 pages, it is not included it its entirety. Data was retrieved from each section of the order in order to portray enough information to obtain a reasonable appreciation of its contents. This is what the order in Appendix J must transform into to be compliant with the database. Franciso Loaiza of the Institute for Defense Analysis generated this order.

B. GH OPERATION ORDER


```
- <!--
 edited with XML Spy v4.0 U beta 3 build Aug 24 2001 (http://www.xmlspy.com) by FRANCISCO L LOAIZA (SED)
  -->
-                    <GH4Complete                    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:noNamespaceSchemaLocation="C:\Program Files\Altova\XML Spy Suite\GH4Complete_3b.xsd">
  - <ObjectItemTable>
    - <ObjectItem>
        <ObjectItem.id>555550001</ObjectItem.id>
        <ObjectItem.name>BLT1/4</ObjectItem.name>
        <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
      </ObjectItem>
    - <ObjectItem>
        <ObjectItem.id>555550002</ObjectItem.id>
        <ObjectItem.name>ALPHA</ObjectItem.name>
```

```
    <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550003</ObjectItem.id>
    <ObjectItem.name>1st PLATOON</ObjectItem.name>
    <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550004</ObjectItem.id>
    <ObjectItem.name>2nd PLATOON</ObjectItem.name>
    <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550005</ObjectItem.id>
    <ObjectItem.name>3rd PLATOON</ObjectItem.name>
    <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550006</ObjectItem.id>
    <ObjectItem.name>InsertStartPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
```

```
    <ObjectItem.id>555550007</ObjectItem.id>
    <ObjectItem.name>Beach Landing Site</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550008</ObjectItem.id>
    <ObjectItem.name>InfilStartPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550009</ObjectItem.id>
    <ObjectItem.name>InfilEndPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550010</ObjectItem.id>
    <ObjectItem.name>InfilWaypoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550011</ObjectItem.id>
    <ObjectItem.name>InfilWaypoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
```

```
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550012</ObjectItem.id>
    <ObjectItem.name>InfilWaypoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550013</ObjectItem.id>
    <ObjectItem.name>ObjStartPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550014</ObjectItem.id>
    <ObjectItem.name>ObjEndPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550015</ObjectItem.id>
    <ObjectItem.name>ExfilStartPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550016</ObjectItem.id>
    <ObjectItem.name>ExfilEndPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
```

```
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550017</ObjectItem.id>
    <ObjectItem.name>ExfilWaypoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550018</ObjectItem.id>
    <ObjectItem.name>ExfilWaypoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550019</ObjectItem.id>
    <ObjectItem.name>ExtractionStartPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550020</ObjectItem.id>
    <ObjectItem.name>ExtractionEndPoint</ObjectItem.name>
    <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550021</ObjectItem.id>
```

```
    <ObjectItem.name >Pendleton AF </ObjectItem.name >
    <ObjectItem.categoryCode >FE </ObjectItem.categoryCode >
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550022</ObjectItem.id>
    <ObjectItem.name >AAAV</ObjectItem.name >
    <ObjectItem.categoryCode >FE</ObjectItem.categoryCode >
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550023</ObjectItem.id>
    <ObjectItem.name >AAAV</ObjectItem.name >
    <ObjectItem.categoryCode >FE</ObjectItem.categoryCode >
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550024</ObjectItem.id>
    <ObjectItem.name >AAAV</ObjectItem.name >
    <ObjectItem.categoryCode >FE</ObjectItem.categoryCode >
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
- <ObjectItem>
    <ObjectItem.id>555550025</ObjectItem.id>
    <ObjectItem.name >USCINCCENT</ObjectItem.name >
    <ObjectItem.categoryCode >OR</ObjectItem.categoryCode >
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ObjectItem>
```

```
  - <ObjectItem>
      <ObjectItem.id>555550026</ObjectItem.id>
      <ObjectItem.name>InsertEndPoint</ObjectItem.name>
      <ObjectItem.categoryCode>FE</ObjectItem.categoryCode>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
    </ObjectItem>
  </ObjectItemTable>
- <ObjectTypeTable>
  - <ObjectType>
      <ObjectType.id>777770001</ObjectType.id>
      <ObjectType.nationalityCode>US</ObjectType.nationalityCode>
      <ObjectType.name>Battalion Landing Team</ObjectType.name>
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      <ActionObjective.priorityCode>1</ActionObjective.priorityCode>
      <ActionObjective.qualifierCode>AUTH</ActionObjective.qualifierCode>
      <ActionObjective.categoryCode>OI</ActionObjective.categoryCode>
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      <ownerId>81234567890</ownerId>
    </ActionObjective>
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      <Context.name>MISSION</Context.name>
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      <ownerId>81234567890</ownerId>
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      <Context.name >EXECUTION</Context.name >
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      <ownerId>81234567890</ownerId >
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      <Context.name >ADMIN AND LOGISTICS</Context.name >
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      <Context.name >COMMAND AND CONTROL</Context.name >
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      <ownerId>81234567890</ownerId >
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  </ContextTable >
- <ActionContextTable >
  - <ActionContext >
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      <ActionContext.categoryCode >DES</ActionContext.categoryCode >
      <Context.id >92220001 </Context.id >
      <Action.id >9999900001</Action.id >
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId >
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- <ContextAssessmentTable >
  - <ContextAssessment >
      <ContextAssessment.index>1001 </ContextAssessment.index>
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    <ContextAssessment.effectiveTime >54000</ContextAssessment.effectiveTime >
    <ContextAssessment.effectiveDate>36518</ContextAssessment.effectiveDate>
    <ContextAssessment.text >A. GENERAL. REFER TO BASIC ORDER; B. ENEMY FORCES. REFER TO
      BASIC ORDER; C. FRIENDLY FORCES. REFER TO BASIC ORDER; D. ATTACHMENTS AND
      DETACHMENTS. ANNEX A (TASK ORGANIZATION)</ContextAssessment.text >
    <Context.id>92220001</Context.id>
    <ContextAssessingOrganisation.id>555550001</ContextAssessingOrganisation.id>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ContextAssessment >
- <ContextAssessment >
    <ContextAssessment.index>1001</ContextAssessment.index>
    <ContextAssessment.effectiveTime >54000</ContextAssessment.effectiveTime >
    <ContextAssessment.effectiveDate>36518</ContextAssessment.effectiveDate>
    <ContextAssessment.text >AT H-HOUR, BLT 1/4 CONDUCTS AN AAAV RAID ACROSS RED BEACH
      AND PROCEEDS INLAND TO SEIZE ATF OBJECTIVE A. ONCE SEIZED, MAINTAIN SECURITY OF
      OBJECTIVE UNTIL RELIEVED BY TF APACHE.</ContextAssessment.text >
    <Context.id>92220002</Context.id>
    <ContextAssessingOrganisation.id>555550001</ContextAssessingOrganisation.id>
    <updateSequenceNumber>777771234567890</updateSequenceNumber>
    <ownerId>81234567890</ownerId>
  </ContextAssessment >
- <ContextAssessment >
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    <ContextAssessment.effectiveTime >54000</ContextAssessment.effectiveTime >
    <ContextAssessment.effectiveDate>36518</ContextAssessment.effectiveDate>
    <ContextAssessment.text >3. CONCEPT OF OPERATIONS. AT H-HOUR, BLT 1/4 CONDUCTS AN
      AMPHIBIOUS RAID TO SEIZE ATF OBJECTIVE A. THREE REINFORCED PLATOONS FROM
      COMPANY A WILL CONDUCT AN AAAV ASSAULT ACROSS RED BEACH AND PROCEED INLAND
      VIA PREDETERMINED ROUTE TO SEIZE ATF OBJECTIVE A. COMPANY A WILL SECURE THE
      OBJECTIVE AND REMAIN UNTIL RELIEVED BY TF APACHE. COMPANY B IS THE RESERVE.
      COMPANY A IS THE MAIN EFFORT AND WILL HAVE PRIORITY OF FIRES FOR THE DURATION
      OF THE OPERATION.</ContextAssessment.text >
```

```
      <Context.id>92220003</Context.id>
      <ContextAssessingOrganisation.id>555550001</ContextAssessingOrganisation.id>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
    </ContextAssessment>
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- <OrganisationActionTaskAssociationTable>
  - <OrganisationActionTaskAssociation>
      <OrganisationActionTaskAssociation.index>113301</OrganisationActionTaskAssociation.index>
      <OrganisationActionTaskAssociation.intentText>1. BATTALION COMMANDERS INTENT. CURRENTLY
        THERE IS MINIMAL THREAT IN OUR ZONE. HOWEVER, MY CONCERN LIES IN THE FACT THAT
        CIVILIAN REACTION IS UNCERTAIN AND THERE ARE GREAT NUMBERS OF THEM NEARBY. AS
        WE ARE DEALING WITH A CIVILIAN GROUP, I SEE THEIR VULNERABILITY AS
        RESPONSIVENESS AND LACK OF TRAINING. I INTEND TO EXPLOIT THIS BY LANDING EARLY
        IN THE MORNING AND MOVING TO THE OBJECTIVE QUICKLY BEFORE THE GENERAL
        POPULACE IS AWAKE. 2. ENDSTATE. I SEE OUR ENDSTATE AS ATF OBJECTIVE A SECURED
        AND IN CONTROL OF CTF 175.</OrganisationActionTaskAssociation.intentText>

        <OrganisationActionTaskAssociation.effectiveTime>54000</OrganisationActionTaskAssociation.effecti
        veTime>

        <OrganisationActionTaskAssociation.effectiveDate>36518</OrganisationActionTaskAssociation.effecti
        veDate>

        <OrganisationActionTaskAssociation.categoryCode>PROVDR</OrganisationActionTaskAssociation.cat
        egoryCode>
      <ActionTask.id>9999900001</ActionTask.id>
      <Organisation.id>555550001</Organisation.id>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
    </OrganisationActionTaskAssociation>
  </OrganisationActionTaskAssociationTable>
</GH4Complete>
```

APPENDIX M. XML TO XML STYLESHEET

A. INTRODUCTION

In order for the operation order in Appendix J to become the operation order in Appendix L, and consequently compliant with the Generic Hub (GH), an XSL stylesheet is applied to change its format. Specifically, XSLT is used to transform one XML document into another. Once "linked", operation orders can be produced with the improved XML-MTF schema (Appendix I), transformed into orders compliant with the GH schema (Appendix K) and read into the database. As soon as autogeneration of the 3D scene is functional, the GH database can feed and update the information in the scene; in other words the data flow and transformation works both ways. This stylesheet is created by Doug Horner and is still a work in progress.

B. STYLESHEET

```
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<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
<xsl:output method="xml" indent="no"/>


<xsl:template match="/">

<xsl:param name="InitialFeatureNumber" select="111110000"></xsl:param>


  <ObjectItemTable>
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```

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        <xsl:call-template name ="AssignOR"/>
        </xsl:for-each>

        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam">
        <xsl:call-template name ="AssignOR"/>
        </xsl:for-each>

        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company">
        <xsl:call-template name ="AssignOR"/>
        </xsl:for-each>

        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company/Platoon"
>
        <xsl:call-template name ="AssignOR"/>
        </xsl:for-each>

        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Insertion">
        <xsl:call-template name ="AssignFE"/>
        </xsl:for-each>

        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
        <xsl:call-template name ="AssignFE"/>
        </xsl:for-each>

        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
        <xsl:call-template name ="AssignFE"/>
        </xsl:for-each>

        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
        <xsl:call-template name ="AssignFE"/>
        </xsl:for-each>
```

```
        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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        <ObjectTypeTable>


            <xsl:if test="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit">
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            </xsl:if>

            <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam">
            <xsl:call-template name="AssignObjectTypeNumber"/>
            </xsl:for-each>

            <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company">
            <xsl:call-template name="AssignObjectTypeNumber"/>
            </xsl:for-each>

            <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company/Platoon"
>
            <xsl:call-template name="AssignObjectTypeNumber"/>
            </xsl:for-each>

            <xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Insertion">
            <xsl:call-template name="AssignObjectTypeNumber"/>
            </xsl:for-each>

        </ObjectTypeTable>

        <OrganisationTable>
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        <xsl:for-each select="/Order/OrderReference/OrderOriginatorAndOrNumber/MilitaryCommandAuthority">
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        </xsl:for-each>


        <xsl:for-each select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit">
        <xsl:call-template name="Organisation"/>
        </xsl:for-each>

        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam">
        <xsl:call-template name="Organisation"/>
        </xsl:for-each>

        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company">
        <xsl:call-template name="Organisation"/>
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        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company/Platoon"
>
        <xsl:call-template name="Organisation"/>
        </xsl:for-each>

        </OrganisationTable>

        <ReferenceTable>
        <xsl:call-template name="References"/>
        </ReferenceTable>

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                <ReportingData.reportingDate>36518</ReportingData.reportingDate>
                <ReportingData.credibilityCode>TRSTED</ReportingData.credibilityCode>
                <ReportingData.countingIndicatorCode>NO</ReportingData.countingIndicatorCode>
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                <ReportingData.categoryCode>REP</ReportingData.categoryCode>
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select="/Order/MessageIdentification/MessageSerialNumber/@referenceIdNumber"/></Reference.id>
                <ReportingOrganisation.id><xsl:value-of
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/@objectItemIdNumber"/></ReportingOrg
anisation.id>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
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        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam">
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       <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company">
        <xsl:call-template name="AssignObjectItemTypeIndex"/>
        </xsl:for-each>
```

```
        <xsl:for-each
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company/Platoon"
>
        <xsl:call-template name ="AssignObjectItemTypeIndex"/>
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        <xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Insertion">
           <xsl:call-template name ="AssignObjectItemTypeIndex"/>
           </xsl:for-each>

        <xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
        <xsl:call-template name ="AssignObjectItemTypeIndex"/>
        </xsl:for-each>

        <xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
        <xsl:call-template name ="AssignObjectItemTypeIndex"/>
        </xsl:for-each>

        <xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
        <xsl:call-template name ="AssignObjectItemTypeIndex"/>
        </xsl:for-each>

        <xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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        </ObjectItemTypeTable >

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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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      <ownerId >81234567890 </ownerId >
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<CandidateTargetDetailTable >

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</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
<xsl:call-template name ="CandidateTargetIndexNumber"/ >
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
<xsl:call-template name ="CandidateTargetIndexNumber"/ >
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
<xsl:call-template name ="CandidateTargetIndexNumber"/ >
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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</CandidateTargetDetailTable >

<CandidateTargetDetailItemTable >

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```
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
<xsl:call-template name ="TargetDetailItemNumber"/>
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
<xsl:call-template name ="TargetDetailItemNumber"/>
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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</CandidateTargetDetailItemTable >

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```
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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</ActionTaskTable>

<ActionFunctionalAssociationTable>

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<xsl:call-template name="ActionFunctionalAssociationIndexNumber"/>
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<xsl:for-each select="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
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</ActionFunctionalAssociationTable>
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
<xsl:call-template name ="ActionResourceItemTableIndex"/>
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
<xsl:call-template name ="ActionResourceItemTableIndex"/>
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
<xsl:call-template name ="ActionResourceItemTableIndex"/>
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</ActionResourceItemTable >

<ActionResourceItemTable >

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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
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<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
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<xsl:call-template name ="LinkingActionId2ObjectItemIdNumber"/>
</xsl:for-each>

</ActionResourceItemTable >

<ActionObjectiveTable >

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Insertion">
<xsl:call-template name ="ActionObjectiveTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
<xsl:call-template name ="ActionObjectiveTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
<xsl:call-template name ="ActionObjectiveTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
<xsl:call-template name ="ActionObjectiveTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
<xsl:call-template name ="ActionObjectiveTable"/>
</xsl:for-each>
```

```
</ActionObjectiveTable >

<ActionObjectiveItemTable >

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Insertion">
<xsl:call-template name ="ActionObjectiveItemCrossReferenceTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Infiltration">
<xsl:call-template name ="ActionObjectiveItemCrossReferenceTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/ActionsAtTheObjective">
<xsl:call-template name ="ActionObjectiveItemCrossReferenceTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Exfil">
<xsl:call-template name ="ActionObjectiveItemCrossReferenceTable"/>
</xsl:for-each>

<xsl:for-each select ="/Order/GeneralTextInformation/Tasks/ExecutionTimelineAndMovement/Extraction">
<xsl:call-template name ="ActionObjectiveItemCrossReferenceTable"/>
</xsl:for-each>

</ActionObjectiveItemTable >

<ContextTable >

<xsl:for-each select ="/Order/GeneralTextInformation/GentextTextIndicator">
<xsl:call-template name ="ContextTableNumbers"/>
</xsl:for-each>

</ContextTable >

<ActionContextTable >
```

```
<xsl:for-each select="/Order/GeneralTextInformation/GentextTextIndicator">
<xsl:call-template name="ActionContextReference"/>
</xsl:for-each>

</ActionContextTable>

<ContextAssessmentTable>

<xsl:if test="/Order/GeneralTextInformation[@name = 'Situation']">

   <ContextAssessment>
      <ContextAssessment.index>1001</ContextAssessment.index>
      <ContextAssessment.effectiveTime></ContextAssessment.effectiveTime>
      <ContextAssessment.effectiveDate></ContextAssessment.effectiveDate>
      <ContextAssessment.text><xsl:value-of select="/Order/GeneralTextInformation[@name =
'Situation']/FreeText"/>
      </ContextAssessment.text>
      <Context.id>
      <xsl:value-of select="/Order/GeneralTextInformation[@name =
'Situation']/GentextTextIndicator/@contextId"/>
      </Context.id>
      <ContextAssessingOrganisation.id>
      <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
      </ContextAssessingOrganisation.id>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
   </ContextAssessment>

</xsl:if>

<xsl:if test="/Order/GeneralTextInformation[@name = 'Mission']">

   <ContextAssessment>
      <ContextAssessment.index>1001</ContextAssessment.index>
```

```
            <ContextAssessment.effectiveTime ></ContextAssessment.effectiveTime >
            <ContextAssessment.effectiveDate></ContextAssessment.effectiveDate>
            <ContextAssessment.text ><xsl:value-of select="/Order/GeneralTextInformation[@name =
'Mission']/FreeText"/>
            </ContextAssessment.text >
            <Context.id>
            <xsl:value-of select="/Order/GeneralTextInformation[@name = 'Mission']/GentextTextIndicator/@contextId"/>
            </Context.id>
            <ContextAssessingOrganisation.id>
            <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
            </ContextAssessingOrganisation.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
         </ContextAssessment>

      </xsl:if>

      <xsl:if test="/Order/GeneralTextInformation[@name = 'Execution']">
         <ContextAssessment>
            <ContextAssessment.index>1001</ContextAssessment.index>
            <ContextAssessment.effectiveTime ></ContextAssessment.effectiveTime >
            <ContextAssessment.effectiveDate></ContextAssessment.effectiveDate>
            <ContextAssessment.text ><xsl:value-of select="/Order/GeneralTextInformation[@name =
'Execution']/FreeText"/>
            </ContextAssessment.text >
            <Context.id>
            <xsl:value-of select="/Order/GeneralTextInformation[@name =
'Execution']/GentextTextIndicator/@contextId"/>
            </Context.id>
            <ContextAssessingOrganisation.id>
            <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
            </ContextAssessingOrganisation.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
         </ContextAssessment>
```

```
        </xsl:if>

        <xsl:if test="/Order/GeneralTextInformation[@name = 'AdminAndLog']">

          <ContextAssessment>
            <ContextAssessment.index>1001</ContextAssessment.index>
            <ContextAssessment.effectiveTime></ContextAssessment.effectiveTime>
            <ContextAssessment.effectiveDate></ContextAssessment.effectiveDate>
            <ContextAssessment.text><xsl:value-of select="/Order/GeneralTextInformation[@name =
'AdminAndLog']/FreeText"/>
            </ContextAssessment.text>
            <Context.id>
            <xsl:value-of select="/Order/GeneralTextInformation[@name =
'AdminAndLog']/GentextTextIndicator/@contextId"/>
            </Context.id>
            <ContextAssessingOrganisation.id>
            <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
            </ContextAssessingOrganisation.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
          </ContextAssessment>

        </xsl:if>

        <xsl:if test="/Order/GeneralTextInformation[@name = 'AdminAndLog']">

          <ContextAssessment>
            <ContextAssessment.index>1001</ContextAssessment.index>
            <ContextAssessment.effectiveTime></ContextAssessment.effectiveTime>
            <ContextAssessment.effectiveDate></ContextAssessment.effectiveDate>
            <ContextAssessment.text><xsl:value-of select="/Order/GeneralTextInformation[@name =
'CommandAndControl']/FreeText"/>
            </ContextAssessment.text>
            <Context.id>
```

```
            <xsl:value-of                          select="/Order/GeneralTextInformation[@name                          =
'CommandAndControl']/GentextTextIndicator/@contextId"/>
            </Context.id>
            <ContextAssessingOrganisation.id>
            <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
            </ContextAssessingOrganisation.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
         </ContextAssessment>

      </xsl:if>

      </ContextAssessmentTable>




      </xsl:template>

      <xsl:template name="AssignOR">
         <ObjectItem>
            <ObjectItem.id><xsl:value-of select="@objectItemIdNumber"/></ObjectItem.id>
            <ObjectItem.name>
            <xsl:value-of select="@name"/>
            </ObjectItem.name>
            <ObjectItem.categoryCode>OR</ObjectItem.categoryCode>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
         </ObjectItem>
      </xsl:template>

      <xsl:template name="AssignFE">
            <ObjectItem>
            <ObjectItem.id><xsl:value-of select="@objectItemIdNumber"/></ObjectItem.id>
```

```
        <ObjectItem.name >
        <xsl:value-of select="@name "/ >
        </ObjectItem.name >
        <ObjectItem.categoryCode >FE</ObjectItem.categoryCode >
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId >81234567890 </ownerId >
        </ObjectItem>
</xsl:template>

<xsl:template name ="AssignObjectTypeNumber">
    <ObjectType>
        <ObjectType.id ><xsl:value-of select ="@objectTypeIdNumber"/></ ObjectType.id >
        <ObjectType.nationalityCode >US </ObjectType.nationalityCode >
        <ObjectType.name >
        <xsl:value-of select="@name "/ >
        </ObjectType.name >
        <ObjectType.dummyIndicatorCode >NO</ ObjectType.dummyIndicatorCode >
        <ObjectType.categoryCode >OR</ ObjectType.categoryCode >
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId >81234567890 </ownerId >
    </ ObjectType>
</xsl:template>


<xsl:template name ="Organisation">

<Organisation >
        <Organisation.nicknameName > <xsl:value-of select="@name"/> </ Organisation.nicknameName >
        <Organisation.categoryCode >UN</ Organisation.categoryCode >
        <Organisation.id> <xsl:value-of select ="@objectItemIdNumber"/> </ Organisation.id >
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId >81234567890 </ownerId >
</Organisation >

</xsl:template>
```

```
<xsl:template name="References">

        <Reference>
        <Reference.id><xsl:value-of
select="/Order/MessageIdentification/MessageSerialNumber/@referenceIdNumber"/></Reference.id>
        <Reference.transmittalTypeCode>TELEX</Reference.transmittalTypeCode>
        <Reference.sourceText><xsl:value-of
select="/Order/MessageIdentification/Originator/MessageClassification"/></Reference.sourceText>
        <Reference.securityClassificationCode><xsl:value-of
select="/Order/MessageIdentification/MessageSerialNumber/@referenceIdNumber"/></Reference.securityClassificationCode>
        <Reference.identificationText>Exercise: <xsl:value-of select="/Order/ExerciseIdentification/@setid"/>; Exercise
Nickname: <xsl:value-of select="/Order/ExerciseIdentification/ExerciseNickname"/>; MessageId: <xsl:value-of
select="/Order/MessageIdentification/@setid"/>; MsgFormat: <xsl:value-of
select="/Order/MessageIdentificationMessageTextFormatIdentifier"/>; SerialNumber: <xsl:value-of
select="/Order/MessageIdentification/MessageSerialNumber"/>; OrderType: <xsl:value-of
select="/Order/TypeOfOrder/@setid"/>; Plan Type; <xsl:value-of select="/Order/TypeOfOrder/TypeOfPlanOrder"/>;
Authority: <xsl:value-of select="/Order/OrderReference/OrderOriginatorAndOrNumber/MilitaryCommandAuthority"/>;
OpOrderNr: <xsl:value-of select="/Order/OrderReference/OrderOriginatorAndOrNumber/OperationOrderNumber"/>
        </Reference.identificationText>
        <Reference.formatCode><xsl:value-of
select="/Order/MessageIdentification/MessageFormat"/></Reference.formatCode>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
        </Reference>
</xsl:template>

<xsl:template name="AssignObjectItemTypeIndex">
  <ObjectItemType>
        <ObjectItemType.index>33300001</ObjectItemType.index>
        <ObjectItem.id><xsl:value-of select="@objectItemIdNumber"/></ObjectItem.id>
        <ObjectType.id><xsl:value-of select="@objectTypeIdNumber"/></ObjectType.id>
        <ReportingData.id>22220001</ReportingData.id>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
```

```
    </ObjectItemType>

  </xsl:template>

  <xsl:template name="FeatureTableIdNumber">

    <Feature>
      <Feature.categoryCode>CF</Feature.categoryCode>
      <Feature.id><xsl:value-of select="@objectItemIdNumber"/></Feature.id>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
    </Feature>

  </xsl:template>

  <xsl:template name="LocationTableIdNumber">

    <Location>
      <Location.id><xsl:value-of select="@locationIdNumber"/></Location.id>
      <Location.categoryCode>PT</Location.categoryCode>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
    </Location>

  </xsl:template>

  <xsl:template name="FeatureLocationTableNumber">

    <FeatureLocation>
      <FeatureLocation.index>
      <xsl:value-of select="@featureLocationIndexNumber"/>
      </FeatureLocation.index>
      <FeatureLocation.accuracyQuantity>0</FeatureLocation.accuracyQuantity>
      <Location.id><xsl:value-of select="@locationIdNumber"/></Location.id>
      <Feature.id><xsl:value-of select="@objectItemIdNumber"/></Feature.id>
```

```
        <ReportingData.id>22220002</ReportingData.id>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
    </FeatureLocation>

</xsl:template>

<xsl:template name="PointTableIdNumber">
    <Point>
        <Point.verticalPrecisionCode>10M</Point.verticalPrecisionCode>
        <Point.horizontalPrecisionCode>10M</Point.horizontalPrecisionCode>
        <Point.categoryCode>ABS</Point.categoryCode>
        <Point.id><xsl:value-of select="@locationIdNumber"/></Point.id>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
    </Point>
</xsl:template>

<xsl:template name="AbsolutePointTableIdNumber">

    <AbsolutePoint>
        <AbsolutePoint.longitudeCoordinate>
        <xsl:value-of select="@longitude"/>
        </AbsolutePoint.longitudeCoordinate>
        <AbsolutePoint.latitudeCoordinate>
        <xsl:value-of select="@latitude"/>
        </AbsolutePoint.latitudeCoordinate>
        <AbsolutePoint.elevationCategoryCode>LOC</AbsolutePoint.elevationCategoryCode>
        <AbsolutePoint.id><xsl:value-of select="@locationIdNumber"/></AbsolutePoint.id>
        <updateSequenceNumber>777771234567890</updateSequenceNumber>
        <ownerId>81234567890</ownerId>
    </AbsolutePoint>


</xsl:template>
```

```
<xsl:template name ="ActionIdNumber">

   <Action>
      <Action.id><xsl:value-of select ="@actionIdNumber"/></Action.id>
      <Action.name><xsl:value-of select ="@actionDescription"/></Action.name>
      <Action.categoryCode>ACTTA</Action.categoryCode>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
   </Action>

</xsl:template>

<xsl:template name ="CandidateTargetIndexNumber">

   <CandidateTargetDetail>
      <CandidateTargetDetail.index>
      <xsl:value-of select ="@candidateTargetDetailIndexNumber"/>
      </CandidateTargetDetail.index>
      <CandidateTargetDetail.schemeCode>SITENR</CandidateTargetDetail.schemeCode>
      <CandidateTargetDetail.priorityQuantity>1</CandidateTargetDetail.priorityQuantity>
      <CandidateTargetDetail.labelText/>
      <CandidateTargetDetail.focusTypeCode>NOS</CandidateTargetDetail.focusTypeCode>
      <CandidateTargetDetail.discriminatorCode>CTDITM</CandidateTargetDetail.discriminatorCode>
      <CandidateTargetList.id>
      <xsl:value-of
select="/Order/GeneralTextInformation/CoordinatingInstructions/MissionObjectiveLocation/@targetIdNumber"/>
      </CandidateTargetList.id>
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId>81234567890</ownerId>
   </CandidateTargetDetail>

</xsl:template>

<xsl:template name ="TargetDetailItemNumber">
```

```
            <CandidateTargetDetailItem>
                <CandidateTargetDetail.index>
                <xsl:value-of select="@candidateTargetDetailIndexNumber"/>
                </CandidateTargetDetail.index>
                <CandidateTargetList.id>
                <xsl:value-of
select="/Order/GeneralTextInformation/CoordinatingInstructions/MissionObjectiveLocation/@targetIdNumber"/>
                </CandidateTargetList.id>
                <ObjectItem.id><xsl:value-of select="@objectItemIdNumber"/></ObjectItem.id>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>
            </CandidateTargetDetailItem>

        </xsl:template>

        <xsl:template name="ActionTaskReferenceTable">

            <ActionTask>
                <ActionTask.plannedEndTime></ActionTask.plannedEndTime>
                <ActionTask.minimumDuration>0</ActionTask.minimumDuration>
                <ActionTask.estimatedDuration>0</ActionTask.estimatedDuration>
                <ActionTask.maximumDuration>0</ActionTask.maximumDuration>
                <ActionTask.plannedStartDate><xsl:value-of select="@julianDate"/>
                </ActionTask.plannedStartDate>
                <ActionTask.plannedStartTime><xsl:value-of select="@startTimeInSecondsPerDay"/>
                </ActionTask.plannedStartTime>
                <ActionTask.startPrecisionCode>HR</ActionTask.startPrecisionCode>
                <ActionTask.categoryCode>ORD</ActionTask.categoryCode>
                <ActionTask.plannedEndDate></ActionTask.plannedEndDate>
                <ActionTask.endPrecisionCode>HR</ActionTask.endPrecisionCode>
                <ActionTask.endQualifierCode>NLT</ActionTask.endQualifierCode>
                <ActionTask.priorityCode>1</ActionTask.priorityCode>
                <ActionTask.verbPhraseCode><xsl:value-of select="@action"/></ActionTask.verbPhraseCode>
                <ActionTask.startQualifierCode>NLT</ActionTask.startQualifierCode>
```

```
            <ActionTask.id><xsl:value-of select="@actionIdNumber"/></ActionTask.id>
            <CandidateTargetList.id><xsl:value-of
select="/Order/GeneralTextInformation/CoordinatingInstructions/MissionObjectiveLocation/@targetIdNumber"/></CandidateTa
rgetList.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
        </ActionTask>

    </xsl:template>

    <xsl:template name="ActionFunctionalAssociationIndexNumber">

        <ActionFunctionalAssociation>
            <ActionFunctionalAssociation.index>331234500001</ActionFunctionalAssociation.index>
            <ActionFunctionalAssociation.categoryCode>HSA</ActionFunctionalAssociation.categoryCode>
            <ObjectAction.id>
            <xsl:value-of select="/Order/ExerciseIdentification/@actionIdNumber"/>
            </ObjectAction.id>
            <SubjectAction.id><xsl:value-of select="@actionIdNumber"/></SubjectAction.id>
            <updateSequenceNumber>777771234567890</updateSequenceNumber>
            <ownerId>81234567890</ownerId>
        </ActionFunctionalAssociation>

    </xsl:template>

    <xsl:template name="ActionResourceItemTableIndex">
        <ActionResource>
            <ActionResource.index>331234560001</ActionResource.index>
            <ActionResource.qualifierCode>AUTH</ActionResource.qualifierCode>
            <ActionResource.criticalityIndicatorCode>YES</ActionResource.criticalityIndicatorCode>
            <ActionResource.categoryCode>RI</ActionResource.categoryCode>
            <Action.id><xsl:value-of select="@actionIdNumber"/></Action.id>
            <AuthorisingOrganisation.id>
```

```
                <xsl:value-of
select="/Order/OrderReference/OrderOriginatorAndOrNumber/MilitaryCommandAuthority/@objectItemIdNumber"/>
    </AuthorisingOrganisation.id>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>

            </ActionResource>

        </xsl:template>

        <xsl:template name="LinkingActionId2ObjectItemIdNumber">

            <ActionResourceItem>
                <ActionResource.index>331234560001</ActionResource.index>
                <Action.id><xsl:value-of select="@actionIdNumber"/></Action.id>
                <ObjectItem.id><xsl:value-of
select="/Order/GeneralTextInformation/Tasks/Organization/MarineExpeditionaryUnit/BattalionLandingTeam/Company[@name=
'AAAV Company']/@objectItemIdNumber"/></ObjectItem.id>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>
            </ActionResourceItem>

        </xsl:template>

        <xsl:template name="ActionObjectiveTable">

            <ActionObjective>
                <ActionObjective.index>441234567001</ActionObjective.index>
                <ActionObjective.priorityCode>1</ActionObjective.priorityCode>
                <ActionObjective.qualifierCode>AUTH</ActionObjective.qualifierCode>
                <ActionObjective.categoryCode>OI</ActionObjective.categoryCode>
                <Action.id><xsl:value-of select="@actionIdNumber"/></Action.id>
                <AuthorisingOrganisation.id>
```

```
                <xsl:value-of
select="/Order/OrderReference/OrderOriginatorAndOrNumber/MilitaryCommandAuthority/@objectItemIdNumber"/>
    </AuthorisingOrganisation.id>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>
            </ActionObjective>

        </xsl:template>

        <xsl:template name="ActionObjectiveItemCrossReferenceTable">

            <ActionObjectiveItem>
                <ActionObjectiveItem.categoryCode>NOS</ActionObjectiveItem.categoryCode>
                <ActionObjective.index>441234567001</ActionObjective.index>
                <Action.id><xsl:value-of select="@actionIdNumber"/></Action.id>
                <ObjectItem.id><xsl:value-of select="@objectItemIdNumber"/></ObjectItem.id>
                <CandidateTargetList.id>
                <xsl:value-of
select="/Order/GeneralTextInformation/CoordinatingInstructions/MissionObjectiveLocation/@targetIdNumber"/>
    </CandidateTargetList.id>
                <CandidateTargetDetail.index><xsl:value-of
select="@candidateTargetDetailIndexNumber"/></CandidateTargetDetail.index>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>
            </ActionObjectiveItem>

        </xsl:template>

        <xsl:template name="ContextTableNumbers">

            <Context>
                <Context.id><xsl:value-of select="@contextId"/></Context.id>
                <Context.name><xsl:value-of select="."/></Context.name>
                <updateSequenceNumber>777771234567890</updateSequenceNumber>
                <ownerId>81234567890</ownerId>
```

```
    </Context >


  </xsl:template>

  <xsl:template name ="ActionContextReference">

    <ActionContext >
      <ActionContext.index>1001</ActionContext.index>
      <ActionContext.categoryCode >DES</ActionContext.categoryCode >
      <Context.id > <xsl:value-of select ="@contextId"/> </Context.id >
      <Action.id > <xsl:value-of select ="/Order/ExerciseIdentification/@actionIdNumber"/ >
      </Action.id >
      <updateSequenceNumber>777771234567890</updateSequenceNumber>
      <ownerId >81234567890 </ownerId >
    </ActionContext >

  </xsl:template>


</xsl:stylesheet >
```

APPENDIX N. AMPHIBIOUS-RAID CODE

A. INTRODUCTION

This appendix contains scripted code for the amphibious-raid. This code is available at

http://web.nps.navy.mil/~brutzman/Savage/Scenarios/CampPendletonCalifornia/AmphibiousRaid

B. AMPHIBIOUS-RAID CODE

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "http://www.web3D.org/TaskGroups/x3d/translation/x3d-compact.dtd"
                "file:///C:/www.web3D.org/TaskGroups/x3d/translation/x3d-compact.dtd">
<X3D>

    <head>

        <meta name='filename' content='<AmphibiousRaid.xml>'/>
<meta name='description' content='Amphibious Raid shows an exemplar amphibious raid at Red Beach, Camp
Pendleton California. It is the primary scenario for the SAVAGE group.'/>
<meta name='author' content='Don Brutzman, Curtis Blais, Jeff Weekley, Jane Wu, Shane Nicklaus, Mike
Hunsberger'/>
<meta name='created' content='9 April 2001'/>
<meta name='revised' content='27 July 2001'/>
<meta name='reference' content='<NpsRedBeachRaidScenario2001May2.html>'/>
<meta name='reference' content='<NpsRedBeachRaidScenario2001May2.ppt>'/>
<meta name='image' content='<HeloPatrolPendletonBackground.png> '/>
<meta name='reference' content='<AmphibiousRaidWithCommunications.xml>'/>
<meta name='warning' content='Coordinate system axes need to be aligned properly.'/>
```

```
    <meta name='url'
    content='<http://web.nps.navy.mil/~brutzman/Savage/Scenarios/CampPendletonCalifornia/AmphibiousRaid.xml> '/>
    <meta name='reference'
    content='<http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/WaypointInterpolator.xml> '/>
    <meta name='generator' content='X3D-Edit, <http://www.web3D.org/TaskGroups/x3d/translation/README.X3D-
    Edit.html> '/>

        </head>
<Scene>

            <!-- Prototype and external prototype declarations must precede scene definition -->
    <ExternProtoDeclare name='HiddenViewpoint'
    url='"../../Tools/Animation/HiddenViewpointPrototype.wrl#HiddenViewpoint
    <../../Tools/Animation/HiddenViewpointPrototype.wrl> "
    "http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/HiddenViewpointPrototype.wrl#HiddenViewpoint
    <http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/HiddenViewpointPrototype.wrl> "
    "../../Tools/Animation/HiddenViewpointPrototype.xml#HiddenViewpoint
    <../../Tools/Animation/HiddenViewpointPrototype.xml> "
    "http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/HiddenViewpointPrototype.xml#HiddenViewpoint
    <http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/HiddenViewpointPrototype.xml> "">

                <field name='position' type='Vector3Float' vrml97Hint='exposedField'/>
        <field name='rotation' type='Rotation' vrml97Hint='exposedField'/>
        <field name='sensorRadius' type='Float' vrml97Hint='field'/>
        <field name='label' type='Strings'/>
        <field name='labelOffset' type='Vector3Float' vrml97Hint='exposedField'/>
        <field name='labelFontSize' type='Float' vrml97Hint='field'/>
        <field name='labelColor' type='Color' vrml97Hint='exposedField'/>

            </ExternProtoDeclare>
    <ExternProtoDeclare name='WaypointInterpolator' nodeTypeHint='Group'
    url='"../../Tools/Animation/WaypointInterpolatorPrototype.wrl#WaypointInterpolator
```

<../../Tools/Animation/WaypointInterpolatorPrototype.wrl>"
"http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/WaypointInterpolatorPrototype.wrl#WaypointInterpolator <http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/WaypointInterpolatorPrototype.wrl>"
"../../Tools/Animation/WaypointInterpolatorPrototype.xml#WaypointInterpolator <../../Tools/Animation/WaypointInterpolatorPrototype.xml>"
"http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/WaypointInterpolatorPrototype.xml#WaypointInterpolator <http://web.nps.navy.mil/~brutzman/Savage/Tools/Animation/WaypointInterpolatorPrototype.xml>"">

```
        <field name='wayPoints' type='Vector3FloatArray' vrml97Hint='field'/>
    <field name='pitchUpDownForVerticalWayPoints' type='Boolean' vrml97Hint='field'/>
    <!-- Priority of use: legSpeeds (m/sec), legDurations (seconds), defaultSpeed (m/sec) -->
    <!-- If used, array lengths for legSpeeds and legDurations must be one less than number of wayPoints. -->
    <field name='legSpeeds' type='Floats' vrml97Hint='field'/>
    <field name='legDurations' type='Times' vrml97Hint='field'/>
    <field name='defaultSpeed' type='Float' vrml97Hint='field'/>
    <!-- turningRate (degrees/second) will also determine standoff distance prior to waypoint where turn
    commences. If 0, turns are instantaneous. -->
    <field name='turningRate' type='Float' vrml97Hint='field'/>
    <field name='totalDuration' type='Time' vrml97Hint='eventOut'/>
    <!-- exposed PositionInterpolator and OrientationInterpolator settings: -->
    <field name='fraction' type='Float' vrml97Hint='eventIn'/>
    <field name='positionValue' type='Vector3Float' vrml97Hint='eventOut'/>
    <field name='orientationValue' type='Rotation' vrml97Hint='eventOut'/>
    <field name='lineColor' type='Color' vrml97Hint='exposedField'/>
    <!-- highlightSegmentColors must contain two color values, for each endpoint of the highlight segment. -->
    <field name='highlightSegmentColors' type='Colors' IS='HighlightSegmentColorNode.color'
    vrml97Hint='exposedField'/>
    <field name='transparency' type='Float' vrml97Hint='exposedField'/>
    <field name='labelOffset' type='Vector3Float' vrml97Hint='field'/>
    <field name='labelFontSize' type='Float' vrml97Hint='field'/>
    <field name='labelColor' type='Color' vrml97Hint='field'/>
```

```
    <field name='traceEnabled' type='Boolean' vrml97Hint='field'/>

        </ExternProtoDeclare>
<ExternProtoDeclare name='ViewPositionOrientation'
url='"../../Tools/Authoring/ViewPositionOrientationPrototype.wrl#ViewPositionOrientation
<../../Tools/Authoring/ViewPositionOrientationPrototype.wrl>"
"http://web.nps.navy.mil/~brutzman/Savage/Tools/Authoring/ViewPositionOrientationPrototype.wrl#ViewPositionOri
entation <http://web.nps.navy.mil/~brutzman/Savage/Tools/Authoring/ViewPositionOrientationPrototype.wrl> "
"../../Tools/Authoring/ViewPositionOrientationPrototype.xml#ViewPositio nOrientation
<../../Tools/Authoring/ViewPositionOrientationPrototype.xml>"
"http://web.nps.navy.mil/~brutzman/Savage/Tools/Authoring/ViewPositionOrientationPrototype.xml#ViewPositionOri
entation <http://web.nps.navy.mil/~brutzman/Savage/Tools/Authoring/ViewPositionOrientationPrototype.xml>"">

            <field name='enabled' type='Boolean' vrml97Hint='exposedField'/>

        </ExternProtoDeclare>
<ExternProtoDeclare name='CameraCompass36'
url='"../../Tools/HeadsUpDisplays/CameraCompassPrototypes.wrl#CameraCompass36
<../../Tools/HeadsUpDisplays/CameraCompassPrototypes.wrl> "
"http://web.nps.navy.mil/~brutzman/Savage/Tools/HeadsUpDisplays/CameraCompassPrototypes.wrl#CameraCompass
36 <http://web.nps.navy.mil/~brutzman/Savage/Tools/HeadsUpDisplays/CameraCompassPrototypes.wrl>"
"../../Tools/HeadsUpDisplays/CameraCompassPrototypes.xml#CameraCompass36
<../../Tools/HeadsUpDisplays/CameraCompassPrototypes.xml>"
"http://web.nps.navy.mil/~brutzman/Savage/Tools/HeadsUpDisplays/CameraCompassPrototypes.xml#CameraCompas
s36 <http://web.nps.navy.mil/~brutzman/Savage/Tools/HeadsUpDisplays/CameraCompassPrototypes.xml>""">

            <field name='enabled' type='Boolean' vrml97Hint='exposedField'/>
    <field name='positionOffsetFromCamera' type='Vector3Float' vrml97Hint='exposedField'/>
    <field name='markerColor' type='Color' vrml97Hint='exposedField'/>
    <field name='labelColor' type='Color' vrml97Hint='exposedField'/>

        </ExternProtoDeclare>
```

```
<ExternProtoDeclare name='AH1SuperCobra' nodeTypeHint='Group' url='"../../AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.wrl#SuperCobra <../../AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.wrl>"
"http://web.nps.navy.mil/~brutzman/Savage/AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.wrl#SuperCobra
<http://web.nps.navy.mil/~brutzman/Savage/AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.wrl>" "../../AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.xml#SuperCobra <../../AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.xml>"
"http://web.nps.navy.mil/~brutzman/Savage/AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.xml#SuperCobra
<http://web.nps.navy.mil/~brutzman/Savage/AircraftHelicopters/AH1SuperCobra-
UnitedStates/SuperCobraPrototype.xml>"">

        <field name='tailBoomColor' type='Node' vrml97Hint='field'/>
    <field name='tailRotorDriveShaftColor' type='Node' vrml97Hint='field'/>
    <field name='horizontalStabilizerColor' type='Node' vrml97Hint='field'/>
    <field name='fuselageColor' type='Node' vrml97Hint='field'/>
    <field name='cockpitColor' type='Node' vrml97Hint='field'/>
    <field name='cowlingColor' type='Node' vrml97Hint='field'/>
    <field name='helicopterName' type='String' vrml97Hint='field'/>
    <field name='inFlight' type='Boolean' vrml97Hint='eventIn'/>

    </ExternProtoDeclare>
<!-- ================= -->
<NavigationInfo avatarSize='2 2 2' speed='100' type='EXAMINE ANY' visibilityLimit='60000'/>
<Background groundAngle='1.309, 1.571' groundColor='0 0.2 0.4, 0.05 0.25 0.6, 0.1 0.2 0.4' skyAngle='1.309, 1.571'
skyColor='0.1 0.1 0.4, 0.1 0.125 0.4, 0.1 0.1 0.3'/>
<Viewpoint description='Amphibious raid - full scenario seen from above' orientation='-0.557 -0.799 -0.229 0.9506'
position='-600 10000 25000'/>
<Viewpoint description='1000m elevation view' orientation='0 1 0 -0.78' position='-200 1000 22000'/>
```

```
<Transform rotation='0 0 1 .1'>

            <Viewpoint description='Waypoint' orientation='0 1 0 1.57' position='9451 20 14935'/>
    <Viewpoint description='waypoint 2' orientation='0 1 0 1.57' position='11217.2 10.0 13996.6'/>

        </Transform>
<!-- ViewPositionOrientation is a prototype lets us find good viewpoints for inclusion in the scene -->
<ProtoInstance name='ViewPositionOrientation'>

            <fieldValue name='enabled' value='true'/>

        </ProtoInstance>
<!-- This is a hack to orient camera to scene. Actually, scene elements need to be rotated. -->
<Transform rotation='0 1 0 1.57'>

            <ProtoInstance name='CameraCompass36'>

                <fieldValue name='enabled' value='true'/>
        <fieldValue name='positionOffsetFromCamera' value='0 5 0'/>
        <fieldValue name='markerColor' value='0.9 0.9 0.9'/>
        <fieldValue name='labelColor' value='0.9 0.9 0.9'/>

            </ProtoInstance>

        </Transform>
<ProtoInstance DEF='CobraCapStartingPoint' name='HiddenViewpoint'>

            <fieldValue name='position' value='6530 18 16800'/>
    <fieldValue name='rotation' value='0 1 0 -0.1'/>
    <fieldValue name='sensorRadius' value='100'/>
    <fieldValue name='label' value='"Cobra CAP" "starting point" "" "6530 11.5 16800"'/>
    <fieldValue name='labelOffset' value='0 -2 0'/>
    <fieldValue name='labelFontSize' value='0.5'/>
```

```
    <fieldValue name='labelColor' value='1 0.5 0'/>

        </ProtoInstance>
<ProtoInstance DEF='CobraCapInitialClimb' name='HiddenViewpoint'>

            <fieldValue name='position' value='6530 500 16800'/>
    <fieldValue name='rotation' value='0 1 0 -0.4'/>
    <fieldValue name='sensorRadius' value='100'/>
    <fieldValue name='label' value='"Cobra CAP" "initial climb point" "" "6530 500 16800"'/>
    <fieldValue name='labelOffset' value='0 1 0'/>
    <fieldValue name='labelFontSize' value='0.5'/>
    <fieldValue name='labelColor' value='1 0.5 0'/>

        </ProtoInstance>
<ProtoInstance DEF='SouthernCapTurnPoint' name='HiddenViewpoint'>

            <fieldValue name='position' value='25400 500 19100'/>
    <fieldValue name='rotation' value='0 1 0 0.4'/>
    <fieldValue name='sensorRadius' value='200'/>
    <fieldValue name='label' value='"Cobra CAP" "Southern Turn Point" "" "25400 500 191000"'/>
    <fieldValue name='labelOffset' value='0 1 0'/>
    <fieldValue name='labelFontSize' value='0.5'/>
    <fieldValue name='labelColor' value='1 0.5 0'/>

        </ProtoInstance>
<ProtoInstance DEF='NorthernCapTurnPoint' name='HiddenViewpoint'>

            <fieldValue name='position' value='5100 500 700'/>
    <fieldValue name='rotation' value='0 1 0 -2.3'/>
    <fieldValue name='sensorRadius' value='200'/>
    <fieldValue name='label' value='"Cobra CAP" "Northern Turn Point" "" "5100 500 700"'/>
    <fieldValue name='labelOffset' value='0 1 0'/>
```

```
    <fieldValue name='labelFontSize' value='0.5'/>
    <fieldValue name='labelColor' value='1 0.5 0'/>

        </ProtoInstance>
<Switch whichChoice='0'>

            <!-- Main group with all players. -->
    <Group DEF='EntireScene'>

                <!-- ==================== Land terrain ==================== -->
        <Transform>

                    <Inline
            url='"<../../Locations/CampPendletonCalifornia/CampPendletonOperatingAreasExample.wrl>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Locations/CampPendletonCalifornia/CampPendletonOperatingAreasExample.wrl>"
            "<../../Locations/CampPendletonCalifornia/CampPendletonOperatingAreasExample.xml>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Locations/CampPendletonCalifornia/CampPendletonOperatingAreasExample.xml>"'/>

                </Transform>
        <!-- ==================== Ships ==================== -->
        <!-- LPD is anchored and not moving. -->
        <Transform DEF='LPD' translation='6600 10 16800'>

                    <Inline url='"<../../Ships/LandingPlatformDock-LPD/LPD.wrl>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Ships/LandingPlatformDock-LPD/LPD.wrl>"
            "<../../Ships/LandingPlatformDock-LPD/LPD.xml>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Ships/LandingPlatformDock-LPD/LPD.xml>"'/>

                </Transform>
        <!-- ==================== Amphibious vehicles ==================== -->
        <!-- AAAV-1 Block -->
```

```
<TimeSensor DEF='AAAV1_Clock' loop='true'/>
<ROUTE fromNode='AAAV1_Clock' fromField='fraction_changed'
toNode='AAAV_1_WaypointInterpolator' toField='fraction'/>
<ROUTE fromNode='AAAV_1_WaypointInterpolator' fromField='totalDuration'
toNode='AAAV1_Clock' toField='cycleInterval'/>
<ProtoInstance DEF='AAAV_1_WaypointInterpolator' name='WaypointInterpolator'>

        <!-- need to improve elevations on beach (final waypoint) -->
    <fieldValue name='wayPoints' value='6802 1 16343 7685.0 1.0 15873.7, 8568.1 1.0 15404.4,
    9451.1 1.0 14935.2, 10334.2 1.0 14465.9, 11217.2 1.0 13996.6, 12100.3 1.0 13527.3, 12983.3
    1.0 13058.0, 13866.4 1.0 12588.7, 14749.4 1.0 12119.5, 15632.5 1.0 11650.2, 16515.5 1.0
    11180.9, 17398.6 1.0 10711.6, 18281.6 1.0 10242.3, 19164.7 1.0 9773.1, 19400.0 1.0 9648.0,
    19782 1 9185 20100 10 8800'/>
    <!-- 1 knot = 0.514444444 meters/second -->
    <fieldValue name='defaultSpeed' value='50'/>
    <fieldValue name='lineColor' value='0.8 0.8 0'/>
    <fieldValue name='labelColor' value='0.8 0.8 0'/>
    <fieldValue name='labelOffset' value='0 3 0'/>
    <fieldValue name='labelFontSize' value='1.5'/>
    <fieldValue name='traceEnabled' value='false'/>

        </ProtoInstance>
<ROUTE fromNode='AAAV_1_WaypointInterpolator' fromField='positionValue' toNode='AAAV-
Location' toField='set_translation'/>
<ROUTE fromNode='AAAV_1_WaypointInterpolator' fromField='orientationValue' toNode='AAAV-
Location' toField='set_rotation'/>
<!-- Most entity transforms will get converted to DIS-Java-VRML EspduTransforms when creating a
networked DIS version. -->
<Transform translation='6600 0 16800'/>
<EspduTransform DEF='AAAV-Location' readInterval='0' traceOffset='0 4 0' traceSize='2 2 2'
translation='6600 0 16800' writeInterval='1'>
```

```
    <Group>

        <Viewpoint description='AAAV raid from behind' orientation='0 1 0 -1.57'
position='-40 2 0'/>
<Viewpoint description='AAAV raid from ahead' orientation='0 1 0 1.57' position='50
12 0'/>
<Transform DEF='VerticalCorrection' translation='0 -4 0'>

            <Inline DEF='AAAV'
    url='"<../../AmphibiousVehicles/AAAV/AAAV.wrl>"
    "<http://web.nps.navy.mil/~brutzman/Savage/AmphibiousVehicles/AAAV/AAA
    V.wrl>" "<../../AmphibiousVehicles/AAAV/AAAV.xml>"
    "<http://web.nps.navy.mil/~brutzman/Savage/AmphibiousVehicles/AAAV/AAA
    V.xml>"'/>

        </Transform>
<Group DEF='OtherAAAVs'>

            <Transform translation='-15 -4 15'>

                <Transform DEF='AAAV-2'>

                    <Inline USE='AAAV'/>
            <PositionInterpolator DEF='AAV-2PATH' key='0.00, 0.11, 0.17,
            0.22, 0.33, 0.44, 0.50, 0.55, 0.66, 0.77, 0.83, 0.88, 0.99'
            keyValue='0.0 0.0 0.0, 1.0 0.96 1.0, 1.5 0.21 1.5, 2.0 0.96 2.0, 3.0
            0.0 3.0, 2.5 0.96 3.0, 1.75 0.41 3.0, 1.0 0.96 3.0, 3.0 0.0 3.0, 2.0
            0.46 2.0, 1.0 0.4 1.5, 0.0 0.46 1.0, 0.0 0.0 0.0'/>
            <ROUTE fromNode='AAV-2PATH' fromField='value_changed'
            toNode='AAAV-2' toField='set_translation'/>

                </Transform>
```

```
                </Transform>
            <Transform translation='-15 -4 -17.5'>

                    <Transform DEF='AAAV-3'>

                        <Inline USE='AAAV'/>
                <PositionInterpolator DEF='AAV-3PATH' key='0.00, 0.07, 0.13,
                0.22, 0.36, 0.47, 0.55, 0.625, 0.66, 0.72, 0.80, 0.85, 0.99'
                keyValue='0.0 0.0 0.0, 1.0 0.96 1.0, 1.5 0.21 2.25, 2.0 0.46 2.66,
                3.0 -0.25 3.0, 2.5 0.96 3.0, 1.75 0.41 3.0, 1.0 0.96 3.0, 3.0 0.0 3.0,
                2.0 0.46 2.0, 1.0 0.4 1.5, 0.0 0.46 1.0, 0.0 0.0 0.0'/>
                <ROUTE fromNode='AAV-3PATH' fromField='value_changed'
                toNode='AAAV-3' toField='set_translation'/>

                    </Transform>

                </Transform>

            </Group>

        </Group>

    </EspduTransform>
<!-- ==================== Helicopter 1 Block ==================== -->
<Transform DEF='Helo-1' translation='6530 11.5 16800'>

        <ProtoInstance DEF='HeloInstance1' name='AH1SuperCobra'>

            <fieldValue name='helicopterName' value='Cobra CAP 1'/>
    <fieldValue name='tailBoomColor'>

                <Appearance DEF='GREY_APPEARANCE'>

                    <Material diffuseColor='0.5 0.5 0.5'/>
```

```
            </Appearance>

        </fieldValue>
<fieldValue name='tailRotorDriveShaftColor'>

            <Appearance USE='GREY_APPEARANCE'/>

        </fieldValue>
<fieldValue name='horizontalStabilizerColor'>

            <Appearance>

                <Material diffuseColor='0.5 0.5 0.5'/>

            </Appearance>

        </fieldValue>
<fieldValue name='fuselageColor'>

            <Appearance>

                <Material diffuseColor='0.6 0.6 0.6'/>

            </Appearance>

        </fieldValue>
<fieldValue name='cockpitColor'>

            <Appearance>

                <Material diffuseColor='0.6 0.6 0.6'/>

            </Appearance>

        </fieldValue>
```

```
        <fieldValue name='cowlingColor'>
                <Appearance>
                    <Material diffuseColor='0.5 0.5 0.5'/>
                </Appearance>
            </fieldValue>
        <fieldValue name='inFlight' value='false'/>
            </ProtoInstance>
        </Transform>
<ProtoInstance DEF='Helo_1_WaypointInterpolator' name='WaypointInterpolator'>
            <fieldValue name='wayPoints' value='6600 600 16800 7592.6 600 16921.4 8585.2 600
    17042.9 9577.8 600 17164.3 10570.4 600 17285.7 11563.0 600 17407.2 12555.6 600 17528.6
    13548.2 600 17650.0 14540.8 600 17771.5 15533.4 600 17892.9 16526.0 600 18014.4 17518.6
    600 18135.8 18511.2 600 18257.2 19503.8 600 18378.7 20496.4 600 18500.1 21489.0 600
    18621.5 22481.6 600 18743.0 23474.2 600 18864.4 24466.8 600 18985.8 25400 600 19100
    24906.2 600 18230.4 24412.4 600 17360.9 23918.5 600 16491.3 23424.7 600 15621.8 22930.9
    600 14752.2 22437.1 600 13882.6 21943.2 600 13013.1 21449.4 600 12143.5 20955.6 600
    11273.9 20800 600 11000 20072.7 600 10313.7 19345.4 600 9627.4 18618.1 600 8941.0
    17890.8 600 8254.7 17163.5 600 7568.4 16436.2 600 6882.1 15708.9 600 6195.7 14981.6 600
    5509.4 14254.3 600 4823.1 13700 600 4300 12777.6 600 3913.9 11855.1 600 3527.7 10932.7
    600 3141.6 10010.2 600 2755.4 9087.8 600 2369.3 8165.4 600 1983.2 7242.9 600 1597.0 6320.5
    600 1210.9 5398.0 600 824.8 5100 600 700 5192.8 600 1695.7 5285.5 600 2691.4 5378.3 600
    3687.1 5471.1 600 4682.8 5563.8 600 5678.4 5656.6 600 6674.1 5749.4 600 7669.8 5842.1 600
    8665.5 5934.9 600 9661.2 6027.7 600 10656.9 6120.4 600 11652.6 6213.2 600 12648.3 6306.0
    600 13643.9 6398.7 600 14639.6 6491.5 600 15635.3 6584.3 600 16631.0 6600 600 16800'/>
    <!-- 1 knot = 0.514444444 meters/second -->
    <fieldValue name='defaultSpeed' value='100'/>
```

```
    <fieldValue name='pitchUpDownForVerticalWayPoints' value='false'/>
    <fieldValue name='lineColor' value='0 0.8 0'/>
    <fieldValue name='labelColor' value='0 0.8 0'/>
    <fieldValue name='labelOffset' value='0 5 0'/>
    <fieldValue name='labelFontSize' value='3'/>
    <fieldValue name='traceEnabled' value='false'/>

        </ProtoInstance>
<TimeSensor DEF='Helo1_Clock' loop='true'/>
<!-- ==================== Helicopter 2 Block ==================== -->
<Transform DEF='Helo-2' translation='6600 50 16800'>

            <Transform>

                <ProtoInstance DEF='HeloInstance2' name='AH1SuperCobra'>

                    <fieldValue name='helicopterName' value='Cobra CAP 2'/>
            <fieldValue name='tailBoomColor'>

                        <Appearance>

                            <Material diffuseColor='0.5 0.5 0.5'/>

                        </Appearance>

                    </fieldValue>
            <fieldValue name='tailRotorDriveShaftColor'>

                        <Appearance>

                            <Material diffuseColor='0.5 0.5 0.5'/>

                        </Appearance>
```

```
        </fieldValue>
<fieldValue name='horizontalStabilizerColor'>

            <Appearance>

                <Material diffuseColor='0.5 0.5 0.5'/>

            </Appearance>

        </fieldValue>
<fieldValue name='fuselageColor'>

            <Appearance>

                <Material diffuseColor='0.6 0.6 0.6'/>

            </Appearance>

        </fieldValue>
<fieldValue name='cockpitColor'>

            <Appearance>

                <Material diffuseColor='0.6 0.6 0.6'/>

            </Appearance>

        </fieldValue>
<fieldValue name='cowlingColor'>

            <Appearance>

                <Material diffuseColor='0.5 0.5 0.5'/>

            </Appearance>
```

```
                </fieldValue>
            <fieldValue name='inFlight' value='true'/>

                </ProtoInstance>

            </Transform>

        </Transform>
<ProtoInstance DEF='Helo_2_WaypointInterpolator' name='WaypointInterpolator'>

            <fieldValue name='wayPoints' value='6530 11.5 16800 6530 500 16800 6600 500
    16800 7592.6 500 16921.4 8585.2 500 17042.9 9577.8 500 17164.3 10570.4 500 17285.7
    11563.0 500 17407.2 12555.6 500 17528.6 13548.2 500 17650.0 14540.8 500 17771.5 15533.4
    500 17892.9 16526.0 500 18014.4 17518.6 500 18135.8 18511.2 500 18257.2 19503.8 500
    18378.7 20496.4 500 18500.1 21489.0 500 18621.5 22481.6 500 18743.0 23474.2 500 18864.4
    24466.8 500 18985.8 25400 500 19100 24906.2 500 18230.4 24412.4 500 17360.9 23918.5 500
    16491.3 23424.7 500 15621.8 22930.9 500 14752.2 22437.1 500 13882.6 21943.2 500 13013.1
    21449.4 500 12143.5 20955.6 500 11273.9 20800 500 11000 20072.7 500 10313.7 19345.4 500
    9627.4 18618.1 500 8941.0 17890.8 500 8254.7 17163.5 500 7568.4 16436.2 500 6882.1
    15708.9 500 6195.7 14981.6 500 5509.4 14254.3 500 4823.1 13700 500 4300 12777.6 500
    3913.9 11855.1 500 3527.7 10932.7 500 3141.6 10010.2 500 2755.4 9087.8 500 2369.3 8165.4
    500 1983.2 7242.9 500 1597.0 6320.5 500 1210.9 5398.0 500 824.8 5100 500 700 5192.8 500
    1695.7 5285.5 500 2691.4 5378.3 500 3687.1 5471.1 500 4682.8 5563.8 500 5678.4 5656.6 500
    6674.1 5749.4 500 7669.8 5842.1 500 8665.5 5934.9 500 9661.2 6027.7 500 10656.9 6120.4 500
    11652.6 6213.2 500 12648.3 6306.0 500 13643.9 6398.7 500 14639.6 6491.5 500 15635.3
    6584.3 500 16631.0 6600 500 16800'/>
    <!-- 1 knot = 0.514444444 meters/second -->
    <fieldValue name='defaultSpeed' value='200'/>
    <fieldValue name='lineColor' value='0.8 0 0'/>
    <fieldValue name='labelColor' value='0.8 0 0'/>
    <fieldValue name='labelOffset' value='0 5 0'/>
    <fieldValue name='labelFontSize' value='3'/>
```

```
        <fieldValue name='traceEnabled' value='false'/>

            </ProtoInstance>
    <TimeSensor DEF='Helo2_Clock' loop='true'/>
    <!-- ============== AAV7PA1 -->
    <Transform DEF='AAV7PA1Location' scale='1.25 1.25 1.25' translation='6620 -2 16900'>

                <Inline url='"<../../AmphibiousVehicles/AAV/AAV.wrl>"
        "<http://web.nps.navy.mil/~brutzman/Savage/AmphibiousVehicles/AAV/AAV.wrl>"
        "<../../AmphibiousVehicles/AAV/AAV.xml>"
        "<http://web.nps.navy.mil/~brutzman/Savage/AmphibiousVehicles/AAV/AAV.xml>"'/>

            </Transform>
    <ProtoInstance DEF='AAV7PA1WaypointInterpolator' name='WaypointInterpolator'>

                <fieldValue name='wayPoints' value='6620 -1 16900 6720 -1 16900 6870 -1 19500
        7400 -1 19500 8400 -1 16900 6620 -1 16900'/>
        <!-- 1 knot = 0.514444444 meters/second -->
        <fieldValue name='defaultSpeed' value='5'/>
        <fieldValue name='lineColor' value='0.8 0 0.65'/>
        <fieldValue name='labelColor' value='0.8 0 0'/>
        <fieldValue name='labelOffset' value='0 5 0'/>
        <fieldValue name='labelFontSize' value='3'/>
        <fieldValue name='traceEnabled' value='false'/>

            </ProtoInstance>
    <TimeSensor DEF='AAV7PA1Clock' loop='true'/>

        </Group>
<!-- hide things here until ready to bring them into the active scene -->
<Switch whichChoice='0'>

            <!-- Ocean bathymetry -->
```

```
        <Transform rotation='0 1 0 1.5708' translation='11900 0 6000'>

                <Inline url='"<../../Locations/CampPendletonCalifornia/ChartletTranscribed.wrl>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Locations/CampPendletonCalifornia/ChartletTrans
            cribed.wrl>" "<../../Locations/CampPendletonCalifornia/ChartletTranscribed.xml>"
            "<http://web.nps.navy.mil/~brutzman/Savage/Locations/CampPendletonCalifornia/ChartletTrans
            cribed.xml>"'/>

            </Transform>
        <!-- GeoVrml versions will be here someday -->
        <Group>

                <!-- Southwest corner reference point: 33:12N 117:38W -->
            <!-- GeoLocation and USE EntireScene to follow -->

            </Group>

            </Switch>

        </Switch>
<!-- AAAV-1 Waypoint Routes -->
<!-- Helo-1 Waypoint Routes -->
<ROUTE fromNode='Helo1_Clock' fromField='isActive' toNode='HeloInstance1' toField='inFlight'/>
<ROUTE fromNode='Helo_1_WaypointInterpolator' fromField='totalDuration' toNode='Helo1_Clock'
toField='cycleInterval'/>
<ROUTE fromNode='Helo1_Clock' fromField='fraction_changed' toNode='Helo_1_WaypointInterpolator'
toField='fraction'/>
<ROUTE fromNode='Helo_1_WaypointInterpolator' fromField='positionValue' toNode='Helo-1'
toField='set_translation'/>
<ROUTE fromNode='Helo_1_WaypointInterpolator' fromField='orientationValue' toNode='Helo-1'
toField='set_rotation'/>
<!-- Helo-2 Waypoint Routes -->
```

```
<ROUTE fromNode='Helo2_Clock' fromField='isActive' toNode='HeloInstance2' toField='inFlight'/>
<ROUTE fromNode='Helo_2_WaypointInterpolator' fromField='totalDuration' toNode='Helo2_Clock'
toField='cycleInterval'/>
<ROUTE fromNode='Helo2_Clock' fromField='fraction_changed' toNode='Helo_2_WaypointInterpolator'
toField='fraction'/>
<ROUTE fromNode='Helo_2_WaypointInterpolator' fromField='positionValue' toNode='Helo-2'
toField='set_translation'/>
<ROUTE fromNode='Helo_2_WaypointInterpolator' fromField='orientationValue' toNode='Helo-2'
toField='set_rotation'/>
<!-- AAV2 -->
<ROUTE fromNode='AAAV1_Clock' fromField='fraction_changed' toNode='AAV-2PATH' toField='set_fraction'/>
<!-- AAV7PA1 Waypoint Routes -->
<ROUTE fromNode='AAV7PA1WaypointInterpolator' fromField='totalDuration' toNode='AAV7PA1Clock'
toField='cycleInterval'/>
<ROUTE fromNode='AAV7PA1Clock' fromField='fraction_changed' toNode='AAV7PA1WaypointInterpolator'
toField='fraction'/>
<ROUTE fromNode='AAV7PA1WaypointInterpolator' fromField='positionValue' toNode='AAV7PA1Location'
toField='set_translation'/>
<ROUTE fromNode='AAV7PA1WaypointInterpolator' fromField='orientationValue' toNode='AAV7PA1Location'
toField='set_rotation'/>

    </Scene>

</X3D>

<!-- Tag color codes: <NodeName attribute='value'/> -->
```

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   3300 Russell Road
   Quantico, VA 22134

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   Chief, S&T Initiatives Division
   Defense Modeling and Simulation Office
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   Naval Postgraduate School
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Naval Postgraduate School
Monterey, CA 93940-5000

10. Alex Bordetsky, Code IS 1
Naval Postgraduate School
Monterey, CA 93943-5101

11. Rex Buddenberg Code IS/Bu 1
Naval Postgraduate School
Monterey, CA 93940-5000

12. Fred Burkley 1
NAVSEA Undersea Warfare Center
Division Newport
Code 2231, Bldg 1171-3
1176 Howell Street
Newport, RI 02841-1708

13. Bob Cabanya 1
Information Operations, Inc.
1298 Bay Dale Dr.
Arnold, MD 21012

14. LtCol Neil Cadwallader, USMC 1
MCTSSA, Box 555171
Camp Pendelton, CA 92055-5171

15. Erik Chaum 1
NAVSEA Undersea Warfare Center
Division Newport
Code 2231, Building 1171-3
1176 Howell Street
Newport, RI 02841-1708

16. Raymond Christian 1
Submarine Sonar Code 21
1141 Howell Street
Newport, RI 02841

17. Robert Clover 1
Institute for Defense Analyses
1801 N. Beauregard St.
Alexandria, VA 22311-1772

18. David Colleen 1
Planet 9 Studios
753 Kansas Street
San Francisco, CA 94107

19. George Conner, Code 01 1
Naval Postgraduate School
Monterey, CA 93943-5101

20. Justin Couch, Alan Hudson, and Stephen Matsuba 1
Yumatech, Inc
600 Malden Ave. East
Suite 202
Seattle, WA 98112

21. Colonel William Crain, USA 1
Defense Modeling and Simulation Office
1901 N. Beauregard St. Suite 500
Alexandria, VA 22311

22. Paul Diefenbach 1
Open Worlds OpenWorlds, Inc.
3508 Market Street
Suite 203
Philadelphia, PA. 19104

23. Maj T.J. Ferrell, USMC 1
MCMSMO
Marine Corps Combat Development Command, Code 46T
3300 Russell Road
Quantico, VA 22134

24. Dr. Paul Fishwick 1
Computer & Information Science and Engineering Department
University of Florida
Post Office Box 115120
322 Building CSE
Gainsville, FL 32611-6120

25. CAPT Donald Gerry, USN 1
Chief Staff Officer
COMSUBDEVRON TWELVE
P.O. Box 70, NSB New London
Groton, CT 06340

26. Simon Goerger, Code 32 1
Naval Postgraduate School
Monterey, CA 93943-5101

27. Dr. Tony Healey, Code ME 1
Naval Postgraduate School
Monterey, CA 93943-5101

28. John Hiles 1
Naval Postgraduate School
Monterey, CA 93943-5101

29. Doug Horner, Code C4I 1
Naval Postgraduate School
Monterey, CA 93943-5101

30. Wayne Hughes, Code OR 1
Naval Postgraduate School
Monterey, CA 93943-5101

31. Captain Mike Hunsberger, USAF 1
Air Force Communications Agency/TCPD
Scott AFB, IL, 62225

32. Jerry Isdale 1
HRL Laboratories
3011 Malibu Canyon Road
Malibu, CA 90265-4797

33. Pamela Krause 1
Advance Systems & Technology
National Reconnaissance Office
14675 Lee Rd
Chantilly, VA 20151-1714

34. S. David Kwak 1
The Mitre Corporation – M/S B155
202 Burlington Rd.
Bedford, MA 01730-1420

35. John Lademan 1
Electronic Sensors and Systems Sector
Northrop Grumman Corporation
PO Box 1488 – MS 9030
Anapolis, MD 21404

36. Major Dave Laflam, USA 1
Army Model and Simulation Office
Office of the Deputy Chief of Staff for Operations and Plans
1111 Jefferson Davis Highway
Crystal Gateway North (Suite 503E)
Arlington, VA 22202

37. Dr. Francisco Loaiza and Dr. Eugene Simaitis 1
Institute for Defense Analyses
Systems Evaluation Division
1801 N. Beauregard St.
Alexandria, VA 22311

38. Dr. R Bown Loftin 1
Director of Simulation Programs
Virginia Modeling Analysis & Simulation Center
Old Dominion University
7000 College Dr
Suffolk, VA 23435

39. CAPT Arnold O. Lotring, USN 1
Strategic Study Group
Naval War College
686 Cushing Rd.
Newport, RI 02841

40. Dell Lunceford 1
Director, Army Model & Simulation Office
Crystal Gateway North Suite 503E
1111 Jefferson Davis Highway
Arlington, VA 22202

41. Mike Macedonia 1
Chief Scientist and Technical Director
US Army STRICOM
12350 Research Parkway
Orlando, FL 32826-3276

42. Fahrid Mamaghani 1
19223 SE 45th St
Issaquah, WA 98027

43. CAPT Robert Maslowsky, USN 1
CNO/N62
Pentagon
Washington, D.C. 20350-2000

44. Michael McCann.....1
Monterey Bay Aquarium Research Institute (MBARI)
PO Box 628
Moss Landing, CA 95039-0628

45. Chuck Mirabile 1
USMC Program Office, D12
52560 Hull St.
San Diego, CA
92152-5001

46. Dr. Katherine L. Morse 1
Chief Scientist
Director, Modeling & Simulation Business Unit
Epsilon Systems Solutions
2550 Fifth Ave., Ste. 725, San Diego, CA 92103

47. Capt Mark Murray USAF 1
Joint Battlespace Infosphere (JBI)
AFRL/IFSE
Building 3, Room E-1078
525 Brooks Road
Rome, NY 13441-4505

48. Michael Myjak 1
Vice President and CTO
The Virtual Workshop
PO Box 98
Titusville, FL 32781

49. Rick Nelson.....1
OpenWorlds, Inc.
3508 Market Street
Suite 203
Philadelphia, PA. 19104

50. Captain Shane Nicklaus, USMC 1
503 Ross Circle
Martinez, CA 94553

51. Neal Park, President 1
Nexternet, Inc.
2900 Gordon Ave.
Suite 202
Santa Clara, CA 95051

52. Marty Paulsen 1
Analytic Graphics, Inc.
3760 Killroy Airport Way
Suite 270
Long Beach, CA 90806

53. CPT Joel Palowski, USA 1
TRAC-Monterey
Naval Postgraduate School
PO Box 8692
Monterey, CA 93943

54. George Philips.....1
CNO, N6M1
2000 Navy Pentagon
Room 4C445
Washington, DC 20350-2000

55. Dr. David Pratt 1
SAIC
12479 Research Parkway
Orlando, FL 32826-3248

56. Dr. Mark Pullen & Dr. Robert Simon.....2
Department of Computer Science/C3I Center MS4A5
George Mason University
FairFax, VA 22030

57. Dick Puk 1
President
Intelligraphicas Incorporated
7644 Cortina Court
Carlsbad, CA 92009-8206

58. CAPT Jason Quigley,USAF 1
Joint Battlespace Infosphere (JBI)
AFRL/IFSE
Building 3, Room E-1078
525 Brooks Road
Rome, NY 13441-4505

59. Dr. Martin Reddy 1
SRI International, EK219
333 Ravenswood Avenue
Menlo Park, CA 94025

60. Nancy Roberts, Code SM 1
Naval Postgraduate School
Monterey, CA 93943-5101

61. Dr. R. Jay Roland, President 1
Rolands and Associates
500 Sloat Avenue
Monterey CA 93940

62. Clyde Scandrett, Code MA 1
Naval Postgraduate School
Monterey, CA 93943-5101

63. Dr. John Sirmalis 1
NUWC
1176 Howell Street
Newport, RI 02841-1708

64. CDR Amy Smith, USN 1
614 Sicard Street, S.E.
Washington Navy Yard
(Bldg 201, 4E458)
Washington, DC 20376

65. John Stewart 1
3701 Carling Ave, Box 11490, Station H
Ottawa, Ontario K2H 8S2

66. RADM Paul Sullivan, USN 1
Director, Submarine Warfare Division N77
2000 Navy Pentagon, 4D542
Washington, DC 20350-2000

67. Craig Swanson 1
Science Applications International Corporation
Information Systems Division
1710 SAIC Dr.
Mclean, VA 22102

68. Dr. Ralph Toms 1
SRI International
333 Ravenswood Ave
Menlo Park, CA 94025

69. CAPT Robert Voigt, USN 1
Chair, Electrical Engineering Department
U.S. Naval Academy
Annapolis, MD 21402

70. Jeffrey Weekley 1
Rolands and Associates
500 Sloat Avenue
Monterey CA 93940

71. Joe Williams 1
3421 Bonita Vista Lane
Santa Rosa, CA 95404

72. LtCol Paul Ziegenfuss 1
HQMC C4I Plans and Policy Division
2 Navy Annex
Washington, D.C. 20380-1775

73. Walter H. Zimmers 1
Defense Threat Reduction Agency
CPOC
6801 Telegraph Road
Alexandria VA 22310-3398

74. Dr. Michael Zyda, Code MOVES 1
Chair, Modeling Virtual Environments and Simulation Academic Group
Naval Postgraduate School
Monterey, CA 93940-5000