JTLS-GO

Executive Overview

October 2021

DEPARTMENT OF DEFENSE
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JOINT THEATER LEVEL SIMULATION - GLOBAL OPERATIONS
(JTLS-GO 6.1.0.0)

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ABSTRACT

The Joint Theater Level Simulation-Global Operations (JTLS-GO®) is an interactive, web-enabled, joint and coalition wargaming system. JTLS-GO represents civil-military decision-making environments from a globally integrated operational-level perspective, which includes Air, Land, Maritime, Space, Intelligence, Logistics, and Special Operations. These environments can be configured and scaled to examine joint tasks, operations, functions, and missions at the strategic national (SN), strategic theater (ST), operational (OP), and tactical (TA) levels of war. It is important to understand that JTLS-GO is primarily an operational-level simulation.

The *Executive Overview* describes the basic operations of the Simulation including the major software programs and numerous smaller support programs that comprise the system. These diverse and interdependent programs inter-operate to prepare the scenario, run the Simulation, and analyze the results. This *Overview* also provides a description of the software and standard hardware needed to run the Simulation. JTLS-GO can operate simultaneously on one or several computers, either at single or multiple distributed sites, depending on the training or analysis environment and size of the scenario. It is theater-independent and does not require knowledge of programming to execute. A few of the new Simulation capabilities and features are highlighted on page iv.

JTLS-GO is a sophisticated simulation designed specifically to examine the changing modality of warfare. Leaders and directors from combatant commands (COCOMs), Services, Reserve Components, National Guard, Combat Support Agencies (CSAs), Joint Staff (JS), and Joint Task Forces (JTFs); including NATO and Coalition military forces, understand this because they must continually plan, program, budget, and execute fiscal policies in the context of national strategies.

This publication is updated and revised for major and maintenance version releases of JTLS-GO. Corrections, additions, or recommendations for improvement must include the specific sections, pages, and paragraphs with appropriate justifications and be forwarded to:

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SUMMARY OF CHANGES
JTLS-GO Version 6.1
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The following improvements were added to Joint Theater Level Simulation - Global Operations (JTLS-GO) as part the JTLS-GO 6.1 version release.

- Properly have Naval unit report their location to Command, Control, Communications, Computer Information (C4I) systems when they are stationary at sea or in port.
- Improve the Web Hosted Interface Program (WHIP) to limit the allowable data field entries based on unit characteristics. Of most importance is the new Fire Artillery Order and Fire Missile Order feature in which the WHIP limits the order's weapon list to the weapons that a unit can physically fire. This improvement greatly enhances the ability of users to enter appropriate orders.
- Display on the WHIP's Information Management Terminal (IMT), the expected time that the currently executing task will complete.
- Implement the ability for a High Resolution Unit (HRU) to be controlled by a limited set of WHIPs.
- Allow users to build Force Control Arrows as part of the WHIP Slide capability.
- Add convoy execution data to the After Action Review (AAR) database.
- Specify the difference in a weapon's Probability of Hit if the receiving object is moving or not.
- Improve the interface for displaying range rings. The user can visually and instantaneously determine which weapon or sensor has the maximum range.
- Improve the Time Phased Force Deployment Data (TPFD) order to quickly alter the TPFDD action for a hierarchy order units.
- Expand the AAR Object Event Query Report. The user can now get a summary of all events on which an object participated for any type of object. Previous versions only supported Air Missions.
- Allows AAR Reports to be requested from a WHIP. There is no longer a requirement to bring up a Total Recall Interactive Post Processor (TRIPP) interface to submit requests for AAR Reports. Many of these reports have associated graphs and charts.
- Allow a satellite to hold more than one sensor.
- Allow Technical Control to create new Combat Systems and Supply Categories during game play.
- Make the tracking of weapons easier.
- Represent multiple types of fuel to better represent fuel logistics requirements.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

THE JOINT THEATER LEVEL SIMULATION - GLOBAL OPERATIONS

(JTLS-GO)

ES.1 The Simulation

JTLS-GO is a web-enabled system. It normally executes at a server location, and any computer, with network access to the Apache server, can use the Simulation to monitor forces and submit orders or commands for those forces. Given the nature of JTLS-GO, the executing scenarios may be classified or sensitive. Web access is inappropriate on the open Internet, but may exist on private civil-military networks or communication channels.

ES.2 Forces

JTLS-GO provides simulated operating environments for multi-sided joint and coalition air, land, sea, and special operations forces. It also supports civilian and non-combatant participants. A maximum of twenty Force Sides can be represented, with each Side potentially divided into an unlimited number of Factions. Force Side relationships are asymmetric and can be changed during Simulation execution. Similarly, a Faction's allegiance is dynamically changeable during the Simulation. Side names, Faction names, and the colors used to display military forces and targets are compliant with US and NATO common military symbols (MIL-STD-2525 and APP-6A).

All processes to develop forces are designed to support doctrine-neutral implementation for maximum flexibility The manner in which multi-sided joint and coalition forces operate are not included in the Simulation code but are described within the database. This means Users build scenarios tailored to their learning requirements or analytic objectives. Scenarios can include military forces, civil agencies, international relief organizations, and specific civilian populations. The User-configurable database is used to define unit types and sizes, combat systems, supply categories, and militarily significant targets. Small units (High Resolution Units, or HRUs) and target systems complement the aggregated unit structures.

ES.3 Basic Operations

The Chairman's Assessment of the 2014 Quadrennial Defense Review, identified 12 mission areas for U.S. Joint Forces.[1] The basic operations in JTLS-GO are well suited to these mission areas in terms of the air, land, maritime, and space domains; including the joint functions of command and control, intelligence, fires, movement and maneuver, and sustainment. SIMULATED ENVIRONMENTS FOR JOINT OPERATIONS, 3.0 provides information on basic operations for artillery (Section 3.3.3); Surface-to-Surface Missiles (SSM); (Section 3.3.4); intelligence, including sensors and jammers (Section 3.3.10); Integrated Air Defense Systems (IADS) (Section 3.3.11); and Military Information Support Operations (MISO) (Section 3.3.13).

ES.4 Input

JTLS-GO recognizes terrain, weapons, movement, attrition tables, unit characteristics, and Time-Phased Force Deployment Data (TPFDD) as input. A Standard Database (SDB) that serves as a repository of unclassified, but well vetted, data is delivered with the software. Estimated time to develop a new database is six to eight months, but development for a scenario that uses the

1. Chairman's Assessment, *Quadrennial Defense Review 2014*, pp.60-61

delivered repository database is approximately four weeks, depending on the availability of Order of Battle (OB) data. Easy to use database development and modification tools are part of each JTLS-GO delivery.

JTLS-GO represents terrain as a multi-level, world-wide grid terrain system, which is a significant move away from the game board configurations and hexagon grid projection systems used in early versions of JTLS. Forces may be placed anywhere in the world and be managed by the Players.

Point targets modify trafficability by providing targetable enhancements to the baseline terrain conditions. For example, bridges, tunnels, and interdiction points can be explicitly represented and targeted. Destruction of these targets affects the underlying terrain representation. Similarly, pumping stations and rail yards can be explicitly represented and targeted. Their destruction affects the underlying capabilities of the associated pipeline and rail networks.

ES.5 User Participation

The JTLS-GO User interface is the Web Hosted Interface Program (WHIP®). It allows visual interaction with the Simulation in the form of order input and graphical image and data displays. The WHIP has been constructed to conform to IEEE Internationalization Standards (i18n), *allowing Users to deploy and utilize the interface in their native language.*

JTLS-GO Players can use order entry panels displayed on the WHIP screen, a spreadsheet of similarly formatted orders, or a standard Decision Support System (DSS) translation program delivered with JTLS-GO. For example, the JTLS-GO Air Tasking Order Translator (ATO-T) accomplishes automatic input of Air Tasking Orders (ATOs) from either the U.S. Theater Battle Management Core Systems (TBMCS), the NATO Integrated Command and Control (ICC), or the Northern European Command- Command and Control Information System (NEC CCIS).

ES.6 Output

Each Player and Controller WHIP workstation provides a graphical display of aggregated land units, individual air missions, surface and subsurface ships, and more detailed entity level High Resolution Units (HRUs). They obtain current status information about force mission, posture, and capabilities from an interactive, real-time Information Management Tool (IMT) component that provides User-configurable, spreadsheet-formatted data displays.

JTLS-GO Players receive messages and reports about movement, attrition, and logistics status of their own forces, as well as intelligence summaries and capabilities of opposing forces. Players at each workstation can elect to view Simulation messages in plain language or U.S. Message Text Format (USMTF). Message outputs may be sent electronically to standard Simple Message Text Protocol (SMTP) electronic mail workstations. Data feeds to C4I systems such as the Global Command Control System (GCCS), Joint Operational Tracking System (JOTS), and Joint Military Command Information System (JMCIS), have been successfully implemented and are frequently used during training exercises to populate real-world Common Operational Picture (COP) displays.

A graphical replay capability that depicts scenario events during Player-selectable time intervals is supported and allows retrieval and summarization of After Action Review (AAR) statistics.

ES.7 Time Processing

JTLS-GO Players specify the desired ratio of elapsed exercise time to elapsed real time. The maximum feasible ratio depends upon the Simulation's hardware platform, scenario size, and current game intensity. Although the capability to maintain a game ratio of at least 6 to 1 is a design objective, ratios of 20 to 1 or more can currently be maintained for large, conflict-intensive scenarios.

ES.8 Limitations

JTLS-GO is designed predominantly for operational plan analysis, wargames, and training exercises at the operational-level of war. This means the Simulation is limited when aggregated ground units are represented below the company level. However, JTLS-GO High Resolution Units (HRUs) are designed to represent very small units such as individual traffic control units, reconnaissance patrols, lifeboats, and special forces teams. This provides senior leadership the ability to examine unit operations in more detail.

ES.9 Hardware and Software

The JTLS-GO Equipment List is included in JTLS-GO OPERATING EQUIPMENT, APPENDIX B. to this document. It provides a summary of supported hardware system configurations. JTLS-GO execution can be on a single Linux laptop for small scenarios. A more robust suite is required for large exercises. JTLS-GO execution requires a Linux operating system, however individual Player workstations can be hosted on Windows clients.

ES.10 HLA Compliance

JTLS-GO is High Level Architecture (HLA-Evolved) compliant and has been successfully integrated with other simulations to provide expanded resolution capabilities in joint and coalition training environments.

- The GlobalSim federation combines JTLS-GO with the GESI high-resolution, entity-level command and staff training system and constructive simulation. GlobalSim creates a simulation environment that encompasses theater-level to tactical-level operations for enhanced training. GESI is developed and managed by CAE Inc.
- The enhanced interface with Multiple Unified Simulation Environment (MUSE) is a high resolution simulation system that represents Unmanned Aerial Systems (UASs). It uses the Transmission Control Protocol (TCP) and Distributed Interactive Simulation (DIS) protocols.
- JTLS-GO also supports a link to Bohemia Interactive Simulation (BISim) Corporation Virtual Battle Space 4 (VBS4). VBS4 is a whole-earth virtual desktop trainer and simulation host that allows users to create and run any imaginable military training scenario.

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1.0 INTRODUCTION

1.1 PURPOSE

This introduction provides an overview of *wargame design* to emphasize the importance of simulation planning relative to the goals and objectives of building an effective and efficient simulation. It includes the Joint Staff J7 and NATO Configuration Control Board updates, along with a list of past and present JTLS-GO Users. Finally, a complete list of all JTLS-GO documents is provided in Table 1.1. These documents are distributed with each Major and Maintenance release (Note the terms *JTLS-GO*, *JTLS-GO 6.1*, and *Simulation* are used interchangeably throughout the Executive Overview).

1.2 WARGAME DESIGN AND EXECUTION

The design and execution of a wargame is directly associated with its purpose and scope. Exercise or analytical objectives, and available resources, will drive design decisions. One of four general designs is typically used with JTLS-GO:

- Seminar Wargame
- Open Support
- Hidden Support
- Distributed Output

1.2.1 Seminar Wargame Design

Seminar Wargame or Analysis designs employ a small cadre of wargamers to operate the simulation and report results to key decision-makers. An experienced wargaming cell enters order sets—to implement a branch of a campaign plan—then runs the game at high speed in "batch mode" until a pre-defined sequel or branch point (i.e. contingency option) is reached or a specified time interval has elapsed. The wargame cell then provides operational results to the seminar director to support the decision process. Once key decisions are made, the cycle continues with a new set of orders being input into the simulation. This approach requires only a few gamers, but they must be well-trained in all aspects of the Simulation and must maintain expertise in a variety of warfare function areas.

1.2.2 Open Support Design

Open Support designs place key decision-makers—members of the training audience—within the simulation facility. These decision-makers and/or their representatives may enter orders directly into the game or retrieve data from the simulation. In this mode, the simulation is completely open to the target training audience. This design is advantageous because it does not require many "overhead" personnel to support simulation inputs. However, the target training audience can become too involved in simulation details at the expense of their focus on training objectives and their decision-making process. Additionally, simplifications made during the simulation process or errors entered by game Players can detract from a rational outcome.

1.2.3 Hidden Support Design

Hidden Support designs attempt to overcome the realism constraints by injecting a response cell between the simulation process, and the training audience. The training audience develops operation orders in their standard format, and ignores simulation constraints or special requirements. A subordinate response cell then processes these operational level orders into

game-level directives. During execution, the response cell monitors reports produced by the simulation and may monitor simulation outputs over organic command and control systems. The response cell reviews all output to ensure spurious responses are corrected before the information and reports are transmitted to the training audience. In this manner, the Simulation is hidden from the training audience. However, this scheme requires "overhead" personnel to operate workstations and additional personnel to establish and maintain the response cells.

1.2.4 Distributed Output Design

Distributed Output designs combine aspects of the Open and Hidden designs to interface the simulation with established Command, Control, Communications, Computer and Intelligence (C4I) systems. This design permits key decision-makers to send orders and monitor results over their organic, wartime command and control systems. Their orders are processed into game directives by a response cell (as in the hidden support design). However, output from the simulation may be broadcast directly to elements of the training audience over their organic C3I. For example, the Air Operations Center (AOC) may establish a Tactical Digital Interface Link (TADIL) from JTLS-GO to an organic battle-space management system. Members of the response cell review all reports prior to them being sent to the training audience.

Additionally, U.S. Message Text Format (USMTF) messages can be transmitted from the game over a local area network (LAN) to an interface with Theater communications systems. When coupled with order input modules like the Air Tasking Order Translator (ATO-T), this design structure will provide powerful and flexible support for training exercises. The challenge with this structure is that every national military has different C4I systems and therefore different requirements to directly interface the simulation with those national systems. Direct funding is provided to the Simulation developers to provide interfaces with U.S. C4I systems. Additional funding is required to develop non-User interface with their own civil-military C4I systems.

All these designs are supported by five key staff positions in JTLS-GO: Exercise Director, Senior Controller/Exercise Controller, Technical Coordinator, Computer Systems Manager, and Players. The functions of each position are summarized here:

- *Exercise Director:* plans and administers the wargaming exercise.
- *Senior Controller/Exercise Controller:* monitors the progress of the campaign and applies JTLS-GO capabilities to shape the simulated battle-space to meet operational-level requirements and/or training objectives as specified by the Exercise Director.
- *Technical Coordinator (or Tech Control):* starts and stops the Simulation, monitors all computer resources needed for the event, and provides technical simulation support.
- *Computer Systems Manager:* configures the computers, coordinates system software changes, and hardware maintenance.
- *Players:* enter game orders and monitor the status of assigned forces. Players may have command authority over all forces on their side, or can be limited in who they may command or in the type of functions they may perform. JTLS-GO requires at least one Player per Force Side. There are generally six distinct types of Players. However, JTLS-GO provides the exercise planning staff the capability to develop other specific Player types that combine any or all of the six Player types. This is done by creating specific Player order menu definition files tailored to exercise requirements. For example, a particular exercise might require a Player who will have access to Air-related orders as well as selected LOGISTICS and INTEL orders. The six commonly-used Player types are briefly described below:

- *Commanders* can perform all Player functions.
- *Ground, Air, and Naval Players:* issue directives required to manage the scenario's ground, air, and naval forces, respectively.
- *Intelligence Players:* issue orders only to intelligence collection assets, processes information gathered by organic resources, and passes information to other interested Players.
- *Logistics Players:* establish stockage objectives, direct resupply operations, and control convoys and supply networks.

1.3 U.S. JOINT STAFF AND NATO CONFIGURATION CONTROL BOARDS (CCB)

1.3.1 U.S. Joint Staff (JS) J7

The Joint Staff CCB establishes priorities for JTLS-GO development and improvement. It comprises representatives from the JS/J7 and Combatant Commands (COCOMs). High-priority developments for JTLS-GO by the JS/J7 CCB include the following:

- Expanded Air Mission Scheduling Service (AMSS) to enhance existing web-based ATO-G and ATO-T services and the interface with JDF MS using JS/J7 established Application Layer Interface (APIs).
- Unconventional Warfare Service to represent SOF at an aggregated level and execute the missions in an automated manner without Player intervention.
- Force Protection Service to simulate force perception at the aggregate level and generate automated SITREPS when various detections occur.
- Create a link to the real-world logistics tracking system called the Logistics Common Operational Picture (LOGCOP).
- Represent the Space domain in more detail to properly represent the interaction between the Space domain and ongoing conflict situations.

1.3.2 North Atlantic Treaty Organization (NATO)

The following areas have been identified by the NATO CCB as high-priority improvement projects for JTLS-GO:

- Provide the user with a geo-location filtering capability.
- NATO also wants to link JTLS-GO to a real-world logistics planning tool, called Logistics Functional Area Services (LOGFAS). The goal is to have JTLS-GO access LOGFAS and automatically generate simulated Convoys in a manner similar to the way JTLS-GO accesses the U.S. Theater Battle Management Core System (TBMCS) and NATO's Integrated Command and Control (ICC) system to generate Air Missions.
- NATO wants an Air Control Order to specifically modeled. Currently the ACO is translated into location information as part of the order translation process. The desire to represent the ACO within the model so Air Missions can be directed or redirected using named Air Control Measure Identifiers (ACMIDs)

1.4 USERS

Joint Theater Level Simulation Users include: US Joint Staff, US Combatant Commands, NATO (CI Agency, JWC, JFTC), the Naval Postgraduate School, U.S. Army Capabilities Integration Center (ARCIC), U.S. Army Redstone Arsenal, Joint Forces Staff College, Norfolk, VA, and the National

Defense University, Washington, DC. International Users include government defense agencies and contractors from:

- France - War College
- Greece - Hellenic National Defense General Staff (HNDGS)
- Italy - Italian Joint Staff, J-7 and NATO's M&S Center of Excellence
- Japan - Mitsubishi Electric Corporation (MELCO) for the Japanese MOD
- Kuwait - Joint Staff College
- Malaysia - Malaysian Armed Forces (MAF)
- Norway - Norwegian Joint Headquarters (NJHQ)
- Pakistan - National Defense University (NDU)
- Poland - National Simulation & War Game Centre (NS&WGC)
- Saudi Arabia - Royal Saudi Land Forces, Command and Staff College (RSLF CSC)
- Taiwan – Joint Exercise and Training Center (JETC)
- Thailand – Royal Thai Supreme Command (RTSC)
- Turkey – Turkish War Colleges, Wargame & Simulation Center (WGSC)
- Ukraine - National Defense University of Ukraine
- United Arab Emirates – Joint Command & Staff College (JCSC)

1.5 SECURITY

The JTLS-GO system, which includes a working scenario, is unclassified. The data used in the preparation and maintenance of a specific scenario database are also unclassified. If the User prepares a classified scenario, local security measures must be established and are their responsibility.

1.6 DOCUMENTATION

The JTLS-GO documentation suite is extensive as shown in Table 1.1. For each major and maintenance release of the Simulation, a complete update of documentation is provided. The table summarizes the content of each volume. The *JTLS-GO Design Plan* is published separately and describes the functional enhancements and database changes implemented for each Major or Maintenance version release.

Table 1.1 JTLS Documentation Suite

JTLS-GO Document Title	Content Description
Analyst Guide	Describes the design, logic, and internal algorithms of the JTLS-GO Combat Events Program (CEP), from the perspective of the simulation developer.
ATO Services Guide	Describes the design, logic, functions, and use of the Air Tasking Order (ATO) Services.

Table 1.1 JTLS Documentation Suite (Continued)

JTLS-GO Document Title	Content Description
C4I Interface Manual	Overview and operator manual that describes the functional capabilities of the external interface programs that feed C4I systems.
Configuration Management Plan	Describes the process that is used by R&A to maintain control over the configuration of the JTLS-GO software system.
Controller Guide	Describes the role of the Controller in monitoring the game and the use of Controller orders.
Data Requirements Manual	Describes data elements and structures required by the software and algorithms.
DDS Training Guide	Provides User instructions to operate the Database Development System (DDS).
DDS User Guide	Describes how to use the Database Development System (DDS) to build, modify, verify, or query databases.
Director Guide	Describes the Director's role of scheduling resources, locating and assembling data, training, and security.
ELS User Guide	Provides information and instructions for using the Entity Level Simulation (ELS), including initialization requirements, template building, configuring and executing the ELS.
Executive Overview	Provides an overview of the types of joint tasks that can be simulated. Highlights joint warfighting capabilities, including the software and hardware needed to execute the Simulation.
Federation User Guide	Describes JTLS-GO usage within federations such as JMRM, MUSE, and Joint Training Synthetic Environment (JTSE).
Installation Manual	Describes procedures for installing component programs and setting system parameters.
Player Guide	Describes the role of the Player and the use of Player orders to interact with the Simulation.
Repository Description	Describes general database characteristics and specific data, including resource Sides, Factions, Unit and Target data, unit prototypes, weapons, logistics, lethality data, and functional prototypes.
Software Maintenance Manual	Provides reference information pertaining to upgrades and maintenance of the JTLS-GO system.
Technical Coordinator Guide	Provides information needed for the Technical Coordinator while starting and maintaining the game and providing system expertise.
Version Description Document	Describes upgrades and code enhancements associated with each JTLS-GO release.

Table 1.1 JTLS Documentation Suite (Continued)

JTLS-GO DOCUMENT TITLE	CONTENT DESCRIPTION
WHIP Training Manual	Provides User instructions to operate the Web Hosted Interface Program (WHIP®) and its associated components: the Map Display, Filters, Order Panels, Message Browser, Information Management Tool (IMT), and Online Player Manual (OPM).

2.0 SIMULATED ENVIRONMENTS FOR JOINT TASKS

2.1 JOINT TASKS

JTLS-GO provides a simulated operating environment to assess joint tasks at strategic national (SN), strategic theater (ST), operational (OP), and tactical (TA) levels of war. This provides civil-military leaders the capability to plan, execute, and assess joint tasks *worldwide*––a feature promoting the examination of joint readiness, training, education, concept and capability development, and operation planning. Provided in sections 2.1.1 through 2.1.9 below are the universal joint task functional categories and samples of selected tasks that are capable of being replicated in the Simulation.

Additionally, JTLS-GO provides the physical and military conditions necessary to assess these tasks. For instance, global sunrise and sunset conditions, weather and weather disruption to aviation and munitions, major area flooding, crop damage, disease epidemics, refugees, earthquakes, landslides, avalanches, facility disasters, power grid failures, and fire damage maybe included in scenarios.

This chapter concludes with an overview of SIMSCRIPT methodology. The purpose of this is to acquaint Users and Players with the best way represent joint and coalition operations at the operational level of war.

2.1.1 Joint Tasks for Deployment and Redeployment

(SN) Conduct Deployment and Redeployment	**(ST) Deploy Forces**
• Coordinate global strategic refueling • Provide transportation assets • Coordinate terminal operations	• Conduct intra-theater deployment • Provide intra-theater refueling • Conduct maneuver • Integrate Direct Action • Conduct Unconventional Warfare • Conduct Strategic Counter-Mobility • Employ Obstacles • Secure air superiority • Establish maritime superiority
(OP) Conduct Operational Maneuver	**(TA) Deploy/Conduct Maneuver**
• Conduct operations in depth • Conduct offensive/defensive operations • Conduct raids • Conduct penetrations, direct assaults, and turning movements • Conduct blockades • Conduct maritime interception • Conduct forcible entry: Airborne, Amphibious, and Air Assault • Conduct raids • Employ system of obstacles • Establish air and naval superiority • Conduct patient evacuation	• Conduct tactical airlift • Conduct air assault • Conduct airborne operations • Conduct site exploitation • Conduct offensive mine operations

2.1.2 Joint Tasks for Intelligence

(SN) Provide Strategic Intelligence	(ST) Conduct Theater Intelligence
• Collect information on strategic situation • Provide Intelligence, Surveillance, and Reconnaissance • Provide current intelligence	• Perform joint intelligence operations functions • Conduct intelligence assessments • Manage target development • Manage intelligence collection
(OP) Conduct Joint Intelligence Operations	**(TA) Share Intelligence**
• Plan and direct intelligence operations • Produce intelligence • Disseminate and integrate operational intelligence • Gain and maintain situational understanding	• Disseminate tactical warning information • Develop candidate targets • Conduct functional damage assessment

2.1.3 Employment of Forces

(SN) Employ Forces	(ST) Employ Fires
• Synchronize Joint fire support • Process strategic targets • Generate and disperse strategic forces • Employ Joint fire support • Conduct global strike	• Attack targets • Attack theater strategic targets • Conduct nonlethal attack • Synchronize theater strategic firepower
(OP) Employ Fires	**(TA) Employ Firepower**
• Conduct targeting • Publish Air Tasking Order (ATO) • Attack (or engage) operational targets • Provide Close Air Support integration for surface forces • Conduct non-lethal attack • Attack aircraft and missiles • Suppress enemy air defense • Conduct air interdiction of operational forces	• Conduct Joint fires • Engage time sensitive targets • Conduct close air support (CAS) • Conduct Joint SEAD (JSEAD) • Conduct missile defense • Conduct air-to-air operations • Conduct offensive counterair (OCA) • Conduct defensive counterair (DCA) • Conduct air defense • Coordinate air tasking order (ATO) • Control tactical airspace • Employ space capabilities

2.1.4 Joint Tasks for Sustainment

(SN) Provide Sustainment	(ST) Sustain Theater Forces
• Provide supplies and services • Provide bulk petroleum • Provide distribution support • Provide base support	• Coordinate support for forces in theater • Coordinate patient movement • Reconstitute theater forces • Determine theater residual capabilities • Direct distribution operations

(OP) Provide Operational Sustainment	(TA) Perform Logistics and Combat Service Spt
• Coordinate logistic services • Manage logistic services • Provide movement services • Supply operational forces • Build sustainment bases • Expand capacity of PODs	• Provide sustainment • Conduct air refueling • Conduct Joint Logistics Over-the-Shore (JLOTS)

2.1.5 Joint Tasks for Command and Control

(SN) Provide Strategic Direction	(ST) Provide Command and Control
• Communicate strategic information • Monitor worldwide strategic situation • Coordinate multinational operations • Provide Common Operational Picture (COP)	• Communicate information • Monitor strategic situation • Assess theater strategic environment • Conduct strategic estimates • Synchronize subordinate forces • Direct electronic warfare
(OP) Provide Command and Control	**(TA) Exercise Command and Control**
• Communicate operational information • Process information • Monitor strategic situation • Assess operational situation • Command and control joint force headquarters • Conduct Electronic Warfare (EW) in the JOA	• Conduct force link-up • Employ electronic warfare (EW) • Employ MISO • Conduct Foreign Humanitarian Assistance • Conduct nation assistance • Conduct civil military operations (CMO)

2.1.6 Joint Tasks for Mobilization/Force Protection

(SN) Conduct Mobilization	(ST) Coordinate Protection
• Assemble forces • Provide movement control • Cross-level resources • Mobilize sustaining base • Expand logistic support • Expand transportation system	• Provide air defense (AD) • Organize air defense • Organize missile defense • Conduct ballistic missile defense (BMD) • Establish protection of LOCs • Conduct personnel recovery
(OP) Provide Operational Force Protection	**(TA) Protect the Force**
• Provide airspace control • Conduct defensive counterair (DCA) • Conduct missile defense • Conduct countermine activities • Conduct NEO operations • Coordinate personnel recovery • Provide counter-reconnaissance in JOA • Secure Air, Land, and Sea LOCs in JOA	• Provide EOD support • Mitigate IED effects • Conduct rear-area security • Conduct NEO • Proved for combat identification • Conduct defensive countermeasure operations

2.1.7 Joint Tasks for Force Development / Readiness / Counter-CBRN

(SN) Conduct Force Development	(ST) Establish Force Requirements
• Provide Joint context • Manage lessons learned • Conduct Joint experimentation	• Determine deployment requirements • Tailor forces • Conduct AAR
(OP) Execute Combating WMD	**(TA) Operate in CBRN Hazardous Areas**
• Conduct combating WMD (CWMD) threat reduction • Execute CWMD interdiction • Integrate CBRN passive defense • Conduct consequence management • Assess CBRN hazards	• Operate in a CBRN environment

2.1.8 Joint Tasks for Multinational / Inter-agency

(SN) Foster Multinational / IA Relations	(ST) Develop Partnerships
• Provide nation assistance • Conduct stability operations • Conduct humanitarian assistance (HA)	• Promote regional security • Coordinate multinational operations • Coordinate countermine activities • Coordinate Foreign Humanitarian Assistance • Restore order
(OP) Develop Religious Liaison	**(TA) Not Applicable**
• Provide advisory assistance • Provide population security • Provide territorial security • Protect infrastructure	

2.1.9 Joint Tasks for CBRN Deterrence

(SN) Combat WMD	(ST) Conduct Countering WMD
• Synchronize Counterproliferation (CP) • Synchronize WMD active defense / elimination • Conduct Nuclear / Radiological search • Assess the Global WMD situation	• Conduct threat reduction cooperation • Conduct WMD interdiction • Conduct WMD active defense • Conduct WMD offensive operations
(OP) Not Applicable	**(TA) Not Applicable**

2.2 EVENT-DRIVEN SIMULATIONS

Simulations can be characterized as continuous or discrete. JTLS-GO is a discrete simulation. Discrete-time simulations may be further characterized as time-stepped or event-driven. In event-driven simulations, state changes occur at specified times, during which interactions between system components occur.

Activities are the basic components of a dynamic system, which have two fundamental characteristics:

- The activity take time.
- The activity potentially change the state of the system.

While constructing a simulation, developers must identify and represent activities in a way that enable the simulation to reproduce time-dependent behavior. Activities must be simulated so that system state changes properly occur with each activity. This requirement imposes additional conditions for correctly simulating the characteristics of activities and for sequencing the execution of activities so that their order of performance within the system corresponds to the order in which the same activities occur in the real-world system.

An activity in a system is bound by two instantaneous events: when the activity starts and when it stops. The event is the simplest component of an activity description, and has two basic properties:

- It occurs at some instant of time.
- The occurrence is instantaneous.

The changes in a system that occur when an activity starts or stops are associated with events rather than activities. Since these events cause all significant system state changes, the passage of time between events need not be accurately followed. Instead, the passage of simulation time is driven by the sequence of events, always advancing to the time of the next significant event.

2.3 SIMSCRIPT

2.3.1 Why SIMSCRIPT?

An event-driven simulation was chosen for JTLS-GO for two reasons:

- The key processes of theater-level, air-sea-land battle are most easily visualized as collections of discrete events.
- Event-driven simulations are relatively fast which makes efficient use of computing resources.

The main routine-subroutine structure of most high-level programming languages is not suitable for event-driven simulations because of the awkward way they represent joint force actions and activities.

2.3.2 The SIMSCRIPT World View

The SIMSCRIPT world is populated with entities and sets. Entities are characterized by attributes, and sets are a collection of entities sharing logical associations. Thus, a military unit such as a division may be an entity. Possible attributes are its name (i.e. 82.AIRBORNE), average ground speed over open terrain, and capacity to carry supplies.

An entity may be both a member of sets and an owner of sets. Thus the entity 82.AIRBORNE might be a member of the CONFLICT SET—the set of all units in the game. This entity also might be the owner of a HEADQUARTERS SUBORDINATE SET—the set of all units subordinate to it (e.g. a division artillery battalion or an engineer battalion).

A special kind of entity is the event, the simplest component of an activity description. Events are managed by a Future Events Set that is provided by SIMSCRIPT. Each event is also associated with a subroutine, whose execution may be scheduled to occur at a specific simulation time. An example of an event in JTLS-GO is the UNIT HOURLY PROCESSING event. This event occurs at specified intervals and calls various subroutines that perform record keeping tasks over a given period of time. It is first scheduled by the routine starting the Simulation. Thereafter, it schedules itself. The Simulation must be started by scheduling one or more future events. Its continuation depends on the existence of at least one pending event in a Future Event Set.

In addition to entities and sets, SIMSCRIPT also uses arrays. The most basic form of array is a list. Another common form of array may be visualized as a table. In SIMSCRIPT, arrays may be linked to entities by means of a specialized attribute of the entity called a pointer. Thus the array (in this case a table) that holds the Rules of Engagement (ROE) for a particular Air Mission entity is linked to the mission by the ROE array pointer. Information is recovered about the status of a unit's ROE merely by retrieving the ROE pointer attribute of the mission and, using the pointer, retrieving the ROE array of the mission.

The data described in this document are used to create the entities, attributes, sets, events, and arrays used by the Combat Events Program (CEP) to simulate the represented combat situations. Refer to Chapter 4 for more detail concerning the CEP and other JTLS-GO component programs.

3.0 SIMULATED ENVIRONMENTS FOR JOINT OPERATIONS

3.1 JOINT OPERATIONS

JTLS-GO provides simulated environments for joint operations in context of air, space, land, maritime, special operations, intelligence, and logistic functions *worldwide*. This provides Exercise Directors much needed flexibility when investigating joint operations across the continuum of conflict in a wide variety of engagement, combat, security, and relief and reconstruction operations.[1]

3.2 FORCE CONTROL

3.2.1 Represented Entities

JTLS-Go represents all important combat entities at an aggregate level. These represented objects are described in Table 3.1.

Table 3.1 Represented Combat And Support Objects

Object	Description Of Capabilities
Unit	A unit is the main combat entity within JTLS-GO. A unit consists of a list of combat systems and a list of supplies owned by the unit. A unit can represent an airbase, squadron, ground combat unit, support unit, Forward Arm and Refuel Point (FARP), high resolution unit capable of operating covertly, or a naval ship. A unit cannot exist and function unless personnel exist within the unit combat system list.
Target	A target is a militarily significant object that is not represented as a unit. Examples of the types of targets are listed in Table 3.2. Targets do not need personnel to operate. The model simply assumes that if the target is functioning, the personnel to operate the target are available.
Combat System	Any number of Combat Systems may be represented in the database. Each system is described in terms of various characteristics, including maximum effective range, lethality, recoverability and repairability, and type of fuel and ammunition required. Combat Systems are also characterized as direct or indirect fire systems, with the appropriate differences in attrition calculations.
Supply Category	Any number of Supply Categories may be represented in the database. Each category is described in terms of various characteristics, such as the method used to transport the supplies. Supplies can be listed as either wet, dry, or self-propelled transport types.
Air Mission	An air mission is a group of aircraft that are told to conduct a specific mission.

1.Joint Publication (JP) 1, *Doctrine for the Armed Forces of the United States*, March 2013, pp I-16 thru I-17

Table 3.1 Represented Combat And Support Objects

Object	Description Of Capabilities
Targetable Weapon	A Targetable Weapon is an object fired from some weapon system asset that causes damage. A Targetable Weapon can be fired from an SSM Target, an Air Defense Target, an indirect Combat System, any HRU-owned Combat System, or an Air Mission. Each projectile has its own set of Targetable Weapon characteristics, including its time to fire, supply category, type of guidance, lethality index (area or point damage), and its effects type.
Joint Desired Point Of Impact (JDPI)	Joint Desired Points of Impact (JDPIs) are used as the standard in the USAF for identifying aim points. JTLS-GO allows the user to link JDPIs to independent targets or equipment owned by a unit. For example, a JDPI that strikes the center bridge span is linked to the JTLS-GO bridge target so the target can be neutralized after the JDPI is hit.

Table 3.2 Represented Target Types

Type Target	Description Of Capabilities
Air Defense	An air defense site has the ability to kill detected air missions. If damaged, they cannot fire upon detected air missions.
Bridge	A bridge can optionally be associated with a road or rail network arc. If not associated with a movement network, damaging the target will have no effect on object movement. If associated with a movement network, damage will remove the arc from the network, slowing or stopping movement over the network.
Tunnel	A tunnel is used in the same manner as bridge targets.
Sensor	A sensor target can detect objects, including units and targets.
Runway	A runway is needed to launch and recover fixed wing aircraft from land locations. If damaged, aircraft are not allowed to launch or recover.
Interdiction Point	An interdiction point can optionally be associated with a road or rail network node. If not associated with a movement network, damaging the target will have no effect on object movement. If associated with a movement network, damage will remove the node, disabling all network arcs leading into and out of the node and slowing or stopping movement over the network.
Supply Storage	A supply storage target holds and protects supplies. If damaged, all of the supplies in the target are lost.
Surface-to-Surface Missile	SSM launchers are used only for explicit fire missions. Land-based and sea-based units that own SSM targets can be given orders to fire missiles at either a location, unit, target, or JDPI. The Targetable Weapon fired by the SSM can represent either a cruise missile or a ballistic missile as specified by one of the Targetable Weapon characteristics. If the SSM is damaged, the owning unit is not allowed to fire missiles.

Table 3.2 Represented Target Types

Type Target	Description Of Capabilities
Facility	A facility target is a militarily significant object that has no impact on model operations. Facility targets normally represent infrastructure or leadership targets within the operations area.
Equipment Shelter	An equipment shelter target holds and protects combat systems. If damaged, the systems within the shelter are also randomly destroyed according to the lethality characteristics of the system.
Materiel Handling Equipment	Materiel Handling Equipment (MHE) targets are used to represent ports within JTLS-GO. The targets help load and offload assets that carry supplies or units. If damaged, it will take longer to load and off load assets such as ships, aircraft, trucks, and rail cars.
Minefield	A minefield target causes damage to any object moving across the represented minefield. If the minefield is cleared, it will no longer cause damaged to objects moving through the area.
Pumping Station	A pumping station target moves supplies through a pipeline. If damaged, object are not allowed to receive supplies from the represented pipeline.
Jammer	A jammer target interferes with the ability of sensors to detect objects or of units to communication with one another. If damaged, the jammer has no ability to interfere with these processes.
Communication Site	A communication site target is part of the representation of an Integrated Air Defense System (IADS). If damaged, it is possible that a sensor will not be allowed to pass detection information to an air defense target, thus making it more difficult for the air defense target to successfully lock on and fire on a detected air mission.

3.2.2 Command Authority

Players interact with the Simulation by sending orders to units over which they have either primary or shared authority. JTLS-GO provides the leadership of each Force Side with the ability to manage the allocation of command and control among the Players on that Side. At game start, one Player on each Side has primary authority over all units on that Side. Thereafter, ordering authority over units, primary or shared, can be granted or revoked for individual Players.

3.2.3 Force Side Relationships

Each Force Side in JTLS-GO has a relationship (Friendly, Neutral, Suspect, or Enemy) with the other Force Sides. At the start of a game, each Side has a relationship with each other Side that is defined in the database for each Side. Relationships can be changed either directly by Player order or indirectly as a result of an attack. Force Side relationships determine how units interact and react to units of other Sides. For example, a unit will kill a discovered convoy only if it perceives the convoy came from a unit on a Force Side with which the relationship is Enemy.

3.2.4 Rules of Engagement (ROE)

JTLS-GO is highly flexible regarding ROE assignments. This allows the representation of situations prior to hostilities, when units and aircraft are operating in close proximity but are not engaged in combat. It also allows game play to easily escalate to limited exchanges by some units without an all-out exchange. It accommodates a situation in which unknown air missions are to be engaged while others are to be intercepted without attack. It permits the situation in which Foreign objects are to be engaged only if they come within a specified distance of Friendly assets. ROE algorithms allow for automatic firing of naval SSMs and torpedoes. Finally, ROEs can be specific to designated Operations Areas (OPAREAs), and can be altitude zone specific within each OPAREA.

JTLS-GO represents Surface-to-Surface, Surface-to-Air, and Air-to-Air ROEs. Each unit has a specific ROE value for each opposing Side for each of these categories. The ROE settings include:

- No Fire: The unit is not allowed to initiate combat or return fire.
- Hold Fire: The unit may not initiate combat, but can defend itself.
- Combat Approved: The unit may initiate engagement with Enemy objects meeting specified criteria; e.g. detection and engagement distance for surface, air, and sea.

3.3 GROUND OPERATIONS

Close combat between and among aggregate ground units (battalion and brigade) is simulated by the use of mixed, heterogeneous, time-stepped Lanchestrian difference equations. Separate equations are used for casualties caused by direct fire Combat Systems and indirect fire systems. The amount of attrition is affected by environmental conditions, such as weather, night or day, and terrain. Engagements involving High Resolution Units (HRUs, see Section 3.3.12) are simulated using explicit representation of the units' capabilities to fire weapons and detailed assessments of the results.

The JTLS-GO ground module has the capabilities described in the following sections.

3.3.1 Ground Force Movement and Deployment

Ground movement in JTLS-GO follows a road network or a straight great circle path, with the unit moving from its current location to the next computed location. Data indicates the longest acceptable time increment for unit movement. Movement paths are specified by Players as Ground Routes. Movement delays are caused by underlying terrain, road speed limits, route congestion or Enemy action such as mining, nuclear or chemical contamination, artillery, and air strikes. Minefields delay moving units and cause attrition.

Ground units can move either administratively or tactically. An Attack, Delay or Withdraw directive results in a tactical move. Any other order that directs a unit to move to a location causes the unit to perform an administrative move. An administrative move can be directed for a single unit or a group of units and is typically faster than a tactical move.

3.3.2 Ground Unit Attack Operations

Only ground combat units perform attack missions. Usually, an attack directive is part of a larger plan, which might consist of several units attacking, other units reinforcing them by fire, and other units following in reserve, or for exploitation.

An attack directive may specify a route to follow, an enemy unit to attack, or both. If both are specified, the unit adds the location of the enemy unit to the end of the attack route, as that location is known at the time of execution of the directive. Whether an enemy unit is specified or not, once the attacking unit reaches its destination, it will remain in the attack posture until the maximum distances of the attacking unit's weapons systems are reached. Once the area is clear of enemy units, the attacking unit reverts to a defend posture.

As an option, the Player may specify that the attacking unit is to perform a move to contact. The unit is permitted to do so, provided it is not already in combat. When a unit uses the move to contact logic, it assumes the attack posture and moves along the attack route, but does not incur the full movement speed penalty for being in the attack posture. Instead, it moves at a speed that is the average (arithmetic mean) of the attack speed and the administrative move speed.

3.3.3 Artillery Operations

Indirect Combat Systems in JTLS-GO can be used in four distinct ways to represent artillery operations:

- Lanchestrian combat: Enemy units are in proximity, and fighting. All of the available Combat Systems are applied to the process of causing Enemy casualties.
- Direct Support: One or more Ground Combat or Naval units have been directed to provide direct support fire for another unit.
- Explicit Fire: Fire missions may be directed against specific latitude/longitude or military grid locations; against a list of Enemy, Neutral, or Friendly targets; a list of JDPIs; or against a list of detected Foreign units.
- Counter-Battery Fire: Automatic engagement of enemy artillery units firing on own forces.

3.3.4 Surface-to-Surface Missile (SSM) Operations

Missiles are fired in two ways.

1. Fire Missile Order. Units that own SSM Targets may be directed to fire a missile at specified locations, targets, Foreign units (naval or ground), or along a range and bearing.

   Like all targets, SSM targets have one of three mobility classes: Stationary, Deployed While Moving, and Mobile. SSMs that are Stationary or Deployed While Moving (aboard ships, for example) are assumed to be in a state of advanced readiness for firing. Mobile missiles may be in a state of Prepared to Fire, Preparing to Fire, or Unprepared. SSM launchers that are Unprepared are more difficult to detect. The initialization of preparations to fire increases the detectability of the SSM launcher and may trigger a detection of the activity by surveillance assets covering the area. The increase in SSM readiness is initiated only in response to a Player's order to fire or to prepare to fire.

2. Automatic Engagement. The model may automatically fire SSMs through automatic engagement between naval units. If the naval unit has a Ground/Surface ROE that permits it to engage ships of other Sides, its owned SSM targets may be used to conduct such engagements. If a Foreign unit is subject to SSM engagement under the ROE, the unit will engage as soon as the Foreign vessel is detected and is within range.

Unlike artillery rounds and air-to-air weapons, SSMs can be shot down before they impact. Depending on the data, they may be engaged during:

- the terminal phase of flight within the impact area;
- the terminal and mid-course phase; or
- not engaged.

Engagement depends on the presence of capable air defense systems. During the mid-course phase, Air Defense Artillery (ADA) systems require permissive ROE to fire. In the terminal phase, any ROE except "No Fire" permits engagement.

3.3.5 Targetable Weapon Effects

All targetable weapons in JTLS-GO cause either area or point damage. Area weapons, both precision-guided and non-precision guided, cause damage to one or more objects in the impact area, and may result in fratricide. Non-precision point weapons hit the targeted object if there is one in the covered area; otherwise, an object in the covered area is randomly selected. Precision point weapons hit the targeted object if it is in the covered area; otherwise, an object in the covered area is selected using an algorithmic "best" pK (probability of kill).

A point damage weapon can cause damage to one object in the affected area. The definition of an "object" depends on the entity being damaged. For a unit, an object may be a packet of combat systems or supplies, whose size is specified in the database. For a supply run, it is one truck, barge or rail car. For an air mission on the ground, it is one aircraft. For surface-to-air missile (SAM), anti-aircraft artillery (AAA), surface-to-surface missile (SSM), equipment shelter, and material handling equipment (MHE) targets, it is one component of the target (one launcher, a single shelter, or a single item of MHE).

There are four types of targetable weapons effects: conventional, chemical, nuclear, and mines. Conventional munitions, including high explosive (HE) and improved conventional munitions (ICM-bomblet type), cause conventional effects based on weapon type, target type, lethality data and algorithms that are described in detail in the *JTLS-GO Analyst Guide*. Chemical and nuclear munitions both cause immediate personnel casualties and also contaminate the area for specified periods of time. Mine munitions either create or add to minefields.

Targetable weapons also can be designated as leaflet rounds by being issued from the LEAFLET supply category. These rounds disperse leaflets in the vicinity of the impact point and may reduce unit effectiveness in the area.

3.3.6 Attaching and Detaching Units

Players may direct the attachment of one unit to another, and the detachment of one unit from another. This feature does not apply to Naval units. The attachment and detachment logic is used for unit arrivals through ports, airlift and airdrop of units, and amphibious operations, including both opposed and unopposed pickups and landings.

Attachment tasks have some restrictions. For instance, the two units to be attached must be on the same Force Side, in the same Faction, be of the same type (e.g., support units), and have the same type of aircraft if they are squadrons. The primary uses of the attachment capability are to rejoin two units that were earlier separated, to provide a reconstitution opportunity, using two units, or to permit task force tailoring.

3.3.7 Mining and Minefield Clearing

Minefields are represented as target entities in JTLS-GO. They are displayed in Player graphics if they exist, i.e., the mines have not been cleared. They are also displayed in the IMT if they have been detected. There can be many types of minefields in the Simulation. One distinguishing characteristic of minefield types is whether the emplacing Force Side retains knowledge of the "paths" through the minefield. For artillery emplaced scatterable mines, a Force Side would probably not know how to safely transit the minefield.

Players can direct ground units, naval ships, or formations to lay or clear minefields, provided the units have that capability. The time expended depends upon the capabilities of the unit and the size and number of the minefields. For mine laying, the Player specifies the number of mines and type to emplace. Each mine requires that the emplacing unit have the required amount of the appropriate category of supply. For example, a unit that does not have sufficient mine supplies will lay all that it has available. The effects of minefields are specified in terms of the number of "standard minefields" encountered. The number of mines in a standard minefield is a data item that may be different for each minefield type.

3.3.8 Missions and Postures

A unit's posture is displayed on graphics and the IMT, and included in some reports to Players. The unit mission is the last thing that the unit was directed to do and is displayed on the IMT. Units change posture either in response to Player directives, because they have completed a task, because they cannot continue a task for some reason, or because they have been attrited until they are too weak to maintain their current posture. Units enter the Simulation in a DEFEND posture, and revert to a DEFEND posture upon completion of an attack or an administrative move. Generally, a unit never increases its posture unless ordered to do so. The decreasing order of postures is ATTACK, DEFEND, DELAY, WITHDRAW, INCAPABLE, WIPED OUT. MOVING and AIR OPS are the same level as DEFEND. A unit that is forced to a WIPED OUT posture is removed from the game.

3.3.9 Air Defense

Most surface-based air defense functions are automated including the communication between sensors, communication centers and air defense sites on an Integrated Air Defense System (IADS) network, since there usually is not enough time for the Player to respond to rapidly changing situations and contingencies. The Player has three principal areas of responsibility for surface-based air defense:

- ROE: Air defense assets need permission to engage enemy objects. Each SAM/AAA target entity is either owned by or associated with a unit. The target obtains its Force Side affiliation and its ROE from the unit.
- Radar: Each ADA site consists of a single target entity that represents one or more ADA assets. The number of assets is specified by the TG NUMBER of the entity. Each asset consists of a sensor, and a number of firing elements. The sensor is considered a fire control sensor, and provides radar tracking for its own asset only. The assets and the entire site are dependent on other sensors for early warning and acquisition. This process is discussed in Section 3.3.11.
- Resupply: When each SAM or AAA target first enters the Simulation, it is provided a full load of missiles or ammunition. As those assets are fired, they must be replaced if the SAM or AAA sites are to remain effective. The ammunition is replenished from the target's associated unit, provided that unit is within a database-specified distance of the site.

Air Defense sites are capable of engaging enemy aircraft, and may be capable of engaging enemy missiles. Engagement ranges and probability of kill (pK) of SAM/AAA sites are dependent on mission altitude and other variables.

3.3.10 Sensors and Jammers

Any unit can own one or more sensor or emitter targets. Three types of sensors are simulated in JTLS-GO: air search, surface search and sonar. Air search sensors detect aircraft and missiles. Surface search radars detect surface ships. Sonars detect submarines and naval surface units. Three emitter types are simulated: communications jammers, radar jammers, and broadcast emitters.

Players can turn on or off the sensors and emitters that a unit owns. They can specify that the emitters be left on until turned off by another directive, or can direct that they be turned on for a specified period of time. Each sensor or emitter target has a target subcategory that specifies the emitter type it represents. Each sensor type has an attribute that specifies whether it is subject to interference from jamming. All ship-owned emitting jammers and jammable sensors are subject to counter-detection by Foreign Sides.

Radar or communications jamming can also originate from Electronic Combat (EC) air missions. The type of jamming for EC missions is determined by the jammers included in the JAMMER LOAD for the type of aircraft flying that mission.

Radar jammers interfere with the capability of enemy air search sensors to detect objects. The algorithm is based on a comparison of jammer power at the sensor source to the sensor's return signal power measured at the location of the object being detected. Communications jammers affect the transmission and receipt of messages in a similar manner, by increasing the amount of time it takes a unit to receive a directive or send a message to a Player. The *JTLS-GO Analyst Guide* provides a detailed discussion of the algorithms for both types of jammers.

Broadcast emitters permit Players to perform broadcast Military Information Support Operations (MISO) directed at specific Factions on other Force Sides. The results of the broadcast are felt by all units in the covered area, but most strongly by units of the targeted Faction. The effect in the Simulation is a reduction in unit effectiveness, resulting in a decreased capability to fight and longer times to perform other actions.

3.3.11 Integrated Air Defense System (IADS) Networks

IADS networks are explicitly represented in JTLS-GO, and are subject to attack and disruption by Ground, Air, and Naval forces. An IADS network consists of ADA Sites, Fire Control sensors, a communications center, and multiple data links.

The link between each IAD component is defined in the database. Communications sites may be linked to other communications sites, to sensors, and to ADA sites. Fire Control sensors may be linked to communications sites and ADA sites. ADA sites can receive data from sensors and communications sites. The data flow is from sensor to communications site to the ADA site. ADA sites only receive data and sensors only send data. Communications sites can receive and send data.

If the ADA site is on an IADS network and has a Fire Control sensor, it is fully functional with its engagement and kill capabilities. If the Fire Control sensor is damaged, the site can still engage given it remains connected to the IADS network. If the site is not connected to an IADS network,

its probability of detecting and engaging aircraft will be reduced. If the ADA site is not connected to an IADS network, and the Fire Control sensor is non-operational, the asset's ability to successfully engage will be greatly degraded. In order for IADS networks to engage properly, sensors on the network must be tracking Enemy air missions.

3.3.12 High Resolution Units (HRU)

Two ground unit levels of resolution are represented in JTLS-GO. Large units such as brigades and divisions are represented at a high level of aggregation, and are called Aggregate Resolution Units (ARUs). These units have been represented in the Simulation since its first release in the early 1980's. Subsequent releases introduced a new unit type, the High Resolution Unit (HRU). This unit type represents very small units, such as SOF teams, small Civil Affairs units, Medical Assistance teams, Traffic Control points, and NGOs.

The HRU structure is based on a set of High Resolution Prototypes (HUPs), which describe the Combat Systems, supplies and target entities the HRU is issued when the unit is created. The HRU can be created as a result of database entries, arriving when its parent unit arrives, or as a result of Player action, being detached from a Parent unit that has the requisite Combat Systems and supplies to outfit the HRU. HRUs can perform the following missions, provided the required capability is indicated on their HUP.

HRUs can move across land using their own resources, or can be moved using air and naval resources. The extraction of downed aircrew HRUs can be played explicitly. HRUs have the capability to operate covertly, and must do so to execute an ambush. For all other combat operations, a Covert status is optional.

All HRU attrition is represented using the explicit expenditure of weapons logic. Data parameters specify the type of munition used by each combat system during high resolution combat. HRUs can attrite and be attrited by other HRUs, and main force units (ARUs). HRUs can also attack and damage targets. HRUs are subject to the full effects of air, artillery and missile fire, but are explicitly excluded from the casualties caused by minefields. They are not permitted to clear minefields.

JTLS-GO includes a limited representation of civil affairs (CA) operations. When a CA HRU is stationed in a location, it provides two benefits to its Force Side. First, any stationary civilian units that are from a Friendly or Neutral Side do not contribute to the congestion penalty assessed against units and convoys moving in the same location. Second, when the unit performs a Tactical Intelligence update for its Side, any of its HRUs that are performing CA can acquire information about any unit or target within intelligence range of any Friendly, Neutral, Suspect, or Foreign unit in the same location as the HRU.[1] This can significantly enhance the intelligence-gathering capability of the unit's Force Side.

3.3.13 Military Information Support Operations (MISO)

JTLS-GO simulates MISO as leaflet delivery and broadcasts. Leaflets can be delivered to targeted units by artillery fire, SSM, air attack, or air drop. The leaflets are delivered to the targeted unit first, and then to other units in the area. Leaflets are fully effective against units that belong to the same Faction as the targeted unit, one half as effective against other units on the same Side, and have no effect on units on other Sides. Units on other Force Sides do pick up leaflets, but the

1.The term "location" relates to tactical distances.

effects are inconsequential. The overall effect of leaflets is to reduce the unit effectiveness. The amount of the reduction depends on the number of leaflets delivered to the unit.

Broadcasts can originate from a broadcast emitter owned by a unit, or from an EC mission that includes a broadcast emitter in its mission load. In either case, a targeted Faction must be specified. The amount of effect from broadcast PSYOP depends on the power and duration of the broadcast. The effect of broadcast PSYOP is to reduce unit effectiveness.

3.4 LOGISTICS OPERATIONS

JTLS-GO provides Logistics Players significant and vital capabilities to augment the automatic requisitioning/delivery process. Logistics Players must interact with the Simulation by monitoring the IMT, requesting reports, interpreting advisory messages, scheduling resupply airlifts, sending supplies to units in trouble or lacking supporting units, changing stockage objectives and reorder levels, assigning new support units, or directing mandatory transfers of supplies. The commander's concept of the operation must consider a variety of combat support and combat service support activities.

Table 3.3 summarizes the logistics functions represented within JTLS-GO:

Table 3.3 Represented JTLS-GO Logistics Functions

Logistics Function
Intra-theater movement of supplies between units by air, truck, barge, or rail
Mandatory transfer of supplies from one unit to another
Creation of logistics loads for use in future orders
Operation of pipelines, including drawing supplies from the pipeline and replenishing supplies
Modification of stockage objectives and/or reorder thresholds of one or more supply categories for either a single unit, a group of units, or all units
Airlift operations (through the air module). An aircraft squadron or helicopter company is capable of lifting either a unit or supply load from a loading location to an offloading location.
Sealift operations (through the naval module). A naval unit or formation is capable of sealifting either units (Amphibious Operations) or a supply load from a loading location to an offloading location.
Evacuation of remains (KIA). A fraction of killed personnel are recovered by their unit. These KIA are retained by the unit until they can be evacuated. Evacuation occurs by the same methods as casualties. Casualties have priority on backhaul convoys.
Use of trucks from one unit to pick up supplies from one or more other units, and deliver them to other units or locations
Automatic or Player-directed resupply of units
Creation of supply caches for future use
Capture of Enemy supplies and recovery of own supplies
Change of the depot from which a unit orders its supplies or from which a pipeline is replenished

Table 3.3 Represented JTLS-GO Logistics Functions

Logistics Function
Airdrop operations (through the air module). An aircraft squadron or helicopter company is capable of airdropping a unit or supply load at a specified primary location or alternate location.
Evacuation of casualties whose expected recovery time is longer than a Faction-specific maximum time.
Casualties are evacuated by convoys that deliver supplies to the unit, and are evacuated to the unit's support unit. Players also can cause evacuation of casualties using an Airlift or Sealift order, in addition to the Directed Resupply and Automatic Push. Evacuation to medical units requires Player intervention.

3.4.1 Supplies and Supply Categories

Database developers and exercise planners have total control over how a Force Side support hierarchy is designed, and over units' initial quantities, usage rates, and other supply status data. On the one hand, units may be given unlimited supplies. This permits assessment of operations in an environment that is totally unconstrained by availability of supplies.

At the other extreme, high-resolution micro-management of the logistics situation is permitted by the very specific Directed Resupply, Airlift, Airdrop, Sealift, Reorder Level, and Stockage Objective directives. Between these two extreme conditions, simulating normal constrained availability, automatic requisitioning, and automatic (Player-initiated) Push shipments provides a medium-level management-by-exception capability.

An unlimited number of different supply categories can be represented. Categories of supply need not correspond to the standard military classes of supply. *For example, a very small unclassified JTLS-GO database included these categories:*

- Personnel
- Ground Fuel
- General Ammunition
- Mines
- Aviation Fuel
- Major End Items
- Artillery Ammunition
- Engineer Supplies

Database variables determine the normal periodic consumption rate for each category of supply by unit. In addition to this "normal" consumption, units that are in combat (or moving) will consume supplies at higher rates. For example, supplies are expended in JTLS-GO when ground or naval units conduct indirect fire missions, convoys are destroyed, depots attacked, air movement occurs (i.e. airlift and airdrop), and when air units engage other units or targets.

The logistics capability includes maintenance functions simulating initial fail rates, repair of systems damaged in combat, and return to operational status. Each combat system has several attributes in the database: one of these specifies a percentage of casualties that can be recovered from combat, and another specifies a percentage of those that will eventually return to their combat unit. This method is used to represent recovery and repair times of various combat systems.

Explicit supply categories may be specified for casualties and remains, i.e. wounded in action (WIA) and killed in action (KIA). If no such categories are specified, the evacuation of casualties is

not represented, nor is recovery and evacuation of remains. A database may have either, neither, or both.

3.4.2 Support Unit Operations

As part of the data that describe a unit, a general support unit and separate support units for each category of supply can be specified, as well as a time between supply adjustments. Each time a unit performs a supply adjustment, it computes the amount of each class of supply it has used, whether it owes supplies to any other unit, and whether it should requisition supplies. If it needs to requisition supplies, it requisitions them from the unit specified to provide that category. If “none” is specified, the requisition is sent to the general support unit.

When a supporting unit receives a requisition, it ships what it can, and places the rest on backorder. As more supplies or more transportation assets become available, the supporting unit looks at each backorder, and fills them in priority order. The priority is: Directed Resupply, Automatic Push, Combat, and Normal. Directed Resupply and Automatic Push result from Player directives. A combat backorder is one from a unit that is in combat or from a unit supporting a unit in combat.

3.4.3 Directed Resupply and Convoys

A Player can direct a support unit, airbase, or Forward Arming and Refueling Point (FARP) to send a *one-time* shipment of supplies to another unit. This creates a Directed Resupply requirement at the shipping unit. The shipping unit will either ship the supplies by convoy or backorder them. A Directed Resupply can be used to build up stocks prior to an operation, or to temporarily solve a supply shortage problem.

Supply convoys can consist of Trucks, Railcars, or Barges. For truck convoys, the truck assets from one unit can be dispatched to another unit, or units, to pick up supplies, for delivery to other units in the scenario. The convoys attempt to fulfill the requirement, but a 'Fill or Kill' philosophy is followed. If the required supplies are not available at a pickup point, the convoy continues on its route, delivering what it can. Upon completion of the route, the convoy returns to the unit that owns the trucks, for further tasking.

3.4.4 Automatic Push

A Player can direct a support unit, airbase, or FARP to send a periodic shipment of supplies to another unit. This creates an Automatic Push requirement at the shipping unit. An Automatic Push requirement is the second highest priority requirement. The shipping unit will either ship the supplies or backorder them. The period may be any length of time. The Automatic Push order was designed to be used by units without a supporting unit from which to requisition. It has also proved useful for establishing throughput shipments for units attacking or supporting attacks, to keep them supplied with fuel and ammunition.

3.4.5 Pipeline Operations

A pipeline consists of a source node, one or more pipelines arcs, and one or more other nodes. Units in the Simulation interact with Supply Storage Area targets associated with the pipeline. When a unit goes through the Adjust Supplies process, it accesses available supplies from Supply Storage Area targets in the area before it requisitions supplies. When it tries to fill a requisition, it takes supplies first from local supply storage area targets. These include pipeline associated targets. The Supply Storage Area targets have a limited amount of supplies available.

When a unit takes supplies from a pipeline target, it creates a requirement that the target be refilled. The supplies are replenished by the unit that is designated to operate the pipeline.

3.4.6 Mandatory Transfer

While only support units, airbases, and FARPs can originate Directed Resupply and Automatic Push actions, any unit can originate a Mandatory Transfer. There are several differences between a Mandatory Transfer and other supply actions. The most significant is that in all supply actions except a Mandatory Transfer, the shipping unit retains a portion of its basic load, and prevents any of its issued Combat Systems from being shipped. For a Mandatory Transfer, nothing is held back. The requirement is fulfilled to the maximum extent of the shipping unit's ability.

3.5 AIR OPERATIONS

JTLS-GO Air operations are achieved using either the automatic ATO-G (Section 4.3.1) by entering all the directives manually, by importing translated real world ATO data created externally, or by a combination of these methods. An ATO can be created for the Players to plan and schedule missions well in advance of their desired launch and alert times. The ATO-G permits building mission "Packages" comprising various types of aircraft and also allows Players to create individual single-aircraft missions. These types of missions can be tasked:

- Defensive Counter Air (DCA)
- Escort
- Electronic Combat (EC)
- Suppression Enemy Air Defense (SEAD)
- Air Transport of Supplies
- Transfer of aircraft to another unit
- Airborne Warning and Control System (AWACS)
- Air Refueling
- Offensive Air Support
- Close Air Support
- Reconnaissance and Armed Reconnaissance
- Airlift of Units
- Insert/extract of an HRU
- Area Patrol Missions (Anti-Submarine Warfare (ASW) surveillance)

Air Tasking Order Translator (ATO-T) software is designed to read data files containing an ATO developed by the U.S. TBMCS, NATO's ICC, or NATO's NEC CCIS. The ATO-T translates the ATO to a set of Air Mission orders for use within a JTLS-GO scenario.

3.5.1 General Functions

Simulating Air functions includes aircraft and the weapons they use. Aircraft are given task orders that describe details such as: the routes to fly, rendezvous or orbit points, the type of mission to perform, number of aircraft, targets to strike, and arrival time. For example, aircraft that are directed to perform combat air patrol missions are assigned an orbit location (or a specific mission patrol area) and will remain there until they are directed to a new orbit location or they must depart due to a fuel or weapon shortage. Airlift and airdrop missions are checked within the Simulation to determine the available aircraft capacity. The Simulation logic for air functions will then schedule the appropriate number of sorties to satisfy mission requirements.

Standard mission loads are configured within the database for each aircraft type. When a JTLS-GO Air Mission is flown, the Simulation selects the load based on database entry priority, mission

type, environmental conditions and ordnance stocks, and then flies the mission. Damage is assessed based on the weapons effects entered in the database for that aircraft and the weapons in the load (either area effects or a specific probability of kill may be specified). Air-to-Air ROE are specifically represented at the squadron and individual mission levels. The Player can override the automatic weapon load directing a new loadout in the order. The task will use the new load provided the items in the load are available at the launch base.

As missions are flown, weapons and fuel are deducted from available stocks. Returning flights return unexpended weapons and fuel to inventory. When the weapons specified in the primary weapon load are not available, a mission will fly with its secondary or tertiary load alternative, if one has been specified in the database.

Returning aircraft may, depending upon the type of aircraft and the amount of recent flying by the squadron, enter maintenance upon landing. These become unavailable for re-tasking until maintenance is complete. Damaged aircraft always enter maintenance, and stay in maintenance longer than those entering for periodic routine maintenance. Player-directed sorties for which aircraft are unavailable will be delayed until aircraft become available or the maximum launch delay time has expired.

When the mission completes, a USMTF Mission Report (MISREP) is generated and can be automatically sent to real-world air tracking systems such as the U.S. Theater Battle Management Core System (TBMCS), and the North Atlantic Treaty Organization (NATO) Integrated Command and Control (ICC) system

3.5.2 Offensive Air Operations

Offensive Air Support (OAS) missions represent the full range of offensive mission profiles, including Suppression of Enemy Air Defense (SEAD), air-ground attack, armed reconnaissance, and patrol.

- The SEAD mission is specifically tasked to suppress enemy air defenses.
- The air-ground attack mission profile is best suited for attacking things that are fixed, whether they are represented as JTLS-GO Targets or as a Joint Desired Point of Impact (JDPIs) within JTLS-GO.
- The armed reconnaissance mission profile is best used to look for and attack moving objects, such as convoys, and moving units, including naval units.
- The patrol mission is used to locate foreign submarines and surface ships, and if armed, will attack them, ROE permitting.

The mission can be placed on alert at any suitable location; told to orbit and wait for specific instructions; or be assigned to a specific target or against multiple targets at a user specified point in time. Under JTLS-GO, the air mission can accomplish multiple tasks. The air tasks are sequenced. For example, you might task a mission to fly to an orbit, proceed to a second orbit and then go sit alert somewhere.

Offensive Air Support missions collect information only in the area associated with their assigned target.

3.5.3 Defensive and Alert Air Operations

Defensive Counter-Air (DCA) missions, orbiting or strip alert, are available to defend a Side's airspace against Enemy air missions. The Enemy missions must be detected and must come within the defensive missions' protection radii. Finally, the defensive missions must have a ROE that permits them to engage after interception.

A DCA mission takes off, flies to its orbit location, turns on its sensors, and waits to be committed. The Player specifies a protection radius in the directive, and also specifies whether the mission is eligible for automatic assignment by the Simulation, or can be committed only by a Player's manual pairing action.

When the mission is committed by the Simulation, it is never committed to intercept a mission that is farther from the DCA orbit point than the protection radius, and the DCA mission will not go outside that radius, even in hot pursuit. However, it may shoot outside that radius if it has long-range weapons and the appropriate ROE.

If a Player attempts to commit the DCA to intercept a mission outside its protection radius, the DCA will commit and fly toward the intercept point. If it reaches the limit of its protection radius, it will break off the intercept and return to its orbit point.

The Alert DCA mission is a strip alert mission. When it begins operations, it loads the specified weapon load for Air-to-Air. If a Forward Operating Location (FOL) is specified, the mission takes off, flies to the FOL, refuels and rearms, and goes on ground alert. Until it finishes refueling and rearming it is not available for intercepts. If no FOL is specified, the mission goes on alert at home. Once on alert, the Alert DCA mission waits to be committed to intercept or moved to orbital alert.

Identification, Friend or Foe (IFF) is represented in JTLS-GO, and may result in initial misidentification of air missions. DCA missions engage based on both the perceived Side of the detected mission and their ROE for that Side. A mission may be engaged and killed before it is correctly identified if it enters the detection capability of a DCA mission with long range weapons and is already within ROE range.

3.5.4 Support Missions

Support missions include AWACS, RECCE, AIREF, EC, and ESCORT missions. These provide functions that assist other JTLS-GO Air missions or Players to perform their functions.

An AWACS carries a sensor load that allows it to detect, track, and identify other missions. Its load may include a surface search sensor giving it the ability to detect and report Naval units.

The AIREF mission is an independent orbiting or strip alert mission. Once the tanker reaches the orbit area, it is designated as available to give fuel. The Simulation handles the entire refueling procedure automatically. The Player can specify that an AIREF mission be permitted to give fuel to missions belonging to another Friendly Force Side. In addition, the Player may reserve fuel on the AIREF mission for specific missions, by specifying a list of missions for which fuel is reserved and the amount reserved for each mission. This list is specified within the AIREF directive.

The RECCE mission provides two important functions. It updates the Side's knowledge of the battlefield. Also, as a support mission in an air mission package, the RECCE task provides

detailed battle damage information when the package returns. An orbiting RECCE mission orbits at a specified location for a directed time collecting intelligence for its Side.

The EC (Electronic Combat) mission is an independent mission like the AIREF mission. EC missions can carry radar jammers, communications jammers, broadcast emitters, or any combination of the three.

The Escort mission exists only to support Air Mission Packages. Its task is to protect the Package from Enemy air missions. Like all other support missions, it meets the rest of the Package at the time release point. Escort missions only engage Air Missions that are attempting to engage the Package they are protecting. Escort missions are automatically provided information concerning intercepting aircraft. They are allowed to fire as soon as the escorted Package is within ROE firing range and weapons range of the intercepting missions.

3.5.5 Mining Missions

JTLS-GO Air Missions can lay and clear mines if the aircraft are capable. Separate capabilities are specified in the database for laying and clearing mines on land and at sea.

3.5.6 Airlift, Airdrop, Air Transport, and Insert/Extract

JTLS-GO provides air transport for units, HRUs, and supply loads. A Player can move a Friendly or Neutral unit or HRU, and specify any friendly unit to receive the supplies. When supplies are moved, they are drawn from units (first priority) or supply dumps in the vicinity of the pickup point.

For both unit airlifts and airdrops, multiple missions may be used, coming not only from different squadrons, but from squadrons with different types of aircraft. For airdrop, fixed-wing aircraft require a runway at only the pickup location. Helicopters do not require a runway at either the pickup or drop locations.

The Air Transport mission is designed to move supplies. The mission permits a Player to commit aircraft to go to a series of locations picking up, dropping off, and/or inserting (parachuting) supplies. Supply pickup requires landing. In addition to a location and a list of supplies, a unit may be specified. If specified, the unit is the intended source or receiver of the supplies. If no receiving unit is specified, the standard airlift/drop delivery logic is followed. If no unit is specified at a pickup point, the mission attempts to find the supplies at local own Side units and targets.

The Insert/Extract mission is an analog to the Air Transport mission, except that the objects being transported are HRUs. As with the Air Transport mission, a series of points are defined. These may be pickup points (landing required), dropoff points (landing and offload), extraction points (retrieve an HRU without landing), insertion points (deliver an HRU without landing), or simply transit points.

3.5.7 Air Mission Packages

A JTLS-GO Air Mission Package is a group of several main and supporting Air Missions, usually from different squadrons and possibly from different coalition sides designed to carry out a coordinated attack on targets within a region. It permits a group of Air-Ground Attack missions to transit the FLOT or another high-intensity environment, and then disperse to attack multiple, geographically separated targets. In addition to the Air-Ground Attack missions, the Package may include Suppression of Enemy Air Defense (SEAD), Escort, or PostStrike RECCE missions. The

Package meets at a common rendezvous Time Release point. The Package leaves the Time Release point at the release time, unless additional assets are engaged to join the Package. In that case, the Package waits. If assets continue to be delayed, the Package may wait until just before a further wait would make them miss their Time Over Target (TOT) by more than the maximum launch delay for the Air-Ground Attack mission. At that point, unless the Package is short of SEAD or Escort missions, it will commit. If it is short of SEAD aircraft or escort air craft, it will abort.

The user can place a package on alert, on orbit or assign to attack a target/s. If the aircraft have not taken off, the package can be altered to assume alert or launch to an airborne on call status. If the missions have taken off but not reached the rendezvous point, the package can move from attack options to airborne on call. **The user also has the ability to create non-strike packages like Search and Rescue (SAR) or VIP with escort packages.**

Missions from any Friendly Side can be assigned to the package. Players can, after appropriate coordination, create three-Sided or four-Sided Packages.

3.5.8 Current Operations

JTLS-GO provides dynamic control of aircraft in any phase-of-flight to include aircraft heading home or to fuel, designating new orbits, new off station times, new alert bases, new ingress/ egress routes, etc. Using the Magic Air Operations, the user can replenish or expend fuel and/or munitions for missions in-flight and speed up aircraft above maximum speeds. The user can cancel tasks, change tasks or add new tasks. **The mission tasks can be displayed on the IMT and the routes can be displayed on the WHIP.** The user also has the ability to request an interim mission report (Interim MISREP) at anytime the mission is active.

3.5.9 Moving Squadrons and Aircraft

Fixed wing squadrons cannot be airlifted from one airbase to another, nor can they perform ground moves. They can, however, airlift themselves. Rotary wing squadrons can perform ground moves, but it is generally more efficient and safer for them to be airlifted or to conduct self-lift.

There are several ways to move aircraft from one squadron to another. In all cases, both squadrons must have the same type of aircraft, as JTLS-GO does not permit composite squadrons.

The Transfer mission is the primary and simplest means to move aircraft. The Transfer mission permits the Player to specify that a squadron must transfer several aircraft to a location. Only the number of aircraft, new location, and the desired time need be specified. The aircraft are transferred to that location, provided a suitable landing area is found. If an own-Side squadron with the same type aircraft is present, the aircraft are added to that squadron. Otherwise, an independent squadron (a Detachment) is created, and assumes ownership of the aircraft. This permits contingency stationing, such as for a Noncombatant Evacuation Operation (NEO), or other possible but uncertain, future operation.

Another way is to specify the unit that is to receive the aircraft as the return squadron on any air mission. The aircraft fly a normal mission, but they return to the new squadron and become part of its complement of aircraft.

3.6 MARITIME OPERATIONS

Naval units can perform the following operations, either independently or in a Formation:

- Ship-to-ship combat using naval gunfire, torpedoes, or SSMs
- Amphibious pickup transportation and assault, supply sealift
- Naval air operations
- Mine warfare
- Shore bombardment using naval gunfire or SSM
- Area patrol and ASW
- Air defense, including terminal defense against missiles
- Shadowing of Foreign naval units

3.6.1 Surface Units

Naval surface units have the ability to maneuver and engage targets with naval gunfire and SSMs. Aviation carrying assets of all types may be included in the scenario. Units have the ability to maneuver and conduct air operations simultaneously. JTLS-GO simulates various types of naval combat. Attrition is based on weapon pK or area effects, as modified by environmental conditions. Ships may be joined in a formation and moved as a task organization

Ships have defined Combat Systems, but do not engage in Lanchester combat with each other as do ground units. Ships can, though, be placed in a Direct Support role supporting own side or friendly land units ashore. For ships in a direct support role, their combat systems assist their supported land units in Lanchester combat when the land unit is fighting.

Ships have ROE just as other units do, and use them in the same way, except for the Ground/ Surface ROE. Naval units whose surface ROE is set to Weapons Free will automatically engage known Enemy ships with missiles, if they can.

Various ship capabilities, including onboard aircraft, may be degraded or rendered inoperable when subjected to Enemy attack. Ships will begin sinking when they have sustained too many hull breaches as defined in the database. Repairs to damaged systems are made based on time factors set in the database. Ships in the process of sinking stop moving and cease accepting most operational orders, and automatically deploy lifeboats, represented as HRUs.

Units can be moved by sea during amphibious operations and supplies may be sealifted with offload rates contingent upon the presence of a port facility and MHE.

3.6.2 Submarines

Submarines are simulated as unique types of naval units. They enter the Simulation in a covert, undetected status. They cannot be seen by radar, but can be detected by shipboard sonar (active and/or passive) or ASW aircraft. After being detected, contact is eventually lost if not maintained by the detecting Side. The submarines are usually equipped with sonar, SSMs and/or torpedoes. They can only be damaged by weapons specifically designated to be effective against submerged targets.

If submarines are required to operate in water shallower than a database-specified depth for the submarine class, they lose their covert capability, and can be detected by any sensor that can detect a surface vessel. Like surface units, they can be part of a formation or operate

independently, and can be used to shadow Enemy surface units, lay mines, or patrol multi-Sided polygonal areas.

Submarines can be nuclear powered, meaning that they can remain submerged indefinitely, or they can be conventionally powered, and must either surface or go to periscope depth periodically to recharge batteries. Surfaced or snorkeling submarines are detectable by radar.

3.6.3 Amphibious Operations

Ground units and assault helicopter squadrons can be embarked on naval units in formation at game start, or picked up from shore locations in preparation for an amphibious assault. Amphibious assaults may be conducted, by moving assault forces ashore in groups via landing craft and helicopters. If such landings are opposed, attrition is simulated using Lanchestrian coefficients. Attrition of landing craft due to artillery and Air-to-Ground action, and the associated loss of Combat Systems are calculated.

3.7 COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE (C3I)

The commander and staff must possess information about the Enemy in order to execute the military mission with adequate and timely decisions. *One of the defining characteristics of a Force Side is that all the units share the same perception of the battlefield.* When any collection resource obtains intelligence, the information is available to the entire Force Side. Different gathering methods have different delays and fusion times, but once the information is passed to the receiving unit, it is available to all members of that Side.

When a unit or target is first detected by a Force Side, complete information about it is not known. Different sensors are capable of different levels of detection, and as these sensors are brought to bear against the target a more complete identification is available.

JTLS-GO Players have the ability to share intelligence (on individual or multiple units and/or targets) with another Side. The specified information is passed to the receiving Side either as a one-time event or periodically.

JTLS-GO execution may be followed using both the graphics display and the Information Management Tool (IMT) to show simulated or game truth, or a Force Side's perception of truth. When running in the perceived mode, the commander must take action to determine the true location of Enemy units. All gathered intelligence data are available to be displayed on the IMT and graphics display as soon as the information have been fused and passed from the gathering agency to the responsible unit. The results are also passed to the Training Audience through USMTF-formatted Intelligence reports, such as Imagery Interpretation Reports (IIRs) and Immediate Photo Interpretation Reports (IPIRs).

3.7.1 Organic Ground and Air Intelligence

Each unit in JTLS-GO can have a capability to note and report the presence and status of Enemy units and targets in its vicinity. The vicinity is defined by a tactical collection distance parameter unique to the unit's prototype. This simulates the unit's capability to patrol the immediate vicinity and report on what is there. The Player does not need to do anything to obtain the resulting intelligence.

3.7.2 HRU Intelligence Collection

A Player may direct an HRU to perform a Patrol mission with a sub-mission to collect Essential Elements of Information (EEI). As part of the order, the Player specifies a single type or list of types of objects that are of high interest to the HRU and either a specific location or a route for the patrol to follow. The patrol moves to the location or the first route point and begins the intelligence gathering. If an object of high interest is encountered, the HRU breaks radio silence and reports the presence of the object in an HRU Urgent Report using SPOT and SALUTE report format suitable for translation into a response cell voice report. Objects that are detected but do not meet the High Interest criteria are retained and reported periodically. A message, graphics, and IMT updates are produced. In addition, any HRU performing a Collect EEI mission may detect and report either missile launches or preparations of mobile Tactical Erector Launchers (TELs) for such launches.

3.7.3 Explicit Air Intelligence

The RECCE mission collects information on all units, targets, and convoys within sensor range of their designated flight paths. There are two basic attributes of a sensor that determine the information that it collects:

- Collection Type. The sensor can be told to collect only within collection deck areas or any covered area. Only sensors that collect within collection deck areas produce intelligence reports. Sensors that collect over their entire range will result in updated perception by new intelligence reports.
- Real Time. Non-real time sensors hold on to the information until the mission lands at its home base. If the mission is killed prior to returning to base, the non-real time data are not reported. Real-time sensors report information gathered each time the mission moves within the global grid system.

3.7.4 Naval Intelligence

Surface naval units can be detected by land based surface sensors, shipboard surface sensors or surface sensors located on JTLS-GO Air Missions that include AWACS, Patrols, Reconnaissance, Armed Reconnaissance, and Air-Ground Attack. Surface detections are accomplished as a stochastic process using a probability of detection. Submarines can be detected by the same sources, but the subsurface detection algorithm uses a stochastically generated time to detection.

Any actively emitting sensor on a naval unit is subject to passive detection by other naval units. The User receives bearing information and a rudimentary indication of the strength of the emitter.

3.7.5 Non-theater Intelligence Collection Resources

Non-theater intelligence collection assets are represented in JTLS-GO by Controller orders. These orders include:

- Area Collection: All detected units and detected targets within the specified rectangular area are reported to the indicated Side. Detection is stochastic and the Controller indicates the baseline probability of detection for units and a baseline probability of detection for targets.
- Unit and Target Collection: Information concerning the Controller-specified units is passed to the indicated Side. The information concerning the specified units is always sent.

- National Asset Collection: The unclassified algorithms that define the orbit mechanics of any Earth satellite exists in a support tool that passes satellite path information to the model. This allows the representation of either classified or unclassified satellite collection ability over the Earth's surface. Collection decks can be input into the model to tell the satellites where to collect information and produce Intelligence reports.

  Electronic Intelligence (ELINT): Users can task national and theater level ELINT collection assets using either the National Asset Collection capability or a theater-level air-breathing reconnaissance mission. In addition to these capabilities, JTLS-GO also has the ability to simply assume that ELINT collection is available anywhere that it is needed, thus eliminating the need to worry about asset deployment. No matter what type of asset collects the electronic emissions, JTLS-GO has the ability to generate a real-world USMTF TACELINT message that includes ELINT notation (ELNOT), emitter frequency, and emitter pulse repetition data. The TACELINT messages are passed in a continuous stream to external real-world C4I systems. One of the more important detection capabilities of the ELINT collection asset is the ability to determine whether an Air Defense site is about to fire by detecting a change of frequency or an increase of pulse rate.

3.7.6 Reports to Players

The capability to obtain information, either through periodically disseminated reports or through Player queries, is essential to the successful planning and decision-making process. JTLS-GO provides 30 queries and multiple reports enabling Players to maintain current situational awareness. These are incorporated into four groups: Command (Ground and Naval), Air, Logistics, and Intelligence. These groups are described in detail in the *JTLS-GO Controller Guide* and *JTLS-GO Player Guide* and include:

Command (Ground and Naval) Reports:

- Situation Report (SITREP): A Player may request a current SITREP for any unit or group of units in that Player's reference database. The SITREP is available for HRUs.
- Periodic Reports: These provide the commander with a summary of current own-side air, ground, and logistical operations; as well as intelligence held on other Foreign units and targets. There are 15 separate messages, each reporting the current status of a subset of all the data concerning a Side. Examples are the Own-Side Combat Systems Summary, Airbase and Squadron Summary, Other-Side Target Intelligence Summary, and BDA (Battle Damage Assessment) Reports. These reports are provided at a time interval specified in the database for the Force Side. A second parameter specifies the frequency of Summary Reports, which roll up two or more Periodic Reports. These reports have the same format as the Periodic Report, but cover multiple single periods.

Air Reports:

- Air Report: This report provides a status summary of a squadron, its currently active missions, and aircraft due out of maintenance. Cumulative information is also provided, including runway length and repair time.
- Air Mission Report: This report is available for a single squadron or all squadrons on the requesting Player's Side (all squadrons for the Controller). It provides information concerning the status of all missions associated with the squadrons, including mission name, posture, time scheduled to launch or come out of maintenance, current number of

aircraft, number of aircraft launched, mission type and location. In addition, the all-squadron report includes a list of unfulfilled CAS requests and a list of all airbases that are out of aviation fuel.

Logistics Reports:

- Logistics Report (LOGREP): This report is available upon request for a particular force or a specific unit. It contains general information, such as the Combat Systems status (Table of Organization and Equipment (TOE) with the number of systems in maintenance and number operational), and the status of supplies (available as supplies, backorders, or due ins). The capacity of the unit to carry wet and dry supplies is included, as well as a listing of the backorders owed to other units or targets, including their origination times. For support units, truck status is provided; for squadrons, aircraft status is included. An abbreviated LOGREP is available for HRUs.
- Logistics Roll-up Report: This report is similar in format to the LOGREP, but contains logistics data for a single unit, all its subordinates, and their subordinates, recursively. Details are omitted concerning individual units' trucks dispatched, aircraft flying and available, and the listing of backorders. This report is useful for obtaining a summary of the operational Combat Systems or the complete ammunition status of an entire division, for example.
- Convoy Status Report: This report provides data about the status of all convoys that are outbound from a unit, inbound to a unit, or bound from one specified unit to another. The report includes the convoy home unit, next destination, location, Estimated Time of Arrival (ETA), status of transportation assets, and supplies carried.

Intelligence Reports:

- HRU Patrol Report: HRUs, with a collect EEI mission, report their observations at a time interval set in the database. This report contains information on units and targets seen. Depending on the length of time the Foreign units are observed, the HRU teams will report posture, status, location, and percent capability. The results are displayed on the graphics and IMT screens, and a message is generated.
- Tactical Intelligence Report: This report is automatically provided by units on a periodic basis. Only units that have a specified capability to do so gather tactical intelligence. The results provide updated information on Foreign units and targets, with the amount of detail depending on the amount of time an entity has been observed. The intelligence is provided directly to the IMT and graphics, and included in the Periodic Report. No printed message is generated.
- ELINT Report: This report provides a listing of all detected and currently emitting jammer targets, and all detected and emitting sensor targets, provided the sensor is a jammable (emitting) sensor.
- Launch Preparation and Launch Reports. Any surveillance asset may detect that a Foreign unit has begun preparations to launch an SSM, or may detect the launch. These assets include units, airborne or surface sensor assets, and patrolling HRUs. When either of these events is detected, the information is communicated as quickly as possible to the Players. A printable message is generated. Patrolling HRUs will break radio silence to report either preparation or launch.

- Battle Damage Assessment Reports: JTLS-GO generates realistic Battle Damage Assessment reports using the concept of damage sayings. When a target is hit and killed, the model generates a random damage saying. These damage sayings add another layer of realism to depict the different levels of functional damage, e.g. light, moderate or severe. When an asset collects on a damaged target, the assigned damage saying is reported.

  Feeding Real World Systems: JTLS-GO has the ability to feed real-world C4I systems. The JTLS-GO Operational Interface (JOI) manages all links to real-world C4I systems. It is responsible for passing OTH-Gold messages, Link-16 messages and distributing TACELINT messages all based on the perceived collected intelligence information.

4.0 SYSTEM OVERVIEW

4.1 OPERATING EQUIPMENT

JTLS-GO is specially designed and constructed to apply the most effective and efficient utilization of component programs to examine strategic theater, operational, and tactical warfare *worldwide*. The Simulation comprises multiple modules that are closely related and integrated into a system that allows Players and Users to create required databases, execute the wargame, and analyze the results.

The Combat Events Program (CEP) and its support software modules, the JTLS-GO Object Distribution Authority (JODA) data server, and the Web Enabled JTLS-GO services (Apache data server, XMS, SYNAPSE, OMA, and JXSR) are designed for execution on 64-bit Linux-based platforms. The Web Hosted Interface Program (WHIP) is the graphical User interface for JTLS-GO. Multiple individually executing WHIPs, possibly located at remote sites, accommodate JTLS-GO exercise Players. WHIPs are executed on Microsoft Windows (TM) or Linux-based workstations that utilize the AMD/Intel AMD64/EM64T architecture.

Equipment required to execute the core components of JTLS-GO (CEP, Web Services, and WHIP) is configured according to intended use of the simulation within an analysis, User training, or exercise environment. JTLS-GO can be executed on an optimized microcomputer or a suite of servers. An analyst who desires to execute operational vignettes for research purposes can utilize a single Linux desktop or laptop. A single computer may also be used to execute the simulation for small groups of trainees. Larger groups require a network configuration similar to the specifications described in Appendix B of the *JTLS-GO Executive Overview*. Other critical elements, such as exercise, analysis, or training environment, scenario size and complexity, must be considered while planning an optimal JTLS-GO installation.

4.2 SYSTEM STRUCTURE

The web-enabled JTLS-GO structure and the relationships among its major components are depicted in Figure 4.1. This diagram illustrates all major JTLS-GO components, subsystems and support tools, including the related data files that are accessed or created. Brief summaries of the essential functions of each subsystem are provided in the remaining sections of this chapter. This overview does not describe all components or their relationships in detail.

Refer to the *JTLS-GO Technical Coordinator Guide* and other JTLS-GO documents that pertain to individual components for detailed descriptions of data files and modules. Each JTLS-GO release includes all executables compiled for the supported systems.

The Red Hat Linux(TM) and Microsoft Windows(TM) operating systems are currently supported. All JTLS-GO components are currently compiled to execute on any platform that supports Red Hat Enterprise Linux 8.3. The Web Hosted Interface Program is a Java (TM) application that is operating system and platform independent and may be hosted on either a Windows or Linux environment.

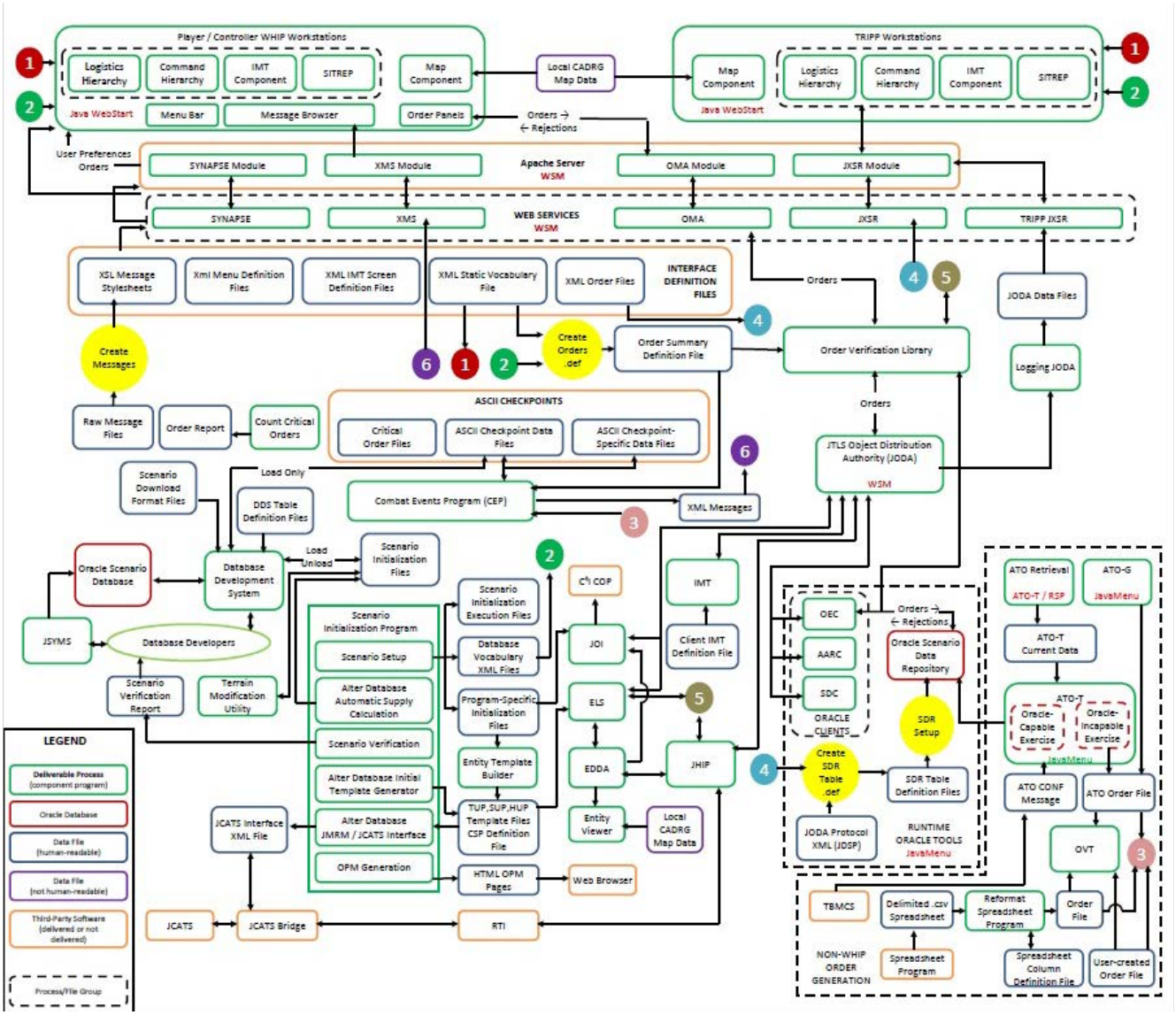

Figure 4.1 Web Enabled JTLS-GO System Structure And Data Flow

4.2.1 Scenario Preparation Tools

The primary tools used to prepare a scenario data base are the Database Development System (DDS), Scenario Verification Program (SVP), Online Player Manual (OPM), and the Geographic Information System Terrain Building Tool (GIS Tool).

Tools	Description
Database Development System (DDS)	The DDS is the primary JTLS-GO database development and modification tool used to build a new database, modify an existing database, or query an existing database for filtered information. The DDS is an application of the PostgreSQL Server, a relational database management system.

Tools	Description
Scenario Verification Program (SVP)	The SVP is a primary component of the Scenario Initialization Program (SIP) that is implemented to verify that data entered for a specified scenario are internally compatible and consistent among variables.
Online Player Manual (OPM)	The OPM provides access to a series of HTML files that contain formatted scenario initialization data.
Geographic Information System Tool (GIS Tool)	The GIS Tool reads in terrain and network shape file data that is delivered with JTLS-GO or, if available, user provided GIS shape file data. The user then defines where terrain grids should be created and the level of detail required. The result is the terrain database needed to support model execution.

4.2.2 System Setup And Initialization Programs

These programs are used to prepare JTLS-GO to execute specific scenarios.

Programs	Description
Scenario Initialization Program (SIP)	The SIP is a suite of tools that must be executed to prepare a scenario that has not been run previously for game start.
Interface Configuration Program (ICP)	The ICP is an interactive program that allows the User to define the specifications for each game process that can be started for a particular scenario. The ICP uses a Graphical User Interface (GUI) to allow the User to edit the default process configuration.

4.2.3 Combat Events Program

The Combat Events Program (CEP) is the combat simulation and central component of the JTLS-GO system. This program determines all of the actions and interactions among the air, land, and naval forces defined and simulated for the specific scenario being run. The CEP creates, maintains, and reports the current status of the warfare environment being simulated. The CEP can simulate a maximum of twenty sides or coalitions in any given scenario. Each side can specify its combat relationship (Friendly, Enemy, Suspect, or Neutral) with each of the other represented sides. Only one CEP is allowed to execute for a specific scenario on any individual machine or network during JTLS-GO execution.

The CEP communicates with the Primary JODA process via a TCP/IP socket connection. The Primary JODA receives an initial data download and periodic updates from the CEP, and, in turn, communicates with the WHIPs, Secondary JODAs, and other client programs that are assigned to it. Each JODA maintains its own current game database and communicates with the programs immediately below it in the information tree structure.

Player inputs to the game are in the form of orders entered at a WHIP station and transmitted to the CEP for processing, up the tree through the Primary JODA. Players receive game information from the CEP, via the Primary JODA down the tree, in the form of WHIP graphics updates, formatted messages, IMT tabular data display updates, and updates to WHIP child processes such as the SITREP tool, the ATO Viewer, and the Command and Logistics Hierarchy displays.

4.2.4 Web Services

The Web Enabled JTLS-GO design is intended to reduce the cost of conducting a simulation-supported joint training event, and to minimize the use of personnel and equipment. Operators using a Web-based connection, or an existing wide area network (WAN) and local area network (LAN), can log on to the simulation via a Web browser on a personal computer, and operate the Player interfaces from this PC. This design significantly reduces both the cost and the turn-around time of a joint training event. Most exercise facilities have existing WANs and LANs that allow Combatant Commands and Supporting Commands access to simulations based at a home station to support a joint training audience.

The infrastructure implements four integrated Web Services that interact with the WHIP through the Apache HTTP Web server. The CEP transmits simulation data to these Web Services through the JTLS-GO Object Distribution Authority (JODA), which provides these data to client programs on a persistent socket connection. The JXSR, XMS, SYNAPSE, and OMA Web Services communicate with the JODA, which functions as an ambassador between the CEP and the Apache.

Services	description
JTLS Object Distribution Authority (JODA)	One JODA connects directly to the CEP and distributes data to the Web Services programs or other registered JTLS-GO Data System (JDS) client programs. It is designated the single Primary JODA. Additional Secondary JODAs can be configured to accommodate certain types of support program clients.
Apache Web Server	The Apache is a modular, open source, HTTP-compliant Web server configured to manage one or more JTLS-GO scenarios for a specific host and port.
JTLS XML Serial Repository (JXSR)	The JXSR program obtains data from a JODA and passes it in XML format to the WHIP through the Apache Web Server. To properly distribute the processing load, additional JXSRs can be configured to run on separate hosts. Each JXSR is independent and maintains a connection only with the JODA.
XML Message Service (XMS)	The XMS connects to the JODA to monitor messages written to the file system, and provides four basic JTLS-GO message indexing services to WEJ clients: searching, sorting and listing based on criteria provided by the client, data-only extraction, and formatting.
Order Management Authority (OMA)	The OMA provides an order verification and forwarding service to the WHIP. This ensures that the orders originating from WHIPs are verified for structural accuracy (not tactical appropriateness) prior to sending them to the CEP.
Synchronized Attribute Preferences Server (SYNAPSE)	The SYNAPSE provides a User data sharing service in a central location and allows a WHIP configuration to be independent of the local workstation. The SYNAPSE is also responsible for the sharing of orders and drawings among WHIPS.
Web Services Manager (WSM)	The WSM allows the User to individually start, monitor, and shut down the Apache server, primary and secondary JODAs, and/or any of the Web Services (JXSR, XMS, OMA, and SYNAPSE) Web Services for a specific scenario.

4.2.5 Player Interface Programs

4.2.5.1 Web Hosted Interface Program (WHIP)

The Web Hosted Interface Program (WHIP) is an integrated Java-based GUI that is downloaded to each JTLS-GO client workstation via Java WebStart, and allows clients to interact with JTLS-GO. A typical WHIP screen is shown in Figure 4.2. The WHIP has several GUI-based features through which the User receives information from and interacts with the simulation. Each of these components is accessible by means of context-sensitive menus displayed within the interface window:

- Map Component
- Command Hierarchy
- Message Browser
- Order Group Editor
- SITREP Tool
- Information Management Tool
- Logistics Hierarchy
- Order Entry Panels
- ATO Viewer

The context-sensitive menus simplify User interaction with objects in the game. For example, detailed Combat System, supply, order, location, and posture information for any unit in the game is directly and easily accessible from the Map, Command Hierarchy, and other windows.

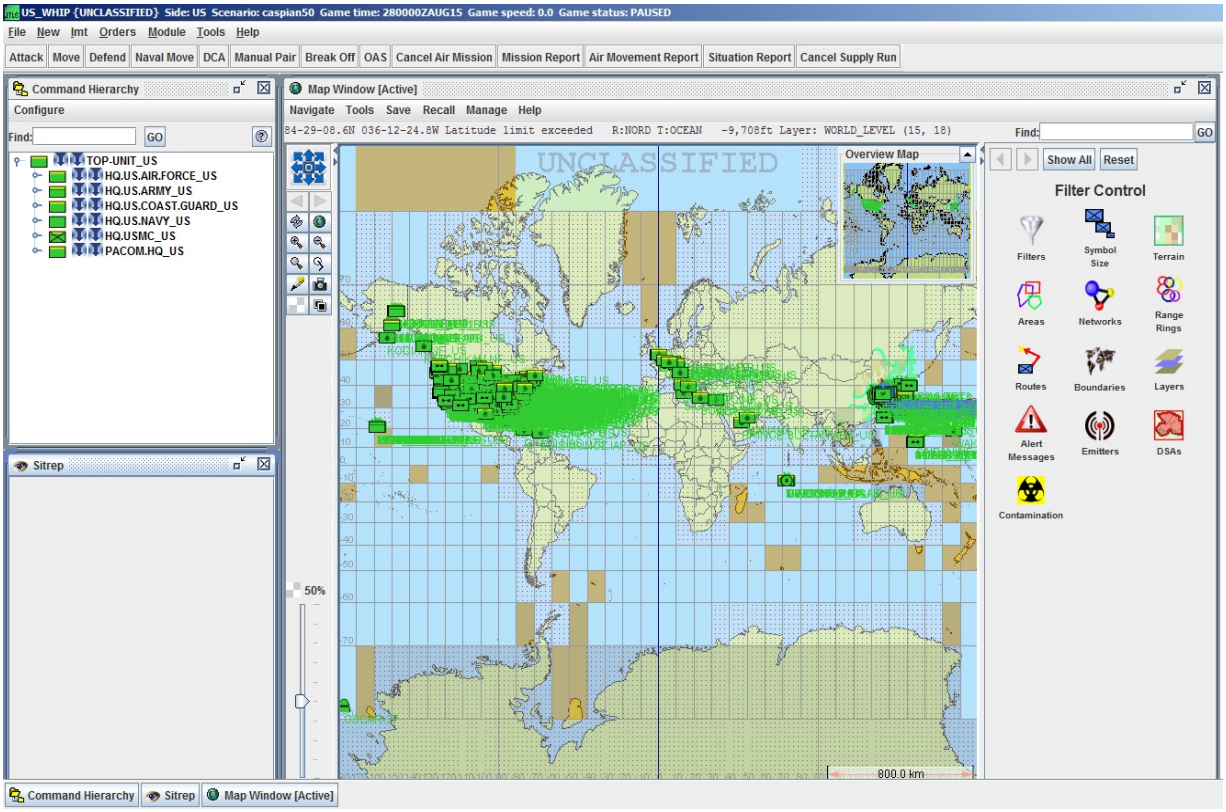

Figure 4.2 WHIP Visual Components

4.2.5.2 Map Component

The WHIP Map Component (Figure 4.2) provides a geographical map display on which terrain features and game objects are placed. A wide range of filtering capabilities exist to manage the objects that are displayed. In addition to basic object on or off filtering, the Map also permits the WHIP User to customize their level of detail. For example, controls exist to zoom in or out of the map display or to center the display in another geographic region. Both filters and map location/ resolution can be saved by the User and recalled at a later time. If the WHIP workstation contains Compressed ARC Digitized Raster Graphics (CADRG) data, the Map Component will allow display of these high-resolution images as a User option.

4.2.5.3 Information Management Tool (IMT)

The IMT (Figure 4.3) allows the WHIP User to display dynamically updated status tables that hold game information regarding the current status, profile, and capabilities of forces including units, targets, convoys, and air missions. The IMT can also display current intelligence gathered about Foreign forces. Several IMT windows can be open or iconized during any WHIP session. These present information, filtered and organized by the Player in various ways, about current operations, the current capabilities of units and targets, the status of Air Missions that are flying or scheduled to fly, and recent intelligence reports.

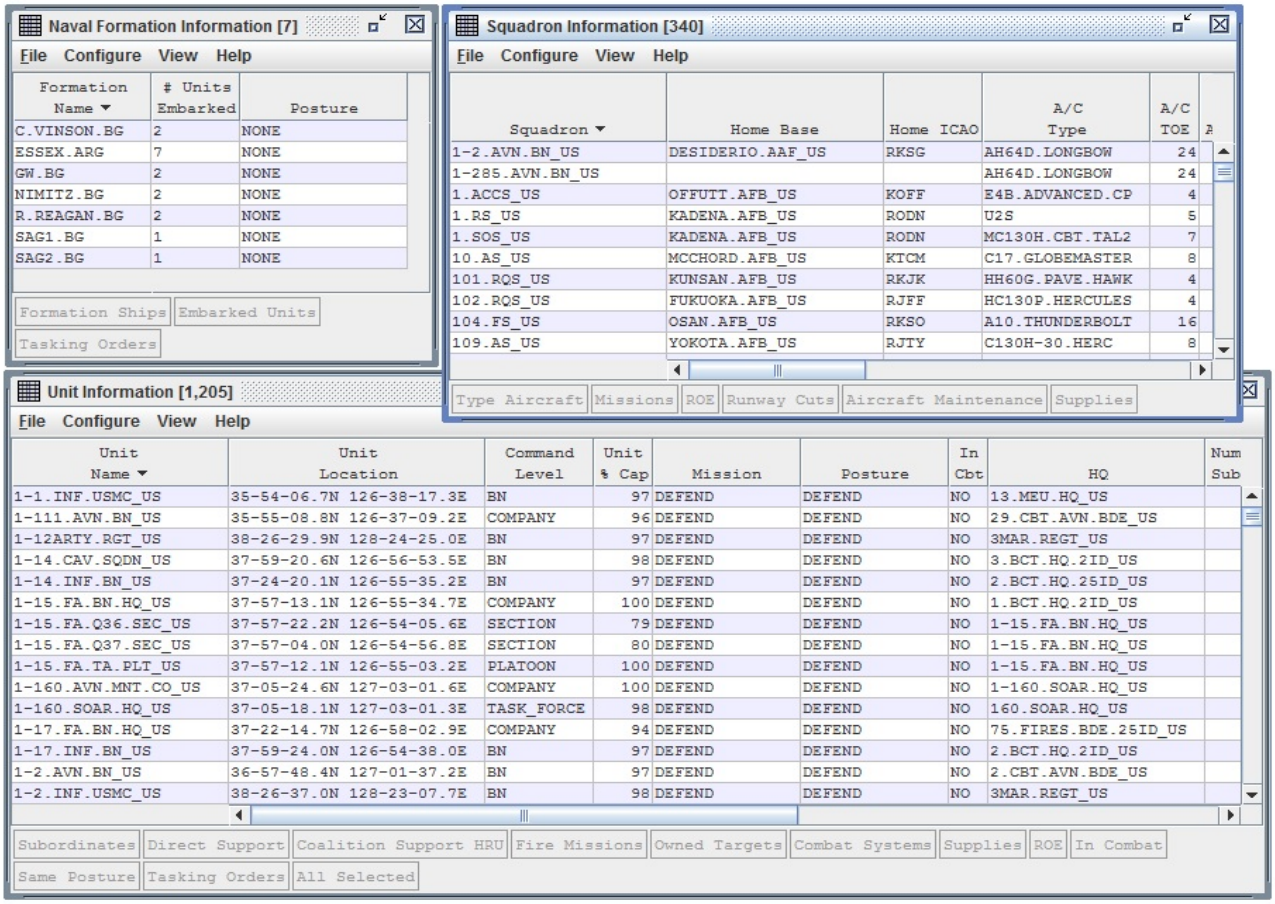

Figure 4.3 Information Management Tool Windows

4.2.5.4 Command and Logistics Hierarchies

The Command Hierarchy and Logistics Hierarchy windows, both illustrated in Figure 4.4, display Force Side, Faction, and unit-level information in tree structures representing the hierarchical chain of command or the supply logistics structure defined for the current scenario.

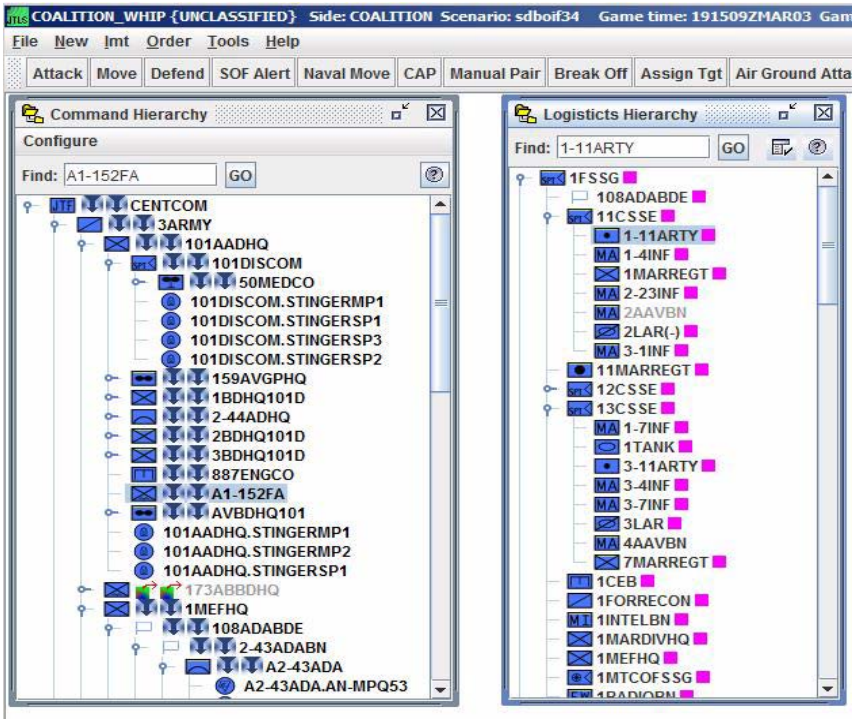

Figure 4.4 Command Hierarchy And Logistics Hierarchy Windows

Players can browse the command or logistics structure of each Force Side by toggling the switch adjacent to each node to show the presence of units within the command or logistical structures of that Force Side. Both hierarchies are organized in tree structures, the Command Hierarchy according to superiors and subordinates and the Logistics Hierarchy according to primary resupply units. A Find option simplifies locating a specific unit within each window's hierarchy. Selecting and clicking a unit name in either window opens a context-sensitive menu for the User. It can be used to open IMT windows, access Online Player Manual pages, activate map displays options, and access selected applicable Orders for the unit.

4.2.5.5 ATO Viewer

The ATO Viewer (ATO-V) provides a graphical display of all Force Side's air missions; past, current, and those scheduled for the future. Missions are shown as individual status bars arranged horizontally along a game time reference axis. A status bar's length is the mission duration. Each shows the mission's planned and actual take off, landing, on station, and off station times. Bars are color-coded according to mission posture. Colors automatically change as mission postures change, for example when a CAP mission completes its on station time and changes from Orbiting to Heading Home. Several filtering, sorting, and display compression options allow the User to tailor the display to the individual WHIP. The ATO-V is useful not only for monitoring current air operations, but also for planning the next day's ATO.

4.2.5.6 Order Management

The JTLS-GO order panels permit the User to create individual named orders from displayed order templates. Each order type-specific template contains fields to be completed, some of which have default values provided. The WHIP allows User access to these templates either from pull-down menus, from a unit's Context Sensitive menu, or from the Quick Order list. For example, a User may desire to administratively Move a unit. The complete Move order template can be accessed from the Ground order menu at the top of the WHIP, or from the context sensitive menu displayed when the User clicks on the desired unit. This order has a number of fields to be completed. For example, it allows the entry of a detailed route to be followed. Alternatively, the User can select the Quick Move order from the list of quick orders at the top of the WHIP. A Quick Move order requires only a Unit name and a single destination location.

The capability to manage orders is also provided. An Order Group Editor window enables Players to combine saved orders, send them simultaneously to the CEP as a named group. Players can also copy, rename, delete, save, load, or share the orders with others. This tool uses a tree interface to organize, save, and display the saved orders and groups.

4.2.5.7 Situation Report (SITREP) Tool

When the User selects a map object the SITREP component will display information about the object. The SITREP information depends on the type of object, its relationship to the WHIP's side, and the perceived (intelligence) data available about the object if it is not on the WHIP's side. In addition to using the map component, a SITREP can also be triggered from the IMT, Command Hierarchy, or Logistics Hierarchy components.

4.2.5.8 Message Browser

This WHIP component optimizes the process of managing and reading CEP messages, allowing Players to receive messages, forward these messages to other Players and C4I systems, and convert messages from text to MTF format. Messages can be displayed and viewed in the Message Browser window (Figure 4.5).

JTLS generates these basic message types:

- A message can be addressed to a specific WHIP client. Only the addressed WHIP User receives the message. If the WHIP is not executing, the XMS retains the messages until the WHIP is ready to accept messages.

- A message can be addressed generally to a Force Side and Faction. This is known as a Broadcast message and the message is sent to each WHIP on the specified Side. A Player can control which Faction messages should or should not be displayed.

Typically, JTLS-GO updates current status information to the WHIP and IMT. Under various circumstances additional information may be distributed in the form of a message. A message is generated when:

- A Player submits a request for detailed force status information;

- The CEP informs a Player about a problem (an invalid order, for example);

- One of the forces under a Players command discovers critical information the Commander should know about (for example, it is experiencing incoming artillery fire);
- A summary of the actions taken within the last reporting period is generated.

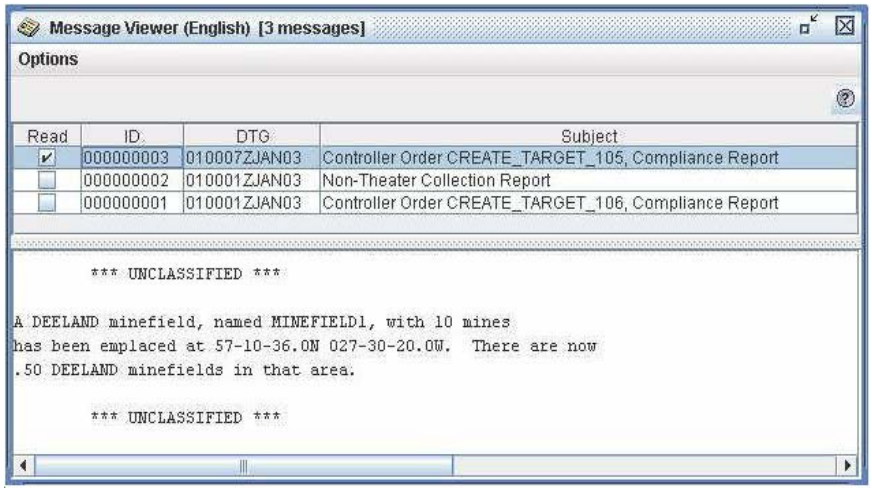

Figure 4.5 Message Browser View Window

4.2.6 Total Recall Interactive Player Program (TRIPP)

The TRIPP is a specialized WHIP that allows Players to recall and replay game events for a specified time interval from a previously run JTLS-GO game. The Interface Configuration Program (ICP) is used to enable the TRIPP and properly configure the game with its three supporting components: a dedicated logging JODA, one or more Replay Servers, and one or more TRIPP display consoles. TRIPP replays can be run both while the game is executing, and after the exercise has completed.

4.2.7 Scenario Support Programs And Tools

The Scenario Support Programs and Tools describe the linkages and connections to other JTLS-GO components.

Programs/Tools	Description
JTLS High Level Architecture Interface Program (JHIP)	When JTLS-GO is used in a High Level Architecture (HLA) federation, the JTLS-GO HLA Interface Program (JHIP) is used to distribute simulation data through the Run Time Infrastructure (RTI) to other members of the HLA federation. While running the HLA federation using Time Management, an additional program, called the Pacer, can be used to regulate game speed.
Order Verification Tool (OVT)	The OVT receives JODA-distributed output from the Combat Events Program (CEP), which is used to verify the format and contents of Player and/or Controller orders that were built using programs other than the WHIP before they are sent to the game. All order checking that would be accomplished by a WHIP is also performed by the OVT.

Programs/Tools	Description
Entity Level Simulation (ELS)	The ELS is designed to receive aggregate level unit and target information from the CEP through the primary JTLS-GO Object Distribution Authority (JODA) and disaggregate these data into individual entity data. The separate entity level objects are then made available to clients by means of two different methods. The Run Time Infrastructure (RTI) can be used to distribute ELS data to other HLA federates or clients may connect to a secondary Entity Level JODA (EODA) to receive the entity data.
JTLS Operational Interface (JOI)	JTLS exercises conducted by the United States Government have required data feeds to real-world Command, Control, Communications, Computers, and Intelligence (C4I) systems. The JOI is designed to provide a configuration-managed capability to convey current JTLS-GO force status information to these systems. This capability allows all JTLS-GO Units and Air Missions to be passed via OTH-Gold message format to the US Global Command Control System (GCCS) or to any other system that accepts OTH-Gold messages by means of a TCP/IP socket connection.
KML Operational Interface (KOI)	Global satellite imagery viewers similar to the C4I systems used by US forces have become widely available to exercise audiences for the display of scenario object and terrain data. One such example, the Google Earth (TM) viewer, supports a robust application interface protocol known as Keyhole Markup Language (KML). The KML data facilitates an imaging program to ingest and display JTLS-GO force status information.
Scenario Data Repository	The Open Access Programs, the Order Entry Client (OEC), Scenario Data Client (SDC), and After Action Review Client (AARC) use a PostgreSQL database to store game data while the game is executing. The Scenario Data Repository (SDR), a PostgreSQL data repository, is used to hold data and interact with these client programs. Since PostgreSQL databases support open standards, data can be accessed by third-party applications, such as reporting tools or C4I systems.

4.3 AIR TASKING SUPPORT TOOLS

JTLS supports a robust set of interactions between Air Missions and the other components of the simulation, such as unit logistic stocks, air defense capabilities, and unit combat systems. The simulation does not automatically assign and task air resources. Assignment and tasking of these resources is the responsibility of a Player, and is performed on a mission-by-mission basis. Two tools exist to support and simplify this capability.

4.3.1 Air Tasking Order Generator (ATO-G)

The ATO-G is designed to assist an Air Player to create offensive and defensive Air Mission orders to be input directly to the simulation with minimal User action. The Player specifies target areas, target priorities, available aircraft resources, and the command's desired apportionment goals for the selected ATO period. The ATO-G uses this guidance, the Players perception of the battlefield, and the current unit logistical status to automatically create a set of coordinated air orders. The Player is allowed to view and/or change individual order parameters prior to sending them to the CEP.

4.3.2 Air Tasking Order Translator (ATO-T)

The Air Tasking Order Translator (ATO-T) is designed to utilize an Air Tasking Order generated by an exercise Air Staff to create the JTLS-GO Air Mission orders needed to properly represent the plan in JTLS-GO. The ATO-T translates a USMTF ATO typically produced by the Theater Battle Management Core System (TBMCS) ATO generator program into JTLS-GO Air Mission orders. Players must obtain the ATO in the specified Joint format. Technical Control personnel load the file into the correct directory on the computer. The program then allows Players to review the results of the translation and provides a limited opportunity to modify some of the taskings. This tool permits wholesale adoption of orders created by a functioning Air Operations Center (AOC). However, some ATO missions do not translate automatically. Hence, air Players are required to input these orders from the WHIP.

The ATO-T also allows Players to translate a spreadsheet specifying intelligence collection areas, known as Directed Search Areas (DSAs), that should be created and used by Reconnaissance missions during an ATO cycle.

The ATO-T executes in two modes, named Basic and Advanced for the purpose of this description. The ATO-T requires libraries from Simscript and Oracle to run in either mode. The Basic mode of the ATO-T reads and processes Air Tasking Orders in USMTF format, as well as Air Mission data prepared using an Excel spreadsheet and delivered in comma-delimited format. The output from the ATO-T at the Basic level consists of ASCII order files that may be read into the CEP using the Read Order File order.

The Advanced ATO-T mode reads Air Tasking Orders and Air Mission data in the same formats as the Basic mode. However, this mode writes the orders directly to SDR tables for error checking and for input directly to the CEP using the Order Entry Client (OEC). Each order written into the PostgreSQL tables specifies a time the order is scheduled for submission to the CEP. The OEC continuously monitors the Oracle tables and performs a final error verification at this specified time before submitting the order.

APPENDIX A. ABBREVIATIONS AND ACRONYMS

Terms are included in this appendix to define their usage in JTLS-GO design, functionality, and documentation.

AAA	Anti-Aircraft Artillery
AADC	Area Air Defense Commander
AAL	Air-to-Air Lethality
A/C	Aircraft
ACP	Air Control Prototype
ADA	Air Defense Artillery
AEW	Airborne Early Warning
AFB	Air Force Base
AG	Air-Ground (Air-to-Ground)
AI	Air Interdiction
AIM	Air Intercept Missile
AIREF	Air Refueling
AKL	Area Kill Lethality
AMMO	Ammunition
AO	Area of Operations
AOC	Air Operations Center
APC	Armored Personnel Carrier
ARECCE	Armed Reconnaissance
ARTE	Air Route
ARTY	Artillery
ASCII	American Standard Code for Information Interchange
ASW	Anti-Submarine Warfare
ATC	Aircraft Target Category
ATGM	Anti-Tank Guided Missile
ATK	Attack
ATO	Air Tasking Order
ATORET	Air Tasking Order Retrieve Program
ATOT	Air Tasking Order Translator
AWACS	Airborne Warning And Control System
AZ	Altitude Zone
BADGE	Bilateral Air Defense Ground Environment (used by Japan Defense Agency)

BAI	Battlefield Air Interdiction
BDA	Battle Damage Assessment
BDE	Brigade
BN	Battalion
C3	Command, Control, and Communications
C3I	Command, Control, Communications, and Intelligence
C4I	Command, Control, Communications, Computers, and Intelligence
CA	Civil Affairs
CADRG	Compressed ARC Digitized Raster Graphics
CAP	Combat Air Patrol
CAS	Close Air Support
CAT	Category
CCF	Central Control Facility
CCP	Command Control Prototype
CCU	Controller Change Unit
CEP	Combat Events Program
CMDR	Commander
COP	Common Operational Picture
CP	Combat Power
CS	Combat System
CSP	Combat System Prototype
CTAPS	Contingency Tactical Air Planning System
CTG	Commander Task Group
CTRL	Control keyboard command
DCA	Defense Counter Air
DCL	Digital Command Language
DDS	Database Development System
DEMSDB	Demonstration Standard Database
DISA	Defense Information Systems Agency
DIV	Division
DMA	Defense Mapping Agency
DoD	Department of Defense
DOS	Days of Supply
DPICM	Dual Purpose Improved Conventional Munitions

DS	Direct Support
DSA	Directed Search Area
DTG	Date Time Group
EC	Electronic Combat
ECM	Electronic Counter Measure
ECP	Engineering Change Proposal
EEI	Essential Elements of Information
ELINT	Electronic Intelligence
ELS	Entity Level Server
EODA	Entity Level JTLS-GO Object Data Authority
ETA	Estimated Time of Arrival
FARP	Forward Arming and Refueling Point
FLP	Fire Lethality Prototype
FLOT	Forward Location of Troops
FOL	Forward Operating Location
FWL	Frederick W. Lanchester (originated a differential equation model of attrition)
GAL	Gallon
GCCS	Global Command and Control System
GRTE	Ground Route
GS	General Support
GSR	General Support Reinforcing
GUI	Graphical User Interface
HARM	High-speed Anti-radiation Missile
HE	High Explosive
HELO	Helicopter
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQ	Headquarters
HRU	High Resolution Unit
HTML	Hypertext Markup Language
HTT	High resolution unit Target Type
HUP	High resolution Unit Prototype
ICM	Improved Conventional Munitions
ICP	Interface Configuration Program
ICPLogin	Interface Login Program

ID	Identifier
IFF	Identification Friend or Foe
IIP	Intelligence Information Prototype
IMT	Information Management Tool
INFO	Information
INTEL	Intelligence
JCATS	Joint Conflict And Tactical Simulation
JDA	Japan Defense Agency
JEDI	JODA Entity Data Identifier
JDS	JTLS Data System
JDSP	JTLS Data System Protocol
JRSG	Joint Rapid Scenario Generation (formerly JIDPS: Joint Integrated Database Preparation System)
JMCIS	Joint Maritime Combat Information System
JMEM	Joint Munitions Effectiveness Manuals
JODA	JTLS Object Distribution Authority
JOI	JTLS Operational Interface
JPL	Jet Propulsion Laboratory
JSDF	Japanese Self-Defense Force
JTLS	Joint Theater Level Simulation
JTOI	JTLS Transaction Operational Interface
JXSR	JTLS XML Serial Repository
KIA	Killed In Action
KM	Kilometer
KNOTS	Nautical miles per hour
LA	Lethal Area
LAN	Local Area Network
LAT	Latitude
LB	Login Build (JTLS order type)
LDAP	Lightweight Directory Access Protocol
LDT	Lanchester coefficient Development Tool
LOG	Logistics
LOGIN	Logistics Input
LOGREP	Logistics Report
LONG	Longitude

LOTS	Logistics Over The Shore
LR	Long Range
M&S	Modeling and Simulation
MAPP	Modern Aids to Planning Program
MB	Megabyte
MCP	Mobility Counter-mobility Prototype
MCR	Model Change Request
MG	Machine Gun
MHE	Materiel Handling Equipment
MIP	Model Interface Program
MOGAS	Motor Gasoline
MOPP	Mission-Oriented Protective Posture
MOSAIC	NCSA user interface software
MOTIF	X Window System graphical interface
MP	Maneuver Prototype
MPP	Message Processor Program
MSC	Major Subordinate Command
MSG	Message
MTF	Message Text Formats
MUREP	Munitions Report
MUSE	Multiple Unified Simulation Environment
NCSA	National Center for Supercomputing Applications (University of Illinois)
NEO	Noncombatant Evacuation Operations
NFS	Network File Server
NGO	Non-Governmental Organization
NIS	Network Information Service or Network Information System
NM	Nautical Mile
NTSC	Naval Telecommunications System Center
OAS	Offensive Air Support
OBS	Order of Battle Service (formerly UGU: Unit Generation Utility)
OCA	Offensive Counter-Air
OJCS	Organization of the Joint Chiefs of Staff
OMA	Order Management Authority
ONC	Operational Navigation Chart

OPM	Online Player Manual
OPP	Order Preprocessing Program
OTH	Over The Horizon
OTH Gold	Over The Horizon message specification
OTH-T	Over The Horizon-Targeting
pD	Probability of Detection
pE	Probability of Engage
pH	Probability of Hit
pK	Probability of Kill
PKL	Point Kill Lethality
POL	Petroleum, Oil, and Lubricants
POSIX	International operating system standard based on System V and BSD
PPS	Postprocessor System
PSYOPS	Psychological Operations
RAM	Random Access Memory
RDMS	Relational Database Management System
RECCE	Reconnaissance (air missions)
RECON	Reconnaissance (ground missions)
REGT	Regiment
RNS	Random Number Seed
ROE	Rules Of Engagement
RPT	Report
RSP	Reformat Spreadsheet Program
SAL	Surface-to-Air Lethality
SAM	Surface-to-Air Missile
SAM/AAA	Surface-to-Air Missile/Anti-Aircraft Artillery
SC	Supply Category
SCP	Simulation Control Plan
SDB	Standard Database
SEAD	Suppression of Enemy Air Defenses
SIMSCRIPT	Simulation programming language (product of CACI, Inc.)
SIP	Scenario Initialization Program
SITREP	Situation Report
SLP	Sustainment Log Prototype

SOF	Special Operations Forces
SP	Survivability Prototype
SQL	Structured Query Language
SR	Short Range
SRP	Start/Restart Program (a JTLS-GO component)
SRTE	Sea Route
SSM	Surface-to-Surface Missile
STR	Software Trouble Report
SUP	Ship Unit Prototype
SVP	Scenario Verification Program
SYNAPSE	Synchronized Authentication and Preferences Service
TADIL	Tactical Digital Interface Link
TCP/IP	Transmission Control Protocol/Internet Protocol
TEL	Transporter Erector Launcher
TG	Target entity attribute prefix
TGS	Terrain Generation Service (formerly TPS:Terrain Preparation System)
TGT	Target
TMU	Terrain Modification Utility
TOE	Table of Organization and Equipment
TOT	Time Over Target
TOW	Tube-launched Optically-tracked Wire-guided missile
TPFDD	Time-Phased Force Deployment Data
TTG	Target Type Group
TTL	Target Types List
TUP	Tactical Unit Prototype
TW	Targetable Weapon
UBL	Unit Basic Load
UIM/X	GUI builder tool
UNIX	POSIX-compliant operating system
UNK	Unknown
UOM	Unit Of Measure
USA	United States Army (U.S. and U.S.A. refer to United States and United States of America)
USAF	United States Air Force
USCG	United States Coast Guard

USMC	United States Marine Corps
USMTF	United States Message Text Format
USN	United States Navy
UT	Unit entity attribute prefix
UTM	Universal Transverse Mercator
VIFRED	Visual Forms Editor
VMS	Virtual Memory System
VTOL	Vertical Take-Off and Landing aircraft
WAN	Wide Area Network
WDRAW	Withdraw
WEJ	Web Enabled JTLS
WHIP	Web Hosted Interface Program
WIA	Wounded In Action
WPC	Warrior Preparation Center
WPN	Weapon
WT	Weight
XMS	XML Message Service

APPENDIX B. JTLS-GO OPERATING EQUIPMENT

The hardware configuration needed to support JTLS-GO depends upon the size of the database, the number of Player stations, and the anticipated level of activity during the game. A large exercise may require additional server capability to distribute the processing load of the CEP and Web Services and to improve simulation performance and User interface response. The CEP and Web Services require Linux operating systems. However, for exercises or User training events, Microsoft Windows platforms are recommended to execute the various user interface processes including WHIPs.

These equipment requirements were established during stress testing by the simulation proponent and have been refined based upon User exercise experiences. The stress test consisted of database of approximately 5,000 units and 30,000 targets. Throughout the test, simulation speeds of 1-to-1 and greater were maintained consistently while supporting 90 or more Player stations. Other critical elements, such as exercise analysis or training environments, and scenario size and complexity, must be considered while planning an optimal JTLS-GO installation.

Because computer hardware is improved continuously, the information here represents nominal JTLS-GO requirements. Users are encouraged to purchase the most capable machines within their budget constraints. Machines with faster processor speeds (greater than 2.8 GHz), more memory (greater than 16 GB) and more disk space (greater than 300 GB) are acceptable and desirable. The end result will be hardware architecture that will be useful well into the future.

If JTLS-GO will be used to support large training exercises, R&A strongly encourages Users to purchase a fully-functioning backup server. Hardware failures can occur and a backup server is a relatively low-cost precaution that may be the difference between an unsuccessful end to an exercise and the successful completion of an expensive training event. JTLS-GO has been designed to have all of its processes operate on similar computer systems to make it easy to re-distribute executing processes, when and if a catastrophic hardware failure occurs during a critical training exercise e vent.

There are three types of 64-bit Linux servers needed for JTLS-GO. These are:

- **Database Server** - The PostgreSQL Relational Database Management System is hosted on this server. R&A suggests that this server be used solely for PostgreSQL and the data held within the various scenario databases created by the user and AAR databases filled during game execution. The minimum requirements for the Database Server are:

  a. **Operating System:** One of the following operating systems: Red Hat Enterprise 64-bit Linux 8.3, CentOS 64-bit, Linux 8.3, or Oracle 64-bit Linux 8.3.

  b. **CPU:** AMD Opteron, Intel Xeon or i7, or greater

  c. **RAM:** 16 Gigabytes

  d. **Disk:** 1 Terabyte

  e. **Video:** Generic Video Card

  f. **Monitor:** Generic Monitor

- **JTLS-GO File Server** - One of the JTLS-GO servers is labeled as the file server. All other JTLS-GO execution servers mount their file system to this one server. This is known as a Network File System (NFS). The file server can be used during game execution for some of the execution processes that extensively save or read data from the file system. The minimum requirements for the File Server are:
    a. **Operating System:** One of the following operating systems: Red Hat Enterprise 64-bit Linux 8.3, CentOS 64-bit, Linux 8.3, or Oracle 64-bit Linux 8.3.
    b. **CPU:** Quad-Core AMD Opteron, Intel Xeon or i7, or greater
    c. **RAM:** 32 Gigabytes
    d. **Disk:** 1 Terabyte
    e. **Video:** Generic Video Card
    f. **Monitor:** Generic Monitor
- JTLS-GO Execution Servers - The JTLS-GO Servers are used for all processes needed during the building of a scenario database, game execution, and AAR analysis evaluation. Although for small demonstrations scenarios JTLS-GO can be run on one JTLS-GO server, R&A suggests that at least three and preferably five servers are available for full and simultaneous exercise support. The minimum requirements for the Execution Servers are:
    a. **Operating System:** One of the following operating systems: Red Hat Enterprise 64-bit Linux 8.3, CentOS 64-bit, Linux 8.3, or Oracle 64-bit Linux 8.3.
    b. **CPU:** Quad-Core AMD Opteron, Intel Xeon or i7, or greater
    c. **RAM:** 32 Gigabytes
    d. **Disk:** 250 Gigabytes
    e. **Video:** Generic Video Card
    f. **Monitor:** Generic Monitor

JTLS-GO Workstation hardware is typically used for two purposes:

- Host the Database Development System (DDS) Client during database building, the Web Hosted Interface Program (WHIP) user interface during game execution, and the Total Recall Interactive Post Processor (TRIPP) during AAR analysis evaluation.
- Access other Windows tools, such a Word, PowerPoint, and Excel tools that are useful to Players for a variety of reasons.

When determining the size of a workstation, the machine WHIP requirements along with the ancillary use requirements should considered. Many users have a need to bring up multiple JTLS-GO user interface processes simultaneously. The more user interfaces planned for simultaneous execution on a single machine, the more workstation memory required. The minimum requirements for a user workstation are:

a. **Operating System:** One of the following operating systems: 64-bit Windows 10 or 64-bit Linux machine. If Linux is used, for ease of maintenance, the machine should use the same operating system select for the JTLS-GO servers.

b. **CPU:** AMD64/EM64T single or dual processor

c. **RAM:** 8 Gigabytes minimum which would support the operating system requirements, ancillary tools, and one JTLS-Go user interface, Add 4 Gigabytes of memory for each planned additional and simultaneous executing JTLS-GO user interface.

d. **Disk:** 250 Gigabytes

e. Video: 3D hardware accelerated; DirectX compatible

f. **Monitor:** Color Minimum full screen resolution 1280 x 1024 or higher. Recommended full screen resolution 1600 x 1200 or higher. If using a widescreen, minimum resolution 1280 x 720 or higher. Recommended widescreen resolution 1920 x 1080.

All servers and workstations used for this configuration require at least one generic CD/DVD R/W drive and 100 MBit or greater Ethernet connectivity. A minimum of one laser printer per installation is optional; one unit per work area is recommended.