

# **JTLS**

## **Version Description Document**

**April 2007**



U.S. Joint Forces Command  
Joint Warfighting Center  
116 Lake View Parkway  
Suffolk, VA 23435-2697

**JOINT THEATER LEVEL SIMULATION  
(JTLS 3.2.0.0)**



## ABSTRACT

This JTLS Version Description Document (VDD) describes Version 3.2.0.0 of the configured software suite identified as the Joint Theater Level Simulation (JTLS). JTLS 3.2.0.0 is a Major release.

As a Major release, JTLS 3.2.0.0 includes a modified and enhanced Standard Database, as well as extensive model functionality changes implemented as Enhancement Change Proposals (ECPs). These ECPs are described in Chapter 2. Chapter 3 of this document describes the code modifications that represent corrections to Software Trouble Reports (STRs). The remaining outstanding STRs are described in Chapter 4.

This publication is updated and revised for each version release of the JTLS model. User corrections, additions, or constructive recommendations for improvement must include justification and be referenced to specific sections, pages, and paragraphs. Submissions must be written in Model Change Request (MCR) format and forwarded to:

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## TABLE OF CONTENTS

1.0 INTRODUCTION	
1.1 SCOPE .....	1-1
1.2 INVENTORY OF MATERIALS .....	1-1
1.2.1 Obsolete/Outdated Documents .....	1-1
1.2.2 Unchanged Documents .....	1-1
1.2.3 Updated Documents .....	1-1
1.2.4 New Documents .....	1-2
1.2.5 Released Software .....	1-2
1.2.6 Released Databases .....	1-3
1.3 INTERFACE COMPATIBILITY .....	1-3
1.3.1 Support Software .....	1-3
1.3.2 HLA Compliance .....	1-5
1.3.3 JTLS Operational Interface (JOI) .....	1-6
1.4 INSTALLATION CONSIDERATIONS .....	1-6
1.5 DATABASE MODIFICATIONS .....	1-6
1.5.1 Graphic Symbols Update .....	1-6
1.5.2 Database Upgrade .....	1-7
1.5.3 Data Elements .....	1-8
1.5.4 Standard Database Changes .....	1-22
1.6 INSTALLATION NOTES .....	1-23
1.6.1 Installation Instructions .....	1-23
1.6.2 Oracle Compatibility and Installation .....	1-23
2.0 ENHANCEMENT CHANGE PROPOSALS	
2.1 JTLS-0004 DISPLAY RANGE RINGS .....	2-1
2.1.1 Summary of Model Change Request .....	2-1
2.1.2 Design Summary .....	2-1
2.1.3 Data Changes .....	2-4
2.1.4 Order Changes .....	2-4
2.1.5 JODA Changes .....	2-4
2.2 JTLS-0008 REAL TIME INTERCEPT REPORT .....	2-4
2.2.1 Summary of Model Change Request .....	2-4
2.2.2 Design Summary .....	2-4
2.2.3 Data Changes .....	2-8
2.2.4 Order Changes .....	2-8
2.2.5 JODA Changes .....	2-8
2.3 JTLS-0018 NAVAL FUEL USAGE .....	2-8
2.3.1 Summary of Model Change Request .....	2-8
2.3.2 Design Summary .....	2-8
2.3.3 Data Changes .....	2-8

2.3.4 Order Changes .....	2-8
2.3.5 JODA Changes .....	2-8
2.4 JTLS-0056 IMPROVE AIRCRAFT DIVERT LOGIC .....	2-9
2.4.1 Summary of Model Change Request .....	2-9
2.4.2 Design Summary .....	2-9
2.4.3 Data Changes .....	2-10
2.4.4 Order Changes .....	2-10
2.4.5 JODA Changes .....	2-10
2.5 JTLS-0074 REFUEL BASE LOGIC IMPROVEMENT .....	2-11
2.5.1 Summary of Model Change Request .....	2-11
2.5.2 Design Summary .....	2-11
2.5.3 Data Changes .....	2-11
2.5.4 Order Changes .....	2-11
2.5.5 JODA Changes .....	2-11
2.6 JTLS-0075 PASSIVE SONARS DO NOT DETECT SURFACE SHIPS .....	2-11
2.6.1 Summary of Model Change Request .....	2-11
2.6.2 Design Summary .....	2-13
2.6.3 Data Changes .....	2-17
2.6.4 Order Changes .....	2-17
2.6.5 JODA Changes .....	2-17
2.7 JTLS-0083 CONTROLLER ADJUSTS AIR MISSION SPEED .....	2-17
2.7.1 Summary of Model Change Request .....	2-17
2.7.2 Design Summary .....	2-18
2.7.3 Data Changes .....	2-18
2.7.4 Order Changes .....	2-19
2.7.5 JODA Changes .....	2-19
2.8 JTLS-0084 CHANGE TERRAIN AND BARRIER VALUES .....	2-19
2.8.1 Summary of Model Change Request .....	2-19
2.8.2 Design Summary .....	2-19
2.8.3 Data Changes .....	2-21
2.8.4 Order Changes .....	2-21
2.8.5 JODA Changes .....	2-22
2.9 JTLS-0091 NEW CONVOY SYMBOLS .....	2-22
2.9.1 Summary of Model Change Request .....	2-22
2.9.2 Design Summary .....	2-22
2.9.3 Data Changes .....	2-23
2.9.4 Order Changes .....	2-24
2.9.5 JODA Changes .....	2-24
2.10 JTLS-0118 CHANGE ALERT BASE .....	2-24
2.10.1 Summary of Model Change Request .....	2-24
2.10.2 Design Summary .....	2-24
2.10.3 Data Changes .....	2-29
2.10.4 Order Changes .....	2-29

2.10.5 JODA Changes .....	2-29
2.11 JTLS-0181 TORPEDOES FOLLOW SHIPS .....	2-30
2.11.1 Summary of Model Change Request .....	2-30
2.11.2 Design Summary .....	2-30
2.11.3 Data Changes .....	2-31
2.11.4 Order Changes .....	2-31
2.11.5 JODA Changes .....	2-32
2.12 JTLS-0224 BUILD RAILROADS, PIPELINES, AND IADS .....	2-32
2.12.1 Summary of Model Change Request .....	2-32
2.12.2 Design Summary .....	2-32
2.12.3 Data Changes .....	2-32
2.12.4 Order Changes .....	2-32
2.12.5 JODA Changes .....	2-32
2.13 JTLS-0264 SLP-SC SPECIFIC NAME UNIQUENESS .....	2-32
2.13.1 Summary of Model Change Request .....	2-32
2.13.2 Design Summary .....	2-33
2.13.3 Data Changes .....	2-35
2.13.4 Order Changes .....	2-35
2.13.5 JODA Changes .....	2-35
2.14 JTLS-0300 MAGIC MOVE TO OFFBOARD LOCATION FORMATION .....	2-36
2.14.1 Summary of Model Change Request .....	2-36
2.14.2 Design Summary .....	2-36
2.14.3 Data Changes .....	2-37
2.14.4 Order Changes .....	2-38
2.14.5 JODA Changes .....	2-38
2.15 JTLS-0326 JUMP MAP .....	2-38
2.15.1 Summary of Model Change Request .....	2-38
2.15.2 Design Summary .....	2-38
2.15.3 Data Changes .....	2-42
2.15.4 Order Changes .....	2-42
2.15.5 JODA Changes .....	2-42
2.16 JTLS-0340 JTLS MESSAGE FORWARDING .....	2-42
2.16.1 Summary of Model Change Request .....	2-42
2.16.2 Design Summary .....	2-43
2.16.3 Data Changes .....	2-46
2.16.4 Order Changes .....	2-46
2.16.5 JODA Changes .....	2-47
2.17 JTLS-0347 UNITS IN COMBAT FLAG .....	2-47
2.17.1 Summary of Model Change Request .....	2-47
2.17.2 Design Summary .....	2-47
2.17.3 Data Changes .....	2-47
2.17.4 Order Changes .....	2-47
2.17.5 JODA Changes .....	2-47

2.18 JTLS-0349 COMMAND HIERARCHY DISPLAY MANAGEMENT .....	2-47
2.18.1 Summary of Model Change Request .....	2-47
2.18.2 Design Summary .....	2-48
2.18.3 Data Changes .....	2-50
2.18.4 Order Changes .....	2-50
2.18.5 JODA Changes .....	2-50
2.19 JTLS-0370 XCHAT PAGING FLAGS .....	2-50
2.19.1 Summary of Model Change Request .....	2-50
2.19.2 Design Summary .....	2-51
2.19.3 Data Changes .....	2-53
2.19.4 Order Changes .....	2-53
2.19.5 JODA Changes .....	2-53
2.20 JTLS-0377 EXERCISE SUBMISSION TOOL .....	2-53
2.20.1 Summary of Model Change Request .....	2-53
2.20.2 Design Summary .....	2-53
2.20.3 Data Changes .....	2-56
2.20.4 Order Changes .....	2-56
2.20.5 JODA Changes .....	2-56
2.21 JTLS-0378 GRAPHICAL DATABASE PROGRAM .....	2-57
2.21.1 Summary of Model Change Request .....	2-57
2.21.2 Design Summary .....	2-57
2.21.3 Data Changes .....	2-58
2.21.4 Order Changes .....	2-58
2.21.5 JODA Changes .....	2-58
2.22 JTLS-0385 SONAR AVAILABILITY FUNCTION OF SPEED .....	2-58
2.22.1 Summary of Model Change Request .....	2-58
2.22.2 Design Summary .....	2-58
2.22.3 Data Changes .....	2-59
2.22.4 Order Changes .....	2-59
2.22.5 JODA Changes .....	2-59
2.23 JTLS-0399 FLIGHT PLAN WHILE HEADING FOR FUEL .....	2-59
2.23.1 Summary of Model Change Request .....	2-59
2.23.2 Design Summary .....	2-60
2.23.3 Data Changes .....	2-68
2.23.4 Order Changes .....	2-68
2.23.5 JODA Changes .....	2-68
2.24 JTLS-0401 ATO-T ACCESS TO MISSION AND TARGET TYPES .....	2-68
2.24.1 Summary of Model Change Request .....	2-68
2.24.2 Design Summary .....	2-68
2.24.3 Data Changes .....	2-72
2.24.4 Order Changes .....	2-72
2.24.5 JODA Changes .....	2-72
2.25 JTLS-0410 CAP INTERCEPT BREAK-OFF FEEDBACK .....	2-72



2.25.1 Summary of Model Change Request .....	2-72
2.25.2 Design Summary .....	2-72
2.25.3 Data Changes .....	2-74
2.25.4 Order Changes .....	2-74
2.25.5 JODA Changes .....	2-75
2.26 JTLS-0430 AUTO PAIR VERSUS HELO/UAV .....	2-75
2.26.1 Summary of Model Change Request .....	2-75
2.26.2 Design Summary .....	2-75
2.26.3 Data Changes .....	2-81
2.26.4 Order Changes .....	2-81
2.26.5 JODA Changes .....	2-81
2.27 JTLS-0501 AAR IMPROVEMENTS .....	2-81
2.27.1 Summary of Model Change Request .....	2-81
2.27.2 Design Summary .....	2-83
2.27.3 Data Changes .....	2-93
2.27.4 Order Changes .....	2-94
2.27.5 JODA Changes .....	2-94
2.28 JTLS-0520 TACSIM IMMEDIATE WRECKAGE PLACEMENT .....	2-94
2.28.1 Summary of Model Change Request .....	2-94
2.28.2 Design Summary .....	2-94
2.28.3 Data Changes .....	2-94
2.28.4 Order Changes .....	2-94
2.29 JTLS-0526 MOVEMENT OF UNITS WITHIN A HEX .....	2-95
2.29.1 Summary of Model Change Request .....	2-95
2.29.2 Design Summary .....	2-95
2.29.3 Data Changes .....	2-95
2.29.4 Order Changes .....	2-95
2.29.5 JODA Changes .....	2-96
2.30 JTLS-0531 IMPROVE ATO-T WING LEVEL TASKING .....	2-96
2.30.1 Summary of Model Change Request .....	2-96
2.30.2 Design Summary .....	2-96
2.30.3 Data Changes .....	2-97
2.30.4 Order Changes .....	2-97
2.30.5 JODA Changes .....	2-97
2.31 JTLS-0549 ORBIT DIRECTION .....	2-97
2.31.1 Summary of Model Change Request .....	2-97
2.31.2 Design Summary .....	2-97
2.31.3 Data Changes .....	2-98
2.31.4 Order Changes .....	2-98
2.31.5 JODA Changes .....	2-98
2.32 JTLS-0572 OFF-MAP SSM FIRE .....	2-98
2.32.1 Summary of Model Change Request .....	2-98
2.32.2 Design Summary .....	2-98

2.32.3 Data Changes .....	2-100
2.32.4 Order Changes .....	2-100
2.32.5 JODA Changes .....	2-101
2.33 JTLS-2005-1431 ATO-T ORBIT POINTS .....	2-101
2.33.1 Summary of Model Change Request .....	2-101
2.33.2 Design Summary .....	2-101
2.33.3 Data Changes .....	2-102
2.33.4 Order Changes .....	2-102
2.33.5 JODA Changes .....	2-102
2.34 JTLS-2005-1483 FILLUP REFUEL CHIT .....	2-103
2.34.1 Summary of Model Change Request .....	2-103
2.34.2 Design Summary .....	2-103
2.34.3 Data Changes .....	2-107
2.34.4 Order Changes .....	2-107
2.34.5 JODA Changes .....	2-107
2.35 JTLS-2005-1558 PRISIM WORKSHEET .....	2-107
2.35.1 Summary of Model Change Request .....	2-107
2.35.2 Design Summary .....	2-108
2.35.3 Data Changes .....	2-110
2.35.4 Order Changes .....	2-110
2.35.5 JODA Changes .....	2-111
2.36 JTLS-2006-1660 INTEGERIZED LANCHESTRIAN COMBAT .....	2-111
2.36.1 Summary of Model Change Request .....	2-111
2.36.2 Design Summary .....	2-112
2.36.3 Data Changes .....	2-125
2.36.4 Order Changes .....	2-126
2.36.5 JODA Changes .....	2-126
2.37 JTLS-2006-1736 FOM REPRESENTATION OF FUEL FOR AIR MISSIONS ..	2-126
2.37.1 Summary of Model Change Request .....	2-126
2.37.2 Design Summary .....	2-127
2.37.3 Data Changes .....	2-128
2.37.4 Order Changes .....	2-128
2.37.5 JODA Changes .....	2-128
2.38 JTLS-2006-1752 IMPROVE FUEL USAGE FLEXIBILITY .....	2-128
2.38.1 Summary of Model Change Request .....	2-128
2.38.2 Design Summary .....	2-128
2.38.3 Data Changes .....	2-131
2.38.4 Order Changes .....	2-138
2.38.5 JODA Changes .....	2-138
2.39 JTLS-2006-1827 NEW COMMAND CONTROL MODEL .....	2-139
2.39.1 Summary of Model Change Request .....	2-139
2.39.2 Design Summary .....	2-139
2.39.3 Data Changes .....	2-152

2.39.4 Order Changes .....	2-154
2.39.5 JODA Changes .....	2-154
2.40 JTLS-2006-1837 REMOVE USMTF 1998 CODE FROM ATO-T .....	2-155
2.40.1 Summary of Model Change Request .....	2-155
2.40.2 Design Summary .....	2-155
2.40.3 Data Changes .....	2-155
2.40.4 Order Changes .....	2-155
2.40.5 JODA Changes .....	2-155
2.41 JTLS-2006-1846 OPM TARGETABLE WEAPONS COMBAT SYSTEMS LINK .....	2-155
2.41.1 Summary of Model Change Request .....	2-155
2.41.2 Design Summary .....	2-156
2.41.3 Data Changes .....	2-158
2.41.4 Order Changes .....	2-158
2.41.5 JODA Changes .....	2-158
2.42 JTLS-2006-1865 TUP SPECIAL CAPABILITIES .....	2-158
2.42.1 Summary of Model Change Request .....	2-158
2.42.2 Design Summary .....	2-158
2.42.3 Data Changes .....	2-159
2.42.4 Order Changes .....	2-159
2.42.5 JODA Changes .....	2-159
2.43 JTLS-2006-1900 IMPROVE MAP ENTRY OF UNITS AND TARGETS .....	2-160
2.43.1 Summary of Model Change Request .....	2-160
2.43.2 Design Summary .....	2-160
2.43.3 Data Changes .....	2-161
2.43.4 Order Changes .....	2-161
2.43.5 JODA Changes .....	2-161
2.44 JTLS-2006-1901 SPACES WITHIN UNIT LONG NAMES .....	2-161
2.44.1 Summary of Model Change Request .....	2-161
2.44.2 Design Summary .....	2-161
2.44.3 Data Changes .....	2-162
2.44.4 Order Changes .....	2-162
2.44.5 JODA Changes .....	2-162
2.45 JTLS-1006-1902 STANDARDIZE CONTEXT-SENSITIVE ORDER MENUS .....	2-163
2.45.1 Summary of Model Change Request .....	2-163
2.45.2 Design Summary .....	2-163
2.45.3 Data Changes .....	2-170
2.45.4 Order Changes .....	2-170
2.45.5 JODA Changes .....	2-170
2.46 JTLS-2006-1904 TRANSPARENT HEX TERRAIN OVERLAY .....	2-170
2.46.1 Summary of Model Change Request .....	2-170
2.46.2 Design Summary .....	2-170
2.46.3 Data Changes .....	2-173
2.46.4 Order Changes .....	2-173

2.46.5 JODA Changes .....	2-173
2.47 JTLS-2007-1973 JTLS FEED TO COMMON OPERATIONAL PICTURE (COP) .....	2-173
2.47.1 Summary of Model Change Request .....	2-173
2.47.2 Design Summary .....	2-173
2.47.3 Data Changes .....	2-174
2.47.4 Order Changes .....	2-174
2.47.5 JODA Changes .....	2-174
3.0 SOFTWARE TROUBLE REPORTS .....	
3.1 INTRODUCTION .....	3-1
3.2 ERRORS CORRECTED FOR THIS RELEASE .....	3-1
3.2.1 JTLS-1386 Accept Ownership And Use For New Runway .....	3-1
3.2.2 JTLS-2007-1993 Zero Used As Invalid Detection Time .....	3-1
4.0 REMAINING ERRORS .....	
4.1 INTRODUCTION .....	4-1
4.2 REMAINING ERRORS .....	4-1
4.2.1 JTLS-0639 Error Determining When Engineering Task Completed .....	4-1
4.2.2 JTLS-0695 Shadow Distance Of Zero Overriding Protection Radius .....	4-1
4.2.3 JTLS-0696 Missions Ignoring Assigned Altitude on Egress .....	4-1
4.2.4 JTLS-0697 Missions On The Ground With Invalid Destination .....	4-2
4.2.5 JTLS-0698 Cannot Re-Activate Destroyed Targets .....	4-2
4.2.6 JTLS-0699 Targets That Require An Owner Are Disassociated .....	4-2
4.2.7 JTLS-0700 GIAC Not Displaying Current Runway Length .....	4-2
4.2.8 JTLS-0701 Air Movement Report Does Not Consider Hold Points .....	4-2
4.2.9 JTLS-0702 Mission Waiting For Delayed Mission .....	4-2
4.2.10 JTLS-0703 Periodic Report Other Side Airbases Lists No Activity .....	4-2
4.2.11 JTLS-0704 Immediate Cancel Of Air Mission in Delay Status .....	4-3
4.2.12 JTLS-0705 Missions Launching With Fewer Aircraft Than Available .....	4-3
4.2.13 JTLS-0843 Error 427 .....	4-3
4.2.14 JTLS-0846 Naval Unit Distance Calculation .....	4-3
4.2.15 JTLS-0865 Incorrect External Program Order .....	4-4
4.2.16 JTLS-0869 Continue Engage Determination .....	4-4
4.2.17 JTLS-0870 Number of Air-to-Air Combat Kills Allowed .....	4-4
4.2.18 JTLS-0871 AC Mission Weapon Drop Determination .....	4-4
4.2.19 JTLS-0906 Change ADA pE To Per-Element pE .....	4-4
4.2.20 JTLS-0907 Scud-Like SSM Representation .....	4-5
4.2.21 JTLS-0908 Naval IADS Link Representation .....	4-5
4.2.22 JTLS-0909 Display Moderate And Severe Attrition Level .....	4-5
4.2.23 JTLS-0910 HRU Patrol Intel Reports .....	4-5
4.2.24 JTLS-0911 Fire Artillery Wait Time Between Missions .....	4-6
4.2.25 JTLS-0929 Ship Changes Sides .....	4-6
4.2.26 JTLS-0934 HRU Overwatch .....	4-6

4.2.27 JTLS-0942 Air Transport Cannot Combine Wet And Dry Supplies .....	4-6
4.2.28 JTLS-0948 Lanchester Double Kills .....	4-7
4.2.29 JTLS-0949 Destroyed Target SITREP Strength Incorrect .....	4-7
4.2.30 JTLS-0950 JTLS Radius Of Effects .....	4-7
4.2.31 JTLS-0952 Air Report .....	4-7
4.2.32 JTLS-0953 All Sides Informed About Supply Dump Error .....	4-7
4.2.33 JTLS-0954 Multiple Supply Storage Targets .....	4-7
4.2.34 JTLS-0955 Air Lift Drop Report Message .....	4-8
4.2.35 JTLS-0956 MPP Messages For Canceled Missions In Error .....	4-8
4.2.36 JTLS-0957 Can't Take Control Of Unowned Runways .....	4-8
4.2.37 JTLS-0958 Withdrawing Units Cannot Destroy Supply Targets .....	4-8
4.2.38 JTLS-0959 Logistics Report Problem .....	4-8
4.2.39 JTLS-0960 Can't Magic Move Airbase To Existing Airbase Location .....	4-8
4.2.40 JTLS-0961 Group Ground Move Delayed To Lead Unit .....	4-9
4.2.41 JTLS-0962 Pass Unit Intelligence Does Not Include Update Information .....	4-9
4.2.42 JTLS-0963 IMT Supply Category Line Disappears When Value Is Zero .....	4-9
4.2.43 JTLS-0964 Reporting Bridge Damage .....	4-9
4.2.44 JTLS-0965 Error In Time Report For SET SP CONVOY DELAYS .....	4-10
4.2.45 JTLS-0966 Incorrect Mission Report Locations .....	4-10
4.2.46 JTLS-0967 Fire Mission Not Deleted From GENIS .....	4-10
4.2.47 JTLS-0968 Inconsistency Between Regular Run And Pusher .....	4-10
4.2.48 JTLS-0969 Changing Mission On Alert .....	4-10
4.2.49 JTLS-0970 Availability Of Aircraft .....	4-11
4.2.50 JTLS-0971 Ship Continuous Tracking Not Working .....	4-11
4.2.51 JTLS-0972 Air Mission Find In Middle Of Ocean .....	4-11
4.2.52 JTLS-0973 Periodic Report Air Supplies And Fuel Not Correct .....	4-11
4.2.53 JTLS-0974 Submarine Detection By Ground Sensors .....	4-11
4.2.54 JTLS-0975 GDS Target Update Error .....	4-11
4.2.55 JTLS-0976 Manual Pairing And Protection Radius .....	4-11
4.2.56 JTLS-0977 Slightly Inaccurate Runway Length Sometimes Used .....	4-12
4.2.57 JTLS-0978 Air Missions Don't Completely Comply With Egress .....	4-12
4.2.58 JTLS-0979 Halted Helo Squadrons Show Mission As MOVING .....	4-12
4.2.59 JTLS-0980 SVP Warning 22 .....	4-12
4.2.60 JTLS-0981 Formation With No Posture .....	4-12
4.2.61 JTLS-0982 GIAC Shows HRU Mission Moving After Move Complete .....	4-13
4.2.62 JTLS-0983 IMT/GIAC Show Insert/Extract Mission Flying .....	4-13
4.2.63 JTLS-0984 IMT Doesn't Add Unit Names .....	4-13
4.2.64 JTLS-0985 PSYOP Results Multiplier .....	4-13
4.2.65 JTLS-0987 Set Periodic Report Times .....	4-13
4.2.66 JTLS-0988 Can't Repair Naval Catapults .....	4-14
4.2.67 JTLS-0989 Controller Damaged Aircraft Not In Periodic Reports .....	4-14
4.2.68 JTLS-0993 Weapons Report on Mission Report .....	4-14
4.2.69 JTLS-0994 HRU Creation Target Requirements Assessed Incorrectly .....	4-14

4.2.70 JTLS-0999 Cancel Naval Mission Fails When A Unit Is Specified ..... 4-14

4.2.71 JTLS-1010 Controller Cannot MM NEUTRAL Unit Onto Formation ..... 4-14

4.2.72 JTLS-1017 Airlift Mission Problem ..... 4-15

4.2.73 JTLS-1260 EMCON Order Problem Subordinates of Embarked Units ..... 4-15

4.2.74 JTLS-1328 SAM/AAA Initial Issue ..... 4-15

4.2.75 JTLS-1341 Assign Multi Attack Order ..... 4-15

4.2.76 JTLS-1351 Air Missions Refuel And Fly At Zero Altitude ..... 4-16

4.2.77 JTLS-1364 ROE Setting Unstable ..... 4-16

4.2.78 JTLS-1368 Orbiting OAS Assign Target ..... 4-16

4.2.79 JTLS-1375 Orbit Location In Ingress Route ..... 4-16

4.2.80 JTLS-1376 Fuel Chits ..... 4-16

4.2.81 JTLS-1377 Attack Posture Heading Home ..... 4-16

4.2.82 JTLS-1378 Mission Refuel Chit Retrieval Button Does Not Work ..... 4-17

4.2.83 JTLS-1379 Improve Mission Splitting Capability ..... 4-17

4.2.84 JTLS-1380 Intercept Stopped for Refuel Chit Time ..... 4-17

4.2.85 JTLS-1381 Mission Stops Moving After Break-off Intercept ..... 4-17

4.2.86 JTLS-1382 TBMCS ATO ID Problems ..... 4-17

4.2.87 JTLS-1383 Alert Missions Display On COP ..... 4-17

4.2.88 JTLS-1384 Area, Target, And Unit Report Documentation ..... 4-17

4.2.89 JTLS-1387 TBMCS Not Updating ATO Change Missions ..... 4-18

4.2.90 JTLS-1390 Orbiting OAS ..... 4-18

4.2.91 JTLS-2005-1455 Changing Support Unit Via Naval Move Incorrect ..... 4-18

4.2.92 JTLS-2005-1456 Improper Formation Arrive Time Message ..... 4-18

4.2.93 JTLS-2005-1457 Target Auto Assign Errors In Orbiting OAS ..... 4-18

4.2.94 JTLS-2005-1458 CAS Damage Errors From Orbiting OAS ..... 4-18

4.2.95 JTLS-2005-1459 Delay Order Not Executed Properly ..... 4-19

4.2.96 JTLS-2005-1460 Ship Heading Inconsistency ..... 4-19

4.2.97 JTLS-2005-1463 Units in Combat While Embarked ..... 4-19

4.2.98 JTLS-2005-1464 Location Fields Allow Invalid Location Formats ..... 4-19

4.2.99 JTLS-2005-1466 Incoming Messages Not In Correct Order ..... 4-19

4.2.100 JTLS-2005-1468 Perceived Aircraft Vectors Point In Wrong Direction ..... 4-19

4.2.101 JTLS-2005-1469 Shooting Side Has No Perception Of Shot Missile ..... 4-20

4.2.102 JTLS-2005-1471 Utilities Should Alter Group When Row Is Edited ..... 4-20

4.2.103 JTLS-2005-1475 Improper Depiction Of Unit Transported By Convoy ..... 4-20

4.2.104 JTLS-2005-1476 Aircraft Orders Allowed After JCATS Has Control ..... 4-20

4.2.105 JTLS-2005-1478 Order Lines Change Position on Map ..... 4-20

4.2.106 JTLS-2005-1598 Strip Alert Missions Unusable In Quick Manual Pair ..... 4-21

APPENDIX A. ABBREVIATIONS AND ACRONYMS ..... A-1

APPENDIX B. COMBAT SYSTEM CATEGORY DEFINITIONS.....B-1

APPENDIX C . VERSION 3.2 STANDARD DATABASE CHANGES.....C-1

C.1 GENERAL MODIFICATIONS .....C-1  
C.2 NEW SDBOIF SCENARIO .....C-2  
C.3 COMBAT SYSTEM UPGRADES .....C-2  
C.4 SUPPORTING EXISTING COMBAT SYSTEMS .....C-7  
C.5 REMAINING ENHANCEMENTS .....C-8





## 1.0 INTRODUCTION

### 1.1 SCOPE

This JTLS Version Description Document (VDD) describes Version 3.2.0.0 of the configured software suite identified as the Joint Theater Level Simulation (JTLS). JTLS 3.2.0.0 represents the follow-on capability to the JTLS 3.1 series of releases.

JTLS 3.2.0.0 is a complete Major release that includes the Web Hosted Interface Program (WHIP), as well as an updated Standard Database, named *sdboif*, that includes a new and more realistic scenario based on Operation Iraqi Freedom. Database modifications that were accomplished to upgrade the previous JTLS Standard Database to this current version are summarized in this chapter. Detailed descriptions of Enhancement Change Proposals (ECPs) implemented for this release are provided in Chapter 2. The code maintenance modifications that represent corrections to Software Trouble Reports (STRs) are described in Chapter 3 of this document. The remaining outstanding STRs are described in Chapter 4.

The JTLS 3.2.0.0 release executes on the SUN/SPARC Solaris and the Red Hat Linux operating systems.

### 1.2 INVENTORY OF MATERIALS

This section lists documents and software relevant to JTLS. JTLS documents can be obtained by contacting the Configuration Management Agent (CMA) at the address listed in the Abstract on Page *iii* of this document. DoD Military Standards can be obtained through the appropriate military channels.

#### 1.2.1 Obsolete/Outdated Documents

No documents have been removed from the JTLS documentation suite for this release.

#### 1.2.2 Unchanged Documents

Due to the extensive changes made as part of JTLS 3.2.0.0, all JTLS documents have been revised as a part of this release.

#### 1.2.3 Updated Documents

The documents listed in this section have been updated for JTLS 3.2.0.0 to reflect functional enhancements or requirements to the JTLS system.

- a. *JTLS Analyst's Guide* (JTLS Document 01, Version 3.2.0.0)
- b. *JTLS ATOG User's Guide* (JTLS Document 02, Version 3.2.0.0)
- c. *JTLS ATOT User's Guide* (JTLS Document 03, Version 3.2.0.0)

- d. *JTLS Controller's Guide* (JTLS Document 04, Version 3.2.0.0)
- e. *JTLS Data Requirements Manual* (JTLS Document 05, Version 3.2.0.0)
- f. *JTLS DDS User's Guide* (JTLS Document 06, Version 3.2.0.0)
- g. *JTLS Director's Guide* (JTLS Document 07, Version 3.2.0.0)
- a. *JTLS Executive Overview* (JTLS Document 08, Version 3.2.0.0)
- a. *JTLS Installation Manual* (JTLS Document 09, Version 3.2.0.0)
- b. *JTLS WHIP Training Manual* (JTLS Document 10, Version 3.2.0.0)
- c. *JTLS Player's Guide* (JTLS Document 12, Version 3.2.0.0)
- d. *JTLS PPS User's Guide* (JTLS Document 13, Version 3.2.0.0)
- e. *JTLS Standard Database Description* (JTLS Document 14, Version 3.2.0.0)
- f. *JTLS Software Maintenance Manual* (JTLS Document 15, Version 3.2.0.0)
- g. *JTLS Technical Coordinator's Guide* (JTLS Document 16, Version 3.2.0.0)
- h. *JTLS Version Description Document* (JTLS Document 17, Version 3.2.0.0)
- i. *JTLS Entity Level Server User's Guide* (JTLS Document 19, Version 3.2.0.0)

#### 1.2.4 New Documents

JTLS 3.2.0.0 includes the Entity Level Server, a new program designed to independently model the movement of entities represented by aggregate JTLS units. The *JTLS ELS User's Manual* (JTLS Document 19, Version 3.2.0.0), which describes the functional requirements and user procedures implemented for the JTLS Entity Level Server, is provided with this release.

#### 1.2.5 Released Software

The JTLS Version 3.2.0.0 may be delivered either on a CD, or as a set of compressed tar files to be downloaded. Either method includes the complete suite of software executable code and command procedures. The following software components are included in this release:

- a. Combat Events Program (CEP)
- b. Information Management Tool (IMT)
- c. Message Processor Program (MPP)
- d. Scenario Initialization Program (SIP)
- e. Interface Configuration Program (ICP)
- f. Interface Configuration Program Login (IPCLogin)
- g. Order Preprocessor Program (OPP)
- h. Reformat Spreadsheet Program (RSP)
- i. Database Development System (DDS)
- j. Terrain Modification Utility (TMU)
- k. Lanchester Development Tool (LDT)
- l. ATO Generator Program (ATOG)
- m. ATO Translator Program (ATOT)
- n. ATO Retrieval Program (ATORET)
- o. Convert Location Program (XCONVERT)
- p. Count Critical Order Program (CCO)

- q. Graphical Database Program (GDP)
- r. HLA Interface Program (HIP)
- s. After Action Review Client (AARC)
- t. Scenario Data Client (SDC)
- u. Order Entry Client (OEC)
- v. Order Verification Tool (OVT)
- w. JTLS Object Distribution Authority (JODA)
- x. Web-Hosted Interface Program (WHIP) and its component programs:
  - 1. Apache Server (APACHE)
  - 2. JTLS XML Serial Repository (JXSR)
  - 3. Order Management Authority (OMA)
  - 4. Synchronized Authentication and Preferences Service (SYNAPSE)
  - 5. Web Services Manager (WSM)
  - 6. XML Message Service (XMS)
- y. Entity Level Server (ELS)
- z. Template Building Tool (TBT)
- aa. JTLS Operational Interface (JOI)

Instructions for installing JTLS 3.2.0.0 are provided in the *JTLS Installation Manual*. It is not necessary to install any previous version of JTLS prior to installing JTLS 3.2.0.0. No other upgrade beyond installation of the compressed tar files (or CD) is required. The software that is provided is a complete release that includes all files and code required to execute JTLS.

### 1.2.6 Released Databases

This release includes two sample unclassified databases.

The scenario developed as *Standard Database Operation Iraqi Freedom* and named *sdboif* is a large-scale, seven-sided scenario database reflecting the approximate starting positions of units involved in the March 2003 invasion of Iraq. This example scenario was developed using unclassified data sources and as a result is not completely accurate. Discrepancies with actual units and their locations are not detrimental to the intended purpose of this database, which is to provide a recognizable and realistic scenario that demonstrates the simulation capabilities and supports JTLS training.

The scenario *blank32* is the *sdboif* database with all force structure data removed. It can be used as the foundation to build your own database.

## 1.3 INTERFACE COMPATIBILITY

### 1.3.1 Support Software

JTLS 3.2.0.0 requires the following versions of support software, including operating systems, compilers, scripting utilities, database tools, transfer protocols, and display managers.

- a. Operating system for the model (one of the following):
  1. Solaris 8 for use on Sun/SPARC Workstations
  2. Solaris 9 for use on Sun/SPARC Workstations
  3. Red Hat Linux Enterprise Edition Version 3.0 (ES)
  4. Red Hat Linux Enterprise Edition Version 4.0 (ES), 32-bit or 64-bit architecture.
- b. Operating system for workstations (one of the following):
  1. Solaris 8 for use on Sun/SPARC Workstations
  2. Solaris 9 for use on Sun/SPARC Workstations
  3. Red Hat Linux Enterprise Edition Version 3.0 (WS)
  4. Red Hat Linux Enterprise Edition Version 4.0 (WS), 32-bit or 64-bit architecture.
  5. Windows 2000
  6. Windows XP

Although Solaris 8 and Solaris 9 are fully supported to operate JTLS workstations, the Java-based Web-Hosted Interface Program (WHIP) is noticeably more efficient on Linux-based or Windows-based operating system machines.

- c. Operating system for Support Software, such as HIP, SIP, etc:
  1. Solaris 8 for use on Sun/SPARC Workstations (excepting all HLA programs)
  2. Solaris 9 for use on Sun/SPARC Workstations
  3. Red Hat Linux Enterprise Edition Version 3.0 (ES)
  4. Red Hat Linux Enterprise Edition Version 4.0 (ES)
- d. Java Version 1.5 or later is required for all platforms.
- e. JTLS database tools require the use of an Oracle database server and the Oracle Form/Reports Developer 6i client/server runtime (with patchset 18 or later). Refer to [Section 1.6.2, Oracle Compatibility and Installation](#) of this chapter for additional installation details.
- f. Windows software, X11R5 server, Motif 1.2 Library, Motif Window Manager: These items are included as part of Solaris 8 or 9 and Linux ES 3.0 or 4.0.
- g. Adobe Acrobat Reader Version 4.0.5 or later, is required to read the delivered JTLS documentation. The JTLS 3.2.0.0 tar file (or CD) includes the freeware version of Acrobat Reader.
- h. TCP/IP is required for inter-process communication between the JODA data server and all user interface programs. The version of TCP/IP included with Solaris 8 or 9, and Red Hat Linux ES/WS 3.0 or 4.0 is sufficient.
- i. The Perl script language is used by the JTLS system and game setup scripts. The version of Perl included with Solaris 8 or 9, or Red Hat Linux ES/WS 3.0 or 4.0 is sufficient. The Perl program is typically located in the /usr/bin directory. If Perl is installed in a another location, a link should be created from the /usr/bin directory to this program.

- j. KDE Desktop support has been added to JTLS Version 3.2.0.0. Support of the GNOME desktop is continuing, and use of the KDE environment is optional. Details regarding the installation and use of KDE are provided in Section 4.4.3.2 of the *JTLS Installation Manual*.
- k. SIMSCRIPT II.5 (SIMSCRIPT to C) translator/compiler: SIMSCRIPT is required for recompiling JTLS code. It is not necessary to have a SIMSCRIPT compiler to execute JTLS, because all JTLS software executables are statically linked with the SIMSCRIPT libraries. The compiler is needed only if you are a U.S. Government organization that can obtain source code and plan to re-compile JTLS SIMSCRIPT code. To obtain a SIMSCRIPT compiler, contact CACI Inc. The following SIMSCRIPT II.5 versions are recommended for each platform:
  - 1. 32-bit SUN Solaris: version 3.0.3
  - 2. 32-bit Red Hat Linux: version 3.4
  - 3. 64-bit Red Hat Linux: version 3.5
- l. ANSI C Compiler: It is not necessary to use a C compiler to execute JTLS. This compiler is needed only if you are a U.S. Government organization that can obtain source code and plan to re-compile any JTLS software program. If you need a C compiler, the following versions will suffice:
  - 1. SUN Solaris: ANSI C 5.2 or later
  - 2. Linux: C Compiler as delivered with Red Hat Linux ES 3.0 or 4.0
- m. C++ Compiler: It is not necessary to use a C++ compiler to execute JTLS. This compiler is needed only if you are a U.S. Government organization that can obtain source code and intend to re-compile any of the JTLS HLA software programs. If you need a C++ compiler, these versions are sufficient:
  - 1. SUN Solaris: ANSI C++ 5.2 or later
  - 2. Linux: C++ Compiler delivered with Red Hat Linux ES 3.0 or 4.0

### 1.3.2 HLA Compliance

The JTLS 3.2.0.0 release is fully High Level Architecture (HLA) compliant, and includes all the programs required to run JTLS in an HLA mode on any operating system listed in Item *c* of [Section 1.3.1, Support Software](#).

The HLA RTI (Run Time Infrastructure) executive program (rtiexec) recommended for use with this release is RTI-NG-Pro-v4.0. However, this program is not included in the JTLS 3.2.0.0 delivery. Users may obtain a full installation package of this RTI software from the vendor, Raytheon Virtual Technology Corporation, by contacting their Web site at <http://www.virtc.com>. For information about executing the HLA RTI Executive and other HLA-related software, refer to the appropriate HLA documentation and user guides.

### 1.3.3 JTLS Operational Interface (JOI)

JTLS exercises conducted by the United States Government have required data feeds to real-world Control, Communications, Computers, and Intelligence (C4I) systems. The JOI is designed to provide a configuration-managed capability to convey current JTLS force status information to these systems. This capability allows all JTLS 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.

The JOI is a JTLS Object Distribution Authority (JODA) client that has the capability to easily start and stop the feed of these OTH-Gold messages according to the status of the JTLS game and is able to alter the naming data passed to the real-world systems. Consequently, any database object naming errors can be corrected independently of the model to allow the exercise audience to view correct names while monitoring the real-world system that is populated by the JOI. The JOI has a complete checkpointing capability and can be restarted from any of its checkpoint files without losing information.

Chapter 15 of the *JTLS Technical Coordinator's Guide* describes procedures for using the JOI and how the program obtains information required to properly fill the OTH-Gold messages. Information about operating the Global Command and Control System (GCCS) is not included. The content and format specifications of each message file that the JOI accesses are described in Chapter 34 of the *JTLS Software Maintenance Manual*.

## 1.4 INSTALLATION CONSIDERATIONS

The procedures for installing JTLS 3.2.0.0 depend on the hardware configuration provided at the installation site. All installation considerations are addressed in *the JTLS Installation Manual*.

## 1.5 DATABASE MODIFICATIONS

This release includes a completely new demonstration database, named *sdboif*, that provides enhanced, realistic support of real-world operations. Additionally, significant database changes were implemented in conjunction with the upgrade from JTLS Version 3.1.0.0 to Version 3.2.0.0. The following sections provide a detailed description of these changes.

### 1.5.1 Graphic Symbols Update

Updating the graphic symbol definitions for your JTLS scenario is required before the database is upgraded to Version 3.2. To upgrade the symbol file for a scenario, use this procedure to run the JSyms application and resave the symbols:

1. Run JSyms for the scenario by typing this command: `jsyms <scenario_name>`.
2. Before JSyms starts, this dialog message appears: "Your symbol files need to be upgraded. Select File Save to upgrade." At this point, you will not need to make any modifications to the symbol file. JSyms will perform the upgrade when the symbols are saved. You can bypass the upgrade process by exiting JSyms without saving.
3. Select File > Save and exit JSyms.

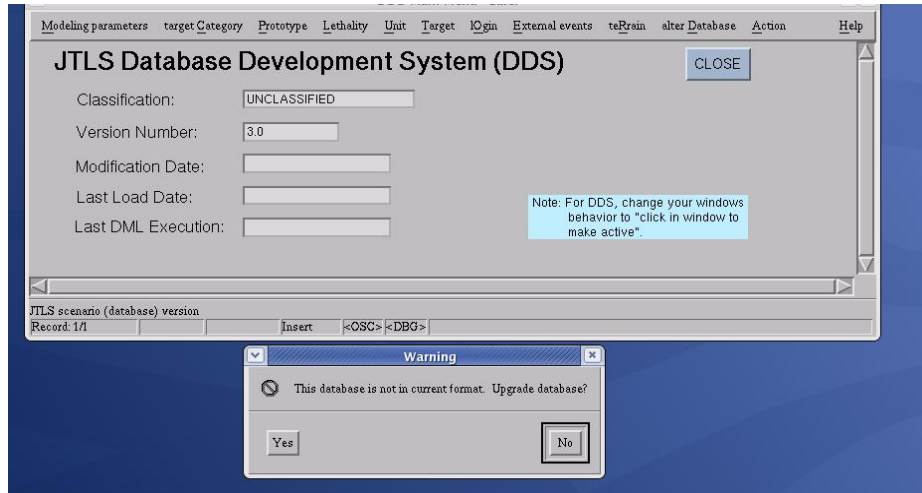
**Note:** JTLS 3.2 graphic symbols have an Organization Type field that is not present in Version 3.1. After this required upgrade process is complete, each symbol will be assigned a default Organization Type of UNK.

### 1.5.2 Database Upgrade

The generic JTLS database upgrade feature of the Database Development System (DDS), known as the JTLS Database Modify process, is accessed by a sequence of three *JTLS Menu* options: *1. Prepare or Alter a Scenario Database > 1. Access the Database Development System Menu > 2. Access an Existing Database*. This upgrade feature must be used to upgrade the JTLS Standard Database from Version 3.1 to Version 3.2.0.0

Oracle Database Server version 9.2.0.8 or later must be used to execute the Database Modify process while upgrading the JTLS Standard Database from any previous version to Version 3.2.0.0. The modification process will fail if performed using earlier Oracle DB versions.

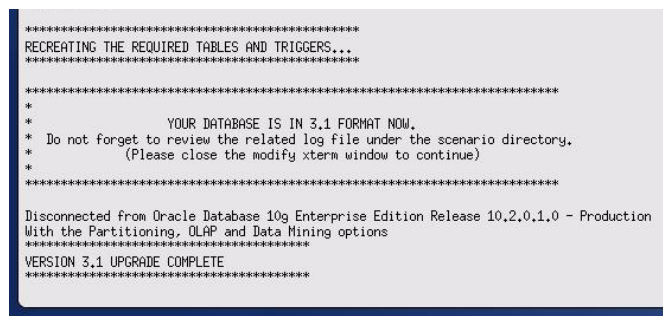
When the user selects and accesses a database that does not conform to the Standard Database 3.2 format, a Warning dialog box (Figure 1.1) queries the JTLS user to begin the upgrade process.



**Figure 1.1 Starting the Database Upgrade**

Selecting the *Yes* option executes a separate process, entitled *Modifying Your JTLS Database*, that determines the existing format of the selected database, begins the upgrade, and displays its progress

The database upgrade is successfully completed when the message shown in Figure 1.2 is displayed. The terminal window should then be closed.



**Figure 1.2 Database Upgrade Completed**

The JTLS Database Modify process for the JTLS 3.1 series of releases includes an interactive feature that requires user input while the upgrade process executes. *This interactive upgrade process must be used to modify your scenario database from JTLS version 3.0 or earlier to JTLS Version 3.2.0.0.* Ensure that you review the corresponding database modification section of Chapter 1 of the *JTLS Version Description Document* for JTLS versions 3.1.0.0, 3.1.1.0, or 3.1.2.0, which describes the interactive modification process for the upgrade from Version 3.0 to 3.1. This process requires specific user input, which is described and illustrated in detail.



After your database has been modified from Version 3.0 or earlier to Version 3.2.0.0 and downloaded to ASCII files, *a successive scenario load is required* to properly create the check constraints in the database to include the new illegal character set ( *space*, " , #, &, @, /, {, }, <, >, ' ). Unit names, Target names, or other object names that contain any of these characters will be automatically removed from your database. These symbols are incompatible with the JTLS 3.2.0.0 WHIP.

### 1.5.3 Data Elements

Currently implemented ECPs have required the addition, deletion, or modification of several data elements. The description and use of the affected variables are presented in Chapter 2 and summarized below in [Table 1](#). Detailed descriptions are provided in Appendix B of the *JTLS Data Requirements Manual*.

**Table 1. Summary of Standard Database OIF Data Elements**

VARIABLE NAME	CHANGE	DESCRIPTION
These parameters support the separate graphical representation of Truck, Barge, and Rail convoys on the WHIP display.		
SLP TRUCK CONVOY SYMBOL	Modified	Formerly SLP CONVOY SYMBOL. This Sustainment Logistics Prototype entity attribute holds the name of the Graphic Symbol used to display a Truck Convoy dispatched from a Support unit belonging to a Faction that uses this SLP.
SLP BARGE CONVOY SYMBOL	Added	This Sustainment Logistics Prototype entity attribute holds the name of the Graphic Symbol used to display a Barge Convoy dispatched from a Support unit belonging to a Faction that uses this SLP. This new attribute will be filled with the symbol held by the obsolete SLP CONVOY SYMBOL database parameter
SLP RAIL CONVOY SYMBOL	Added	This Sustainment Logistics Prototype entity attribute holds the name of the Graphic Symbol used to display a Rail Convoy dispatched from a Support unit belonging to a Faction that uses this SLP. This new attribute will be filled with the symbol held by the obsolete SLP CONVOY SYMBOL database parameter
This data parameter represents the limitations of Towed Array sensors employed by Naval units.		

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
ST MAXIMUM SPEED ALLOWED	Added	This Sensor Type entity attribute holds the maximum speed at which the ship carrying a sensor of Type I can be moving and still be able to use the sensor to detect other assets.
The meaning of this Aircraft Class attribute has been changed as a result of implementing a reason code for an Air Mission's intercept termination.		
AC CONTINUE ENGAGE MULT	Modified	This attribute of the Aircraft Class permanent entity is used to determine whether an attacking aircraft continues an air-to-air engagement after the first shot is fired. The data held for this variable should be reviewed in any database that is upgraded to a JTLS 3.2 format.
This parameter supports the capability of the Interceptor Assignment logic to prevent a Combat Air Patrol mission from automatically intercepting a specified aircraft target type.		
ACP ATC AUTO INTERCEPT ALLOWED	Added	This variable holds an indicator that signifies whether the CAP missions from a Faction that uses ACP I can be automatically sent to intercept a mission that has aircraft that use ATC J. This data element requires a new Oracle table, a new initialization data file, and a new Database Development System (DDS) Air Control Prototype (ACP) child form.
These parameters support modification of the JTLS Lanchester attrition capability to reduce its dependence upon the hexagonal terrain model.		
CSP CS FRACTION FAIL ON ISSUE	Deleted	All references apply to CSP CS PROB NON COMBAT FAILURE.
CSP CS FRACTION REPAIRED PER PERIOD	Deleted	All references apply to CSP CS MEAN TIME BETWEEN REPAIRS.
CSP CS FRACTION RECOVERABLE	Deleted	All references apply to CSP CS PROB SYSTEM RECOVERED
CSP FRACTION REMAINS RECOVERABLE.	Deleted	All references apply to CSP PROB REMAINS RECOVERED.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
MIN TONS CL VII TO DISTRIBUTE	Deleted	Not used
SP CS PACKET SIZE	Modified	Except for personnel Combat Systems, 1 is a reasonable value. For personnel, a value between five and 20 is reasonable.
SP CS HRU PACKET SIZE	Modified	Typically, this value should be 1.
SP TU UNIT LEVEL ATTRITION MODERATE	Modified	This variable specifies the fractional loss per hour that constitutes attrition at a moderate level.
SP TU UNIT LEVEL ATTRITION SEVERE	Modified	This variable specifies the fractional loss per hour that constitutes attrition at a severe level.
TUP CS TOE	Modified	This variable represents the number of items of the Combat System that the Unit is authorized to have on hand as a integer value.
CSP CS ATTRITION TYPE	Modified	The new value SHORT-INDIRECT indicates an indirect fire computation subject to combat power distribution.
CSP CS SUPPLY USAGE PER DAY	Modified	This Combat System entity attribute specifies the amount of supplies that a single Combat System of this type uses during <b>per day</b> if the unit is in a Lanchester Battle Set.
LANCHESTER COEFFICIENT BASE TIME	Added	This general modeling parameter holds the time period for which the Lanchester coefficients in this database were computed.
MINIMUM ASSESS COMBAT INTERVAL	Added	This general modeling parameter holds the minimum time interval during which an Assess Combat will be conducted and represents the greatest acceptable period of time to withhold the computation of combat results.
CSP CS PROB NON COMBAT FAILURE	Added	This Combat System Prototype, Combat System entity attribute represents the probability that a Combat System of this type will be unavailable due to non-combat failure when the unit arrives in the game.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
CSP CS PROB SYSTEM RECOVERED	Added	This Combat System Prototype, Combat System entity attribute represents the probability that a Combat System loss is recovered and placed into maintenance for repair.
CSP PROB REMAINS RECOVERED	Added	This Combat System Prototype, Combat System entity attribute represents the probability that personnel Combat Systems are recovered, even though they have been catastrophically destroyed or Killed In Action.
CSP CS MEAN TIME BETWEEN FAILURE	Added	This Combat System Prototype, Combat System entity attribute is the mean of an exponential distribution that represents the average time between non-combat failures for a Combat System of this type.
CSP CS MEAN TIME BETWEEN REPAIR	Added	This Combat System Prototype, Combat System entity attribute is the mean of an exponential distribution that represents the average time between repairs for a Combat System of this type.
These parameters support a capability to enable a single JTLS SSM launcher to fire more than one Targetable Weapon type.		
SSM TARGETABLE WEAPON	Deleted	Not used
SSM TW CAN FIRE	Added	This indicator signifies whether the SSM is permitted to fire the specified Targetable Weapon. Database builders must thoroughly review their SSM target data and remove any SSMs that were created to provide their units the capability to fire various Targetable Weapons.
These parameters support the JTLS logistics consumption algorithm enhancements that track supply consumption according to the type and number of Combat Systems owned by a particular unit.		
CSP CS NON COMBAT FUEL USAGE	Added	This Combat System Prototype, Combat System entity attribute holds the amount of fuel Combat System J uses per day when it is owned by a unit belonging to a faction that uses Combat System Prototype I while the unit is in a non-combat mode.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
CSP CS COMBAT FUEL USAGE	Added	This Combat System Prototype, Combat System entity attribute holds the amount of fuel Combat System J uses per day when it is owned by a unit belonging to a faction that uses Combat System Prototype I while the unit is participating in a force-on-force Lanchestrian battle.
CSP CS FUEL PER KM	Added	This Combat System Prototype, Combat System entity attribute holds the amount of fuel Combat System J uses per day when it is owned by a unit belonging to a faction that uses Combat System Prototype I while the unit is moving.
SLP UP FUEL MODIFIER	Added	This Combat System Prototype, Combat System entity attribute holds the modifier for the amount of fuel a unit belonging to a Faction that uses Sustainment Logistics Prototype I while the unit is in posture J.
CSP UP AMMUNITION MODIFIER	Added	This Combat System Prototype, Combat System entity attribute holds the modifier for the amount of ammunition a unit belonging to a Faction that uses Combat System Prototype I while the unit is in posture J.
CATEGORY CLASS III NAVAL	Added	This variable specifies the supply category that is used for naval movement fuel.
CSP CS AMMUNITION SUPPLY USAGE	Modified	Formerly CSP CS SUPPLY USAGE PER PERIOD. This variable specifies the amount of supplies that a single Combat System of this type uses during one day, if the owning unit is in combat.
TUP SC USAGE ATTACK	Modified	Formerly TUP SC PER PERIOD USAGE ATTACK. This variable specifies the rate at which an attacking Unit consumes the category of supply per day, which is added to the normal consumption rate specified in the TUP SC BASIC USAGE attribute if the Unit is in the ATTACK posture and is in contact with enemy units.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
TUP SC USAGE DEFEND	Modified	Formerly TUP SC PER PERIOD USAGE DEFEND. This variable specifies the rate at which an attacking Unit consumes the category of supply per day, which is added to the normal consumption rate specified in the TUP SC BASIC USAGE attribute if the Unit is in the DEFEND posture and is in contact with enemy units.
TUP SC USAGE DELAY	Modified	Formerly TUP SC PER PERIOD USAGE DELAY. This variable specifies the rate at which an attacking Unit consumes the category of supply per day, which is added to the normal consumption rate specified in the TUP SC BASIC USAGE attribute if the Unit is in the DELAY posture and is in contact with enemy units.
TUP SC USAGE WITHDRAW	Modified	Formerly TUP SC PER PERIOD USAGE WITHDRAW. This variable specifies the rate at which an attacking Unit consumes the category of supply per day, which is added to the normal consumption rate specified in the TUP SC BASIC USAGE attribute if the Unit is in the WITHDRAW posture and is in contact with enemy units.
SUP SC USAGE AIR OPS	Modified	Formerly TUP SC PER PERIOD AIR OPS USAGE. This variable specifies the rate at which a ship consumes the category of supply while it is in an AIR OPERATIONS posture, which is added to the normal consumption rate specified in the SUP SC BASIC USAGE attribute,
SUP SC USAGE GUNFIRE	Modified	Formerly TUP SC PER PERIOD GUNFIRE USAGE. This attribute of the SHIP UNIT PROTOTYPE, SUPPLY CATEGORY entity specifies the rate at which a ship consumes the category of supply while it is reinforcing a land Unit that is involved in Lanchestrian combat, and is added to the normal consumption rate specified in the SUP SC BASIC USAGE attribute.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
SUP SC PER KM USAGE	Modified	This SHIP UNIT PROTOTYPE entity attribute and specifies the amount of the Supply Category required to move the unit one kilometer.
These parameters support the C3 representation as a unit capability rather than a Combat System.		
CP TIME DELAY PER 100 KM	Deleted	Communications are no longer a function of the distance between units, and are based solely on the communication capability of the two units that attempt contact.
CP JAMMING DELAY TIME MAX	Deleted	All references apply to CQR JAMMING DELAY TIME MEAN.
CP JAMMING DELAY TIME MEAN	Deleted	All references apply to CQR JAMMING DELAY TIME MEAN.
CP PROB BACKGROUND MESSAGE DELAY	Deleted	All references apply to CP CQR PROB MESSAGE DELAY.
CP COMM JAM ADA ENGAGE EFFECTIVENESS	Deleted	All references apply to CP CQR COMM JAM ADA ENGAGE MULT.
CP COMM JAM COMBAT EFFECTIVENESS	Deleted	All references apply to CP CQR COMM JAM COMBAT MULT.
CP COMM JAM COMM SITE EFFECTIVENESS	Deleted	All references apply to CP CQR COMM JAM COMM SITE MULT
CP COMM JAM INDIRECT FIRE DELAY FACTOR	Deleted	All references apply to CP CQR COMM JAM FIRE DELAY MULT.
CP COMM JAM MOVE DELAY FACTOR	Deleted	All references apply to CP CQR COMM JAM MOVE DELAY MULT.
CP COMM JAM INTERNAL TIME DELAY FACTOR	Deleted	All references apply to CP CQR COMM JAM INTERNAL MULT.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
COMBAT SYSTEM C3	Deleted	The Combat System specified by COMBAT SYSTEM C3 will also be removed from the Combat System list when the Modify program is executed.
CC TYPE	Modified	This variable is an attribute of the Communication Center entity. CC TYPE (I) holds the function that a Communications Site target, which has a TG SUBCATEGORY value of I, will fulfill.
CC DATALINK RANGE	Modified	This attribute is used only if the CC TYPE is AIR_DEFENSE, and not used for subcategories with CC TYPE of COMMAND.
CC JAMMING FACTOR	Modified	The message is delayed due to jamming for a period of time drawn from an exponential distribution with a mean equal to the value held in the CQR JAMMING DELAY TIME MEAN attribute of the C3 QUALITY RATING entity.
CP JAMMING THRESHOLD	Modified	This attribute is used only if the CC TYPE is AIR_DEFENSE, and not used for subcategories with CC TYPE of COMMAND.
TG NUMBER	Modified	The allowable range of values is different for each target type for which the Target Number attribute is used. This is a new data field for Communication Site targets. For type COMMAND, this value represents the number of percentage points subtracted from the UT C3 EFFECTIVENESS of the target's owning or associated unit when the target is destroyed.
TG ASSOCIATED UNIT	Modified	This attribute of the TARGET entity holds the name of the unit with which the target is associated. This may be a unit other than the unit that owns the target.
TG OWNING UNIT	Modified	This attribute of the TARGET entity holds the name of the owning unit, if assigned, and represents the unit that determines the target's Faction, and by extension, other Faction-related attributes



**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
CQR NAME	Added	This attribute of the C3 QUALITY RATING permanent entity holds the text name of the quality rating.
CQR EFFECTIVENESS MULTIPLIER	Added	This attribute of the C3 QUALITY RATING permanent entity holds the value of the quality rating modifier that is applied to the unit's UT C3 EFFECTIVENESS when the C3 effectiveness level is used for other than computing message delays
CQR MINIMUM C3 EFFECTIVENESS	Added	This attribute of the C3 QUALITY RATING permanent entity holds the minimum value that the product of the quality rating modifier and the unit's C3 effectiveness is allowed to be for this quality rating.
CQR MEAN MSG DELAY HIGHEST HQ	Added	This attribute of the C3 QUALITY RATING permanent entity holds the exponential mean of the message delay time between a unit and the highest headquarters unit on the side for this quality rating when both units' UT C3 EFFECTIVENESS is 1.0.
CQR MAX MSG DELAY NEXT HIGHER	Added	This attribute of the C3 QUALITY RATING permanent entity holds the maximum message delay time between a unit and its next higher level headquarters unit for this quality rating.
CQR JAMMING DELAY TIME MEAN	Added	This attribute of the C3 QUALITY RATING permanent entity represents the mean time a jammed message is delayed when a unit with this quality rating is being jammed.
CQR JAMMING DELAY TIME MAX	Added	This attribute of the C3 QUALITY RATING permanent entity represents the maximum time a jammed message is delayed when a unit with this quality rating is being jammed
CQR PRIORITY	Added	This attribute of the C3 QUALITY RATING permanent entity holds the ranking or priority value of the quality rating. This data parameter is used to compare the general quality or capability of two different CQR objects.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
CQR NEXT LOWER QUALITY RATING	Added	This attribute of the C3 QUALITY RATING permanent entity holds the name of the CQR object that should be assigned to a unit when the unit's UT C3 EFFECTIVENESS becomes zero
CQR LOWER RATING EFFECTIVENESS	Added	This attribute of the C3 QUALITY RATING permanent entity holds the initial value of the unit's UT C3 EFFECTIVENESS after the unit is assigned the new lower quality rating because the unit's UT C3 EFFECTIVENESS is equal to zero.
CQR NEXT HIGHER QUALITY RATING	Added	This attribute of the C3 QUALITY RATING permanent entity holds the name of the CQR object that should be assigned to a unit when the unit's UT C3 EFFECTIVENESS value exceeds 1.0. An SVP check is added to ensure that the CQR PRIORITY is consistently assigned.
CQR HIGHER RATING EFFECTIVENESS	Added	This attribute of the C3 QUALITY RATING permanent entity holds the initial value of the unit's UT C3 EFFECTIVENESS after the unit is assigned the new higher quality rating because the unit's UT C3 EFFECTIVENESS value exceeds 1.0.
CQR HIGHER RATING EFFECTIVENESS	Added	This attribute of the C3 QUALITY RATING permanent entity holds the initial value of the unit's UT C3 EFFECTIVENESS after the unit is assigned the new higher quality rating because the unit's UT C3 EFFECTIVENESS value exceeds 1.0.
CQR C3 LOSS MULT	Added	This attribute of the C3 QUALITY RATING permanent entity holds the portion of the unit's weighted unit strength loss that is subtracted from the unit's UT C3 EFFECTIVENESS.
The Communication Prototype (CP) entity already exists in the initialization database. A new sub-entity table is added to hold data required for each CP and CQR combination.		
CP CQR PERCENT RECOVERED PER DAY	Added	This attribute of the Communications Prototype, C3 Quality Rating compound entity holds the percent of C3 effectiveness that a unit can recover in one day.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
CP CQR PROB MESSAGE DELAY	Added	This attribute of the Communications Prototype, C3 Quality Rating compound entity represents the probability that a message sent by a unit is delayed.
CP CQR COMM JAM ADA ENGAGE MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. The quality rating referenced is the CQR of the unit that is being jammed and attempting to engage.
CP CQR COMM JAM COMBAT MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. The referenced quality rating is the CQR of the attriting unit.
CP CQR COMM JAM COMM SITE MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. This factor is a measure of the Faction's susceptibility to communications jamming when the owning unit of the COMM SITE has the referenced quality rating.
CP CQR COMM JAM FIRE DELAY MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. The communications prototype referenced is the CP of the unit firing the mission. The referenced quality rating is the CQR of the unit that is being jammed and is firing the mission
CP CQR COMM JAM INTERNAL MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. The referenced communications prototype is the CP of the unit conducting the task. The referenced quality rating is the CQR of the unit conducting the task.
CP CQR COMM JAM MOVE DELAY MULT	Modified	This variable is an attribute of the Communications Prototype, C3 Quality Rating compound entity. The communications prototype referenced is the CP of the unit conducting the move. The quality rating referenced is the CQR of the unit conducting the move.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
UT C3 EFFECTIVENESS	Added	This variable is an attribute of the Unit entity, and holds the current effectiveness level of a unit's Command and Control capability.
UT C3 QUALITY RATING	Added	This variable is an attribute of the Unit entity, and holds the name of the C3 QUALITY RATING that this unit is assigned when it arrives in the game.
UT HIGHEST C3 QUALITY RATING	Added	This variable is an attribute of the Unit entity, and holds the name of the highest possible C3 QUALITY RATING to which this unit may be set during the game.
HUP C3 QUALITY RATING	Added	This variable is an attribute of the High Resolution Unit Prototype entity, and holds the name of the HRU C3 QUALITY RATING that should be assigned to an HRU that uses this HUP when the HRU is initially created.
HUP STARTING C3 EFFECTIVENESS	Added	This variable is an attribute of the High Resolution Unit Prototype entity, and holds the initial C3 effectiveness level of an HRU that uses this HUP.
This parameter replaces a graphic symbol as the identifier of a TUP's special capability.		
TUP CAPABILITIES TYPE	Added	This attribute of the Tactical Unit Prototype permanent entity holds the name value of the TUP's special capability.
These parameters were added or modified to support JOI improvements related to TADIL-J.		
ACP AIR INFORMATION PROTOCOL	Modified	This variable is an attribute of the AIR CONTROL PROTOTYPE permanent entity and specifies the protocol for sharing real-time air detection information.
AC LINK16 CAPABLE	Added	This Aircraft Class permanent entity attribute indicates whether the aircraft class is linked to the side's Common Operational Picture (COP).
SUP SHIP CLASS NAME	Added	This variable is an attribute of the Ship Unit Prototype permanent entity that holds the name the SUP's Ship Class, and is specifically required to properly link to real-world C4I systems, such as the Global Command and Control System (GCCS).

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
TG COUNTRY CODE	Added	This attribute of the Target entity is a two-character text name variable used to identify the country in which a target is located, and is meaningful for unowned targets only.
TG LINK16 BLOCK START	Added	This variable is an attribute of the Target entity, and specifies the starting octal track number that the target is allowed to assign. Relationships: This attribute is only associated with Sensor_Site targets and is only used by Air Search Sensor targets. Furthermore, the attribute is only access by JTLS algorithms if the target is owned by a Faction that uses an ACP indicating that the Link16 track reporting algorithm should be used.
TG LINK16 BLOCK END	Added	This variable is an attribute of the Target entity, and specifies the ending octal track number that the target is allowed to assign. This attribute is only associated with Sensor_Site targets and is only used by Air Search Sensor targets. Furthermore, the attribute is accessed by JTLS algorithms only if the target is owned by a Faction that uses an ACP indicating that the Link16 track reporting algorithm should be used.
UT COUNTRY CODE	Added	This attribute of the Unit entity is a two-character text name variable used to identify a unit s country affiliation.
UT HULL NUMBER	Added	This variable is a text attribute of a Unit entity, and holds the hull number that should be reported to real-world C4I systems or the Common Operational Picture (COP). This attribute is only used by units that have a UT TYPE set to NAVAL.
UT LINK16 BLOCK START	Added	This variable is an attribute of the Unit entity, and specifies the starting octal track number that air mission s flying from the unit are allowed to assign. This attribute is only accessed by Squadron units that own aircraft for which the AC LINK16 CAPABLE attribute is set to YES. Furthermore, the attribute is only accessed by JTLS algorithms if the unit is owned by a Faction that uses an ACP indicating that the Link16 track reporting algorithm should be used.

**Table 1. Summary of Standard Database OIF Data Elements (Continued)**

VARIABLE NAME	CHANGE	DESCRIPTION
UT LINK16 BLOCK END	Added	This variable is an attribute of the Unit entity, and specifies the starting octal track number that air missions flying from the unit are allowed to assign. This attribute is only accessed by Squadron units that own aircraft for which the AC LINK16 CAPABLE attribute is set to YES. Furthermore, the attribute is only accessed by JTLS algorithms if the unit is owned by a Faction that uses an ACP indicating that the Link16 track reporting algorithm should be used.
UT PIFF CODE	Added	This variable is an attribute of a Unit entity and represents the octal code output of a ship's Passive Identification of Friend or Foe (PIFF) apparatus. This attribute applies only to units that have a UT TYPE of NAVAL.
This unused parameter is removed from the database.		
MAX FIRE MISSION DURATION	Deleted	Not Used
The set of restricted characters for all text variable values is redefined.		
General	Modified	The characters #, &, \$, @, /, {, }, <, >, ' , and embedded spaces are prohibited.
UT LONG NAME	Modified	The characters #, &, \$, @, /, {, }, <, >, and ' are prohibited. Embedded spaces are allowed.
SUP SHIP CLASS NAME	Modified	The characters #, &, \$, @, /, {, }, <, >, ' , and - are prohibited. Embedded spaces are allowed.

#### 1.5.4 Standard Database Changes

The new JTLS 3.2 Standard Database based on Operation Iraqi Freedom (*sdboif*) includes extensive data item modifications implemented since the Standard Database (SDB) version 3.1 (*sdbv31*) release. If you have used *sdbv31* as a basis for your existing scenarios, evaluating the modifications included in *sdboif* is advised. A total of 99 Combat Systems, which are described in [APPENDIX B](#) of this document, are represented in *sdboif*. Reviewing your existing SDB-derived databases and upgrading them to the new data standard is strongly recommended. The detailed procedures required to upgrade *sdbv30* or *sdbv31* to *sdboif* are provided in [APPENDIX C](#).

## 1.6 INSTALLATION NOTES

### 1.6.1 Installation Instructions

The *JTLS Installation Manual* (included in the *documents* compressed tar file that is part of this JTLS release) provides detailed instructions for installing a new version of JTLS.

### 1.6.2 Oracle Compatibility and Installation

This release of JTLS requires a complete installation of Oracle Forms/Reports Developer 6i client/server runtime.

Developer 6i is the final version of the client/server development and deployment of Oracle Forms, Reports, and Graphics. Oracle Corporation will provide only limited support for this Developer version until January 2008, and Oracle10g will become the final certified database server compatible with Developer 6i. Beginning with the release of JTLS 3.1.0.0, Oracle 10g iAS EE (Internet Application Server Enterprise Edition) has been implemented to deploy JTLS database applications, such as DDS Forms. The compatible database server version is Oracle 10gR2 Standard Edition One or newer. Database server requirements that are updated prior to a future JTLS release will be described in the appropriate *JTLS Version Description Document*.

Utilizing the framework of iAS EE, which includes Forms Services, Reports Services, Portal, Single Sign-On, Java, and other components, will enable the delivery of JTLS-specific data from a central location. This also allows the development of more scalable JTLS database applications, such as the SDR and AAR.

Currently, the following combinations of Forms 6i runtime and the Oracle Server are approved for use with JTLS:

- a. Oracle Database Server 9.2.0.8 or later (10gR2 Standard Edition One is recommended)
- b. Forms 6i client/server runtime (with patchset 18 or later) for Solaris and/or Linux
- c. iAS EE 10.1.2.0.2 full stack (optional)

Refer to Chapter 6 of the *JTLS Installation Manual* for additional details regarding the Oracle Forms/Reports Developer 6i client/server custom runtime installation.





## 2.0 ENHANCEMENT CHANGE PROPOSALS

JTLS 3.2.0.0 is a Major JTLS release that includes the implemented Enhancement Change Proposals (ECPs) described in this chapter.

### 2.1 JTLS-0004 Display Range Rings

#### 2.1.1 Summary of Model Change Request

This design addresses a requirement to graphically display range data for units, targets, and Air Missions on the Web Hosted Interface Program (WHIP) Map Component.

#### 2.1.2 Design Summary

JTLS object types for which Range Rings have been added to the WHIP are described in [Table 2](#).

**TABLE 2. Range Ring Object Types**

OBJECT TYPE	CANDIDATE DATA	EXPLANATION
Squadron	Aircraft Range Radius	The flight radius of the standard fuel load for aircraft flying from this Squadron while the mission flies at its cruise speed and at the most fuel-efficient altitude. If the aircraft has a database-specified default load, the fuel from that default load is also considered in the range computation. The flight radius is determined by computing the range of the aircraft under the specified conditions and dividing by 2.0.
Support	Min or Max Distance For Truck Convoys	The database values for the minimum or maximum range to which the Support unit sends convoy trucks.
FARP Ground Naval	Direct Weapon Range	The range of the longest manned Direct Fire Combat System that the unit owns. As the unit loses systems or crews to operate those systems, this range is adjusted. Supplies are considered for this computation. If the unit has no supplies available for this Combat System to fire, the range is listed as zero.
	Indirect Weapon Range	The range of the longest-range weapon that can be fired from the unit's manned Indirect Fire Combat Systems, considering the unit's caliber and available supplies. As the unit loses systems or crews, or consumes supplies to operate those systems, this range is adjusted. Due to the implementation of the ECP <b>JTLS-2006-1660 Integerized Lanchestrian Combat</b> , a third Combat System type is added to the model. This new LONG-INDIRECT system type is also used to compute this range. Thus, this range represents the longest manned Combat System that has a type of INDIRECT or LONG-INDIRECT.
	Mandatory Transfer Distance	The distance at which mandatory transfers of supplies can occur. This range is adjusted only if the Controller changes this database parameter.

**TABLE 2. Range Ring Object Types (Continued)**

OBJECT TYPE	CANDIDATE DATA	EXPLANATION
High Resolution Unit (HRU)	Weapons Range	The range of the HRU's longest-range combat system for which it has required ammunition. As the HRU uses ammunition or loses Combat Systems, this range is adjusted. HRUs that represent Non-Government Organizations (NGOs) and other charity organizations may not have Combat Systems. The ranges specified for these HRUs are zero.
Air Mission	Surface Weapons Range	The range of the mission's longest Air-to-Ground weapon. As munitions are expended, the range is adjusted.
	Air Weapons Range	The range of the mission's longest Air-to-Air weapon. As munitions are expended, the range is adjusted.
	Surface Sensor Range	The range of the mission's longest-range activated Surface Search sensor. The model determines when JTLS Air Search radars are activated. If no sensors are activated, the range is zero.
	Air Sensor Range	The range of the longest-range activated Air Search sensors that are activated according to the same criteria described for Surface Sensor Range.
Target: ADA	Allowed Firing Range by Altitude Zone	Air Defense Artillery (ADA) targets have database range data for each Altitude Zone represented in the database. The range of the two weapons associated with each ADA type does not affect the capability of the ADA site within JTLS, and therefore is used to provide range information to the WHIP. On the other hand, the database parameter called TG RANGE limits the database ADA prototype altitude-based range data. This limiting factor is considered when the firing range array data are passed to the JTLS Object Distribution Authority (JODA).
Target: Communications Site	Communications Range	Communications targets have a range over which they can communicate with Airborne Warning and Control System (AWACS) aircraft. Any enemy targets detected by an AWACS mission within range of an AIR DEFENSE Communications Site target is automatically processed using the Integrated Air Defense System (IADS) to which the Communications Site is linked. This range is displayed for these Communications Site targets. Communications Site targets of type COMMAND do not have an associated range. Their ranges are specified as equal to zero.
Target: Jammer	Jammer Range	The minimum of the range of the Jammer represented by the target (JT RANGE) and the limiting range of the target (TG RANGE). Although this range is the maximum range at which the target is able to jam the communications of units or enemy radars, not all objects within the range are jammed. Like the Air Mission objects discussed previously, the actual jamming range is a function of the power of the enemy capability being jammed.

**TABLE 2. Range Ring Object Types (Continued)**

OBJECT TYPE	CANDIDATE DATA	EXPLANATION
Target: SSM Site	Weapons Range	The obvious choice for a Surface-to-Surface Missile (SSM) target is the range of the weapon that the site is allowed to fire. A JTLS SSM site can fire only one type of weapon; thus, only one range would be necessary. A planned JTLS improvement will enable SSM sites to fire several types of weapons that may have different range capabilities, which implies a requirement to associate several ranges, or an array of ranges, with each SSM type. This approach is problematic because the number of weapons that can be fired by the SSM is variable and can change as the exercise progresses. This is different than the capability of ADA targets, for which the number of Altitude Zones is fixed for a given scenario.
Target: Sensor Site	Allowed Sensor Range by Altitude Zone	Available data for JTLS Air Search sensors and Surface Search sensors are different. Surface Search sensors, similar to Jammers, have a range limited by the minimum of the range of the sensor represented by the target (ST RANGE) and the limiting range of the target (TG RANGE). This value is available to the WHIP for Range Ring representation. Although Air Search sensors have only a single ST RANGE value limited by the target TG RANGE, the radar horizon effectively limits this range if the sensor is not Over the Horizon (OTH) capable. Thus, range data associated with Air Search sensors are determined by Altitude Zone; the model computes the range of the sensor, Limited by the radar horizon at the midpoint within each Altitude Zone, the model computes the range of the sensor and considers the height of the radar as specified in the database. If the sensor is OTH capable, the ranges within each Altitude Zone are identical, but all other Air Search sensor targets have different ranges.

2.1.2.1 Range Ring Display Management

Range Rings are displayed for an object only when the object is visible. Range Ring filters are saved with the existing set of filters when a user saves a view or the filters. Since the Range Ring filters are saved with the existing filters, the Range Ring filter can be shared with other Players.

Range Rings are displayed for an object only when the object is visible. Range Ring filters are saved with the existing set of WHIP display filters when a user saves a Map view or a desired filter configuration. Since the Range Ring filters are saved with the existing filters, any Range Ring display configuration created by a user can be shared with other Players.

Users can access the Range Ring interface features by means of the WHIP Map Component filters. Four new filter panels are added: a general Range Ring filter panel, and separate Range Ring panels for ADA, Sensors, and SSMs., which are required to accommodate the characteristic data differences among these object types. Additionally, an On Demand Rings filter panel is provided to create a customized list and view of various Range Ring types directly from the Map display. The *JTLS WHIP Training Manual* included within the JTLS 3.2.0.0 documentation suite provides a detailed description of the procedures for using these Range Ring capabilities.

### 2.1.3 Data Changes

No database changes are required to implement this enhancement.

### 2.1.4 Order Changes

No order changes are required to implement this enhancement.

### 2.1.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.2 JTLS-0008 Real Time Intercept Report**

### 2.2.1 Summary of Model Change Request

Prior to this change, JTLS user only knew that an Air Mission had begun to intercept a foreign detected mission by viewing the posture of the mission by means of the Information Management Terminal (IMT) or Map Component of the Web Hosted Interface Program (WHIP). An air-to-air engagement was indicated when the Player received a Pilot Trouble Report conveying information that would typically be provided by a voice message from an aircraft commander.

In 2005, the JTLS air-to-air engagement logic was modified to represent the events of Mission A firing on Mission B and Mission B returning fire to Mission A as independently scheduled events. Consequently, the Controller and Player lost the ability to easily track the results of air-to-air engagements. Several reports, generated after each firing event, had to be manually combined by the Player or Controller to obtain detailed information regarding the results of a specific engagement. This model enhancement provides reporting capabilities that replace this process.

### 2.2.2 Design Summary

This enhancement implements a new mission damage Summary Report that delivers air-to-air engagement information to Players and Controllers. JTLS internally retains historical engagement information for each Air Mission. After each engagement, a report of the current engagement and all previous engagements for a specific Air Mission is placed in a message. Additional engagement tracking options included using interim mission reports and the new JTLS After Action Review capability must developed under a separate ECP.

The new Engagement Summary report is not limited to air-to-air engagements, but also includes a list all surface-to-air engagements against the aircraft. **Table 3** describes the data held for each engagement.

**TABLE 3. Information Held for Each Engagement**

AIR-TO-AIR ENGAGEMENT	SURFACE-TO-AIR ENGAGEMENT
Time of engagement	Time of engagement
Name of firing object	Name of firing object
Side of firing object	Side of firing object
Type of firing object, designated as the aircraft class of the firing object	Type of firing object, designated as the sub-category of the firing object
Latitude and longitude of the firing object	Latitude and longitude of the firing object
Altitude of the firing object	
Name of the receiving Air Mission	Name of the receiving Air Mission
Side of the receiving object	Side of the receiving object
Type of receiving object, designated as the aircraft class of the receiving object	Type of receiving object, designated as the aircraft class of the receiving object
Altitude of the receiving object	Altitude of the receiving object
Type of weapon fired	Type of weapon that is fired
Number of weapons fired	Number of weapons fired
Distance between the engaging objects	Distance between the engaging objects
Probability of Hit	Probability of Hit
Random variate drawn	Random variate drawn
Hit or No Hit identifier	Hit or No Hit identifier
Probability of Kill; equal to zero if no hit occurs	Probability of Kill; equal to zero if no hit occurs
Number of aircraft killed	Number of aircraft killed

Two separate Engagement Summary Reports pertaining to the firing object and the receiving Air Mission are generated when an engagement occurs. These reports replace the Controller's Air Combat Report and the Surface-to-Air Damage Report, and are generated only if the Controller Air Damage Report flag is set to YES. **Table 4** describes the contents of these Summary Reports.

**TABLE 4. Engagement Summary Report Content**

OBJECT PERSPECTIVE REPORT	AFTER AIR-TO-AIR ENGAGEMENT	AFTER SURFACE-TO-AIR ENGAGEMENT
Firing Object Report	The report lists all of the firing Air Mission’s engagements. As the Air Mission progresses, the summary report accumulates records. When the mission completes, a final Controller engagement report is generated.	The report lists all of the firing SAM Site engagements. As time passes, this report will accumulate records. The existing SAM site engagement records for the reporting Side are cleared when a Side’s Summary Report event executes. A final Summary Engagement report is not sent when the engagements are cleared. The new AAR tool is the appropriate source for a long-term SAM site firing history. Therefore, generating these reports unnecessarily burdens the system and the IC with information that may not be desired.
Receiving Object Report	The report will lists all of the receiving Air Mission’s engagements from the start of the mission and in the same manner as previously described. The mission’s final Summary Report includes all of its engagements, whether they were generated as a result of the Air Mission in the role of the firing object or the receiving object.	The report lists all of the receiving Air Mission’s engagements from the start of the mission and in the same manner as previously described.

This report contains  $P_K$  values and the dawn random variate, but is made available as a broadcast message to all Players involved in the engagement. The Sides that have access to a copy of this generated message are summarized in **Table 5**. Provided with the detailed content of this message, the Player may deliver selected information to the exercise audience.

**TABLE 5. Message Delivery Information**

OBJECT PERSPECTIVE REPORT	AFTER AIR-TO-AIR ENGAGEMENT	AFTER SURFACE-TO-AIR ENGAGEMENT
Firing Object Report	Controller and the Side that owns the firing Air Mission	Controller and the Side that owns the firing SAM site
	Air Function	Ground function if the SAM site is owned by a ground unit or Naval function if the SAM is owned by a naval unit
Receiving Object Report	Controller and the Side that owns the receiving Air Mission	Controller and the Side that owns the receiving Air Mission
	Air Function	Air Function

The possible values for the result of each stochastic hit and kill determination are summarized in **Table 6**.

**TABLE 6. Possible Hit/Kill Values Reported**

HIT RESULTS	KILL RESULTS
Hit - The mission was hit.	Kill - One aircraft in the mission was killed by the weapon.
No Hit - The mission was not hit	No Kill - The weapon did not kill the aircraft.
	Impossible - The weapon did not hit the aircraft; no kill determination was made.
	Undetermined - JTLS does not know the effect of the weapon fired on the aircraft, since the Air Mission is externally controlled. The model that owns the aircraft must report the results.

To supplement the automatically-generated reports for each engagement, the Player is able to request the status of the Engagement Summary for Air Missions and Air Defense sites. The JTLS MISSION REPORT order is altered to include a new field that allows the use to request a mission engagement report instead of a squadron mission Summary Report. The JTLS user may also request the current Engagement Summary for an Air Defense site or a group of sites by means of a field added to the Air Defense Status report. If the Include Engagement Results flag is set, the generated report includes the engagement information for each Air Defense site. The engagements reported include only those engagements fired since the previous Periodic Summary. The AAR tool must be utilized to generate reports to reflect prior engagements.

The existing Pilot Trouble Report capability is not modified or removed; whether these limited information messages should be viewed or passed to the exercise audience is left to user discretion. The Controller air-to-air engagement and surface-to-air engagement messages are removed and replaced by the Engagement Summary messages previously described.

Since the new AAR has all of the same information readily available, three new queries, described in **Table 7**, were developed and added to the AAR toolkit.

**TABLE 7. New AAR Query Description**

QUERY TITLE	USER INPUT
Detailed Mission Engagement Report	Full Mission Name - Mandatory
Detailed ADA Engagement Report	Start Time - Optional - If not entered, assumed to be the start of the game.
	End Time - Optional - If not entered, assumed to be the current game time.
	Name of ADA Site - Mandatory
Detailed Unit ADA Engagement Report	Start Time - Optional - If not entered, assumed to be the start of the game.
	End Time - Optional - If not entered, assumed to be the current game time.
	Name of ADA Site - Mandatory
	Subordinate Flag - Mandatory - an indicator whether ADA sites for this unit or this unit and subordinates should be generated.

### 2.2.3 Data Changes

No data changes are required to implement this enhancement.

### 2.2.4 Order Changes

The Mission Report order is modified to allow the Controller or Player to specify the name of an Air Mission for which an Engagement Summary message is desired.

The Air Defense Status order is modified to allow the Controller or Player to specify whether the status report will include Air Defense engagement information.

### 2.2.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.3 JTLS-0018 Naval Fuel Usage

### 2.3.1 Summary of Model Change Request

The design for this model enhancement is included in the more comprehensive fuel design also implemented as part of JTLS 3.2.0.0. This ECP, **JTLS-2006-1752 Improve Fuel Usage Flexibility**, includes the improvements implemented for Ground unit as well as Naval unit fuel consumption.

### 2.3.2 Design Summary

The logic used for this enhancement is included in **JTLS-2006-1752 Improve Fuel Usage Flexibility**.

### 2.3.3 Data Changes

The data changes required to implement this capability are included in **JTLS-2006-1752 Improve Fuel Usage Flexibility**.

### 2.3.4 Order Changes

The required order changes are included in **JTLS-2006-1752 Improve Fuel Usage Flexibility**.

### 2.3.5 JODA Changes

The required JTLS Object Distribution Authority changes are included in **JTLS-2006-1752 Improve Fuel Usage Flexibility**.



## 2.4 JTLS-0056 Improve Aircraft Divert Logic

### 2.4.1 Summary of Model Change Request

Previously, a JTLS Air Mission returning to its home Airbase attempted to find a logical alternative landing location if the home base runway had been damaged to the extent that the mission could not land. The model's runway selection logic considered the following assets in priority order:

1. The user-specified alternate Airbase
2. An Airbase that has a usable runway and available parking spaces for which mission has enough fuel to reach
3. An unoccupied runway that is long enough to support the mission's aircraft and for which the mission has enough fuel to reach

The model neither attempted to locate an alternative landing site nearest the mission's assigned home base, nor considered whether the alternative location supported similar aircraft, nor whether it had available aviation fuel or weapons. This model enhancement has established a more robust automatic divert location selection logic.

### 2.4.2 Design Summary

When a mission returns to its home base and cannot land, the new divert logic is executed. The first condition of this logic establishes whether an alternative location is minimally acceptable. The following rules were previously applied to this determination, and have not been changed due to implementing this design:

- The mission must be able to reach the location, considering its current fuel load.
- If the alternative is a Naval unit, the Air Mission must be naval-qualified.
- If the Air Mission requires a runway, the runway at the alternative location must be long enough for the mission to land.
- The alternative location must have enough available parking spaces to accommodate the Air Mission. This check is implemented primarily to prevent all returning aircraft from selecting the same alternative landing location when a major base is closed.

The model logic first considers the user-assigned alternative base. If this location is feasible, the model selects the location and the Air Mission is immediately diverted. If this alternative is not feasible or the user has not assigned an alternative base, the new automatic selection logic is executed.

This new logic does not automatically select the first identified feasible location, but requires the model to consider all feasible locations. The logic is based on a point system for which a numerical value is assigned to each feasible location according to its suitability for the mission. The alternative location that is assigned the greatest point value is selected. In the case of a point value tie between two locations, the nearest alternative location is selected.

**Table 8** summarizes the point values that can be assigned to a divert landing location.

**TABLE 8. Divert Location Point Assignment Values**

ALTERNATIVE CHARACTERISTIC	POINT VALUE
The Airbase or Naval unit is a feasible divert location.	1.0
The location has other squadrons with the same type of aircraft as the diverting mission.	1.0
The location has available fuel to enable at least one aircraft to take off again.	0.5
The location has weapons typically used by the Air Mission. This is determined by reviewing the list of weapons that were originally loaded on the mission and determining whether the location being considered has at least one such weapon available. For each weapon that can be supported by a Supply Category at the base, the location is assigned 0.01 points. Thus, an Airbase with three of the required weapons supported by supplies will be assigned a point value of 0.03, but a location with only two weapons stocked in supply will be assigned a point value of 0.02. The Airbase with three stocked weapons will have priority over an Airbase with two stocked categories.	0.01 per weapon supported by a Supply Category
The location is Unsupported (i.e., the runway is unused).	0.01

Consider the examples presented in **Table 9**. Alternative 4, highlighted green, is selected; its point value is equal to Alternative 2, but its location is 100 KM closer.

**TABLE 9. Example Location Point Value**

ID	ALTERNATIVE LOCATION CHARACTERISTICS	COMPUTED POINT VALUE	DISTANCE
1	The Airbase has similar aircraft, but no fuel or weapons are currently available.	$1.0 + 1.0 = 2.0$	100 KM
2	The Airbase has similar aircraft, fuel, but no weapons.	$1.0 + 1.0 + 0.5 = 2.5$	125 KM
3	The Airbase has fuel and two needed weapon supplies, but no similar aircraft.	$1.0 + 0.5 + 0.02 = 1.52$	50 KM
4	The Naval unit has similar aircraft, fuel, but no weapons.	$1.0 + 1.0 + 0.5 = 2.5$	25 KM
5	The runway is abandoned.	0.01	5 KM

2.4.3 Data Changes

No data changes are required to implement this enhancement.

2.4.4 Order Changes

No order changes are required to implement this enhancement.

2.4.5 JODA Changes

No JTLS Object distribution Authority changes are required to implement this design.

## 2.5 JTLS-0074 Refuel Base Logic Improvement

### 2.5.1 Summary of Model Change Request

When an Air Mission needs fuel and it is heading home, the mission should always give priority to its home base and not the closest source of fuel.

### 2.5.2 Design Summary

The logic specified in the ECP was implemented.

### 2.5.3 Data Changes

No data changes were required for this improvement.

### 2.5.4 Order Changes

No order changes were required for this improvement.

### 2.5.5 JODA Changes

No JODA data structure changes were required for this improvement.

## 2.6 JTLS-0075 Passive Sonars Do Not Detect Surface Ships

### 2.6.1 Summary of Model Change Request

The previous JTLS naval detection capability representation is summarized in [Table 10](#). Note that the terms Surface and Sub-surface are used instead of referring to a Naval unit as a surface vessel or a submarine. This reflects an element of the JTLS detection algorithm; a submarine in shallow water is considered to be on the surface and will be detected using the Surface vessel algorithms.

**TABLE 10. Previous JTLS Ship Detection Capability Representation**

OBJECT TYPE	ATTEMPTS TO DETECT NAVAL UNIT OF TYPE	
	SURFACE	SUB-SURFACE
SURFACE NAVAL UNIT	Within the same hex: 100% Probability of Detection ( $P_D$ )	Within the same hex: Not considered
	Within the same formation: 100% $P_D$	Within the same formation: 100% $P_D$
	Surface Search Sensor: $P_D$ of all operating sensors covering the object.	Surface Search Sensor: Not considered
	Active Sonar: $P_D$ of all operating sensors covering the object with sufficient reflected power.	Active Sonar: $P_D$ of all operating sensors covering the object with sufficient reflected power.

**TABLE 10. Previous JTLS Ship Detection Capability Representation (Continued)**

OBJECT TYPE	ATTEMPTS TO DETECT NAVAL UNIT OF TYPE	
	SURFACE	SUB-SURFACE
<b>SURFACE NAVAL UNIT (CONTINUED)</b>	Passive Sonar: Not considered	Passive Sonar: Reduce time to detection if covered object generates sufficient noise
<b>SUB-SURFACE NAVAL UNIT</b>	Within same hex: 100% P <sub>D</sub>	Within same hex: Not considered
	Within same formation: 100% P <sub>D</sub>	Within same formation: 100% P <sub>D</sub>
	Surface Search Sensor: P <sub>D</sub> of all operating sensors covering the object.	Surface Search Sensor: Not considered
	Active Sonar: P <sub>D</sub> of all operating sensors covering the object with sufficient reflected power.	Active Sonar: P <sub>D</sub> of all operating sensors covering the object with sufficient reflected power.
	Passive Sonar: Not considered	Passive Sonar: Reduce time to detection if covered object generates sufficient noise
<b>AIR MISSION</b>	Within same hex, P <sub>D</sub>	Within same hex: Not considered
	Shadowing: 100% P <sub>D</sub>	Shadowing: 100% P <sub>D</sub>
	Surface Search Sensor: P <sub>D</sub> of all operating sensors covering the object.	Surface Search Sensor: Not considered
	Active Sonar: P <sub>D</sub> of all operating sensors covering the object with sufficient reflected power.	Active Sonar: P <sub>D</sub> of all operating sensors covering the object with sufficient reflected power.
	Passive Sonar: Not considered	Passive Sonar: Reduce time to detection if covered object generates sufficient noise

To assist interpreting the previous table, **Table 11** defines specific terms referenced in the detection representation summary.

**TABLE 11. Detection Term Definitions**

TERM	DEFINITION
100% P <sub>D</sub>	The sensor will automatically accomplish the detection.
Not considered	The sensor is not allowed to accomplish the detection.
Operating sensors covering the object	The sensor must be turned on.
	The sensor must not be destroyed.
	The sensor must not be onboard a Naval unit traveling faster than the sensor's ST MAXIMUM SPEED ALLOWED value.
	If the sensor is capable of being jammed, power of the sensor at the object's location must be greater than the jammer power at the object's location reduced by the MIN JAM DECIBEL LEVEL. The sensor is considered to be operable if: $Power_{Sensor} > Power_{Jammer} - \text{MIN JAM DECIBEL LEVEL}$

**TABLE 11. Detection Term Definitions (Continued)**

TERM	DEFINITION
with sufficient reflected power	<p>If the object remains at its most recently known location, the reflected power is assumed to be sufficient because the object has been localized.</p> <p>If the object is not at its most recently known location or has not been previously detected, determine whether the reflected ping is sufficiently strong by accomplishing the following computations:</p> $Power_{At\ Ship} = Power_{Sensor} - Transmission\ Loss$ $Power_{Leaving\ Ship} = Power_{At\ Ship} \times SUP\ RERADIATE\ FACTOR_{Ship}$ $Power_{At\ Sensor} = Power_{Leaving\ Ship} - Transmission\ Loss$ $Noise_{At\ Sensor} = Noise_{In\ Sensor\ Hex} \times (1.0 - \% \text{ AMBIENT NOISE MASK}_{Sensors\ IIP})$ <p>If the <math>Power_{At\ Sensor}</math> is greater than <math>Noise_{At\ Sensor}</math>, the reflected power is sufficiently strong.</p>

As the red highlight indicates, passive sonars were not allowed to detect surface vessels. Passive sonars onboard surface or subsurface Naval units have this real-world capability. Passive acoustic systems deployed from aircraft can also detect surface vessels, and this enhancement represents that capability.

## 2.6.2 Design Summary

### 2.6.2.1 Basic Concept

The routine that processes process sonar detections is initiated each instance a Naval unit enters or exits a hex, and is called whether or not the moving unit possesses a sonar. The presence or absence of each Naval unit alters the ambient noise in the hex region, which affects the ability of both passive and active sonars to detect objects.

Within the affected hex, this sonar detection routine that previously searched a list of submarines only is expanded to include surface vessels. If a submarine is located within the changed hex, the algorithm altering the time at which the submarine is to be detected will be initiated. This enhancement does not modify this algorithm.

If a surface vessel is located within the changed hex, a new algorithm is called to determine whether any of the passive sonars covering the hex can differentiate the noise generated by the surface vessel from other ambient noise at the sonar's location. This check is performed only if the detecting Side does not have current location information for the surface ship. The passive detection process is omitted if it cannot provide new information to the detecting Side.

2.6.2.2 Passive Detection of Surface Vessel Algorithm

Figure 1 depicts the conceptual framework of this new logic.

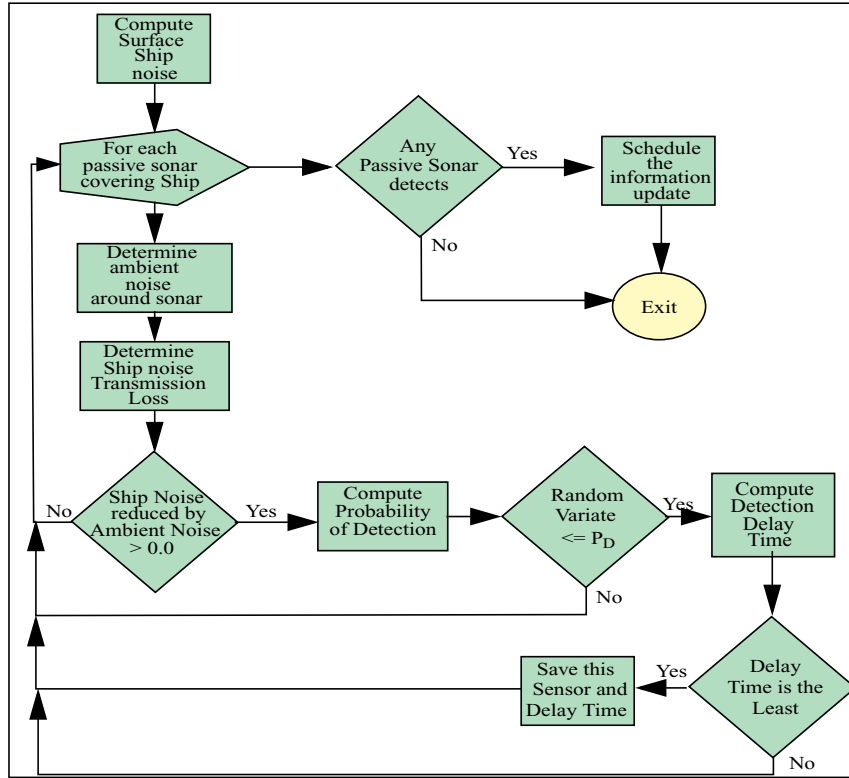
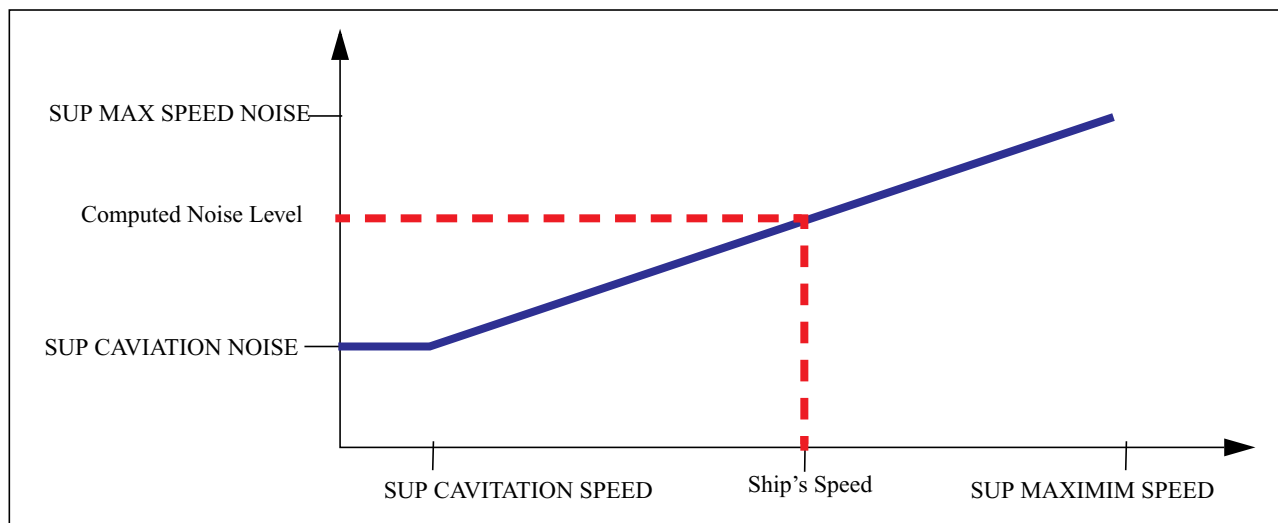


FIGURE 1. Conceptual Logic: Passive Sonar Detection of Surface Ship

Each illustrated logic element is described in the following presentation. The existing JTLS algorithms for computing surface ship noise, determining ambient noise surrounding sonars, and determining ship noise transmission loss are described separately in the following sections. These are included in this design to assist understanding the new detection algorithms that are implemented for this design.

2.6.2.3 Compute Surface Ship Noise

JTLS utilizes a linear noise generation model, depicted in Figure 2. Linear interpolation is applied to compute the ship’s noise level according to the ship’s current speed.



**FIGURE 2. Linear Noise Generation Algorithm**

Noise produced by any active sonars owned by the ship is also included in the ship's computed noise level by means of an existing logarithmic combination algorithm.

#### 2.6.2.4 Determine Ambient Noise Surrounding Sonar

The next algorithmic element determines the ambient noise in the sonar's vicinity. Ambient noise originates from two sources: other ships, including their active sonars, and the noise caused by environmental conditions. The algorithm that accomplishes this task is based on several simplifying assumptions.

The environment ambient noise is represented by a database parameter, WC SEASTATE AMBIENT NOISE, that is a function of the current weather condition at the sonar's location. The only ship-generated ambient noise considered is the noise caused by ships in the passive sonar's hex, active sonars covering the passive sonar's hex, and any other ships in the surface vessel's hex. Ships in any other hexes that could also be contributing to the ambient noise at the sonar's location are not considered.

The total ambient noise is the logarithmic combination of the noise produced by the environment and the total noise generated by all ships in the sonar's hex and the hex in which the detected ship is located. The total noise for these ships is obtained by using the logarithmic combination of each ship's generated noise that reaches the sonar. This value is computed by subtracting the noise lost as it propagates through water. The following section describes the transmission loss algorithm for the noise produced by the ship being detected. This algorithm is also applied to compute the noise that reaches the sonar from all of the other ships that are considered.

### 2.6.2.5 Determine Ship Noise Transmission Loss

The next logical element determines the amount of noise reaching the location of the passive sonar that is generated by the ship the algorithm is attempting to detect. This noise level is different for each passive sonar that covers the location of the ship being detected, since the transmission loss is logarithmically correlated to the noise propagation distance  $D$  in water, measured in meters. This loss can be represented as a spherical loss (a loss parameter of 20.0), which is applied to distances less than 1.0 meters, or a cylindrical loss (a loss parameter of 10.0), which is applied to distances greater than or equal to 1.0 meters and less than or equal to 1.0 kilometers.

The cylindrical model includes additional transmission loss attributed to Terrain Attenuation, which represents the sound dissipation characteristics of the hexes through which the sounds must travel. The terrain type of each hex through which the noise must pass is accessed, including the existing database parameter TT SOUND ATTENUATION LOSS. A partial hex distance computation model represents the distance the sound travels through each hex. This model consist of a series of segments from the midpoint of the hex barrier across which the noise "enters" the hex to the midpoint of the barrier from which the noise "exits" the hex. However, the sum of these distances does not exactly represent the linear distance between the source ship and the sonar.

### 2.6.2.6 Compute Probability of Detection

At this point, the algorithm is prepared to determine whether the passive sensor can detect the surface vessel. If the noise generated by the detected ship does not exceed the ambient noise, a detection does not occur. The sonar senses the presence of noise, but cannot distinguish the type of noise to complete a detection. Conversely, if the ambient noise is less than or equal to the ship-generated sound that reaches the sonar, a detection is possible but not certain. The model still requires that the passive sonar passes the probability of detection,  $P_D$ . The ST EFFECTIVENESS is accessed and modified by the sonar's ST NIGHT FACTOR and ST WC FACTOR. The model does not consider the sonar's ST JAM FACTOR. Finally, the  $P_D$  is adjusted for the Ship Unit Prototype (SUP) of the detected surface vessel and the terrain type of the hex within which the vessel is located (TT SHIP DETECTION MODIFIER). A random variate is drawn and compared to the computed  $P_D$  to determine whether a detection occurs. If a detection is not possible, the algorithm proceeds to the next passive sensor that may be able to detect the surface vessel.

### 2.6.2.7 Compute Detection Delay Time

If the random draw indicates that a detection has occurred, the next step determines the time the detection will be received by the detecting Side. The time delay for reporting the detection has two components, the initial report time of the sensor (ST INITIAL REPORT TIME) and the delay for the unit that owns the passive sensor that made the detection to report the detection to its next higher headquarters. The method used to compute the unit delay component has also been changed within JTLS 3.2.0.0 to implement the ECP **JTLS-2006-1827 New Command Control Model**, and is described in the corresponding section.



As shown in **Figure 1**, the algorithm then loops to determine the next passive sonar from the detecting Side that can detect the surface vessel. The passive sonar that has the least report delay time is selected to report the presence of the surface vessel.

### 2.6.3 Data Changes

No data changes are required to implement this enhancement. The following sensor data parameters are accessed and used for those sensors that are assigned an ST USE value of PASSIVE SONAR:

- ST EFFECTIVENESS
- ST NIGHT FACTOR
- ST WC WEATHER FACTOR
- ST INITIAL REPORT TIME

A database developer should review these data elements for all represented passive sonars to ensure that they represent appropriate values. As a result of this model enhancement, these values will be accessed when the passive sonar attempts to detect surface vessels.

### 2.6.4 Order Changes

No order changes are required to implement this enhancement.

### 2.6.5 JODA Changes

No JTLS Object Distribution Authority (JODA) changes are required to implement this enhancement.

## **2.7 JTLS-0083 Controller Adjusts Air Mission Speed**

### 2.7.1 Summary of Model Change Request

The capability to change an individual JTLS Air Mission's speed was previously limited to the range of valid air speeds that the aircraft type could fly. The Player who manages the mission can use the Change Air Mission Parameter order to set the mission's speed to a value between or including the aircraft type's stall speed and maximum flight speed.

During exercises, a requirement may arise to expedite an Air Mission to compensate for a Player's order entry error, or a planning or execution problem within the Air Tasking Order (ATO). The ability to increase or decrease an Air Mission's speed to values less than the stall speed or greater than the maximum speed would provide Players the flexibility to correct undesirable situations to ensure that training objectives are satisfied. Furthermore, this capability is useful during software and database tests.

## 2.7.2 Design Summary

This model enhancement establishes a new Controller and trusted Air Player capability to change the air speed of an individual Air Mission beyond the limitations of the aircraft type in the mission. This capability was added to the existing Magic Replenish Air Mission order currently used to refuel and re-arm active missions, and required changes to several JTLS components: the Magic Replenish Air Mission order panel (renamed to Magic Air Ops), the Web-Hosted Interface Program (WHIP) menus and messages, and the underlying Combat Events Program (CEP) routines.

### 2.7.2.1 Messages

A new line was added to the existing Air Order Received/Complied message that is sent to the WHIP Message Browser to inform the Controller about the mission's new air speed after it is changed by means of the Magic Air Ops order.

Since at least one of the fields in the Magic Air Ops order must be filled or selected, the Speed field was added to the existing list of fields in the Air Order Received/Cannot Comply message. The message is sent to notify the Controller who fails to enter or select at least one field in the order panel. This message is a merely a precaution, because the order panel also forces the Player to enter or select at least one field.

### 2.7.2.2 CEP Changes

The underlying CEP routine that processes the Magic Replenish Air Mission order was modified to accommodate the New Aircraft Speed field in the panel and reflect the new Magic Air Ops order name.

If a value is entered in the New Aircraft Speed field, the CEP routine sets the mission's current speed to the desired value and updates the WHIP displays. The mission's ordered speed is also set to the desired value to allow the mission to resume the desired speed without further Controller intervention after landing for fuel or an airlift stop. Beyond the limits imposed by the order panel, no restrictions are placed on the speed set for the mission. In this way, a very high air speed approximates a magic move of the Air Mission, although fuel is still consumed over the distance traveled.

If the mission's speed exceeds the aircraft type's cruise speed, fuel consumption is limited to the cruise consumption rate to avoid excessive fuel usage. If the mission's speed is set to a value less than the aircraft type's stall speed, fuel consumption is calculated according to the stall consumption rate.

## 2.7.3 Data Changes

No data changes are required to implement this enhancement.

#### 2.7.4 Order Changes

The existing Magic Replenish Air Mission order panel, available to both the Controller and the trusted Air Player WHIPs, is renamed Magic Air Ops to reflect the expanded functionality of the order. The corresponding WHIP menu options are renamed to reflect the new order name. A New Aircraft speed optional field is added to the order panel. The New Aircraft Speed is limited to a range of 1.0 to 999999.0 Km/Day, Km/Hr, or Knots.

#### 2.7.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

### 2.8 JTLS-0084 Change Terrain and Barrier Values

#### 2.8.1 Summary of Model Change Request

The JTLS Controller has the capability to modify a number of environment parameters in order to satisfy the training or analysis goals of the simulation audience. This ECP provided for augmenting this capability to allow the Controller to change the terrain within a hex, the elevation of the hex, the water depth within a hex, and/or the barriers between hexes on the game board. For example, changing the depth of water in hexes at a location might be done to increase the accessibility to shipping. Some residual effects of such a change would include changes the hex's depth zone characteristics, including a changed water movement time multiplier for the specified new depth.

#### 2.8.2 Design Summary

This enhancement implements the model changes necessary to allow the JTLS game Controller to modify certain terrain characteristics of a hex, such as water depth, as well as a capability to modify barriers between hexes.

##### 2.8.2.1 Terrain Changes

The water depth for all small island, open water, or dual-capable hexes is initially defined in the scenario database prior to starting the game. Thereafter, all ships having a water depth restriction are prevented from entering any hex that does not meet or exceed the depth restriction for the ship, as defined by the ship unit prototype. This hex restriction provides a useful technique for the game Controller to use to control access of certain ship types to the area of interest. For example, there is no current method in JTLS to model shipping avoidance of mined waters. The CEP is just as likely to include a mined water hex of sufficient depth in the automatically generated route for a moving ship as any other hex that has sufficient depth. This design implements a new Controller order named Alter Terrain, from which terrain changes can be made after the game has started (**Figure 3**).

Water depth at a specific location can be modified using this order. The location exclusively identifies the containing hex and CEP changes the depth is changed for this hex; however, changing the depth to zero for open water and small island hexes is prohibited. Additionally, this new order allows changes to the Altitude in a hex, to the actual Terrain Type of the hex, and finally to the type of Hex Barrier defined for any of the six sides of a given hex.

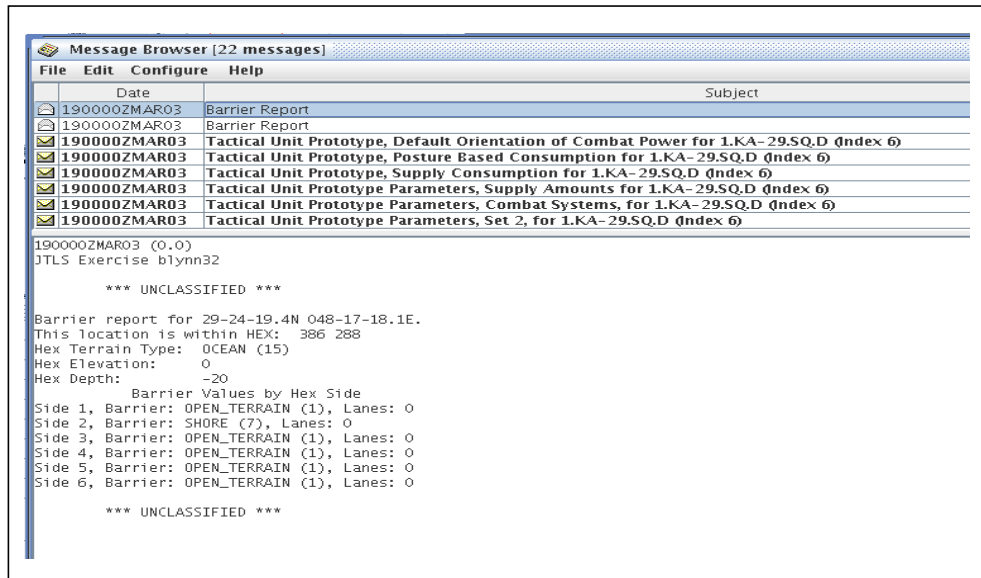


**FIGURE 3. Alter Terrain Order Panel**

All CEP routines that apply the depth of water and the specified altitude in a hex were adapted to manage changes dynamically. This design requires that a moving ship must reoptimize its route if the new depth prevents the ship from entering any of its original route hexes. However, these restrictions apply to the effects of the depth change upon existing objects and environment conditions:

- A stationary ship, which otherwise would be restricted from being inside a recently modified hex because of a depth, will not be evicted.
- An aircraft carrier, which otherwise would be restricted from launching aircraft within a recently modified hex because of a depth, will not be prevented from launching the mission.
- Stationary submarines will not be forced to surface or submerge.
- Intelligence coverage for the affected hex will not instantly change due to a related change in depth zone characteristics.
- Sensor target ranges for the affected hex will not instantly change due to a related change in depth zone characteristics.
- Any moving ship that encounters a hex in its route that has a depth restriction due to a depth change will reoptimize its route only when the ship arrives at the hex.
- Any ship within a moving formation that encounters [complete this statement].

Provided this new capability, the Controller can dynamically model a characteristic that produces a more realistic effect, such as ships avoiding an area of water containing mines. The Controller also receives a reply message (**Figure 4**) to confirm the modification.



**FIGURE 4. Alter Terrain Reply Message**

### 2.8.2.2 Barrier Changes

This design provides Controller capability to modify any barrier defining the edge of one hex and the adjoining hex. Barriers affect trafficability between the hex and the adjoining hex on the other side of the barrier.

### 2.8.2.3 Terrain Changes

This design provides Controller capability to modify the underlying Terrain defined for a hex. The terrain affects trafficability and/or accessibility of the hex. Land units can move within Land terrain hexes and Dual Capable hexes. They can be in Small Island hexes, but cannot move on their own. Ships can move within Water hexes, Small Island hexes, and Dual Capable hexes. A Dual Capable hex is one that has one of the Land terrain types and a Hex Elevation, but also has a Hex Water Depth.

### 2.8.3 Data Changes

No data changes are required to implement this enhancement.

### 2.8.4 Order Changes

The new Alter Terrain order is provided to allow a Controller to change the underlying Terrain of a Hex, the Altitude in the hex, the hex Water Depth, and/or any of the six Hex Barrier defined for the hex. The associated CEP order processing routine was added.

2.8.5 JODA Changes

No JTLS Object Distribution Authority changes were required to implement this design.

2.9 JTLS-0091 New Convoy Symbols

2.9.1 Summary of Model Change Request

JTLS Convoys, also referenced as Supply Runs within the simulation code, exist as JTLS Object Distribution Authority (JODA) objects that can be viewed on the Web Hosted Interface Program (WHIP). In previous versions of JTLS, a single graphical identifier was used to display these Convoy objects. It was specified by the single Sustainment Logistics Prototype (SLP) SLP CONVOY SYMBOL database parameter.

However, the model represents three basic types of Convoys, described in [Table 12](#).

TABLE 12. JTLS Convoy Type Summary

CONVOY TYPE	TYPE ENUMERATION	TYPE DESCRIPTION
Barge	1	These Convoys travel over adjoining River hex edges or within Ocean or Dual Capable terrain hexes.
Rail	2	These Convoys travel over Rail Networks only.
Truck	3	These Convoys consist of a combination of tanker, cargo, or Heavy Equipment Transport (HET) trucks and can travel over any terrain type except Ocean. They can cross any hex barrier except Shorelines and Impassable barriers.

All JTLS Convoys sent by units in a given Faction were displayed using the SLP CONVOY SYMBOL parameter of the FLP accessed by that Faction, regardless of their type. This model enhancement enables the database developer to graphically distinguish each Convoy type.

2.9.2 Design Summary

2.9.2.1 Creating New Symbols

The previous default symbol table did not provide unique symbols to represent Barge Convoys or Rail Convoys. Two new symbols were created for this purpose. An example of the symbol set is shown in [Figure 5](#).

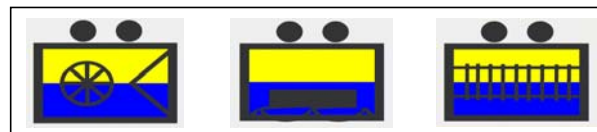


FIGURE 5. Truck, Barge and Rail Convoy Symbols

JTLS database builders are responsible for creating object graphical symbols. The database team may develop and use alternative symbols to satisfy a JTLS user's specific requirements. The depicted symbols, Truck, Barge, and Rail convoy symbols respectively in the figure, are provided to allow users to quickly and conveniently implement this improvement in any converted scenario.

### 2.9.2.2 Specifying Distinct Symbols

The existing database parameter SLP CONVOY SYMBOL is renamed and converted to the SLP TRUCK CONVOY SYMBOL. Two new SLP parameters, SLP BARGE CONVOY SYMBOL and SLP RAIL CONVOY SYMBOL, are added to the initialization database. These new parameters may point to any defined scenario symbol. If the database builder prefers all Convoys to be assigned the same symbol, then these three SLP Convoy parameters can point to the desired symbol. Otherwise, these parameters can hold different symbols if distinct graphical identifiers are desired.

When the model creates and initializes a new Convoy, it determines the Convoy type by accessing the internal object attribute SR TYPE. This attribute holds the integer enumeration for the Convoy type, as described in [Table 12](#). According to the value held by this attribute, the model passes the correct symbolic identifier to the JODA. [Table 13](#) summarizes the database parameters that are accessed and used to display the listed Convoy types.

**TABLE 13. Supply Run Type and Symbol Assignment**

SUPPLY RUN TYPE	SYMBOL HELD IN DATABASE ATTRIBUTE
Barge (1)	SLP BARGE CONVOY SYMBOL
Rail (2)	SLP RAIL CONVOY SYMBOL
Truck (3)	SLP TRUCK CONVOY SYMBOL

### 2.9.2.3 Modified WHIP Filters

This detailed graphic representation of JTLS Convoy types was expanded to provide the WHIP user a new capability to filter Convoy activity according to this information. For this reason, an additional filtering level for Supply Run objects is available on the Map filter panel. This WHIP enhancement extends the existing capability to filter Air Missions by Mission Type, and allows the user to filter Supply Runs by Supply Run Type.

### 2.9.3 Data Changes

The existing database parameter SLP CONVOY SYMBOL is redefined as SLP TRUCK CONVOY SYMBOL. Additionally, the new database parameters SLP BARGE CONVOY SYMBOL and SLP RAIL CONVOY SYMBOL are included in the SLP definition:

#### 2.9.4 Order Changes

The Sustainment Logistics Prototype entity Set and Show orders are modified. If the Controller changes the symbol assigned to any Convoy symbol database parameter, the model examines all Support units in the scenario that currently use the altered SLP and updates the symbol for any active Convoy.

#### 2.9.5 JODA Changes

To enhance the Map Filter panel and allow the interface user to filter Convoy activity according to Supply Run Type, the JODA must access the corresponding Supply Run Type data. A new Common Knowledge attribute named Type is added to the JODA Supply Run object. This integer variable is an enumeration, as described in **Table 12**. The JODA passes Supply Run Type information to the Information Management Tool (IMT) to be reported on the Supply Run display.

### 2.10 JTLS-0118 Change Alert Base

#### 2.10.1 Summary of Model Change Request

JTLS provides the capability to alter an existing mission's current tasking based on the exercises audience's current operational requirement. For example, the JTLS player has the ability to order a specific:

- CAP mission to alter its orbit location,
- Air-Ground Attack mission to alter its primary target, or
- Airlift mission to add or delete a planned stop within its flight plan.

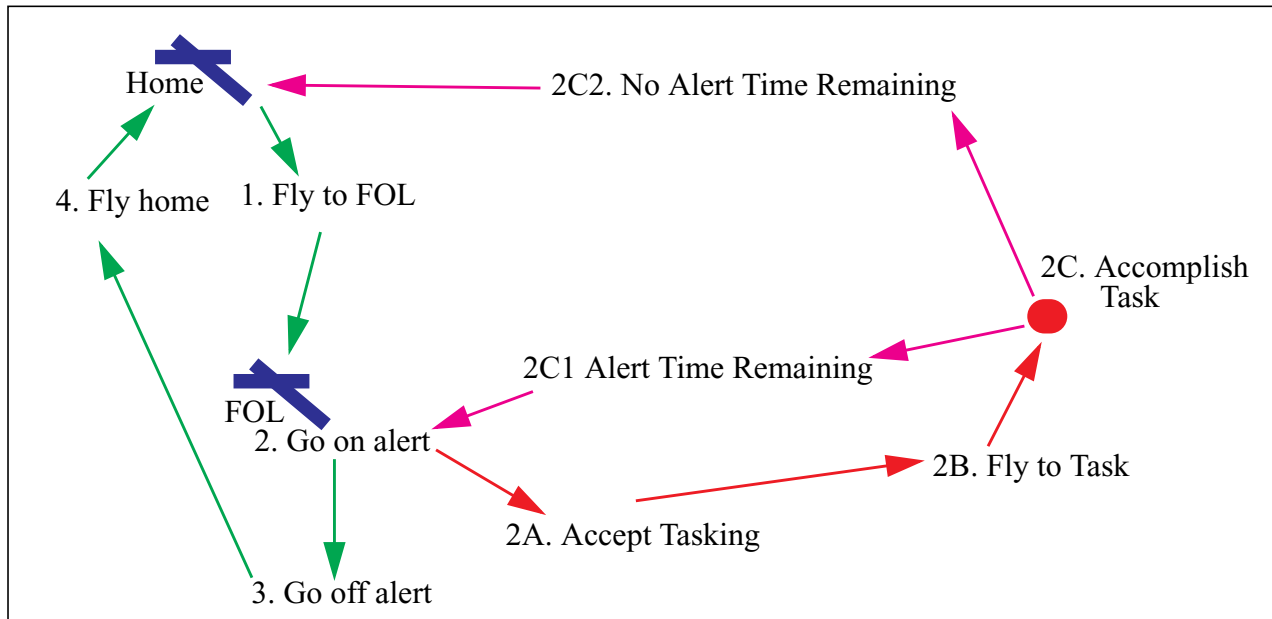
An Air Mission's assigned alert base previously could not be changed after being assigned for a specific Air Mission. The Player could cancel the existing mission and resubmit a new mission with the newly desired alert location. This enhancement improves the current operations capability of JTLS to allow the Player capability to alter a specific mission's alert base at any time during the mission profile.

#### 2.10.2 Design Summary

JTLS Air mission types that can be placed on alert include: Airborne Warning and Control System (AWACS), Air Refuel, Reconnaissance, Armed Reconnaissance, Electronic Combat (EC), Wild Weasel, Combat Air Patrol (CAP), Mine Warfare, Offensive Air Support (OAS), and Patrol. Each of these missions can be ordered on alert at its home base or at a Forward Operating Location (FOL). **Figure 6** depicts the flight profile of a mission placed on alert at an FOL. A mission on alert at its home base is not required to fly from its home base to the FOL; therefore, Step 1 and Step 4 would be omitted.



**Table 14** summarizes the rules that govern whether alert assignment changes will be allowed when requested by the Player, and how the ones that are allowed will be implemented. **Figure 7** and **Table 15** depict and explain examples of how Air Mission routes are adjusted after assigning new FOLs at various locations and distances from the current mission location.



**FIGURE 6. Alert Mission Flight Profile**

**TABLE 14. Change Alert Location Rules and Logic**

MISSION STATE	RULE	REQUIRED CHANGE ALERT BASE LOGIC
Prior to order entry	1	No model changes are required. The existing ATO-T capability supports this type of change.
Mission Scheduled; this state considers the mission from the time the mission order enters the system to the time at which the mission resources have been assigned.	2	The planned route for the mission must be altered. Three situations are possible:
	2A	The previous order had a home alert base; the new order has an FOL. The mission's route must add the FOL. A new launch time must be computed and the mission resourcing event must be rescheduled to meet the designated task time.
	2B	The previous order specified an FOL; the new order uses home base. The mission's route must have the FOL removed. A new launch time must be computed and the mission resourcing event rescheduled to meet the designated task time.
	2C	The previous order specified an FOL; the new order has specified a different FOL. The mission's route must be adjusted by changing the existing alert location to the new alert location. A new launch time must be computed and the mission resourcing event rescheduled to meet the designated task time.

**TABLE 14. Change Alert Location Rules and Logic (Continued)**

MISSION STATE	RULE	REQUIRED CHANGE ALERT BASE LOGIC
Mission Prelaunch; this state considers the mission from the time the mission has been assigned resources until the mission either goes on alert at its home base or takes off to fly to its designated FOL.	3	The planned route for the mission must be altered. Four situations are possible:
	3A	The previous order had a home alert base; the new order has an FOL. The mission’s route needs to have the FOL added. A new launch time must be computed and the mission launch event rescheduled to meet the designated task time.
	3B	The previous order specified an FOL; the new order uses home base. The mission’s route remove the FOL. A new launch time must be computed and the mission launch event rescheduled to meet the designated task time.
	3C	The previous order specified an FOL; the new order has specified a different FOL. The mission’s route must be adjusted by changing the existing alert location to the new alert location. A new launch time must be computed and the mission launch event rescheduled to meet the designated task time.
The mission is airborne and its next important route point is its Alert Base. This state considers the mission that is either heading toward its FOL after its initial launch. It also applies to an Air Mission that has finished its first assigned task and is heading back to its alert base, whether that base is the mission’s home base or a specified FOL.	4	Two situations are possible for this mission state:
	4A	The mission is headed toward an intermediate transit or turn point. In this case, the location for the alert base must be altered within the mission’s route.
	4B	The mission has already optimized a path to the old alert location. In this case, the mission’s optimized path must be removed from its planned route, the location for the alert base must be altered within the mission’s route, and an optimal path to the new alert base must be computed.
The mission is airborne and its next important route point is its Home Base. This state considers the mission that is heading home for a variety of reasons, including aircraft loss or completing the mission’s original alert time.	5	Three situations are possible for this mission state:
	5A	If the mission has fewer than the Air Control Prototype ACP SEND HOME PERCENT aircraft, the order is rejected.
	5B	If the mission has enough aircraft to continue and the new alert location is the mission’s home base, the mission’s route is adjusted. A new alter location hex is added to the end of the mission’s currently planned route, just prior to the mission’s home hex.
	5C	If the mission has enough aircraft to continue and the new alert location is not the mission’s home base, the mission’s route must also be adjusted. This is more difficult than the previous situation because it is not easy to determine the most logical placement of the alert location in the mission’s route. Primarily, the model determines which planned route point is nearest the newly specified alert base. The alert base is placed immediately following the determined point. <b>Figure 7</b> shows all of the possible situations for determine the proper placement of the alert base. Circles represent the mission’s current route. The green circles represent non-mandatory route points created as a result of the JTLS optimal route algorithm. The red circles represent mandatory route points. Four FOL locations are possible. The algorithm loops through the mission’s planned route, seeking the position in the route at which the next route point is further away than the last route point from the newly entered FOL. <b>Table 15</b> describes these rules for the examples shown in <b>Figure 7</b> .

**TABLE 14. Change Alert Location Rules and Logic (Continued)**

MISSION STATE	RULE	REQUIRED CHANGE ALERT BASE LOGIC
The mission is airborne and its next major location is not its Alert location and it is not home. This means that the mission is heading towards its airborne task location.	6	Two situations are possible for this mission state:
	6A	The mission does not have an existing alert location in its route. This occurs if the mission is not ordered to go on alert. For this case, the model rejects the order.
	6B	The mission has an existing alert location in its route. This alert location is changed to the newly entered alert location.
Mission is currently on alert.	7	The new alert location is placed at the top of the mission's route. The mission is removed from alert, takes off immediately, optimizes a path to the new location, and proceeds toward the new location.
The mission is currently on the ground, either refueling or rearming.	8	Two situations are possible for this mission state:
	8A	The mission is scheduled to go on alert as soon as the refueling or rearming task is complete. The Air Mission's data structure is changed to indicate that it should not go on alert after the procedure is complete. Instead, the mission is set to take off as soon as the refuel/rearm procedure is complete. The new alert location is placed at the top of the mission's route. After the refuel/rearm process is complete, the mission takes off, optimizes a path to the new alert base, and proceeds to the new FOL.
	8B	The mission is not scheduled to go on alert as soon as the refueling/rearming task is complete. For this situation, the model applies the same logic for a currently airborne mission. The logic depends on whether the next major route point is a task location (Rule 6), an alert location (Rule 4), or home (Rule 5).
The mission is currently airborne and is heading toward fuel tanker fuel, heading toward base fuel, or is intercepting.	9	Two situations are possible for this mission state:
	9A	The mission does not have an existing alert location in its route. This occurs if the mission is not ordered to go on alert. For this case, the model rejects the order.
	9B	The mission has an existing alert location in its route. This alert location is changed to the newly entered alert location.

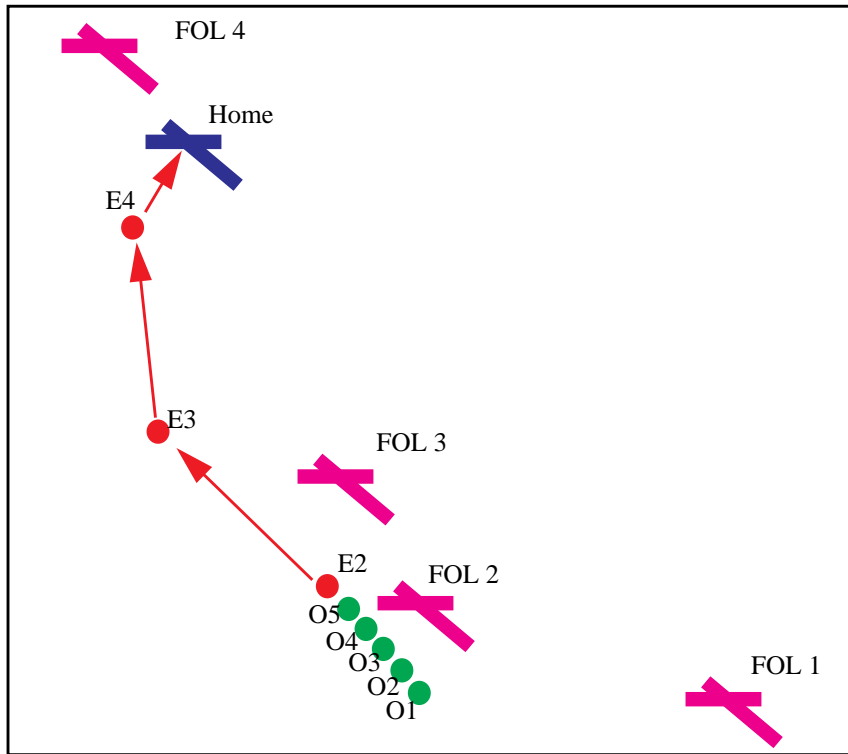


FIGURE 7. Example Alert Location Insertion Logic

TABLE 15. Example FOL Positions

FOL NUMBER	PROCESSING RULES
FOL 1	$D(O_2, FOL_1) > D(O_1, FOL_1)$ <p>The distance between <math>O_2</math> and <math>FOL_1</math> is greater than the distance between <math>O_1</math> and <math>FOL_1</math>. Therefore, the Alert location must be placed prior to <math>O_2</math> in the route. Since <math>O_2</math> is not a mandatory route point, all optimal route points are removed from the planned route. The mission removes all non-mandatory route points, labeled <math>O_1</math>, <math>O_2</math>, <math>O_3</math>, <math>O_4</math>, and <math>O_5</math>. The new alert base is placed at the top of the mission's planned route and the mission is ordered to optimize a new route to the FOL.</p>

TABLE 15. Example FOL Positions (Continued)

FOL NUMBER	PROCESSING RULES
FOL 2	$D(O_4, FOL_2) > D(O_3, FOL_2)$ <p>The distance between <math>O_4</math> and <math>FOL_2</math> is greater than the distance between <math>O_3</math> and <math>FOL_2</math>. Therefore, the Alert location must be placed prior to <math>O_4</math> in the route. Since <math>O_4</math> is not a mandatory route point, all optimal route points are removed from the planned route. The mission removes all non-mandatory route points, labeled <math>O_1, O_2, O_3, O_4,</math> and <math>O_5</math>. The new alert base is placed at the top of the mission's planned route and then the mission is ordered to optimize a new route to the FOL.</p>
FOL 3	$D(E_3, FOL_3) > D(E_2, FOL_3)$ <p>The distance between <math>E_3</math> and <math>FOL_3</math> is greater than the distance between <math>E_2</math> and <math>FOL_3</math>. Therefore, the Alert location must be placed prior to <math>E_2</math> in the route. Since <math>E_3</math> is a mandatory route point, no route adjustment is required. The mission's new route is: <math>O_1, O_2, O_3, O_4, O_5, E_2, FOL_3, E_3, E_4,</math> and Home.</p>
FOL 4	$D(Home, FOL_4) < D(E_4, FOL_4)$ <p>The distance between <math>E_4</math> and <math>FOL_4</math> is greater than the distance between Home and <math>FOL_4</math>. This special situation means that the mission must follow the planned route and proceed to the FOL instead of heading home. The mission's new route is: <math>O_1, O_2, O_3, O_4, O_5, E_2, E_3, E_4, FOL_4,</math> and Home.</p>

### 2.10.3 Data Changes

No data changes are required to implement this enhancement.

### 2.10.4 Order Changes

The Change Air Mission Parameter Order, which is currently used to alter all current operational changes for an Air Mission, is changed. For each of the mission types listed in [Section 2.10.2](#), a new change parameter option is added. The user may enter a new alert base for the mission.

### 2.10.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.11 JTLS-0181 Torpedoes Follow Ships

### 2.11.1 Summary of Model Change Request

In previous versions, JTLS torpedoes did not update the locations of their targeted Naval Units during their "flyout" after being fired. They were launched toward the perceived location of a targeted naval vessel specified by the Player. The ship's coordinates were retained as an impact destination by the weapon and were not alterable after launch. If the targeted ship moved a sufficient distance after launch, the torpedo could arrive at the impact destination after the ship has left the vicinity, resulting in a miss. The model's representation of a real-world, sophisticated weapon needed to reflect a capability to track and intercept the ship as it moves.

This model enhancement improves the behavior of JTLS torpedoes that are launched to attack moving Naval units. This design effectively enables real-time updating of the impact location that is retained by the fired weapon as the ship moves, and allows a torpedo to adjust its course during flight to intercept the ship in its new location.

### 2.11.2 Design Summary

This design involves changes in the Combat Events Program (CEP) routine that "flies" the weapon along a course toward its specified Naval target. This software event routine individually moves targetable weapons that are represented for modeling purposes as Cruise Missile objects. Thus, the CEP represents torpedoes as slowly moving, submerged Cruise Missiles. The new capability to adjust course applies to all Cruise Missile representations, as well as torpedoes, which are referenced in this design as missiles.

#### 2.11.2.1 Previous Implementation

The Player initiates a Fire Missile order for the surface-to-surface missile site—onboard the ship or submarine in this case—and specifies a named Naval unit to attack. When the order is sent to the CEP and the target is verified to be located within range of the missile, a Fire Mission is created that contains the perceived location of the specified Naval unit (i.e., the impact location) and other information from the order. After launch, the Cruise Missile (torpedo) proceeds toward the impact location. As simulation time advances, the MOVE ALONG ROUTE CRUISE MISSILE event is repeatedly scheduled to update the missile's position as it moves from hex to hex, according to its speed. During flight, the missile is subject to detection and being shot down if the appropriate countermeasures are available and employed. Once the missile reaches the impact location as originally stored in the Fire Mission, the ASSESS WEAPONS DAMAGE routine calculates any damage to the targeted ship. If no ship is present at the impact location, no damage occurs. However, a precision-guided weapon may attack other ships in the vicinity or continue its flight until it is out-of-range.

### 2.11.2.2 Logic Changes

The following logic additions to the MOVE ALONG ROUTE CRUISE MISSILE event were required to allow a Cruise Missile to follow a moving Naval unit.

New code was added to examine each Fire Mission as it is processed to determine whether the targetable weapon is precision-guided and the specified target is a Naval unit. If both conditions are true, the Fire Mission's impact location is reset to match the current (actual, not perceived) location of the targeted Naval unit. Whether the ship has actually changed location after the missile launched is immaterial. The ship's previous location is not known in this context and therefore cannot be determined if the ship has actually moved. Next, the missile's maximum time of flight (endurance) is calculated and considers its speed and the time elapsed since the missile's launch. If this elapsed time exceeds the missile's endurance, the missile is destroyed and the Fire Mission is terminated. Otherwise, the missile is permitted to continue its flight. Existing logic calculates the new bearing to the impact location, which now considers the updated ship location, and then determines where the missile should move next. In this manner, each time the missile plans a hex move, it is subject to a position update event, and a new course is applied according to the actual location of the targeted ship, allowing pursuit until the missile's range as represented by its endurance is exceeded. When the impact location is reached, the ASSESS WEAPON DAMAGE event uses the Fire Mission's updated impact location to determine whether damage occurs.

Now, the targeted ship's perceived location at the time the Player tries to fire an SSM or Torpedo could be radically different from the targeted ship's actual game location. It might have been quite a while since its last detection by the firing side. Therefore, to prevent Players from using missile firings as "search tools", the model will not allow an SSM firing at a ship or submarine unless the targeted vessel is actually at the perceived location at the time of firing.

A Great Circle distance calculation between the missile's launch latitude/longitude coordinates and its current location coordinates is insufficient to determine whether the missile's range has been exceeded. The missile may perform several course adjustments while pursuing a rapidly moving naval vessel within the Great Circle distance and continue beyond its true range. Furthermore, determining the actual distance traversed is not possible because the Fire Mission does not retain the missile's previous location information. Instead, each position update within the MOVE ALONG ROUTE CRUISE MISSILE event employs look-ahead logic to determine the next location to move the missile. The missile's previous location is irrelevant. For these two reasons, the endurance calculation is used as a surrogate for the actual distance traveled.

### 2.11.3 Data Changes

No data changes are required to implement this enhancement.

### 2.11.4 Order Changes

No order changes are required to implement this enhancement.

#### 2.11.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

### **2.12 JTLS-0224 Build Railroads, Pipelines, and IADs**

#### 2.12.1 Summary of Model Change Request

This ECP addresses a requirement to provide the JTLS user capability to build railroads and pipelines using the Graphical Database Program (GDP).

The features of this model enhancement is are included in the more comprehensive design, entitled **JTLS-0378 Graphical Database Program**, also implemented as part of JTLS 3.2.0.0.

#### 2.12.2 Design Summary

The logic used to implement this capability is included in **JTLS-0378 Graphical Database Program**.

#### 2.12.3 Data Changes

No data changes are required to implement this enhancement.

#### 2.12.4 Order Changes

No data changes are required to implement this enhancement.

#### 2.12.5 JODA Changes

The JTLS Object Distribution Authority changes required to implement this capability are included in **JTLS-0378 Graphical Database Program**.

### **2.13 JTLS-0264 SLP-SC Specific Name Uniqueness**

#### 2.13.1 Summary of Model Change Request

Previously, a problem existed when a new JTLS Supply Category was created by cascade duplicating a similar supply category. The duplication of SLP Supply Category Names caused confusion when the supply category was referenced by its SLP-specific supply category name in Logistic reports, Periodic reports, IMT supply screens, the OPM and other data reporting tools. Within a specific SLP, the SLP-specific supply category name must be unique.



2.13.2 Design Summary

In the JTLS DDS database, the SLP\_SC child table has only a single composite unique key defined at the table level. This composite unique key, based on the slp\_name and the sc\_name fields, ensures that each record in this table is unique if the slp\_name (sustainment log prototype name) and the sc\_name (supply category name) combination is also unique.

A similar composite key currently did not exist for the slp\_name and the slp\_sc\_name data fields. An example scenario has 11 supply categories. **Figure 8** and **Figure 9** show that the same slp\_sc\_name (AMMO and PEOPLE) is assigned to more than one record in the SLP\_SC table for the BLUE\_SLP.

## Supply Categories

<a href="#">AMMO</a>	<a href="#">CASUALTIES</a>	<a href="#">CL-IV</a>	<a href="#">CL-VII</a>
<a href="#">FOOD</a>	<a href="#">MISCELLANEOUS</a>	<a href="#">MISSILE</a>	<a href="#">PEOPLE</a>
<a href="#">POL</a>	<a href="#">REMAINS</a>	<a href="#">WATER</a>	

**FIGURE 8. Existing Supply Categories (Indexed From Left To Right)**

SLP_NAME	SC_NAME	SLP_SC_NAME
BLUE_SLP	AMMO	AMMO
BLUE_SLP	MISSILE	AMMO
BLUE_SLP	CL-IV	AMMO
BLUE_SLP	CL-VII	CL-VII
BLUE_SLP	FOOD	FOOD
BLUE_SLP	WATER	FOOD
BLUE_SLP	MISCELLANEOUS	MISCELLANEOUS
BLUE_SLP	CASUALTIES	PEOPLE
BLUE_SLP	PEOPLE	PEOPLE
BLUE_SLP	REMAINS	PEOPLE
BLUE_SLP	POL	POL

**FIGURE 9. SLP\_SC Data Before Modification**

To avoid this confusion, a new composite unique key was created to ensure that for each record in the SLP\_SC child table, the slp\_name (sustainment log prototype name) and the slp\_sc\_name (sustainment log prototype supply category name) combination is also unique, as shown in **Figure 10**.

2.13.2.1 Creating the Composite Unique Key Database Constraint

The new composite unique key for the SLP\_SC table is created during the JTLS 3.1 to JTLS 3.2 scenario database modification process.

To create the new composite unique key in the database, the modification process ensures that the uniqueness of the records is based on the slp\_name and slp\_sc\_name fields of the SLP\_SC child table. Existing records in this table SLP\_SC child table that satisfy the new composite unique key constraint are unchanged. Duplicate records for the selected slp\_name and slp\_sc\_name combination are processed. For those records, the update process generates unique slp\_sc\_name values by concatenating a unique number to the existing slp\_sc\_name, which satisfies the new composite unique key constraint. For existing slp\_sc\_name values greater than the default 15-character field length, the initial 12 characters are used to generate the new unique slp\_sc\_name values.

At the end of this scan/update process, the SLP\_SC table is recreated with the new table level composite unique key constraint, and repopulated.

2.13.2.2 Reviewing and Changing SLP\_SC Records After JTLS 3.2 Modification Process

After the JTLS scenario database is modified from the 3.1 version to the 3.2 version, the modified JTLS scenario database is downloaded to ASCII scenario files. After this download is complete the SLP\_SC database table records should be reviewed and the slp\_sc\_name field values modified as necessary.

The SLP\_SC database table is downloaded to the <scenario\_name>.slp\_sc ASCII file under the \$JTLSHOME/data/scenario/<scenario\_name>/ subdirectory. The records in this file are indexed by the slp\_sc\_name data field, which simplifies review of the slp\_name and slp\_sc\_name combinations. **Figure 10** depicts the modified SLP\_SC table records.

SLP_NAME	SC_NAME	SLP_SC_NAME
BLUE_SLP	AMMO	AMMO
BLUE_SLP	CL-IV	AMM01
BLUE_SLP	MISSILE	AMM02
BLUE_SLP	CL-VII	CL-VII
BLUE_SLP	FOOD	FOOD
BLUE_SLP	WATER	FOOD1
BLUE_SLP	MISCELLANEOUS	MISCELLANEOUS
BLUE_SLP	PEOPLE	PEOPLE
BLUE_SLP	CASUALTIES	PEOPLE1
BLUE_SLP	REMAINS	PEOPLE2
BLUE_SLP	POL	POL

**FIGURE 10. SLP\_SC Data After Modification**

Various methods can be used change the slp\_sc\_name values. Using the DDS Forms, saving the changes, followed by another database download into scenario ASCII files is recommended.

Users who do not have access to the DDS Forms can use SQL\*Plus to modify the slp\_sc\_name values. The following SQL query can be used for any JTLS 3.2 formatted scenario database to view all SLP\_SC child table records for the new composite unique key constraint:

```
SELECT slp_name, slp_sc_name FROM slp_sc ORDER BY slp_name;
```

Users familiar with SQL can change the slp\_sc\_name value for the desired SLP\_SC record. For example, if the slp\_name is BLUE\_SLP, and the user desires to change the slp\_sc\_name value from AMMO1 to AMMUNITION for that particular record, the following SQL query can be used:

```
UPDATE slp_sc SET slp_sc_name = 'AMMUNITION' WHERE slp_name = 'BLUE_SLP'  
and slp_sc_name = 'AMMO1';
```

If no other SLP\_SC - BLUE\_SLP record uses AMMUNITION for the slp\_sc\_name value, the related record will be updated. Otherwise, Oracle database server will issue an error, indicating that the new composite unique key constraint is violated. Changes should be committed to the database prior to another download into the scenario ASCII files.

Another method involves editing the JTLS 3.2 formatted <scenario\_name>.slp\_sc ASCII file, which should be done with care. The first field (column) in the file holds the slp\_name values and the third field holds the slp\_sc\_name values. Only the slp\_sc\_name values should be edited in this file; the combination of the first and third field values must be unique. If this requirement is satisfied and the new <scenario\_name>.slp\_sc file is saved, the scenario should be reloaded into the database server to avoid future downloads to replace the edited file.

### 2.13.3 Data Changes

No data changes are required to implement this enhancement. The JTLS 3.1 to 3.2 scenario database modification process searches the existing SLP\_SC records to ensure that the slp\_sc\_name values are unique, and will recreate and repopulate the SLP\_SC table with the new composite unique key.

### 2.13.4 Order Changes

No order changes are required to implement this enhancement.

### 2.13.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.14 JTLS-0300 Magic Move To Offboard Location Formation

### 2.14.1 Summary of Model Change Request

The JTLS Magic Move capability allows the Controller three methods to instantaneously relocate a unit. A Controller can specify a set of latitude/longitude coordinates, specify a Formation of ships on which the land unit is to embark, or, in the case of a high-resolution unit (HRU), specify a unit to which the HRU is to link up. However, a Ground unit could not be magically embarked on a Formation not in the theater of operations. Also, the Controller needed to specify latitude/longitude coordinates as well as an Airbase (or Ship) name in order to move a Squadron to a new base, instead of simply entering the new base's name.

These improvements provide the JTLS Controller additional options to re-deploy forces more efficiently. The Controller can:

- Permit a Ground unit to be embarked on an off-map Formation of ship(s).
- Enable a Squadron to be relocated to a specified home base, on the map or off the map.

### 2.14.2 Design Summary

This enhancement involves changes to the Magic Move (MM) order panel and the associated routines within the Combat Events Program (CEP).

#### 2.14.2.1 Logic Changes

The MM processing code is modified to permit a Ground unit to be Magic Moved to a Formation that is out-of-theater (off the game board). Specifically, new logic is added to the routine that completes the Magic Move processing. When a Magic Move order to an off-map Formation is identified, some of the processing code required for on-map Magic Moves is bypassed. For example, there are no hexes defined off the map; all code that associates the unit with a hex at its new location is bypassed. Such an attempted association would cause an invalid set owner pointer game crash.

#### 2.14.2.2 New Order Constraints

A Squadron Home Base entry is added to the MM order panel. This field allows the Controller to exactly specify the name of a new home base (and, by extension, the location) for the Squadron. New panel constraints are implemented to:

- Reject a home base that belongs to a different Force Side than the Squadron to be Magic Moved.
- Reject a home base if the unit to be moved is not a Squadron.
- Reject a home base if it is not an Airbase, Naval unit (ship), or Forward Air Refueling Point (FARP).

- Reject a Formation if the unit to be moved is a Squadron.
- Reject a home base that is a FARP if the Squadron has fixed wing aircraft.

The underlying order processing routines in the CEP are modified to use the latitude/longitude of the Squadron Homebase to relocate the Squadron and assign it to the Squadron Homebase (i.e., an airbase, ship, or FARP). This logic change is implemented in the main routine that parses the original Magic Move order, and includes the routines that determine the suitability of the new location and complete the Magic Move of the Squadron. When the Squadron Homebase is specified in the order, the code omits the logic that searches for a new home base (when a latitude/longitude is specified) and uses the Squadron Homebase instead. This new procedure also applies to Magic Moves to another base within the same hex.

2.14.2.3 New Magic Move Capabilities

The existing capability to relocate a Ground unit, ship, HRU, or Squadron to a specified latitude/longitude is not altered, with one exception: a fixed-wing Squadron Magic Moved to an off-map hex is associated with the nearest off-map airbase or ship that is present. The existing capability to relocate a unit or HRU to a Formation (List of Ships) is not altered. Certain logical and practical limitations exist that are related to which unit types can be moved and how the destination can be defined in the order. **Table 16** summarizes the existing and new capabilities for Squadrons and Ground unit Magic Moves germane to this ECP. The cells highlighted yellow are new capabilities added to implement this design.

**TABLE 16. Legal Magic Move Combinations Summary**

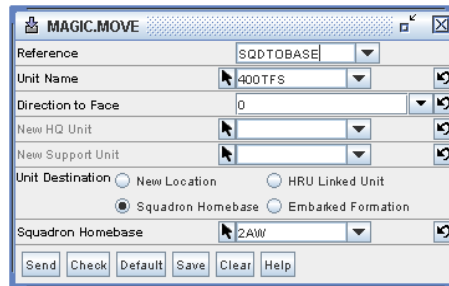
UNIT TYPE	NEW MOVE LOCATIONS		DESTINATION AS SPECIFIED ON ORDER PANEL		
	TERRAIN	MAP	LAT/LON	HOMEBASE	FORMATION
Squadron	Land	On	Comply	Comply	N/A
	Land	Off	Comply	Comply	N/A
	Ship	On	Comply	Comply	N/A
	Ship	Off	Comply	Comply	N/A
Land Unit	Land	On	Comply	N/A	N/A
	Land	Off	Not Comply	N/A	N/A
	Ship	On	Not Comply	N/A	Comply
	Ship	Off	Not Comply	N/A	Comply

2.14.3 Data Changes

No data changes are required to implement this enhancement.

### 2.14.4 Order Changes

The MM order panel and underlying order processing subroutines are modified to accommodate the new Squadron Homebase field. The Unit Destination group and corresponding Squadron Homebase text entry field appears as shown. The revised and less ambiguous HRU Linked Unit (formerly Link-To-Unit) and Embarked Formation (formerly List of Ships) labels retain their previous functionality.



**FIGURE 11. Magic Move Order Format**

### 2.14.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.15 JTLS-0326 Jump Map

### 2.15.1 Summary of Model Change Request

This design enhances the existing Overview Map feature of the Web Hosted Interface Program (WHIP) and allows the interface user to:

- Change the zoom level for the Overview Map
- Use a filter option to hide the Overview Map

Additionally, the user accessibility of Overview Map and its display of terrain and visual reference information are enhanced.

### 2.15.2 Design Summary

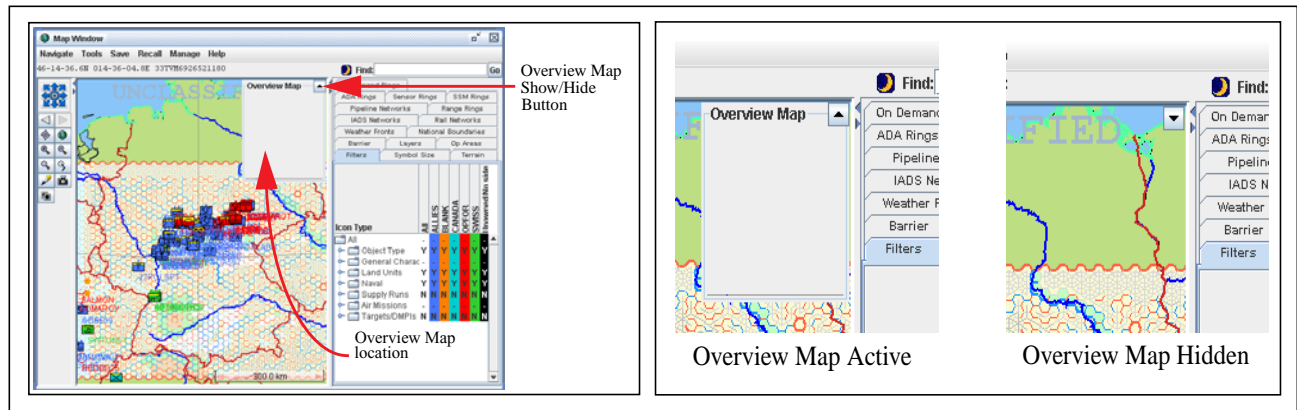
The Overview Map uses an OpenMap tool that implements a third-party mapping library accessed by the WHIP Map window to interact with the Source Map. The Source Map that provides the primary view of the game area is linked to the Overview Map by means of a scale that is defined as the ratio of the map view to the window size, and a Scale Factor used as a multiplier to obtain the Overview Map scale. For example, if the Source Map scale is set to 50,000:1 and the Overview Map Scale Factor is set to 10, then the Overview Map will use a scale of 500,000:1.

### 2.15.2.1 Previous Capability

The previous Overview Map did not display artificial terrain information for some Source Map views. For a source Map view that contained no National Boundaries, the Overview Map displayed an empty region that has no corresponding reference features. Also, a blank Overview map would result as the user zoomed the Source Map inward to a smaller scale to display additional detail.

#### 2.15.2.1.1 Overview Map Placement

The Overview Map is moved from its previous Filter Panel location in the Filter to the upper right corner of the Source Map to permit user access when the Filter Panel closes (**Figure 12**). The capability to hide and restore the Overview Map by means of a Show/Hide button placed within the map area is also provided.



**FIGURE 12. Overview Map Location and Display States**

The Overview Map maintains the aspect (height-to-width) ratio of the Source Map. Maintaining this aspect ratio displays an Overview Map that is shaped proportionally to the Source Map. If the user resizes the WHIP Map window to 800 x 400 pixels, an aspect ratio of 2:1, the Overview Map adjusts its size to an equal aspect ratio. The maximum area dimensioned for the Overview Map is 150 x 150 pixels. The Overview Map window will be less than or equal to 150 pixels in either dimension, due to the application of the aspect ratio. For the 800 x 400 pixel example, the Overview Map dimension would be 150 x 75 pixels.

The Map window has the capability to display four projection types; Lambert Conformal, Mercator, Orthographic, and CADRG. The Overview Map uses the Mercator conformal projection because it is commonly used for global navigation and suitable for panning to local map views.

#### 2.15.2.2 Frame of Reference Features

The Overview Map renders simulation objects such as units and targets, the hex terrain model, the JTLS playbox boundary, graticule, the JTLS terrain outline map, and a Source Map coverage area

outline (Figure 13). Adding these layers provides the reference objects that the user needs to maintain positional awareness with respect to the Overview Map.

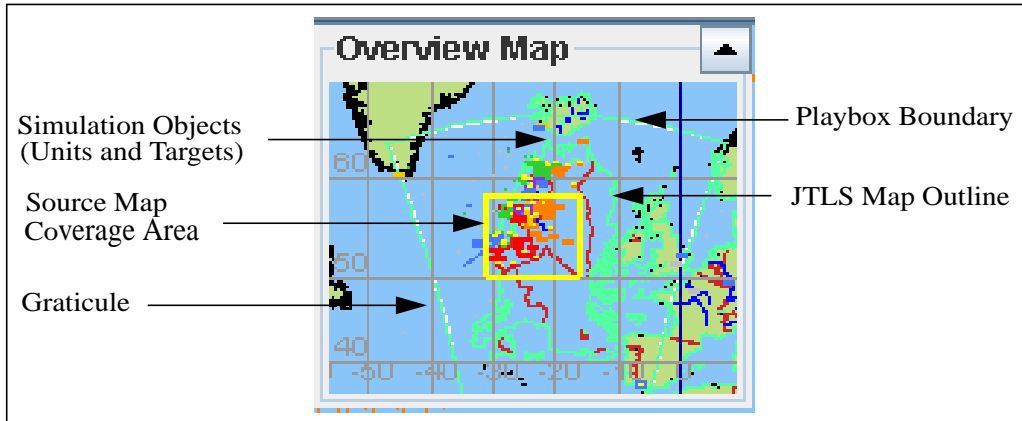


FIGURE 13. Overview Map Reference Layers

The JTLS hex terrain is rendered within the Overview Map when the user zooms inward to an appropriate scale (Figure 14). The terrain layer in the Overview Map reflects the user's filter settings in the Terrain filter panel.

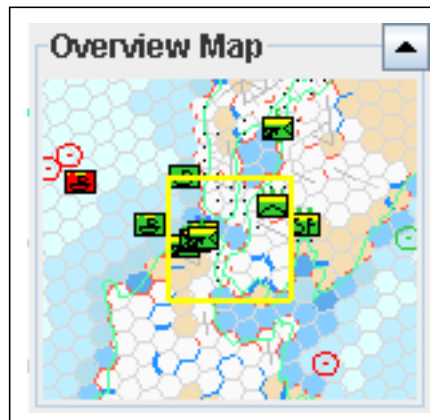


FIGURE 14. Overview Map Hex Terrain Layer

The display of simulation objects reflects the Filter Panel settings. Thus, the Overview Map displays the same types of objects as the Source Map. The displayed size of the icons that represent the simulation objects are managed according to the Overview Map's current scale and cannot be configured by the user.

Unit or terrain data displayed in the Source Map coverage area is reflected in corresponding layers of the Overview Map. If the Source Map displays an off-the-board location that lacks JTLS terrain data, or contains no units or targets, the Overview Map is blank and devoid of reference elements. For this



reason, a link between the Overview Map scale and the Source Map scale enables the user to specify the area coverage of the Overview Map.

### 2.15.2.3 Overview Map Scale Settings

To provide an appropriate depiction of the Source Map's coverage area, the WHIP Overview Map must adjust its scale as the Source Map's scale changes. The user typically applies the map navigation controls to determine the scale of the Source Map view instead of setting a numerical scale value.

The user can control of the Overview Map's relative scale with respect to the Source Map. Instead of a scale value that is specified as an Overview Map parameter, a radial distance is used. The Overview Map Scale Factor and Minimum Radius parameters defined in [Table 17](#) will determine the scaling of the Overview Map.

**TABLE 17. OpenMap Overview Map Parameters**

PARAMETER	DESCRIPTION	VALUES
Scale Factor	This multiplier is based on the Source Map scale and adjusts the relative scale used by the Overview Map.	1.0 through 20.0
Minimum Radius	This Minimum Radius is applied to the area coverage of the Overview Map. As the Source Map zooms in to a smaller scale, the Overview Map will not zoom in closer than this radius.	1 kilometer to 40,000 kilometers

The Overview Scale Factor controls the relative scale of the Overview Map with respect to the Source Map scale. This multiplier is applied to the Source Map scale to produce the Overview Map scale. If the Source Map's current scale displays an approximate 100 kilometer radius and the Overview Map Scale Factor is 10, the corresponding Overview Map will represent an approximate 1000 kilometer radius.

The Overview Map Minimum Radius defines, as a distance, the minimum scale the Overview Map will use to display the Source Map coverage. The user can restrict the Overview Map to zoom in no closer than a radius of 250 kilometers by setting the Minimum Radius for the Overview Map to this value.

The Scale Factor and Minimum Radius parameters can be accessed and changed the by means of the Preferences Manager, and will apply to all Map Windows that may currently be open and also to any Map windows the user opens during the progress of the game.

### 2.15.2.4 Overview Map User Interface

The WHIP Map window uses the OpenMap interface to interact with the Source Map. These Overview Map user interface actions are supported:

- Center Map. The center of the Source Map can be changed by performing a mouse click on the Overview Map at the desired location. The Overview Map and the Source Map change to reflect the new location.
- Zoom In/Out. The scale of the Source Map by can be changed by performing a mouse drag action to define a rectangle that represents a larger or smaller coverage area. The Source Map change to reflect the new scale.

The Source Map's coverage is depicted on the Overview Map as a yellow polygon. Due to differences among the projection types, the Source Map's coverage area may appear as a vertically oriented rectangle or a slightly distorted rectangle, due to the various plane representations of the spherical terrain surface.

The scale Factor, Radius, and Font Size of the Overview Map can be changed by the WHIP user. Options to do this are under the WHIP top menu bar "Tools" selection, "Preferences" option.

### 2.15.3 Data Changes

No data changes are required to implement this enhancement.

### 2.15.4 Order Changes

No order changes are required to implement this enhancement.

### 2.15.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.16 JTLS-0340 JTLS Message Forwarding

### 2.16.1 Summary of Model Change Request

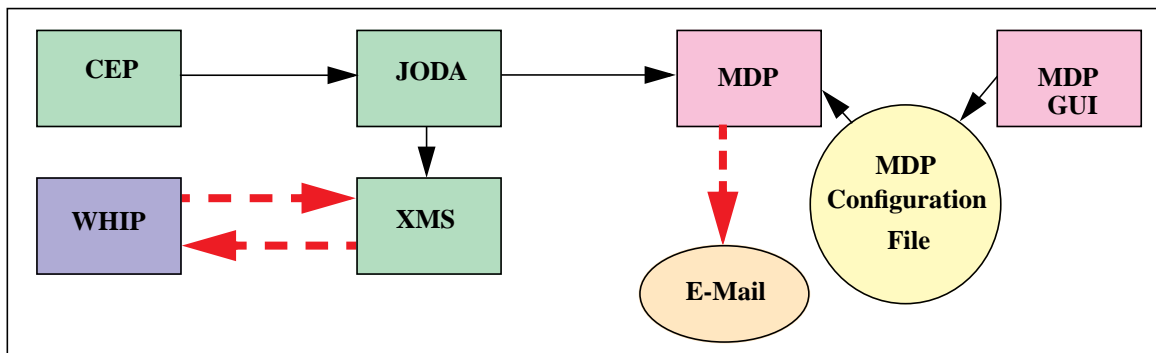
Previous JTLS versions that did not support the Web-enabled capability allowed a Message Processor Program (MPP) user to direct messages received by the MPP to be automatically forwarded to a specific e-mail address. This capability was used to automatically deliver selected certain message types to real-world Command, Control, Communication, Computer, and Intelligence (C4I) systems.

The MPP capability to forward received messages to a configured C4I e-mail account was lost with the implementation of the Web-hosted simulation, primarily because the WHIP-based Message Processor Program does not actually receive messages. Instead, this component requests the Extensible Markup Language Message Service (XMS) data representation for only the messages that satisfy its current retrieval constraints. As a user modifies these constraints, the XMS serves and re-serves the messages for each request.

This enhancement implements a methodology within the Web-hosted paradigm that fulfills the requirement to automatically deliver messages to a specific e-mail account.

### 2.16.2 Design Summary

A JTLS Message Delivery Program (MDP) was developed that consists of a server process and a Java-based graphic user interface (GUI). The server process is a JODA client similar to the XMS that "listens" for messages from the CEP and uses a configuration file to forward them to a specific e-mail address. The Java GUI manages this configuration file and the MDP checks for modifications before performing any action. This process is shown in **Figure 15**.



**FIGURE 15. MDP Within the JTLS System**

#### 2.16.2.1 Message Delivery Program (MDP)

The WHIP Message Component has the capability to merge XML messages created by the CEP with their XML Stylesheets to form a readable message. The MDP also uses this capability. As a JODA client, the MDP is developed in C and the WHIP Message Component is written in Java. A service library of C routines enables the MDP to merge the XML message data with the XML Stylesheet information. The design of the C code needed for the MDP to become a JODA client in this manner enables users to create their own programs to output JTLS messages for any desired purpose by using the MDP service library.

The MDP user interface provides the flexibility to choose which messages should be sent by selecting the originating Side, the message type, and the message format. The MDP is able to manage as many combinations as the MDP user desires to establish. Each message definition group is capable of delivery to single or multiple e-mail addresses. The methodology the MDP uses to select and direct messages includes additional history log, resend capability, and forward to directory functions.

##### 2.16.2.1.1 MDP History Log

All messages e-mailed by the MDP are logged in a file with the corresponding JTLS game time and local time at which they were sent. This file, named *scenario\_name.mdp\_log*, is written to the *\$JGAME/scenario\_name/messages* directory. The MDP is sufficiently flexible to automatically e-

mail any combination of messages to several e-mail locations simultaneously. Therefore, the user can rely on a single instance of the MDP. For this reason, the file naming convention does not require including a specific MDP client name.

Besides listing which messages have been e-mailed, the MDP history log file includes other event information, such as checkpoints, restarts, lost JODA communication, and delivery errors. Lost JODA communication is especially important because the JODA does not save JTLS messages. The CEP writes the XML version of a message to a data file, then passes a message notification to the JODA. As JODA clients, the XMS and the MDP register to receive these notifications. If the MDP crashes for any reason, it may not recognize some of these notifications and their associated messages. The MDP history log will assist Technical Control to manage this situation.

The *.mdf\_log* file is cleared each instance a scenario is started from Checkpoint 0000. Like the same scheme used for the JTLS Critical Input file, a single log file is recommended to assist locating managing message handling errors, instead of a log file for each checkpoint.

#### 2.16.2.1.2 MDP Resend Capability

The MDP includes re-send message capability that is managed by the MDP interface user. This capability may be used for several reasons. For example, if e-mail service fails and messages are lost, the MDP can be deployed to re-consider and re-send a group of messages.

The MDP uses the interface to create a *scenario\_name.mdg\_resend* file within same directory as the *.mdp\_log* file. This file contains the JTLS unique scenario message identification codes for the messages that must be resent. The MDP continuously polls and reads this file, and handles its message contents in the same manner as it responds to the message existence notifications from the JODA. Thus, if the connection to the JODA is lost, the MDP can examine and evaluate any messages associated with missed notifications.

After reading the contents of this file, the MDP moves and rename the file to a reserved *mdp* subdirectory that is located under the *\$JGAME/scenario\_name/messages* directory. The text of the new file name is the current system time during which the MDP processes the file, appended to the *.mdg\_resend* extension. The GUI user is able to create a new MDP resend file as needed. The MDP continues to poll for this file, and the resend process is repeated when the MDP locates the file.

#### 2.16.2.1.3 Forward To Directory

The MDP has the capability to forward messages to a directory on the file system. This feature is useful for debugging and redundancy if the MDP machine fails to send e-mail or if messages must be delivered by other means besides e-mail. Some C4I systems are able to poll a directory to search for message files. The forwarding feature allows the MDP to also fulfill this capability. The interface user will have the ability to specify which messages should be saved to a file system directory as well as an unlimited number of save directories.

### 2.16.2.2 MDP Graphical User Interface (GUI)

The MDP GUI is started by first selecting Option 9, Scenario Execution Tools Menu, from the JTLS Main Menu. Then, from the resulting tools menu, Option 8, Configure Message Forwarding, is selected. The MDP GUI will appear and the MDP will begin attempting connection with the appropriate JODA.

The JMDP configuration file contains two basic types of configuration data for rendering and delivery.

#### 2.16.2.2.1 Rendering Configuration Data

The user may create an unlimited number of rendering profiles. Each profile defines the desired format for rendering the messages and is equivalent to the Preferences options that are available for the WHIP Map component. The message rendering profile components include Rendering Profile Name, Language File, Message Header File, Decimal Precision, Generating Side, Unit Of Measure, and Sustainment Logistics Prototype (SLP) Supply Unit Of Measure.

#### 2.16.2.2.2 Delivery Configuration Data

The user may create an unlimited number of delivery profiles. Each profile precisely defines which messages should be delivered, the message recipients, and the message rendering format. Each profile can specify several messages and several delivery destinations. The deliver profile components include Delivery Profile Name, Rendering Profile Name, Sending E-Mail Address, Messages To Be Sent, and Delivery List.

The filename and the e-mail subject line can be specified in the delivery profile according to a simple protocol of descriptor variables. The protocol recognizes the variables listed in [Table 18](#).

**TABLE 18. MDP Protocol Variables**

VARIABLE NAME	DESCRIPTION
ID	Current message ID
SUBJECT	Subject line of the current message
SCENARIO	Scenario name
FORMAT	Format used to render the message
JTLS_CLOCK	Current game time displayed in XML date format
WALL_CLOCK	Current time in XML date format
CHECKPOINT	Current checkpoint number

The user forms the message filename in the delivery profile by means of a sequence of characters and variable names. For example, the file specification `/home/jtlsmsg/{messageID}._:{SCENARIO}` writes each delivered message to the `/home/jtlsmsg` directory as a file named

*MessageID\_ScenarioName*. A message *000000235.xml* from the scenario *Webtest32* that satisfies the delivery profile constraints will be written as a file named *235\_webtest32*. If the delivery profile specifies the filename to be */home/jtlsmsg/{ID}::{JTLS\_CLOCK}*, the combined path and filename will be */home/jtlsmsg/235.301600JAN07*.

The e-mail subject line provides the same functionality. Within the delivery profile, the user indicates the destination e-mail address and the subject description for the e-mail message. If the subject is specified as *{SUBJECT}*, the message source is the subject of the e-mail. For example, the message *000000235.xml* is a Type 4105 (Cannot Comply) message from Unit 1BD. The subject of the e-mail is written as: *Log Order received, 1BD, Cannot Comply*. The format of this subject is derived directly from the language file selected within the rendering profile. If the user specifies the e-mail subject as *{SUBJECT}:at:{JTLS\_CLOCK}*, The format of the e-mail subject line is: *Log Order received, 1BD, Cannot Comply at 01600JAN07*.

#### 2.16.2.2.3 MDP Event Log

The MDP logs events that occur while the program executes. This log can be viewed from the GUI. The MDP user can monitor the progress of the delivery instructions on a real-time basis. From this Event Log interface, the user can easily create the resend file.

#### 2.16.2.3 JTLS Message Rendering Library

The MDP includes a reusable *libjtlsmsg* C library for rendering JTLS messages according to criteria specified in the rendering profiles panel, which will be used to configure this library. The library provides a means to configure the rendering of messages and a handler that will parse XML code to a rendering profile structure. Due the implementation of this feature, users can develop customized programs and interfaces to render JTLS messages.

#### 2.16.3 Data Changes

No data changes are required to implement this enhancement.

To allow rendering library access, the Game Start Day, Start Month, and Start Year data parameters embedded in the JTLS general global data file are relocated. This file begins with the Game Classification and the database version number, then lists the Game Start Month, Start Day, and Start Year. While updating a database from any previous version, the database conversion process writes these existing data to the required new position in the data file.

#### 2.16.4 Order Changes

No order changes are required to implement this enhancement. Due to this design, the JTLS Duplicate Message order is obsolete. However, this capability is retained in the model because it is thoroughly tested and does not consume significant resources.

### 2.16.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.17 JTLS-0347 Units In Combat Flag**

### 2.17.1 Summary of Model Change Request

This enhancement supports a requirement to visually indicate the combat status of each unit in the game on the WHIP Command Hierarchy component.

### 2.17.2 Design Summary

The combat status of a unit is a Boolean value; the unit is either in combat or not in combat. A red colored background highlight for the name field of each unit on the Command tree is implemented as a flag that indicates a unit is in combat. This display option was chosen as the least confusing and most easily identifiable visual indicator.

### 2.17.3 Data Changes

No data changes are required to implement this enhancement.

### 2.17.4 Order Changes

No order changes are required to implement this enhancement.

### 2.17.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.18 JTLS-0349 Command Hierarchy Display Management**

### 2.18.1 Summary of Model Change Request

This ECP defines a requirement to allow the user to hide or display portions of the WHIP Command Hierarchy. This feature enhances the functionality of this interface tool to permit the user to display only those units that are of interest in the Command Hierarchy window. This changes applies only to the Command Hierarchy window, not to the Logistics Hierarchy window.

### 2.18.2 Design Summary

Managing the Command Hierarchy display structure is accomplished by providing the user with options to selectively display or hide units within the Command Hierarchy window. Unit symbols to be displayed or hidden are simultaneously visible during the unit selection process.

The Command Hierarchy window support two modes of operation, a Display Mode and a Prune Mode. The Display Mode presents the command structure with the hidden units removed. The Prune Mode displays each unit symbol in the structure with an adjacent checkbox that indicates the display status of the unit.

The content of this checkbox indicates three states:

- A check symbol indicates that a unit will be displayed.
- An empty check box indicates that the unit will be hidden and not displayed.
- A partial checked state indicates that the unit has subordinate units in both the displayed and hidden states. The checkbox contains a hyphen character (-) to indicate this display status.

In the Prune mode, the user may toggle the state of a unit between hidden or displayed states by performing a left click on a selected unit symbol of interest. The display state of this unit and all subordinates is changed according to these rules:

- The state of a displayed unit and each subordinate is changed to hidden.
- The state of a hidden unit and each subordinate is changed to displayed.
- The state of a partial unit and each subordinate is changed to displayed.



Figure 16 depicts the Command Hierarchy window displayed in the Prune Mode.

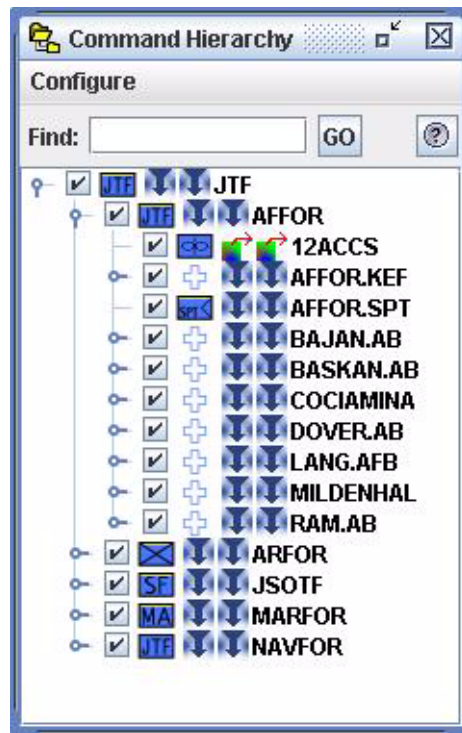


FIGURE 16. Prune Mode Example

A menu bar is added to the Command Hierarchy to provide access to the new user interface features described in Table 19. This menu bar is accessed by clicking on the "Configure" selection.

TABLE 19. New Command Hierarchy User Interface Features

FEATURE	ACTIVATION	DESCRIPTION
Display Mode	Configure > Display Mode menu item	Display the Command Hierarchy with selected units visible and unselected units hidden.
Prune Mode	Configure > Prune Mode menu item	Display all units with check boxes to allow the user to select which units should be displayed.
Reset Tree	Configure > Reset Tree menu item	Reset the Command Hierarchy to its initial state with all units visible.
Expand All	Configure > Expand All menu item	Expand all unit nodes in the Command Hierarchy.
Collapse All	Configure > Collapse All menu item	Collapse all unit nodes in the Command Hierarchy.

**TABLE 19. New Command Hierarchy User Interface Features (Continued)**

FEATURE	ACTIVATION	DESCRIPTION
Save	Configure > Save menu item	Save the current Command Hierarchy configuration. This feature functions in a manner similar to the map Save Location/Filters/View features.
Recall	Configure > Recall menu item	Recall a previously saved Command Hierarchy configuration. This feature functions in a manner similar to the map Recall Location/Filters/View features.
Manage	Configure > Manage menu item	Provide the user the capability to manage existing Command Hierarchy configurations. This feature functions in a manner similar to the map Manage Location/Filters/View features. The user can delete, share, and copy existing Command Hierarchy configurations.

2.18.3 Data Changes

No data changes are required to implement this enhancement.

2.18.4 Order Changes

No order changes are required to implement this enhancement.

2.18.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

**2.19 JTLS-0370 XChat Paging Flags**

2.19.1 Summary of Model Change Request

This design addresses a requirement to provide a paging flag capability for the WHIP that allows Technical Control to post messages to a group of WHIPs.

The legacy GIAC user interface included an external XChat application provided with previous JTLS releases that permitted communication among workstations. This application was used as the primary communication tool among experienced JTLS users, but presented difficulties for users more accustomed to graphically-oriented operating systems. The WHIP prototype developed for the Agile Response 2003 exercise (AR03) provided an interim Government-required chat capability to support communications sessions among users. The implemented open-source Babylon Chat feature was not intended to be a permanent configuration-managed solution.

The current requirement is only for developing a tool to push messages from Technical Control to the WHIP. The requirement for a more robust chat feature has been deferred to allow administrative issues to be resolved.

### 2.19.2 Design Summary

This enhancement replaces the Babylon Chat server and client implementation with a proprietary message push capability. Integrating the Babylon capabilities with the WHIP and its server component presented a maintenance issue and would have prevented future enhancement. Due to security issues, the message notification capability is implemented within the WHIP.

These essential elements of the Chat feature requirement have been identified:

- Capability to send a notification message to all WHIPs
- Capability to send a notification message to all WHIPs on a Side
- Capability to send a notification message to a selected subset of WHIPs
- Capability to select the background color of the notification message

This solution functions independently of any Web Services or the CEP, which allows sending messages even if the model or any services are not executing. However, the Web Server must be executing and the WHIP must connect to the server. The WHIP uses standard protocols to maintain this connection without requiring a proprietary Apache module.

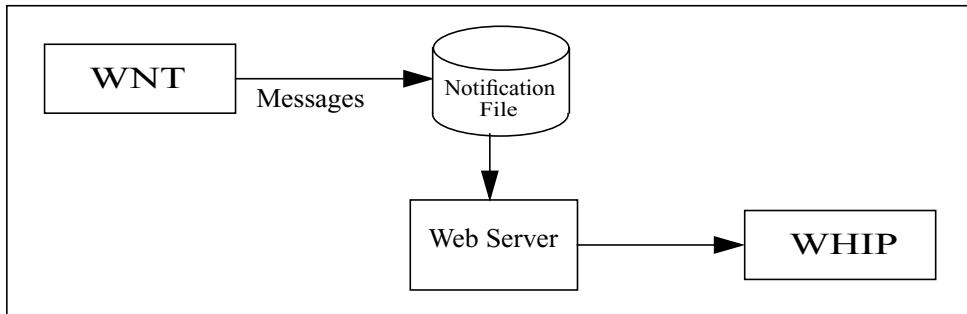
A Java-based messaging application called the WHIP Notification Tool (WNT) has been created. It allows Technical Control to create, update, and save messages and send them to the WHIPs.

The WNT provides a simple editing facility that produces and saves notification messages. Notifications created using a text editor and saved in a configuration directory can be sent later. Technical Control may create or select saved notifications, and send them to all WHIPs, WHIPs on a specific Side, or individual WHIPs.

The notification is copied to a notification directory (*\$JGAME/{scenario}/config/wnt*) for access from the WHIP via the Apache Server. Each WHIP has an assigned file that contains the notification message, and retrieves this message via the server. The WHIP periodically checks this file for new

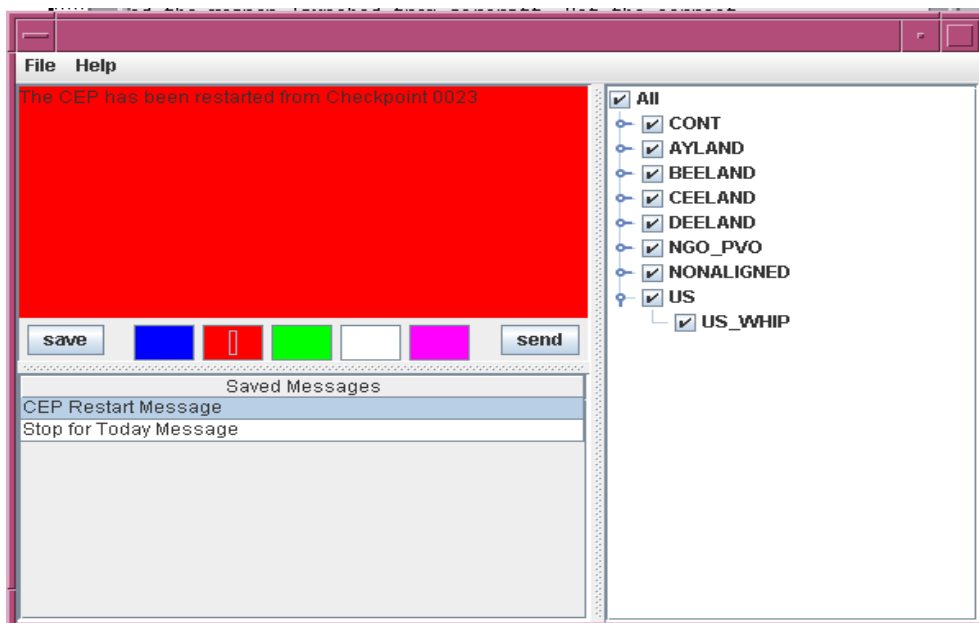
notifications. When the WHIP detects a new sent notification, it retrieves the item to display in a notification dialog box. The user can dismiss the notification dialog by clicking an OK button.

The message traffic between WHIPs is depicted in **Figure 17**.



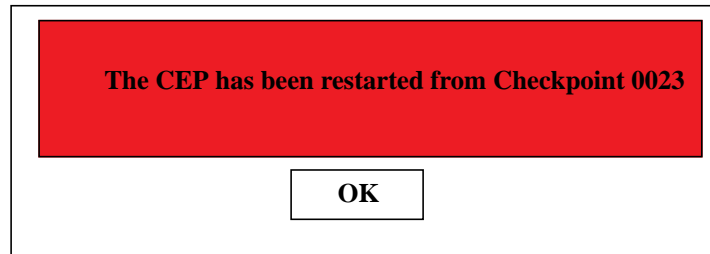
**FIGURE 17. WHIP Notification Flow**

The WNT is evoked by entering the command *wnt* in a terminal window. After selecting the desired scenario, the user interface depicted in **Figure 18** is displayed. This window includes a field to enter or edit notifications, a field that displays the list of prepared notifications, a field to specify which WHIPs to notify, buttons to select the background color of the notification, and a Send button to deliver the notifications to the selected WHIPs.



**FIGURE 18. Instant Message Window**

When a WHIP detects a new notification, a dialog window as depicted in **Figure 19** appears, centered on the screen. This example shows the color red selected as the notification background.



**FIGURE 19. Whip Notification Dialog**

### 2.19.3 Data Changes

No data changes are required to implement this enhancement.

### 2.19.4 Order Changes

No order changes are required to implement this enhancement.

### 2.19.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.20 JTLS-0377 Exercise Submission Tool**

### 2.20.1 Summary of Model Change Request

The JTLS Exercise Submission Tool is an enhancement developed for the purpose of collecting and monitoring problems and issues that occur during JTLS exercises. The Oracle Relational Database Server is used as a central data repository to provide easier access and maintenance of log entries over the Internet or an Intranet. This tool is available to JTLS users as well as developers for JTLS exercises, event tests, version tests, testing before a major release, and other related purposes.

### 2.20.2 Design Summary

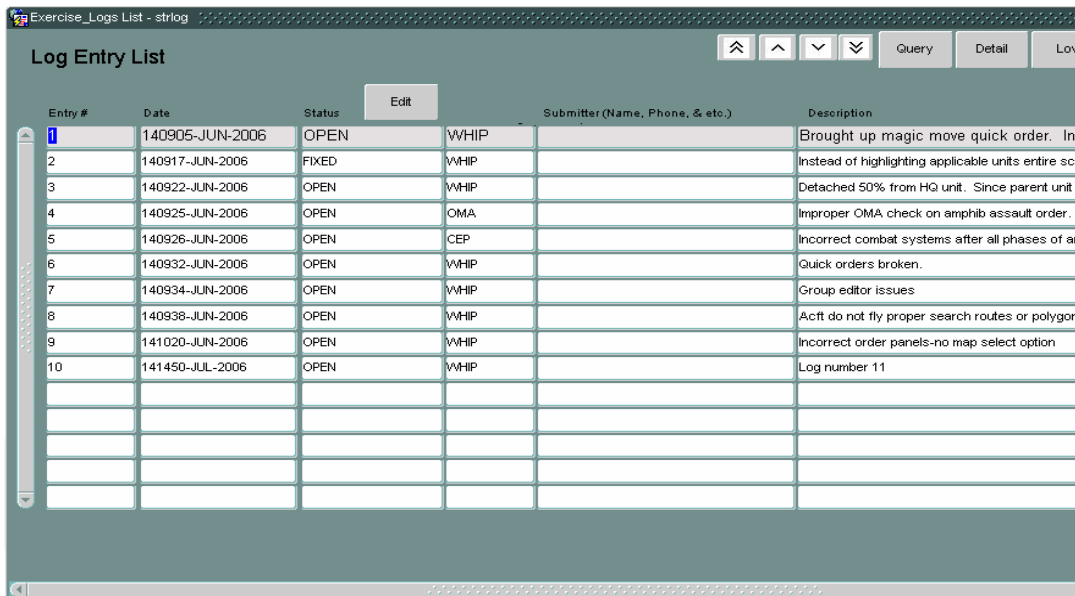
The Exercise Submission tool uses the Oracle database to store data, and supports the user-friendly Oracle forms interface for easier submission of problems, query capability to review reported problems, and report generation capability. Several Oracle database objects are defined for the Submission Tool. This tool requires the Oracle iAS (Internet Application Server) single sign-on (SSO) to be enabled and the related Resource Access Descriptor (RAD), named *jtlsSTR*, to be

created. The detailed instructions are included in the *JTLS Installation Guide, Section 6.6 Oracle iAS Enterprise Edition Installation Procedures*.

### 2.20.2.1 STRLOG Database

The STRLOG database and related tables are created during the setup process. The database includes four database tables and a sequence to assign a unique number to each log entry when a new entry is created. Oracle Data Entry Forms

The Exercise Submission Tool provides access to an Oracle Form that allows JTLS users to submit a log entry and query, review, update, or delete existing log entries.



**FIGURE 20. Exercise Log Entry Main Form**

Additional comments may be entered by clicking the Comment button and filling the Comment text field (Figure 21).

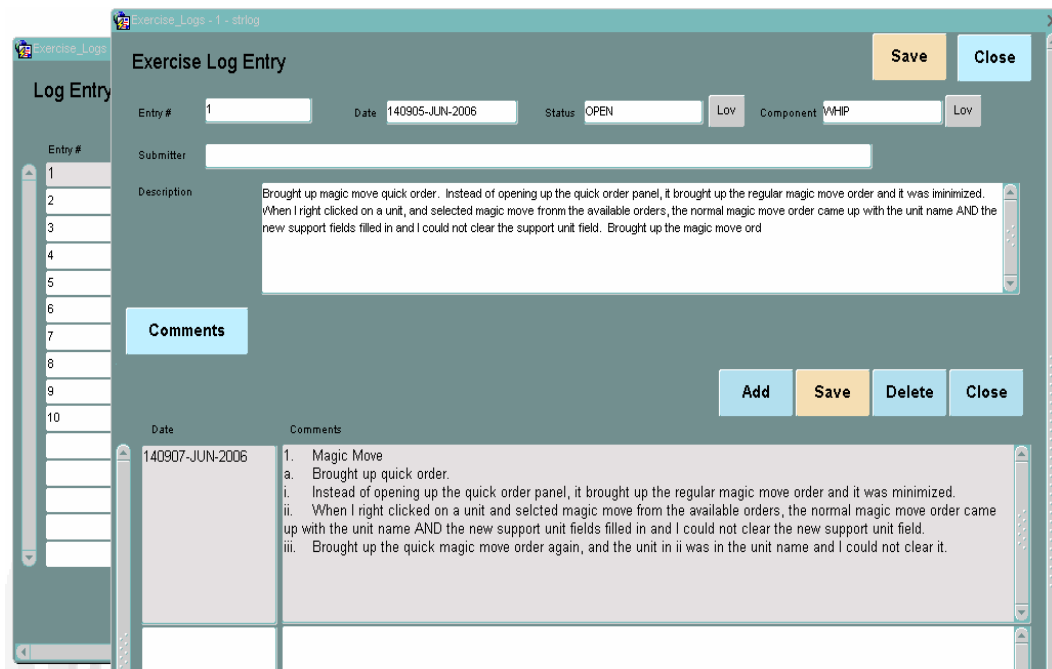


FIGURE 21. Log Comments Form

2.20.2.2 Log Reports

The Exercise Submission Tool provides a capability to generate a Log Report. The report is generated from the Parameter Selection form, displayed by clicking the Report button from the Main form. (Figure 22). The report period, indicated by the From Time and To Time fields, is used to select log entries queried for this period.

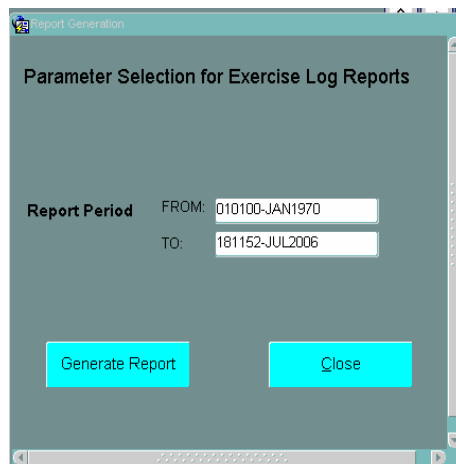
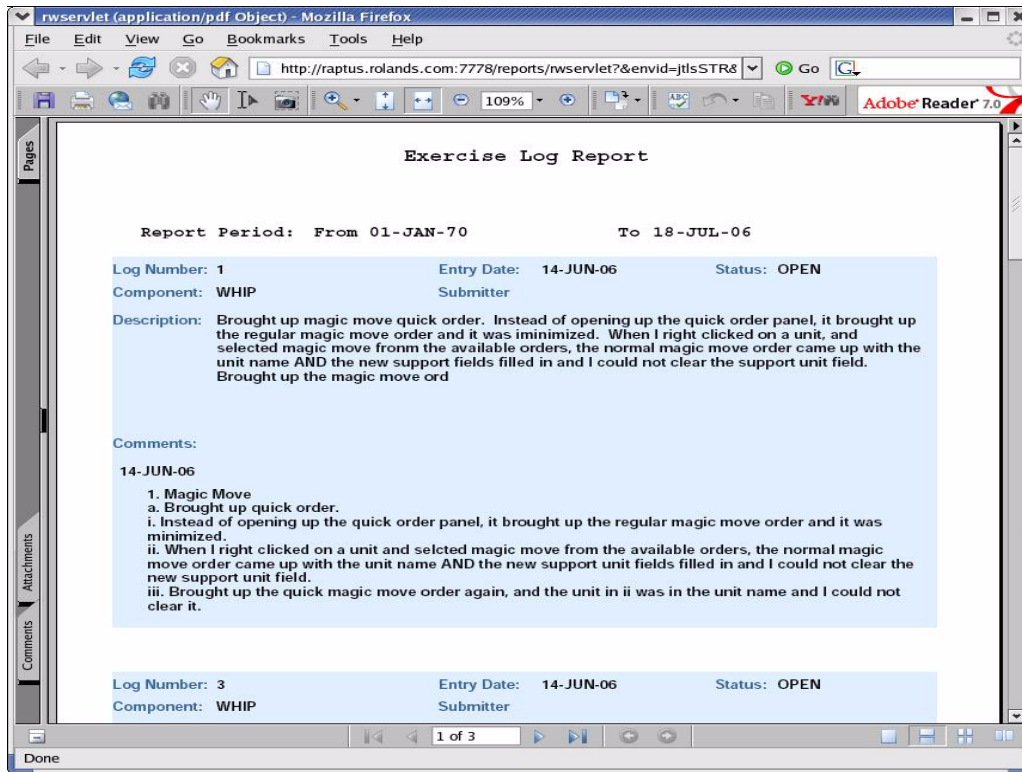


FIGURE 22. Report Period Selection Form

**Figure 23** illustrates an example Log Report generated as a Portable Document Format (PDF) file.



**FIGURE 23. Log Report Example**

### 2.20.3 Data Changes

The SQL script *create\_log\_tables.sql*, which resides in the *\$JTLSSHOME/script/est* subdirectory, must be run against the strlog database to create and populate the JTLS Exercise Submission Tool database objects.

### 2.20.4 Order Changes

No order changes are required to implement this enhancement.

### 2.20.5 JODA Changes

No JTLS Object Distribution Authority Changes are required to implement this enhancement.



## 2.21 JTLS-0378 Graphical Database Program

### 2.21.1 Summary of Model Change Request

This enhancement addresses the requirement to develop a new Graphical Database Program (GDP) that incorporates components developed for the Web Hosted Interface Program (WHIP). The GDP delivered for the JTLS 3.1 version series implemented the original JTLS graphical user interface for display and manipulation of a JTLS scenario database. This enhancement liberates JTLS model from further dependence upon this obsolete interface and also includes the improvements proposed for the JTLS 3.2.0.0 ECP entitled **JTLS-0224 Build Railroads, Pipelines, and IADs**.

### 2.21.2 Design Summary

The JTLS 3.1 series GDP is a C program that implements a small Motif X-Windows interface and connects to the Oracle scenario database and makes changes directly to the database tables. PRO-C is used to accomplish this database manipulation. This GDP uses the original JTLS graphical user interface to display selected data from the database and to input user actions.

The JTLS 3.2 GDP is a Java program and leverages the WHIP the Map and Command Hierarchy components. These components support the graphical presentation and manipulation of scenario data, as well as a consistent graphical user interface between the WHIP and the GDP. This enhancement is intended to reduce the learning curve for a novice GDP user who has experience using the WHIP. Access to the Oracle database is provided by a new database-access package that supports generic definition of data from the database table to allow these data to be loaded to a GDP repository. Multiple users can manipulate the scenario data and reflect their changes from all executing GDPs connected to a database.

These basic capabilities of the JTLS 3.1 GDP are implemented:

- Object Move
- Group Move
- Object Disperse
- National Boundary
- Operations Area
- IADS Network
- Unit Hierarchy

These new capabilities are included:

- Graphically build Railroad Networks
- Graphically build Pipeline Networks

The JTLS 3.2 GDP provides users with database editing capabilities that are consistent with modern graphical user interfaces and behave in a manner similar to the familiar features of the Windows platform. Detailed procedures for using the enhanced GDP are provided in Chapter 6 of the *JTLS DDS User's Guide*.

#### 2.21.3 Data Changes

No data changes are required to implement this enhancement.

#### 2.21.4 Order Changes

No order changes are required to implement this enhancement.

#### 2.21.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

### **2.22 JTLS-0385 Sonar Availability Function Of Speed**

#### 2.22.1 Summary of Model Change Request

All JTLS passive sonars were previously usable while turned on. The representation of Towed Arrays, which must maintain a straight course and are employed only at low speeds, and Variable Depth Sonars (VDSs), which are employed only at low speeds or a virtual standstill, was unrealistic. The inability of certain passive sonars to operate when a ship exceeds a specific speed needed to be properly modeled within JTLS.

#### 2.22.2 Design Summary

This enhancement primarily addresses the situation that a sonar cannot realistically receive detections if the speed of the ship exceeds a design limit speed for the sonar type. This design is limited to how speed affects ship-mounted passive sonars. It does not consider the inability of ships to maneuver when sensors such as Towed Arrays are deployed. Additionally, this design does not address the requirement for VDS-equipped patrol helicopters to hover while obtaining detection information. Finally, note that the speed limitation is only applied to Passive sonars. Ship based Active sonars are not ship speed limited by the model.

##### 2.22.2.1 New Sensor Data Parameter

An individual sensor attribute, ST MAXIMUM SPEED ALLOWED, is added to represent a limiting speed for sonar detections. A sensor becomes ineffective when moving faster than this speed. This data parameter represents the limitations of Towed Array sensors (as well as hull mounted sonars) employed by naval units. ST MAXIMUM SPEED ALLOWED is the maximum speed at which the

ship carrying a sensor of this type can be moving and still be able to use the sensor to detect submarines. If the ship is traveling faster than this speed, the sensor of this type cannot accomplish detections.

#### 2.22.2.2 Modified Sensor Detection Algorithm

A sensor that is turned on and not damaged automatically begins detecting when the ship's speed decreases to the limiting value. The sensor is managed when it attempts to accomplish a detection. For each attempt, the model determines whether the sensor is turned on, is currently active, and whether the owning naval unit's speed of travel is sufficiently slow. In other words, the Player is not required to turn a Passive sonar back on, by Player Order, if it had been rendered useless for a time because the ship had gone too fast.

Minor modifications of the sensor detection algorithm were accomplished to implement this method. Each instance a check occurs that the sensor is turned on and has a positive percent capability, a third check is accomplished. If the Passive Sonar sensor is owned by a naval unit and the speed of the naval unit is greater than the new ST MAXIMUM SPEED ALLOWED data parameter, the sensor is omitted, considered not turned on.

#### 2.22.3 Data Changes

The ST MAXIMUM SPEED ALLOWED parameter is added to the database as a Sensor Type entity attribute.

#### 2.22.4 Order Changes

The Controller parameter Set and Show orders are modified as necessary. No other order changes are required to implement this enhancement.

#### 2.22.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

### **2.23 JTLS-0399 Flight Plan While Heading For Fuel**

#### 2.23.1 Summary of Model Change Request

The JTLS Air Design Review Board requested the capability to divert an Air Mission heading for fuel to resume its original flight plan, despite the mission's perceived need for refueling.

The previously implemented capability to magically replenish an Air Mission with fuel while airborne was designed to be invoked by a Trusted JTLS Player only as necessary to meet exercise objectives. This designated Player was tasked to ensure that this capability was not abused and to

maintain mission flight realism, despite indications from the JTLS algorithms that mission refueling was required.

This fuel replenishment enhancement did not completely satisfy user requirements; a mission continued to head for fuel after receiving the magically-placed replenishment. This enhancement corrects this deficiency by automatically preventing a mission from seeking either tanker or base fuel after receiving a magic fuel replenishment.

2.23.2 Design Summary

Understanding an Air Mission’s logic as it begins to head for fuel explains the model’s behavior when an Air Mission heading for fuel receives a Magic Replenish Air Mission order. **Table 20** summarizes the logic implemented for various JTLS Air Mission types when each mission must select a location from which fuel can be obtained. All missions heading for tanker fuel maintain knowledge of their assigned flight profile, and the model is adjusted to direct them to resume this flight profile after receiving the magic replenishment fuel order.

**TABLE 20. Mission Profile After Heading For Fuel**

MISSION TYPE	TANKER FUEL	BASE FUEL
Airlift Transport Transfer Insert/Extract Strategic Lift	These missions remember their flight profiles and resume their original flight plan after receiving fuel from the tanker.	These missions remember their flight profiles and resume their original flight plan after receiving fuel from the base.
AWACS Air Refuel Close Air Support (CAS) Escort RECCE Armed RECCE Electronic Combat (EC) Air Attack Wild Weasel Combat Air Patrol (CAP) Mine Warfare Orbiting OAS Patrol	These missions remember their flight profiles and resume their original flight plan after receiving fuel from the tanker.	These missions do not remember their flight profiles. If these missions require fuel while conducting their mission, base fuel is not a feasible option. If no tanker is available, the mission is canceled. The next time the mission moves, it again checks whether fuel is needed. When the mission is canceled, it heads home and fuel may or may not be required to get it home. If no fuel is needed, the mission proceeds home and complete normally. If more fuel is required, the logic allows these mission types to consider an airbase as a legal option when heading home. Presumably, an airbase would be selected because no tanker was available the first time the check was accomplished. After receiving fuel from the selected base, the mission optimizes a path to its home base.

However, the majority of direct action missions that have been canceled due to a lack of fuel may or may not be heading for base fuel immediately after the cancellation, as explained in **Table 20**. The user is able to magically replenish these missions and permit them to continue their planned flight profile. For this purpose, the model saves the mission’s assigned flight profile prior to cancellation to

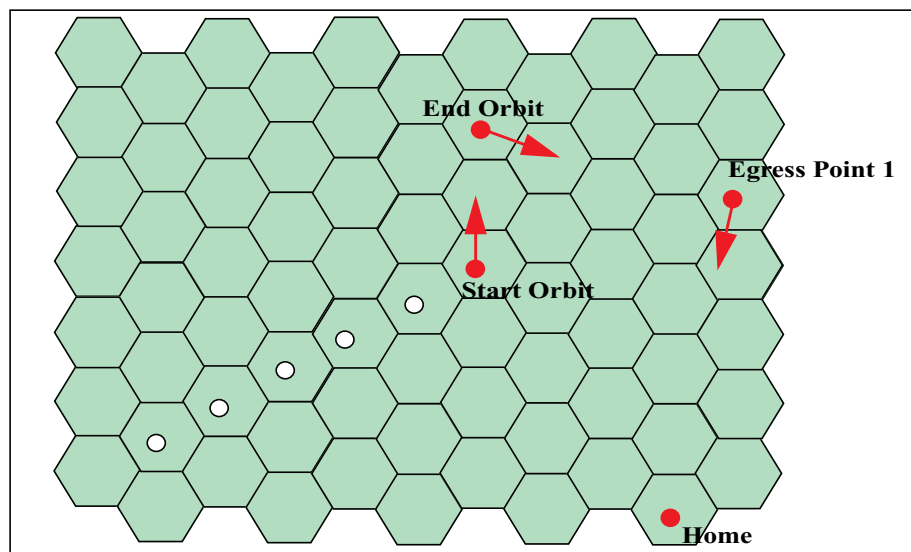
anticipate that the user may override the model's computed fuel requirement by magically replenishing the fuel while the mission is in flight.

The logic implemented to support this enhancement consists of three components: saving the mission's flight profile when it is canceled, stopping the mission from heading for fuel when it receives a magic replenishment order, and reestablishing the mission's assigned task after it receives the magic fuel replenishment.

### 2.23.2.1 Saving Mission Flight Profile

The routine to cancel an Air Mission is a key component of the mission's flight logic and can be called for many reasons, only one of which is the cancellation of the mission due to a lack of fuel. Prior to canceling the mission, regardless of the reason for the cancellation, the mission's currently planned flight route is saved in a new route set. Only the key components or directed hexes are saved in this set. If the mission is provided a magic replenishment of fuel, this saved set is used to re-initialize the mission's flight profile to enable it to continue its originally planned tasks.

Consider the example shown in [Figure 24](#). The mission's route consists of optimized hexes, indicated with white dots, and directed hexes, indicated with red dots. When the mission cannot locate tanker fuel and cancels, the model saves the directed hexes in the saved route set. This means that only the four directed hexes are saved. [Section 2.23.2.3](#) explains the use of this saved flight profile.



**FIGURE 24. Example Route Path Saving Algorithm**

### 2.23.2.2 Stopping a Mission Heading for Fuel

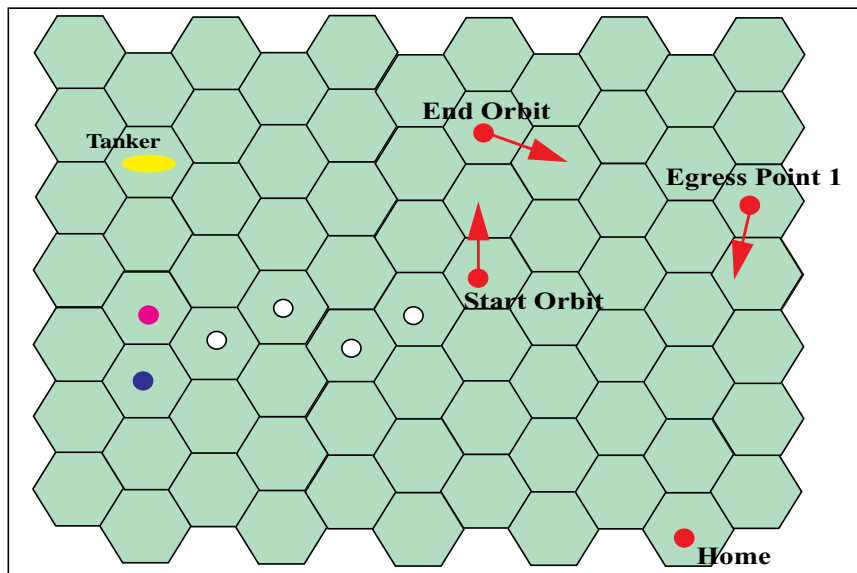
If a mission is magically replenished with fuel, the mission can experience four possible situations. These situations and the logic applied to each are summarized in [Table 21](#).

**TABLE 21. Logic After Receipt of Magic Fuel Replenishment Order**

SITUATION	LOGIC IMPLEMENTED
Mission Heading for Tanker Fuel	<p>The mission posture is changed to Flying.</p> <p>Under all circumstances, a mission in a Tank Fuel posture has a single “intercepting” hex at the top of its assigned route. This is the next hex the mission enters as it flies an intercepting route to its assigned tanker. This single hex is accessed and its type is changed to optimizing. The next time the mission moves, it enters the hex and optimizes a path to the next point in its flight profile. <b>Figure 25</b> shows the flight profile for the mission shown in <b>Figure 24</b> if it receives the magic fuel replenishment order while located in the hex indicated with the blue dot. The hex indicated with the magenta dot is the mission’s tanker intercepting hex. When the mission enters this hex, it optimizes a route to the mission’s next directed hex, which is its planned orbit location.</p> <p>The final step removes the mission’s Refuel Chit for the fuel it was scheduled to obtain from the tanker. Two types of Refuel Chits can be held by the mission. The ordered Refuel Chit holds the fuel the mission was specifically ordered by the Player to obtain. The model-generated Refuel Chit is automatically created by the model when the mission decides to head for the tanker. A mission may have more than one Refuel Chit. It could have several ordered Refuel chits, but if the mission is heading for fuel because the model determined that it needed fuel, the mission should have only one model-generated refuel chit.</p> <p>This design assumes that the user intends one and only one Refuel Chit to be canceled as a result of the magic fuel replenishment order. This chit is either a model-generated refuel chit if the mission independently determined to search for fuel, or a Player order Refuel Chit with the earliest possible refuel time if the mission headed for fuel while implementing the user’s original orders. The selected Refuel Chit is removed from both the mission and the tanker. The Refuel Chit is discarded and the tanker’s available fuel to provide other missions is updated. All of this status information is reported to the user on the Information Management Terminal (IMT).</p> <p>All other Refuel Chits remain part of the mission. At the appropriate time, as identified on the order Refuel Chit, the mission heads for fuel and meets any remaining ordered refuel times.</p>
Mission Heading for Base Fuel	<p>The mission posture is changed to Flying.</p> <p>Similarly, a mission in a Base Fuel posture has a single “intercepting” hex at the top of its assigned route. This hex is used because the mission may be heading toward a ship to refuel, which like a tanker, has the ability to move while missions are approaching. This single hex is accessed and its type is changed to optimizing. The next time the mission moves, it computes an optimal path to its next route point. The mission then completes the remainder of its assigned route.</p>

**TABLE 21. Logic After Receipt of Magic Fuel Replenishment Order (Continued)**

SITUATION	LOGIC IMPLEMENTED
Mission Heading for Base Fuel (Continued)	For support missions (Airlift, Transport, Transfer, Insert/Extract, and Strategic Airlift) the logic ends here. Refuel Chits do not exist for missions heading for Base Fuel. These missions have retained their entire flight profile and therefore have all the information required to normally complete their assigned task.
	For all other missions, the model must consider the possibility of reestablishing the mission profile. If the mission does not have a saved flight plan, then it was never canceled. This could occur if the mission decided to land at an airbase enroute home after it normally completed its assigned task. Therefore, no flight profile is available that can be reestablished. The mission completed its assigned task normally and decided it needed fuel as it was heading home. This means that providing the magically replenished fuel causes these missions to not stop at their selected airbase, but complete their planned mission to return home.
	If the mission has a saved route set due to mission cancellation, the logic described in <a href="#">Section 2.23.2.3</a> is applied.



**FIGURE 25. Example Tanker Fuel Route Readjustment Algorithm**

2.23.2.3 Reestablishing Mission Profile

The Magic Replenish Air Mission order displays a new Reestablish Flight Path field. If this field is set to No (its initialized value), the model does not reestablish the mission’s flight profile from its Saved Route set. If this new field is set to Yes and the mission has a saved route, the mission’s current route is replaced by the saved route.

Recall that the model saves the current route of a cancelled mission and replace it with the new route to its home base. When the Magic Replenish Air Mission order is processed, the procedure to reestablish the flight profile is simple. The mission’s current route is cleared and the saved route is used instead. This causes the mission to continue the route planned prior to the cancellation. A few examples explain the implications of this change.

The situation presented in **Table 22** illustrates an Attack Air Mission that needs fuel and cannot locate a tanker.

**TABLE 22. reestablish Flight Profile Example 1**

#	EVENT	MISSION’S CURRENT ROUTE	MISSION’S SAVED ROUTE
1	Mission moves while heading to its first target and decides that it needs fuel. The mission is currently in Hex 120 120.	Hex 120 121 - Optimized Hex 120 122 - Optimized Hex 120 123 - Optimized Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	
2	Assume that the mission cannot find a tanker. The mission decides to cancel. The mission route is saved, the current route is cleared, an optimizing hex is added to the mission’s route.	Hex 120 120 - Compute Route Hex 120 100 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
3	The mission decides it still needs fuel and assumes a posture of Base Fuel, adds an intercepting hex to its route, and begins to head toward the base.	Hex 119 119 - Intercepting Hex 120 100 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
4	The mission has moved several hexes toward the base from which it can obtain fuel. The user enters an order to magically replenish the mission and indicates that the mission should reestablish its flight profile. The mission’s route when the order is received is shown.	Hex 119 123 - Intercepting Hex 120 100 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
5	The mission posture is set to Flying, its route is cleared, and the saved route is moved to the mission’s current route. Note the addition of a compute route hex. The next time the mission moves, it computes an optimal path to Ingress Point 1.	Hex 119 122 - Compute Route Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	



Next, assume that the same mission is flown, but after the mission is canceled (**Table 22**, Event 2) the mission's posture is Heading Home. **Table 23** describes the mission at this point

**TABLE 23. Reestablish Flight Profile Example 2**

#	EVENT	MISSION'S CURRENT ROUTE	MISSION'S SAVED ROUTE
3	The mission moves and has computed an optimal path home.	Hex 120 119 - Optimized Hex 120 118 - Optimized Hex 120 117 - Optimized Hex 120 116 - Optimized Hex 120 115 - Optimized Hex 120 114 - Optimized Hex 120 113 - Optimized Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
4	The mission has moved several hexes toward home. The user enters an order to magically replenish the mission and indicates that the mission should reestablish its flight profile. The mission's route when the order is received is shown.	Hex 120 114 - Optimized Hex 120 113 - Optimized Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
5	The mission posture is set to Flying, its route is cleared, and the saved route is moved to the missions current route. Note the addition of a compute route hex. The next time the mission moves, it computes an optimal path to Ingress Point 1.	Hex 120 114 - Compute Route Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	

This improvement does not apply only to the cancellation of a mission due to fuel depletion. Assume that the user enters a Cancel Air Mission order to the same Attack mission. **Table 24** describes the logic for this mission.

**TABLE 24. Reestablish Flight Profile Example 3**

#	EVENT	MISSION'S CURRENT ROUTE	MISSION'S SAVED ROUTE
1	Mission moves while heading to its first target and decides that it needs fuel. The mission is currently in Hex 120 120.	Hex 120 121 - Optimized Hex 120 122 - Optimized Hex 120 123 - Optimized Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	

**TABLE 24. Reestablish Flight Profile Example 3 (Continued)**

#	EVENT	MISSION'S CURRENT ROUTE	MISSION'S SAVED ROUTE
2	Assume that the user has entered a Cancel Air Mission order. The mission's route is saved, then cleared.	Hex 120 120 - Compute Route Hex 120 100 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
3	Assume that the mission has moved a few hexes toward home and the user decides that the mission should not be canceled. The user submits a Magic Replenish Air Mission order and provides the mission with the fuel it inadvertently wasted by the Cancel Air Mission order. The order is entered to indicate that the mission's previous profile should be reestablished. Prior to processing the order, The mission's route prior to processing the order is shown.	Hex 120 116 - Optimized Hex 120 115 - Optimized Hex 120 114 - Optimized Hex 120 113 - Optimized Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
4	After processing the order, the mission has moved the saved route to its current route and added an air optimizing hex. The next time the mission moves, it computes an optimal route to the first Ingress Point and continues with its originally planned flight profile.	Hex 120 116 - Compute Route Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	

Next, consider the situation for which a user submits a Cancel Air Mission order to a mission that has already been automatically canceled while attempting to find fuel. Consider again the first example for which an Attack mission is automatically canceled because it could not locate a tanker to obtain fuel. The situation is described in [Table 25](#).

**TABLE 25. Reestablish Flight Profile Example 4**

#	EVENT	MISSION'S CURRENT ROUTE	MISSION'S SAVED ROUTE
1	Mission moves while heading to its first target and decides that it needs fuel. The mission is currently in Hex 120 120.	Hex 120 121 - Optimized Hex 120 122 - Optimized Hex 120 123 - Optimized Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	

**TABLE 25. Reestablish Flight Profile Example 4 (Continued)**

#	EVENT	MISSION'S CURRENT ROUTE	MISSION'S SAVED ROUTE
2	Assume that the mission cannot find a tanker. The mission decides to cancel. The mission route is saved, the current route is cleared, an optimizing hex is added to the mission's route.	Hex 120 120 - Compute Route Hex 120 100 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
3	The mission has moved several hexes toward home. The user enters a Cancel Air Mission order. Since the mission is already heading home, the order is not processed and the mission structure is not altered.	Hex 120 114 - Optimized Hex 120 113 - Optimized Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
4	The mission has moved along its route one more hex when the user decides that the mission should reestablish its flight profile. The user should submit a Magic Replenish Air Mission order with the Reestablish flag set to Yes. Assume that the user inadvertently sends the order with a flag set to No. The mission is magically replenished and continues as previously planned.	Hex 120 113 - Optimized Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
5	The mission has moved along its route one more hex when the user realizes the mistake. The order is submitted again with the Reestablish flag set to Yes. Before the order is processed, the mission's route is as indicated.	Hex 120 112 - Optimized Hex 120 111 - Optimized Hex 120 110 - Home	Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home
6	After processing the order, the mission's saved route has been moved to its current route and the mission is assigned an optimizing hex.	Hex 120 112 - Optimized Hex 120 124 - Ingress Point 1 Hex 130 135 - Ingress Point 2 Hex 140 150 - Target 1 Hex 145 151 - Target 2 Hex 120 100 - Home	

The Reestablish Mission Profile capability imposes a limitation. Airlift unit missions are never automatically canceled because this action permanently separates a unit into two parts, the forward detachment and the remaining rear detachment. If an airlift mission is canceled while carrying a portion of a unit, the unit portion is delivered and the mission heads home. If no other missions are participating in the airlift procedure for the unit, the airlift operation is halted and the unit is permanently separated. This design does not allow an Airlift mission's flight profile to be reestablished if the unit being lifted has completed its lift or has been permanently separated. The profile is be reestablished only while the airlift remains active.

### 2.23.3 Data Changes

No data changes are required to implement this enhancement.

### 2.23.4 Order Changes

A mandatory Reestablish Flight Path field is added to the Magic Replenish Air Mission order. If this field is set to No (its initialized value), the model does not reestablish the mission's flight profile from its Saved Route set. If this new field is set to Yes and the mission has a saved route, the mission's current route is replaced by the saved route.

### 2.23.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.24 JTLS-0401 ATO-T Access To Mission And Target Types

### 2.24.1 Summary of Model Change Request

JTLS must match TBMCS Air Mission types to effectively interface with TBMCS. Missing or misnamed JTLS mission types do not comply with Joint or TBMCS mission types. These mismatches create ignored missions and mission errors. For example, ignored missions that have assigned refueling chits lose their refueling assignments. This requires significant manpower and extensive coordination to discover and correct.

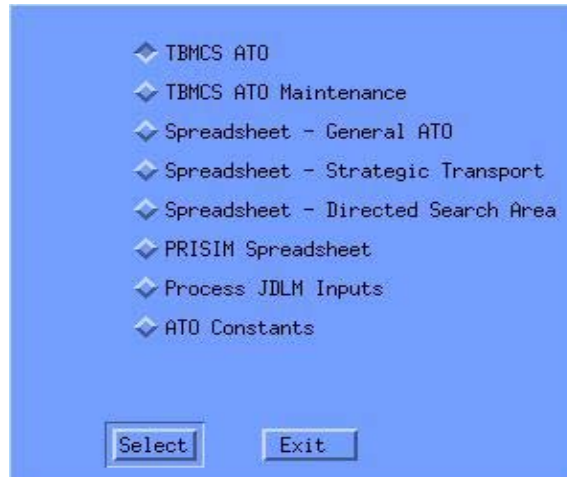
### 2.24.2 Design Summary

To manage JTLS Mission type and Target type assignments, the Air Tasking Order (ATO) process reads the *constants.ato* data from the *\$JGAME/game/data* directory. This file contains two sections. The first section holds the mapping of the ATO target assignments to JTLS target types. The second section contains the mapping of ATO mission types to JTLS mission type assignments.

When the Air Tasking Order Translator (ATO-T) executes, the initialization process opens this file, reads the information into memory, and closes the file. Until the ATO-T is stopped, all information read in is static data. Before this upgrade, if any of the matching information for target or mission type was incorrect, the operator was required to exit the translator, manually modify the *constants.ato* file, and restart the translator to effect the changes.

This enhancement eliminates the necessity for the ATO-T operator to stop the translator to change the Mission Type or Target Type assignments. Now, as the ATO-T reads the *constants.ato* files, it also

reads any file modifications stored in the configuration file for the scenario. When a change is required, the operator exits to the Main Menu (**Figure 26**) and selects the ATO Constants option.



**FIGURE 26. ATO-T Main Menu**

After selecting ATO Constants from the Main Menu, the operator views the Target Types screen (**Figure 27**). The Target Type and Mission Type screens operate in the same manner. The program displays a complete table listing all target or mission type assignments. The operator can select an item to be modified from the master list. The item information is displayed in editable fields on the right side of the page. After updating the fields, the user selects the Update Record option and the change is complete. When the user returns to ATO processing, the new mapping is effective.

A Save Data button provided in this screen invokes the program to write all user mapping changes to the configuration file. When the interface is restarted and the *constants.ato* is read, the ATO-T reads and applies the changes from the configuration file.

Using the configuration file to store user changes maintains the integrity of the default values for all JTLS sites. Changes are therefore scenario-dependent, which accommodates the minor differences among training audiences.

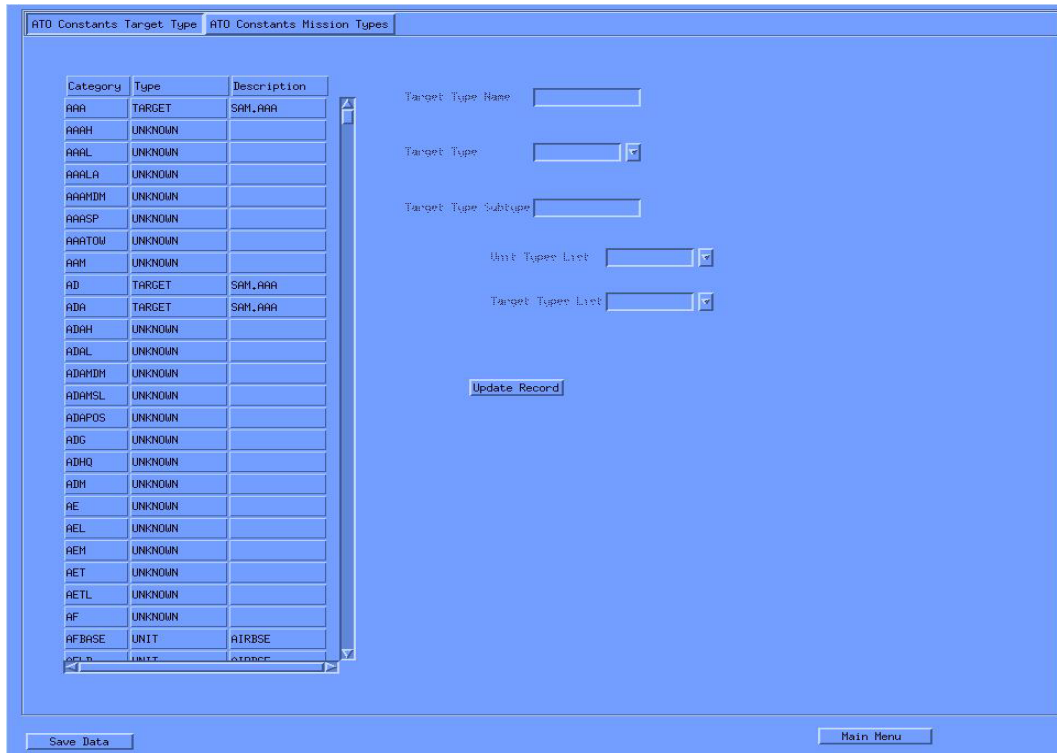


FIGURE 27. ATO Constants Target Type Screen

### 2.24.2.1 Target Type Data Fields

After a record is selected from the main Target Type table, its data fields are displayed to the right of the table. The first field, Target Type Name, is non-changeable.

For the second Target Type field, the user has the option to select UNKNOWN, TARGET, or UNIT. Based on the selection for this field, the operator receives these options in Field 3:

- If Field 2 is UNKNOWN, Field 3 is invalid and not filled.
- If Field 2 is TARGET, the operator will view a drop-down list of all Target Type values to select for Field 3.
- If Field 2 is UNIT, the operator will view a drop-down list of all Unit Type values to select for Field 3.

### 2.24.2.2 Mission Type Data Fields

After selecting a record from the main Mission Type table, its data fields are displayed to the right of the table. The first Mission Type field is non-changeable.

For the second Mission Type field, the user has the option to select one of the 18 JTLS Mission Types.

The following fields are optional, depending on the value selected for the JTLS Mission Type field.

- Field 3 - WHIP Input Required: This is a Yes/No field. Current ATO-T capabilities cannot handle the complexity of certain orders. If this field is set to Yes, the ATO-T will not translate this mission, which must then be accomplished by direct WHIP input.
- Field 4 - Alert Mission Type: This is a Yes/No field. A Yes entry indicates that this mission should be treated as a Ground Alert mission.
- Field 5 - Against Target Type: If this is a offensive air-to-ground mission, the user may select the Target Type from a drop-down list, as described previously.
- Field 6 - Available for CAS: For applicable JTLS mission types, this Yes/No field indicates whether this mission can be used for Close Air Support.
- Field 7 - Specific Jammer Type: For JTLS Jammer missions, the user may select the type of jamming this mission type will perform: Broadcast, Radio or Communications.
- Field 8 - Minefield Clear/Lay: For JTLS Mining missions, this field describes the mission's minefield activity: Clearing or Laying.

### 2.24.2.3 Mission Type Field Reference

Each JTLS Mission Type and its corresponding available field are listed in **Table 26**.

**TABLE 26. JTLS Mission Type Data Fields**

JTLS MISSION TYPE	WHIP INPUT	ALERT MISSION	TARGET TYPE	CAS CAPABLE	JAMMER TYPE	MINEFIELD CLEAR/LAY
AIRLIFT	X					
TRANSPORT	X					
CAS	X					
ESCORT	X					
AIR ATTACK	X					
TRANSFER	X					
INS/EXT	X					
AWACS	X	X				
AIR REF	X	X				
CAP	X	X				

**TABLE 26. JTLS Mission Type Data Fields (Continued)**

JTLS MISSION TYPE	WHIP INPUT	ALERT MISSION	TARGET TYPE	CAS CAPABLE	JAMMER TYPE	MINEFIELD CLEAR/LAY
RECCE	X	X				
PATROL	X	X				
EC	X	X			X	
ARMED RECCE	X	X	X			
WILD WEASEL	X	X	X			
MINE WARFARE	X	X				X
ORBITING OAS	X	X	X	X		

**2.24.3 Data Changes**

No data changes are required to implement this enhancement.

**2.24.4 Order Changes**

No order changes are required to implement this enhancement.

**2.24.5 JODA Changes**

No JTLS Object Distribution Authority changes are required to implement this enhancement.

**2.25 JTLS-0410 CAP Intercept Break-off Feedback**

**2.25.1 Summary of Model Change Request**

An intercepting JTLS Air Mission may break off from an intercept for several reasons, which the user is currently unable to determine. Consequently, Players typically submit a Manual Pair order to induce the mission to resume a desired intercept, which is stopped again. To take appropriate action, users must know the reason an intercept is terminated.

**2.25.2 Design Summary**

This enhancement adds a Last Break-off Reason attribute to the Air Mission structure held by the JTLS Object Distribution Authority (JODA). The model updates this attribute when it terminates an



intercept. This attribute value is available to the user on the Information Management Terminal (IMT). **Table 27** summarizes the reason codes generated by the model.

**TABLE 27. Break-off Reason Codes**

BREAK-OFF CODE	MEANING
Mission Killed	The intercept mission has been killed, but may or may not have been killed by the interceptor. The engagement reports implemented for the ECP <b>JTLS-0008 Real Time Intercept Report</b> provide this information.
Mission Landed	The intercepted mission has landed and can no longer be intercepted.
Fuel	The intercepting mission ended the intercept due to a shortage of fuel.
Weapons	The intercepting mission ended the intercept because its air-to-air weapons were expended.
Aircraft Loss	The intercepting mission was automatically sent home because it has lost too many aircraft.
ROE	The intercepting mission automatically ended the intercept because the ROE rules for break-off were satisfied
Mission Uninteresting	The intercepted mission was no longer of interest to the intercepting mission. This typically occurs due to a change in the IFF recognition of the intercepted Air Mission.
Unequal Odds	The intercepting mission automatically ended the intercept because it determined that the odds of continuing the engagement were not in its best interest. This capability was temporarily removed to implement new intercept logic to define Air Mission fire and return fire as independent events. This previous capability will be restored for this design.
Ordered	The Player has submitted an order to break off the intercept.
Interceptor Killed	The intercepting mission was killed. Although the Air Mission structure is removed from the JODA, the new attribute is updated to indicate to all JODA clients the reason for the break-off event. A structure delete message is passed to JODA immediately after this attribute is updated.

The logic for continuing an engagement is re-implemented for this enhancement, as indicated in **Table 27**. Consequently, the meaning of the existing data parameter AC CONTINUE ENGAGE MULT is changed. The decision to break off an intercept is based on the expected outcome of the ensuing engagement.

First, the distance between the interceptor and the intercepted mission is computed. An average hex distance is subtracted from this distance to estimate the expected distance between the two missions when the next engagement will occur.

After computing this distance, the model determines which weapon the interceptor will likely fire. This is accomplished by considering only those available air-to-air weapons that can be fired across the expected distance between the two missions. From these legal distance weapons, the model selects the weapon that has the greatest Probability of Kill ( $P_K$ ), considering the type of aircraft being intercepted and the weather in the intercepted mission's current hex.

A similar computation is accomplished from the intercepted mission's perspective. However, the model considers all air-to-air weapons that were loaded on the interested mission, instead of only the available air-to-air weapons. This logic simulates the concept that the pilot of the intercepting mission

knows the typical weapon load of an enemy mission, but not the actual load of the intercepted mission.

After the Probabilities of Kill for the interceptor ( $P_{KI}$ ) and intercepted mission ( $P_{KM}$ ) are determined, this ratio is computed:

$$\frac{P_{KI}}{P_{KM}}$$

This value is compared to the data parameter AC CONTINUE ENGAGE MULT. If the ratio of comparison is greater than or equal to this data parameter, the intercept continues.

Consider the example described in [Table 28](#).

**TABLE 28. Continue Intercept Logic Example**

AC CONTINUE ENGAGE MULT	$P_{KI}$	$P_{KM}$	RATIO	RESULT
0.5	0.30	0.45	0.67	The interceptor is "brave" and continues the intercept, despite the likelihood of an unsuccessful attack.
0.5	0.2	0.45	0.44	The interceptor is "prudent" and breaks off the intercept, but may re-engage according to the availability of other interceptors and other intercept rules.
2.0	0.8	0.45	1.78	The interceptor is "cautious" and breaks off the engagement, despite the likelihood of a successful attack.

### 2.25.3 Data Changes

No initialization database changes are required to implement this enhancement. A new static vocabulary item is created to support this new functionality. However, these new data are delivered with JTLS and are available to all JTLS scenarios.

The meaning of the existing data parameter AC CONTINUE ENGAGE MULT has been changed. The user should review the data held for this variable in any database that is upgraded to a JTLS 3.2 format. The revised data element description is provided in the *JTLS Data Requirements Manual*.

### 2.25.4 Order Changes

No order structure changes are required to implement this enhancement. However the Help field for the AC CONTINUE ENGAGE MULT updated on the appropriate SET order to reflect the new meaning of this data parameter.

### 2.25.5 JODA Changes

The new `Air_Mission` object attribute `Last_Breakoff_Reason` is added to the `Air_Mission` object structure represented in the JODA.

## 2.26 JTLS-0430 Auto Pair Versus Helo/UAV

### 2.26.1 Summary of Model Change Request

JTLS applies a detailed set of rules to determine whether an Air Mission should intercept another. These rules comprise the Interceptor Assignment logic, which all Combat Air Patrol (CAP) missions and Escort missions use to automatically determine their pairing against a detected mission.

This enhancement improves the Interceptor Assignment to allow JTLS users to prevent a CAP from automatically intercepting a specified aircraft target type, such as a helicopter or UAV mission.

### 2.26.2 Design Summary

The existing Interceptor Assignment logic comprises three intercept strategies that can be used to automatically assign an Air Mission to intercept another mission.

- **Protected Circle:** A CAP mission directed to use this strategy is assigned a Protection Circle by the user. The mission is also assigned a Shadow Distance for each Force Side in the game by means of the Rules of Engagement (ROE) order. By default, the CAP mission uses the ROE assigned to its home squadron. The user may specifically change the ROE-based Shadow Distance for each mission.
- **Protected Operations Area (OPAREA):** For a CAP mission directed to use this strategy, the OPAREA has data that indicate whether the detected mission should be intercepted. The decision is based on the CAP's perception of the Side that owns the detected mission, the altitude zone in which the detected mission is flying, and the historical flight record for the detected mission, which considers whether the mission has ever violated the altitude restrictions for the OPAREA.
- **Protected Mission List:** A CAP mission directed to use this strategy has a specific list of missions that it is designated to protect. If any mission begins to intercept a mission on the CAP's protection list, the CAP mission will automatically be assigned to intercept the detected intercepting mission. Escort missions always apply this strategy.

This enhancement does not change the logic currently used by the Protected Mission List strategy for Interceptor Assignment. If an enemy asset is intercepting a mission in the CAP mission or Escort mission protected mission list, the type of enemy asset (helicopter or fixed-wing) should not be considered to determine whether the asset should be intercepted.

The remaining strategies, Protected Circle and Protected OPAREA, implement an additional check to determine whether an automatic intercept should be executed. This new check considers the detected mission’s aircraft type. If the detected mission does not satisfy the new aircraft type restrictions, the CAP mission is assigned to intercept the mission automatically. This new aircraft type check is accomplished in three levels of restriction.

2.26.2.1 Default Aircraft Type Restrictions

A new data parameter is added to the JTLS initialization database to hold the default list of allowable Interceptor Assignment combinations. This new data element, ACP ATC AUTO INTERCEPT ALLOWED, holds an indicator whether the Air Control Prototype (ACP) intends its CAP and Escort missions to automatically intercept aircraft that belong to the Aircraft Target Class (ATC). The model assumes that this value is YES. If the database developer desires to set any of these values to NO, a record must be added to the new ACP ATC child table that can be accessed from the ACP detailed data form via the DDS.

For example, assume that the database has ACP\_1, ACP\_2, and ACP\_3, and defines six Aircraft Target Classes: BOMBER, FIGHTER, CARGO, HELO, UAV, and MISSILE. The model holds the new data table shown as **Table 29**.

**TABLE 29. ACP ATC AUTO INTERCEPT ALLOWED Data Table Example**

AIR CONTROL PROTOTYPE (ACP)	AIRCRAFT TARGET CLASSES (ATC)					
	BOMBER	FIGHTER	CARGO	HELO	UAV	MISSILE
ACP_1	YES	YES	YES	NO	NO	NO
ACP_2	YES	YES	YES	YES	NO	NO
ACP_3	YES	YES	NO	NO	NO	NO

As illustrated, a CAP mission belonging to a Faction that uses ACP\_1 is allowed to be automatically sent to intercept an enemy Air Mission that uses aircraft belonging to an Aircraft Target Class of BOMBER, FIGHTER, or CARGO. It is not allowed to automatically intercept an enemy Air Mission with aircraft belonging to an Aircraft Target Class of HELO, UAV, or, MISSILE.

The model assumes that the entire array holds values of YES. Thus, the database developer can add only the NO records to the initialization database, and may add the YES records to the database, if the explicit assignment within the DDS is considered worthwhile. The ACP’s default data is not Side-dependent because several Factions on various Sides can access and use the same ACP.

2.26.2.2 Unit Level Aircraft Type Restrictions

This next level of decision logic is designed to allow the user to establish type aircraft rules that are Side-dependent. This decision layer is not part of the initialization database. The user establishes

these rules within a new Rules of Engagement (ROE) Order at the same time that Side-related Shadow Distance restrictions are established.

The user can create an ACP ATC AUTO INTERCEPT ALLOWED override list and pass this list to a specific squadron or all squadrons within a selected command chain. This override list is Side-specific and is owned by a squadron. The squadron retains this list when it changes Sides; therefore, specifying the ACP to which the override list pertains is not necessary. Consider the example shown in **Table 30**.

**TABLE 30. Squadron Automatic Intercept Allowed Override List Example**

AIRCRAFT TARGET CLASS	FORCE SIDE	AUTO INTERCEPT OVERRIDE
CARGO	GREEN	NO
HELO	GREEN	YES
HELO	RED	YES

The override can consist of changing a default value from YES to NO, as in the case of the CARGO override for Force Side GREEN, or from NO to YES, as in the case of the HELO override for both Force Sides GREEN and RED.

### 2.26.2.3 Mission Level Aircraft Type Restrictions

All CAP and Escort missions that fly from a specific squadron automatically inherit the squadron's override list, if such a list exists. Additionally, the user is allowed to create a mission-specific override list that has the same appearance and behavior as the squadron's list (**Table 30**). The only difference is that the user assigns the override list to a specific mission instead of assigning the list to a squadron.

The implemented logic examines the CAP mission's override list to determine whether an entry exists that matches the situation. If such an override record exists, the model applies the rule established by the mission's list. If no such override record exists on the mission's list, the override list for the mission's home squadron is searched. If an squadron-level override record exists that matches the situation, this record is used to determine whether the mission can be automatically directed to intercept the detected mission. If the squadron does not have a matching override record, the model accesses the default data established for the ACP used by the mission's Faction.

The CAP Mission or Escort Mission order panels are not altered to implement this new logic. The user must apply a two-step procedure to issue a specific mission an Interceptor Assignment override list: submit the CAP order, then submit the ROE order that contains the Interceptor Assignment override list. This is identical the existing procedure used to alter an Air Mission's ROE.

#### 2.26.2.4 Changing Default Automatic Intercept Allowed Data

The Controller can change the default Automatic Intercept Allowed data as part of the SET ACP order. Current ACP default settings that are not acceptable to a user can be managed by one of these methods:

- Request the Controller to change the default data. The Controller must coordinate any changes made with the Players from all Sides that use the ACP that is being changed.
- Submit an override list to the top unit on the Player's Force Side and all of its subordinates. An override list is generated for each squadron on the Player's Force Side.

#### 2.26.2.5 Changing Override Automatic Intercept Allowed Data

The Player can add override rules to the squadron-owned override lists and the Air Mission-owned override lists. The model ensures that only one override record exists on a specific list for a specific situation. Thus, a squadron is not allowed to hold two records for GREEN CARGO missions. The model also verifies that override records are not default records.

#### 2.26.2.6 Viewing Current Automatic Intercept Allowed Data

An AUTOMATIC INTERCEPT STATUS REPORT order is provided to enable users to quickly identify the current status of the intercept logic for a squadron or a mission. The order panel provides two optional fields to input either the name of a squadron or an existing Air Mission. The report format depicted by **Table 31** indicates whether aircraft from the squadron or the mission itself can be sent to automatically intercept aircraft from each of the ATC categories and each of the Force Sides defined in the database. A sample report generated for the squadron from a Faction that uses ACP\_1, using a database that uses the default data outlined in **Table 29** and that the squadron's override data is depicted in **Table 30**.

**TABLE 31. Example Automatic Intercept Status Report Example**

FORCE SIDE	ATC	AUTOMATIC INTERCEPT ALLOWED
GREEN	BOMBER	YES (Default)
	FIGHTER	YES (Default)
	CARGO	NO (Squadron Override)
	HELO	YES (Squadron Override)
	UAV	NO (Default)
	MISSILE	NO (Default)

**TABLE 31. Example Automatic Intercept Status Report Example (Continued)**

FORCE SIDE	ATC	AUTOMATIC INTERCEPT ALLOWED
RED	BOMBER	YES (Default)
	FIGHTER	YES (Default)
	CARGO	YES (Default)
	HELO	YES (Squadron Override)
	UAV	NO (Default)
	MISSILE	NO (Default)
UNKNOWN	BOMBER	YES (Default)
	FIGHTER	YES (Default)
	CARGO	YES (Default)
	HELO	NO (Default)
	UAV	NO (Default)
	MISSILE	NO (Default)

The reporting squadron is a Force Side BLUE squadron; this Force Side does not appear in this generated report.

#### 2.26.2.7 Handling Existing Missions

Active missions automatically receive an air combat ROE that is altered by a user. However, this paradigm is not applied to the Automatic Interceptor Override lists. Once a mission is created and provided an override list, the list is maintained throughout its entire flight profile. The user can change the override list, but the model will not change the list as a result of a change to the default ACP ATC AUTO INTERCEPT ALLOWED data or a change to the override list held by the squadron.

#### 2.26.2.8 Automatic Assignment Logic Summary

The implemented logic that supports the automatic assignment of interceptors is depicted by **Figure 28**, and applies the interceptor legality checks listed in **Table 32**. When a mission is detected by Side Alpha and perceived to be owned by Side Bravo, this interceptor assignment logic is applied to

determine which CAP and/or Escort missions are automatically assigned to intercept the detected mission.

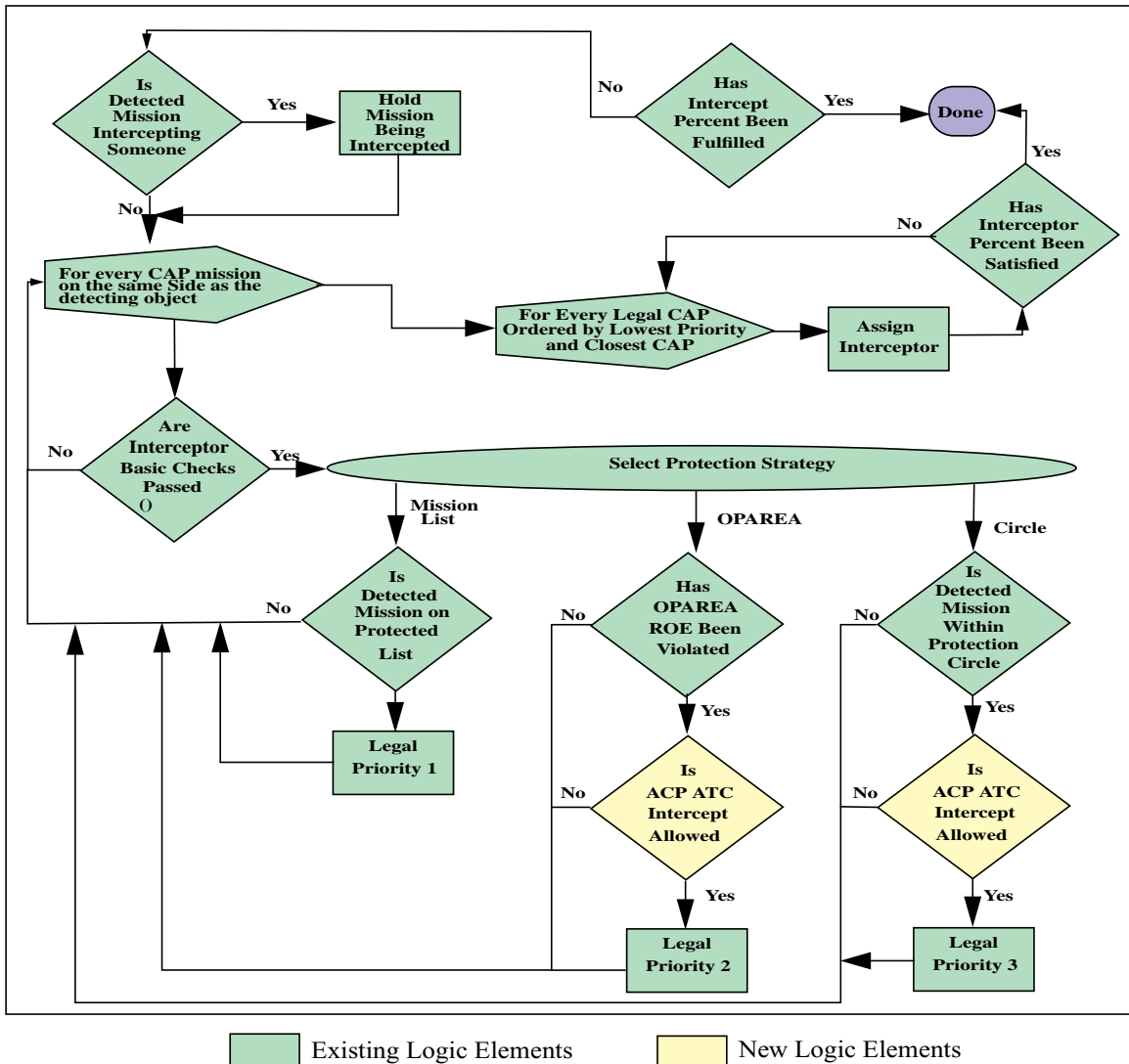


FIGURE 28. Automatic Interceptor Assignment Logic

TABLE 32. Basic Interceptor Legality Checks

CHECK	RESPONSE	
	YES	NO
The interceptor's manual pair flag is set to YES.	Auto assign is not legal; do not consider the interceptor.	Auto assign is legal, perform the next check.



**TABLE 32. Basic Interceptor Legality Checks**

CHECK	RESPONSE	
	YES	NO
The detected mission is a fixed-wing aircraft and this interceptor is a helicopter.	This assignment is not legal; do not consider the interceptor.	This assignment is legal; perform the next check.
The detected mission is a helicopter flying in Altitude Zone 1 and this interceptor is a fixed-wing aircraft.	This assignment is not legal; do not consider the interceptor.	This assignment is legal; perform the next check.
The Player has issued the interceptor a Force Side intercept restriction order or a Specific Mission intercept restriction order that matches the detected mission.	This assignment is not legal; do not consider the interceptor.	This assignment is legal; perform the next check.
The interceptor is on alert and has sufficient fuel and weapons to conduct the intercept.	This assignment is legal; perform the next check.	This assignment is not legal; do not consider the interceptor.

### 2.26.3 Data Changes

A new ACP ATC AUTO INTERCEPT ALLOWED data parameter is added to the JTLS initialization database that requires a new Oracle table, a new initialization data file, and a new Database Development System (DDS) Air Control Prototype (ACP) child form.

### 2.26.4 Order Changes

The Unit level and Mission level options of the ROE order are modified.

The SET ACP Orders are altered to allow the Controller to change the values held in the ACP ATC AUTO INTERCEPT ALLOWED table.

A new AUTOMATIC INTERCEPT STATUS REPORT order is implemented. Controllers and Players can submit the report request.

### 2.26.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.27 JTLS-0501 AAR Improvements

### 2.27.1 Summary of Model Change Request

To date, versions of the Joint Theater Level Simulation (JTLS) have been delivered with a Post-Processing System (PPS) capable of loading information saved by the model during game execution. The PPS uses the Oracle Relational Database Server as its core database structure, and is delivered with a series of form-based retrievals that can be used to create summary reports for a data analyst.

The PPS delivered with the previous release was the result a series of attempts to create an After Action Review (AAR) capability for JTLS. This system solved several problems experienced during previous efforts by several other contractors. Specifically, it corrected the following deficiencies of other developed AAR tools:

- Ability to handle several simulation runs. A JTLS simulation run is defined as a contiguous timeline from the beginning of the scenario to the present time within the scenario. During a JTLS exercise, the simulation is frequently reset to a previous game time to replay portions of the scenario. This situation can occur either by exercise design or because of exercise error conditions. The PPS considered the concepts of runs and had the ability to maintain database integrity across runs.
- Ability to reduce the information held within the database as the exercise progresses. As an exercise progresses, more data is saved. This leads to an increase in the amount of time required to search, collect, and create reports supporting a users query. In an attempt to reduce this time, the JTLS PPS had the ability to delete some of the data held within the system, but the data was not lost. A user could reload the information at any point in time as needed to support a specific query.
- Ability to correct information. It is not unusual for the model to compute a result that is disputed by the response cell or the exercise audience. This situation can be caused by a model problem, a database problem, a user order input error, or because the legal result will degrade the planned exercise objectives. The JTLS PPS had the capability to correct or nullify data held within the database so that all future retrievals and reports accurately represented desired outcomes instead of actual outcomes. For example, when Senior Control nullifies an air-to-air kill by returning the aircraft to its home squadron, the Senior Control cell should also use the PPS Tool to nullify the kill within the database. The data was not removed from the database; instead, it was marked with the reason why it should not be considered in future retrievals.

The current PPS has been used infrequently by JTLS users. Although no specific reasons have been identified, we can presume the following model deficiencies:

- The data was not available on a real-time basis. The data was made available only after a checkpoint was taken. This did not allow users the type of access required.
- The collected data concentrated only on the air war and more data needed to be available.
- The PPS did not receive the necessary exposure. Therefore, the refinements needed to make any tool useful have never been suggested or implemented.

This Enhancement Change Proposal (ECP) provided for expanding the current PPS capability, particularly, but not solely, to address these deficiencies while retaining the existing capabilities.

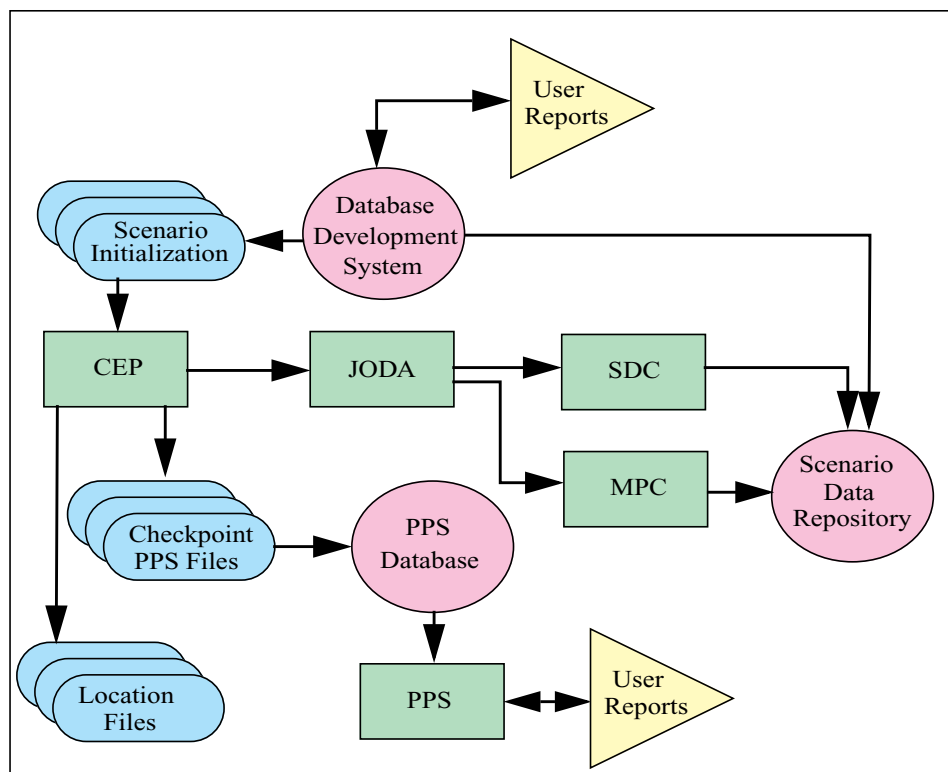
This VDD section provides an overview of the AAR Tool delivered with this release. For a more comprehensive analysis of the capabilities of this tool, including detailed descriptions of the Oracle

Tables, Forms and Reports that are included, refer to the detailed design document for this ECP included in the *JTLS 3.2.0.0 Design Plan*.

2.27.2 Design Summary

2.27.2.1 Previous PPS System Design

**Figure 29** depicts the current role of the PPS in the JTLS system. Three Oracle-based databases are included in the JTLS structure: the Database Development System (DDS) scenario initialization database, the Scenario Data Repository (SDR) of current status and some historical information, and the Post-Processing System (PPS) database.



**FIGURE 29. Current PPS System Design**

The DDS database was used only to feed certain static information such as Ship Unit Prototype (SUP) definitions to the Scenario Data Repository. The SDR was primarily developed by NATO Consultation, Command, and Control Agency (NC3A) and serves two primary functions:

- SDR converts the dynamic scenario information available from the JODA data server to a relational database format. This data can then be used to create reports using Standard Query Language (SQL), making it unnecessary that clients write original code to become JODA clients to access the same data. Information regarding the Combat System and

Logistics levels of the various JTLS units used to format Logistics Reports and Situation Reports is especially important.

- SDR provides specific historical information, particularly for Air Missions, by parsing the JTLS-generated mission reports (MISREPs) and placing this information into the SDR in relational database format.

The previously delivered PPS database is solely a historical database that primarily holds air event data, such as aircraft kills.

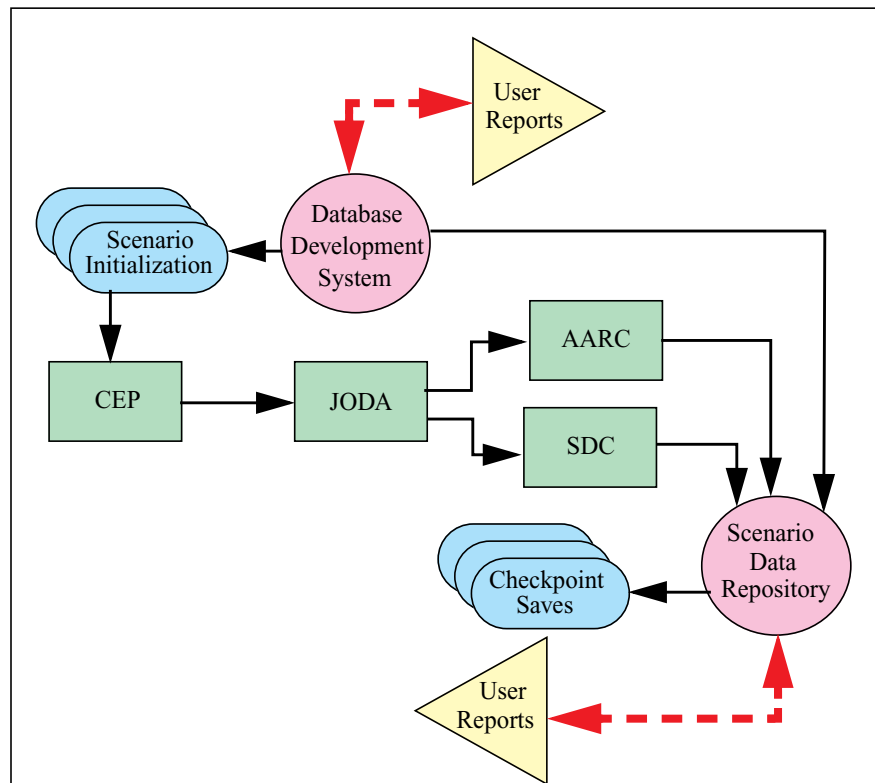
These two AAR databases, compared in **Table 33**, each have unique advantages (green highlight) and disadvantages (red highlight).

**TABLE 33. Comparison of the SDR and PPS Databases**

CHARACTERISTIC	SDR	PPS
Historical data collection method	The SDR obtains historical information by parsing user messages that contain this information. The maintenance process for this code is intensive because message generation is closely tied to the data collection process.	The PPS obtains information via formatted data output directly from the model. If new information is desired in the PPS, only the PPS-formatted data must be changed. Existing message formats can remain unchanged. Similarly, if new information is requested in a message, effects on the data collection code can be ignored.
Data collection efficiency	The SDR's characteristic parsing of message information ignores the inefficient nature of code maintenance. Historical event information is output only once.	Historical information is output twice: once into the MISREP messages and once into the PPS data files loaded into the PPS.
Real-time data collection	The dynamic information contains real-time data. After the data update is passed to the JODA, the JODA passes the information to the Scenario Data Client (SDC) to be entered into the SDR database. For historical information, the SDR is approximately real-time. It must wait for the model to deliver the delayed MISREP before its data can be parsed and entered into the database.	The historical data is not available in real-time, but only after a checkpoint, which is typically completed every two hours during major exercises.
Data reliability	Data is lost if the SDC breaks its connection to the JODA for any reason. The lost data cannot be recovered.	The CEP writes the historical information directly to the PPS. Data loss is avoided because the data is directly output to a file and not handled by several other sequentially linked programs.
Collected data recovery	Data is saved only to the Oracle database. No capability exists to delete information to make retrievals faster. Deleted data cannot be recovered.	All data is saved in data files to be easily reloaded at any time.

### 2.27.2.2 New Postprocessor System Including AAR Improvement

**Figure 30** illustrates the system design that satisfies the requirements defined for this model enhancement. The core of this change is based on the concept of merging the real-time data collection capability of the SDR with the model-generated historical data capability of the PPS, with an attempt to merge the positive aspects of each system.



**FIGURE 30. Enhanced PPS System Design**

The processing begins in the same manner as the current SDR process. As part of the scenario setup procedure, the SDR data is initialized with the static information needed from the scenario database. Once this is done, the SDC is started as a JODA client. The SDC receives two types of data:

- **Current Dynamic information.** As updates to these data are sent to the JODA, the JODA passes the information to the SDC and the SDC updates the related tables in the SDR database. Saving this information is unnecessary. If the model is stopped and restarted, the JODA download re-populates the dynamic SDR data tables.
- **.Historical Event data.** These data are passed from the CEP through the JODA and directly to the AARC, in a manner similar to the CEP passage of message existence information through the JODA to the XMS. Each historical data message has a specific format that is based on the type of event being reported.

While comparing **Figure 29** and **Figure 30**, please note several items that require detailed explanation:

- The MPC has been eliminated. Data obtained from parsing the messages become part of the historical event data passed from the CEP through the JODA to the AARC. This simplified design will be easier to maintain.
- The design schematic depicts the interaction between the user and the Oracle database as a dashed line. The user interface developed and delivered as part of this ECP use the Oracle Web-based access capability. This does not prevent other users from using standard SQL to access the Oracle relational database.
- The SDC is also responsible for maintaining a copy of periodic dynamic history information such as object locations. At the beginning of each checkpoint procedure, the CEP currently saves the location of every active aggregate unit. The desire is to continue to save this periodic dynamic data for post-game analysis. The type of data saved under this concept is discussed in detail within **Section 2.27.2.3**. The principle is that the SDC will be responsible for starting the procedure to save this period information and these data are to be saved in data files as well as in relational data tables that can be accessed by users.
- The SDC is also responsible for having the SDR perform a database-level checkpoint procedure. This will allow the SDR to be reloaded quickly as part of the checkpoint restart procedure, and the data held in the SDR will match the data at the time the checkpoint was taken.

2.27.2.3 Database Tables

The Government’s Statement of Work for this ECP clearly specified the type of historical data that is necessary for the AAR. Historical data are gathered for the object types listed in **Table 34**, with each object type having an entity table, which list all objects of that type, and an event table, which provides the historical information concerning the object.

**TABLE 34. Historical Data Objects**

OBJECT TYPE	COMMENTS
Air Mission	Air Mission records are already created as part of the existing PPS. Air mission names may be re-used and so do not constitute a unique identifier.
Air Mission Package	Air Mission Package names may be re-used and so do not constitute a unique identifier.
Faction	The primary purpose of this object type will be as a reference table when units or targets change side.
Naval Formation	Formations are never destroyed within the CEP. However, when a formation is dissolved and then re-used a new JEDI index will be assigned by the CEP.
Order	Order objects will act as both reference information and as historical information. As an example of the former a minefield target created due to an explicit artillery mission would reference the Fire Artillery order within its Target historical event table.
Tactical Ground Formation	

**TABLE 34. Historical Data Objects (Continued)**

OBJECT TYPE	COMMENTS
Target	Target records are already created as part of the existing PPS.
Unit	Includes both ARU and HRU units. Unit records are already created as part of the existing PPS.

Each of these object types has an associated Relational Database table; **Table 35** is an illustrative example. Some of these object types, such as Air Missions, allow the re-use of their name, so that the name does not provide a unique key. Therefore, each entry in the object tables also has a Unique Id, assigned by the CEP, that serves as a unique identifier.

Along with their item tables, each of the objects listed in **Table 34** will also have an Associated Event table. The event tables allow a historical record of the activities and changes for each object. Each event has an associated text and value. For example, an Air Mission assigned weapons generates numerous LOAD\_WEAPON events, one for each type of weapon that is loaded. The associated text is the weapon name and the value will contain the count. **Table 36** illustrates the contents of the Air Mission object's event table

**TABLE 35. AAR Air Mission Table**

COLUMN NAME	COLUMN DESCRIPTION
Time	Time the mission was created in the game. This is not the time the mission was told to accomplish its task.
Name	Name of the mission. This name may be re-used and is not guaranteed to be unique.
Unique_Id	The JEDI index assigned by the CEP to the Air Mission.
Home_Squadron_Id	Unique Id of the mission's squadron. This is the squadron from which the mission originally launches. If an Air Mission does adjust its Home Squadron this column will not be updated; instead the update will be recorded in the Air Mission Event table.
Order_Id	The Receiver Number of the order that resulted in the creation of the Air Mission. It might be an explicit order such as a CAP order with a mission name specified or a more generic (in air terms) order such as an Amphibious Assault using Helo assets which may result in multiple Air Missions being created.
TOT	Ordered time on target, or the time at which the mission was ordered to be at its operational location. Changes to the TOT will be recorded in the Air Mission Event table.
Type_Mission	Type of the original mission; for example, CAP, AWACS, REFUEL, etc. Changes to the type of mission would be recorded in the Air Mission Event table.
Aircraft_Type	Type of aircraft to be used For example, it will eventually be possible to request the following information: How many missions were flown during the entire exercise using aircraft that have a range of over 5000 KM, i.e. long range strategic lift aircraft?
Alert_Flag	Indicator whether the mission was ordered to fly a mission or go on alert. This is information from the initial mission order. The player may change the mission instructions, but that will not result in a change to this column. Instead any changes to the Alert Flag will be recorded in the Air Mission Event table.

**TABLE 35. AAR Air Mission Table (Continued)**

COLUMN NAME	COLUMN DESCRIPTION
Requested_AC	Number of aircraft requested on the mission order

Note that some compound events, such as loading fuel and weapons, will require multiple records in the Event History table to adequately and completely describe them.

**TABLE 36. AAR Air Mission Event Table**

COLUMN NAME	COLUMN DESCRIPTION
Time	Time the event occurred
Object_Id	The Air Mission's JEDI index.
Event	Enumerated identifier of the event type.
Text	Text value of an associated event object. Sometimes this will be a valid text string, at other times it will hold integer values as text.
Value	Real value associated with the event
Latitude	Mission decimal latitude when the event takes place
Longitude	Mission decimal longitude when the event takes place
Altitude	Mission altitude in feet when the event takes place

As stated, each of the object types listed in [Table 34](#) has an associated Event History table. The general location information is listed in each of the tables along with associated text and value fields. The exceptions to the location information are the Order Event table and the Faction Event table, for which location information is meaningless. Some activities may be recorded in more than one Event History table. As an example, when a naval unit joins a formation it will be recorded in both the Unit Event table and the Naval Formation Event table. This redundancy is designed to support data retrieval and investigation.

The combination of the Order table and the Order Event table ([Table 37](#)) enable Technical Control to investigate problems and track externally submitted orders. External interfaces will be able to use these tables to track orders that they have submitted through the OEC to determine whether the order has been successful or rejected. Initial implementation for these tables will focus on the Air Mission orders, Fire Artillery, Fire Missile, Attack, CAS Request, engineering task orders, and naval mine laying and clearing orders. These orders reflect the totality of orders and their related messages that were tracked and parsed by previous versions of the MPC.

**TABLE 37. AAR Order Event Table**

COLUMN NAME	COLUMN DESCRIPTION
Time	Time the event occurred
Object_Id	The order's JEDI index. Not all orders will be sent to the JODA, however all orders will be assigned a unique JEDI index by the CEP.



**TABLE 37. AAR Order Event Table (Continued)**

COLUMN NAME	COLUMN DESCRIPTION
Event	Enumerated identifier of the event type. Codes will be broken into even and odd categories for quick analysis, where even codes will represent problem/rejection events and odd codes will represent success or informational events.
Text	Name of the object associated with the event
Value	Value associated with the event

In addition to the Object and Object Event tables, the SDR provides Attrition tables that allow tracking of attrition from all sources. These sources can be as varied as Air Missions, SSM firing, or even a Controller order. Each Attrition table contains information about the killer object, the victim, and the damage. An Engagement table is illustrated as **Table 38**.

**TABLE 38. AAR Engagement Air-to-Air Table**

COLUMN NAME	COLUMN DESCRIPTION
Time	Time the engagement occurred
Unique_Id	Unique ID associated with this damage event.
Killer_Id	Unique ID of the intercepting mission. If the engagement is an Air-Air Controller action this will have the Unique ID of the Controller order.
Killer_Latitude	Latitude of the intercepting mission
Killer_Longitude	Longitude of the intercepting mission
Killer_Altitude	Firer altitude in feet at time of firing
Victim_Id	Unique ID of the intercepted mission
Victim_Latitude	Latitude of the intercepted mission
Victim_Longitude	Longitude of the intercepted mission
Victim_Altitude	Intercepted mission altitude at time of firing
Number_Weapons_Fired	Number of weapons fired in this engagement
Type_Weapon_Fired	Type of targetable weapon fired For example, it will eventually be possible to request the following information: How many aircraft were killed throughout the exercise by air-to-air weapons fired within 10% of the weapon's maximum range?
Firing_Range	Range at time of weapon firing
Weapon_Pk	Probability of Kill at time of firing
Number_AC_Hit	The number of aircraft that suffered complete or partial damage
Number_AC_Killed	Number of aircraft killed
Number_AC_Remaining	Number of aircraft remaining in the Air Mission that was receiving the fire

The final set of tables pertain to intelligence collection events, whether airborne collection, ground tactical, sonar, ELINT, or Controller-provided. ELINT data appear in a separate table and the other

collection methodologies will appear in a pair of tables; one denotes the collection event and the other lists the detected objects. **Table 39** is an example of one of these detection tables. Detection events will not be used to record the detection of airborne missions. This capability, if desirable, could subsequently be added to these tables.

**TABLE 39. AAR Detection Item Table**

COLUMN NAME	COLUMN DESCRIPTION
Time	Time that the detection occurred.
Event_Id	The Unique ID of the detection event. There may be numerous records within this table with the same Unique ID, all generated from the same detection event.
Object_Id	The Unique ID of the detected object. This may be a unit (HRU or ARU), a target, a submarine (naval unit), or an Air Mission. We are not initially tracking convoys so it will not be possible list detections of convoy objects.
Object_Capability	The percent capable of the detected object. For units and targets this will be their strength and percent capable respectively. For Air Missions this will always be 100%.
Object_Latitude	The detected latitude of the object
Object_Longitude	The detected longitude of the object

#### 2.27.2.4 MPC Migration

The MPC was designed to parse MPP messages and insert items of interest into Oracle tables. Some of these items, such as Air-to-Air engagements, were events of historical interest and others where items containing tracking data that allowed progress from externally input orders to be monitored. In developing the AAR, the data provided by the MPC was mapped to the AAR data format to aid in the migration from the MPC tables to the new AAR database tables. Some of the MPC table columns list multiple table names where the secondary tables are sub-tables of the first listed table. Refer to the *JTLS 3.2.0.0 Design Plan* description of this enhancement for a complete list of these mappings.

#### 2.27.2.5 JWFC Requirements Study

Several years ago, the Joint Warfighting Center conducted a study and created a prioritized list of 24 specific capabilities to be available to the J7 staff for evaluation of exercises. This list included items such as Near Real-Time Capability and Capability to Populate and Query SQL Databases. This AAR enhancement accommodates 13 of these requirements. Refer to the *JTLS 3.2.0.0 Design Plan* description of this enhancement for a complete list of these capabilities.

#### 2.27.2.6 AAR User Reports

##### 2.27.2.6.1 Overview and Background

AAR is viewed as a data repository and not as a tool to be used for AAR analysis. This task is assigned to the Primary Training Audience evaluation staff. Since the AAR data repository is held in the Oracle relational database management system, the AAR evaluation team has the full capability to

query, summarize, and graphically depict a summary of the information collected during the conduct of the JTLS game. It is impossible to pre-determine all evaluation team requirements; however, some basic requirements exist any evaluation team would want fulfilled.

The JTLS AAR User Report Tool is being designed to provide the AAR evaluation team with a set of standard query, summary, and graphical report capabilities that will typical queries that would be useful to the evaluation team. JTLS 3.2.0.0 provides the initial capability.

The generation of an AAR report is a two-step process; the retrieval of the desired information is followed by the definition of the summary and display of the retrieved data. The efficiency that is achieved justifies this separation. The new AAR data repository has the capability of holding a vast quantity of data. The speed with which the data can be saved and placed in the Oracle database must be considered against the speed with which the data can be retrieved. A goal of the AAR project is to refine the Oracle database structure to prevent creation and storage of the AAR data from interfering with the game execution and to provide a reasonable retrieval rate for needed information.

By considering retrieval and reporting as separate functions, the user can retrieve the required data and then consider various methods to report and summarize the data without requiring a re-retrieval of the data for each summary. For example, assume the user is interested in Side Blue aircraft kills on the second day of combat. The first step would be to retrieve this information and once retrieved the AAR staff could consider summarizing this data by killing side, killing weapon, killing altitude zone or other criterion. Each summary could be produced without re-retrieving the data. Thus if the original data took 3 minutes to retrieve, the three example reports could be produced immediately after the 3 minute retrieval was complete, versus requiring a 3 minute retrieval for each of the three example reports.

#### 2.27.2.6.2 Retrieval Capability

Our goal for this initial capability is to provide a retrieval and reporting capability that is equivalent to the previous Post Processor System, which emphasized air-related data. The future capability will be expanded to include the ground war, the naval surface and sub-surface war, the available logistics data, and the intelligence collection capability represented within JTLS.

Three types of data will be made available for retrieval by the AAR User Report tool:

1. Specific Air Mission Details

This is the simplest retrieval. the user will be presented with a list of all of the Air Missions that existed since the start of the exercise. The user will highlight the desired mission by clicking on the mission record. This click will then display some basic mission information concerning the selected mission such as creation time and the number of events that exist for the mission. Based on this basic information, the user can then click on the Retrieve button. All event information will be retrieved and placed in a separate temporary table. Once the retrieval is complete, the user can then move to the Report Summary phase, as described in [Section 2.27.2.6.3](#).

**Figure 31** shows the format of the Specific Mission Selection Form. In this example, note that there are two missions 1234F-08NOV. This would be a very real possible situation. The user entered the first mission 1234F-08NOV and found a problem with the mission and immediately canceled the mission and then re-submitted the order a second time. By viewing the number of events held for each mission, the user could easily determine that the second mission 1234F-08NOV was the real mission of interest.

Mission Name: 1234F-08NOV Creation Time: 1.25 Number Events: 23		
Mission Name	AAR ID	Creation Time
0034-08NOV	121950	0.200
1234F-08NOV	122134	0.203
1234F-08NOV	880328	0.211
2102-09NOV	930331	1.205
2104-09NOV	951030	1.545
2222-10NOV	970922	2.195

**FIGURE 31. Example Specific Mission Selection Form**

2. Aircraft flown

There are a number of retrieval possibilities depending upon what is best for the individual user. As an example retrieval, all missions from the Side AYLAND or BEELAND that are of Mission Type CAP or ESCORT that were created between time 1.5 (1200 noon on 09 NOV) and 1.75 (1800 on 09 NOV) might be retrieved and listed with specific mission events, such as Takeoff, Start Orbit, etc., displayed.

3. Aircraft killed

The user will be able to retrieve aircraft kills based on any or all of a defined set of characteristics.

2.27.2.6.3 Report Summary Capability

The initial AAR User Report Tool has the capability to produce Event Reports, Pie Charts, Bar Histograms, and Tabular Summary Reports. Each of these report types is currently being developed.

Development of the Event Report, which is currently described for use with an Air Mission Retrieval, is the most advanced to date. Once a user has selected a specific Air Mission and the Air Mission information, Air Mission Order information, and Air Mission Event information have all been retrieved, the user will be presented with a Report Specification Form. In this form, the user can

indicate exactly what information should be included in the report. The Report Specification Form provides the options shown in **Table 40**.

**TABLE 40. Event Report Specification Form For Air Missions**

TYPE OPTION	AVAILABLE OPTIONS	OPTION MEANING
Order Information	On	If selected, information concerning the order will be included in the report.
	Off	If selected, information concerning the order will not be included in the report.
Major Route Point	On	If selected, each event record for the arrival at major route points will be included in the report.
	Off	If selected, each event record for the arrival at major route points will be included in the report.
ADA Encountered Summary	On	If selected, information concerning the ADA Firing Events will be included in the report.
	Off	If selected, information concerning the ADA Firing Events will not be included in the report.
Air Engagement Summary	On	If selected, information concerning Air Engagements Events will be included in the report.
	Off	If selected, information concerning the Air Engagement Events will not be included in the report.
Event Information	List Of Available Events	This will be a list box of all available events that can be generated for an Air Mission. The user can highlight as many or few as desired. For example, some events are: Refueling completed, arrival at the target area, and going on alert, Note that the arrival at major Route Points, the being fired upon by an Air Defense Site, and the participation in an air Engagement are also events. If the user chooses to do so, the events can be printed out twice in the report, once in the section geared to the event and once in the time ordered event list.

Users familiar with the US Message Text Format (USMTF) version of a Mission Report (MISREP) may recognize that the selections provided in **Table 40** correspond to the sections or major parts of the MISREP. Eventually, the user will be able to design and print a legally-formatted USMTF MISREP report using the AAR Tool. This future capability is not feasible in the initial AAR Tool, but its design is presently being developed.

Once the user has filled in the Report Specification Form, the AAR Tool can generate the report.

### 2.27.3 Data Changes

No data changes are required to implement this enhancement.

#### 2.27.4 Order Changes

No order changes are required to implement this enhancement.

#### 2.27.5 JODA Changes

The AAR data are passed from the JODA to the After Action Review Client (AARC) interface. These data are held in reserved AAR objects that are defined within the JODA data structure. The AARC registers for the receipt of these objects, which are transitory in nature. This scheme is similar to the method used to inform the XML Message Server (XMS) regarding the existence of a message.

### **2.28 JTLS-0520 TACSIM Immediate Wreckage Placement**

#### 2.28.1 Summary of Model Change Request

This ECP requested that entities killed during force-on-force Lanchestrian combat be placed on the game board as JTLS Catastrophic Killed entities in a timely manner.

#### 2.28.2 Design Summary

In previous versions of JTLS, it was possible to kill partial combat as a result of the Lanchestrian computation. As a result of integerizing the Lanchester algorithm and reducing the time interval at which damage occurs from a typical 1 hour to 15 minutes, the TACSIM requirements have been satisfied.

At the end of each assessment period, the model now determines the number of Combat Systems that have been killed. Each killed system is determined to be either repairable or non-repairable. If the system is not repairable, it is abandoned and a JTLS Catastrophic Kill entity is create. This entity is published in the JODA and via the HLA feed and is thus available to TACSIM immediately following the combat calculation in the model.

#### 2.28.3 Data Changes

No data changes are required to implement this enhancement.

#### 2.28.4 Order Changes

No order changes are required to implement this enhancement.

##### 2.28.4.1 JODA Changes

No JODA changes are required to implement this enhancement.

## 2.29 JTLS-0526 Movement of Units Within a Hex

### 2.29.1 Summary of Model Change Request

Although a user is allowed to create a route for a ground unit that includes several points within the same hex, the model holds on to only the first point in any given hex. The remainder of the points in the hex are thrown away. This restriction makes it hard for a user to properly represent the movement of a small aggregate-level unit.

### 2.29.2 Design Summary

The restriction which only kept a single point in any one hex was removed from the model. **Table 41** summarizes the new acceptance criteria for all ground routes represented within JTLS.

**TABLE 41. Route Specifications for Ground Movement Orders**

ORDER TYPE	ACCEPTANCE CRITERIA
Move	The order is rejected if the unit cannot find the entire path.
Attack	The order is rejected if the unit cannot find the entire path.
Defend	The user can enter an emergency Withdraw route. If the unit can find the entire path, the path is ignored and only the route is saved. If necessary, a new path will be computed that is optimal for the time it is used. If the unit cannot find the entire path, the Defend order is accepted and the user is notified accordingly.
Delay	The user must enter the delay path, which may begin immediately, or hours or days in the future. If the unit can find the entire path is found, the path is not saved. At the time the unit must follow the Delay path, the unit will optimize its movement to the next point only. Hours or days may elapse before the next delay point is required. Optimization will occur only when the route must be followed. If the entire path cannot be found, the order is rejected.
Withdraw	The user must enter a Withdraw path. If the unit can find the entire path, it is saved because the unit will immediately start to follow the path. Otherwise, the order is rejected.
Engineering Task	The user may enter a path to the task. If the unit can find the entire path, it is saved because the unit will immediately begin to follow the path. Otherwise, the order is rejected.

### 2.29.3 Data Changes

No data changes were required for this ECP.

### 2.29.4 Order Changes

No order changes were required for this ECP.

### 2.29.5 JODA Changes

No JODA changes were required for this ECP.

## 2.30 JTLS-0531 Improve ATO-T Wing Level Tasking

### 2.30.1 Summary of Model Change Request

Processing a JTLS Air Tasking Order (ATO) involves matching ATO air squadrons to an appropriate JTLS squadron unit. The previous matching process to assign aircraft did not properly represent real-world Wing Level air squadron tasking. This enhancement improves the representation of Wing Level tasking as well as the one-to-many associations that occur within the Air Tasking Order during the ATO translation process.

### 2.30.2 Design Summary

Previous ATO processing used a highly simplified method for tasking squadrons when more than one JTLS unit was assigned to represent a single ATO unit. All JTLS units assigned as tasked units for the ATO squadron were placed in a first-in, first-out list. As each mission was processed, the unit at the top of the stack was tasked and then moved to the bottom of the stack.

Under the enhanced Wing Level tasking method, separate squadrons consisting of the same aircraft type are typically assigned to fulfill the same mission roles under a single Wing Commander. These squadrons may or may not be collocated, and therefore may be subject to the Wing Level tasking method. The Wing Commander is responsible for equally distributing the missions among the eligible squadrons.

When the ATO tasks one of these squadrons, part of the tasking information includes the departure location for the squadron to be tasked. This enables the ATO builders to task the squadron that is located nearest to the mission location. Implementing this feature of this enhancement involves a simple logic improvement to use the information provided by the ATO builders in the departure location field to determine which squadron is to be tasked.

Since multiple units can still be tasked from the same location, the previous first-in, first-out logic process for selecting a squadron is improved.

For each mission tasking that is received, the ATO-T first processes the list of available squadrons and attempts to select a squadron from the desired departure location. Since more than one squadron may be situated at the location, the selected unit is moved to the end of the stack after being tasked. If no unit is found at the desired location, the first unit in the stack is tasked, then moved to the end of the list. The absence of a suitable unit at the desired departure location causes a warning message to be generated and displayed in the Error and Warning list.



Tasking squadrons as first-in, first-out has been proven to be not completely reliable. Instances of over-tasking individual squadrons have occurred using this method. If more than one unit exists at the tasking location, an additional process is applied. Each squadron will have a 24-hour tasking clock. As each mission is processed, a 24-hour clock array is updated to track the total number of aircraft scheduled to be flying during each of the hourly blocks. For each instance a squadron is tasked for a new mission, each hourly interval of the 24-hour clock is checked to determine whether the total number of aircraft scheduled to fly during that hour exceeds the number of aircraft available from the squadron. If this occurs, the program does not schedule the mission, and instead places it in a hold queue. After all missions for all units have been processed through the first cycle, the program reprocesses the missions in the hold queue. The program now considers all units in the task unit set for that squadron, and attempts to reassign the mission to a squadron that will not cause overtasking. If no squadrons with aircraft are available, the first listed squadron is selected and an appropriate warning is displayed within the Error and Warning list. The ATO-T operator is responsible to inform the Air Cell regarding possible overtaskings identified during processing.

### 2.30.3 Data Changes

No data changes are required to implement this enhancement.

### 2.30.4 Order Changes

No order changes are required to implement this enhancement.

### 2.30.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.31 JTLS-0549 Orbit Direction**

### 2.31.1 Summary of Model Change Request

If an Air Mission is given a single orbit point within JTLS, the mission goes to the orbit point and appears to the Common Operational Picture (COP) to be stationary since its location never changes.

### 2.31.2 Design Summary

Within the model, a single-point orbiting mission is not stationary. It continues to move, update its fuel, and conduct all of the other movement functions, such as determining whether it has been hit by enemy air defense. The location of the mission is not altered, but it has a speed and heading. To support realistic COP representation, a single-point orbiting mission will appear to be orbiting its designated orbit point. Each time the mission moves, it moves close to a different hex edge. The Air Mission's new latitude and longitude are output to the JODA and this information can then be passed

on to a real-world COP using whatever interface method has been developed by the user's organization.

### 2.31.3 Data Changes

No data changes were required to implement this ECP.

### 2.31.4 Order Changes

No order changes were required to implement this ECP.

### 2.31.5 JODA Changes

No JODA changes were required to implement this ECP.

## **2.32 JTLS-0572 Off-Map SSM Fire**

### 2.32.1 Summary of Model Change Request

The previous JTLS Fire Missile order did not allow Surface-to-Surface Missiles (SSMs) to launch from off-map locations. Allowing off-map SSM targets to launch against on-map locations or targets, provides JTLS Players the flexibility to represent long-range missile attacks from locations beyond the focused area of operations.

Off-map status is not synonymous with out-of-theater status. Out-of-theater status describes objects that have not yet arrived in the game via the Time Phased Force Deployment (TPFDD) process. Off-map objects have arrived, but are located outside of the playbox. In other words, they are outside the region of defined hexagons.

### 2.32.2 Design Summary

This enhancement implements changes in the Fire Missile order and the underlying routines that process this order in the JTLS Combat Events Program (CEP). Furthermore, the routines that model the flight paths of SSMs are modified to accommodate missiles that originate off-map.

#### 2.32.2.1 Existing Fire Missile Logic Retained

The existing internal logic for processing a Fire Missile order allows the player to initiate an SSM attack against a named Target, named Unit, specific geographic coordinates, or at a location defined by a distance and bearing from the launch location. Before the order is executed, a set of feasibility checks are made to ensure that the order is reasonable.

If the Fire Missile order passes the initial feasibility checks, the CEP routines begin processing the order in detail. Information is extracted from the order and the latitude/longitude of the impact

location is calculated. If an SSM weapon type is not specified in the order, the CEP attempts to identify a suitable targetable weapon for the launcher type, considering range to impact, impact hex terrain, effectiveness against the intended target, and supplies on hand. If a suitable targetable weapon cannot be identified, the order is rejected. Further feasibility checks consider Time Over Target (TOT), orbit times (if any), launch time, and distance to impact criteria. If any of these criteria cannot be met, the order is rejected.

Before the actual launch event is scheduled, the location of the impact point is checked to verify that it is on the map and that the terrain in the impact hex is compatible with the SSM targetable weapon type. If not, the Fire Missile order is rejected.

At this point, the missile fly-out (now a Fire Mission) begins. If the SSM does not have a boost phase, the weapon is represented as a cruise missile in the CEP. The SSM is explicitly flown from the launch location to the impact location hex-by-hex and is detectable. An SSM that has a boost phase is treated as a ballistic missile and is not explicitly flown by the model. Instead, an impact time computed and the assessment of damage at the target location is scheduled at that time. During the boost phase, the ballistic missile is susceptible to attack and damage or destruction.

For the ballistic missile, a flight path from launch to impact hex is calculated to ensure that the weapon is capable of traversing the terrain along the route. If the weapon is incompatible with the terrain type, it is destroyed immediately.

For the cruise missile representation, the next hex location update is scheduled to begin the missile's flight toward its target. From this point onward, the missile's location is periodically updated, based on its speed. Each instance the missile's hex location is updated, the terrain is checked to determine whether the missile is destroyed due to terrain incompatibility. For example, some weapons are incapable of flying over land hexes and are destroyed if the next hex in the route is not an ocean hex.

Although this existing logic did not allow SSMs to launch or fly off-map, other non-SSM objects such as aircraft, ships, and ship formations are permitted to move while located in areas that are off the map. Note that off-map areas do not have terrain definitions; therefore, terrain limitations for object movement do not apply. Furthermore, off-map objects cannot be targeted for attack.

#### 2.32.2.2 Expanded SSM Fire Capabilities

Implemented logic changes now allow an SSM to be launched from off the map and proceed to its impact location on the map.

The Fire Missile order is modified to permit an SSM target to launch when located off the map board. An previous initial feasibility check that verified whether the firing unit was on the map was removed from the order template to allow the CEP to accept the Fire Missile order for further processing.

Similarly, the off-map unit check in the Change Launcher Status order is removed to allow set-up or tear-down of SSM target launchers that are off the map. The OUT OF THEATER status (instead of

NOT PREPARED) is no longer assigned to off-map targets simply because they are located off the map. This allows Change Launcher Status to recognize the SSM target. The logic that checks for detections of the launcher (the SSM Report routine) is bypassed because foreign sensors are allowed to cover on-map areas only—no hexes are defined off the map to hold an indicator that a sensor is projecting into that location.

New logic is added to accommodate a firing unit (and by extension, the SSM target launcher) that is off-map after the launch (Fire) event is scheduled. A check for on/off map status is added to the Start Missile Fly Out routine to appropriately handle the new off-map situation. If the SSM target is off-map, an Off Board Movement event will be scheduled. While off-map, the missile will not be subject to detection or attack because no hexes are defined. The SSM Report routine is bypassed. If the SSM target is on-map, the Move Along Route Cruise Missile event is scheduled and the missile is vulnerable to attack.

Within the Off Board Movement event, new logic is added to accommodate an SSM targetable weapon. The Fire Mission object type, which represents an SSM modeled as a cruise missile, is added to the Off Board Movement event as a special case. New code calculates the mission's next location and schedules the next Off Board Movement event. The routine Get Current Location includes new code that calculates the current location of an object, because a Fire Mission does not have an associated route or current hex. The Off Board Movement continues to be scheduled while the mission's next location is off-map. However, if the next location update places the mission on the map, the Move Along Route Cruise Missile event is scheduled from that location forward.

Since off-map areas do not have terrain definitions, any terrain-limiting attributes of the SSM targetable weapon are ignored during off-map flight within the Off Board Movement event. After the SSM enters the map, terrain limitations are applied in the Move Along Route Cruise Missile event. The pre-launch feasibility checks in the Start Missile Fly Out routine that verify that the impact hex and projected flight path contain acceptable terrain are retained.

Finally, the game save process was modified to accommodate introducing the Fire Mission object in the Fire event. This ensures that the new object is included in the Fire event written to checkpoint file and is successfully read during the restore process.

### 2.32.3 Data Changes

No data changes are required to implement this enhancement.

### 2.32.4 Order Changes

The unit check constraint that causes an order rejection when the Firing Unit is located off-map is removed from the Fire Missile order.

### 2.32.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.33 JTLS-2005-1431 ATO-T Orbit Points**

### 2.33.1 Summary of Model Change Request

The Air Tasking Order Translator (ATO-T) performs a basic translation of an ATO. This model enhancement creates and schedules JTLS orders that regulate the movement of the Air Mission among different orbit points.

### 2.33.2 Design Summary

The ATO-T receives and processes the current day ATO and ACO for input to the JTLS model. This processing assigns the initial mission locations based on the ACO information. The assignment of the mission locations uses only the first location information record. The text of the ATO may contain multiple location changes for a specific mission at different times. Under the previous processing system, these changes were the responsibility of the Air Operator. This model enhancement automates the process of submitting these change orders to schedule the movement of orbiting Air Missions from one location to the next location at the time specified in the ATO.

This enhancement does not process all JTLS Air Missions types, and is limited by the software environment of the supported exercise, as well as a requirement to use an off-map ProC environment.

JTLS defines 18 different Air Mission types. Some of these require special processing, due to limited or missing information in the ATO, or the complexity of the order. Only the following mission types will be considered for the new automated Change Orbit processing:

- Air Refuel
- Armed RECCE
- AWACS
- Combat Air Patrol
- Electronic Combat
- Mine Warfare
- Orbiting OAS
- Patrol
- RECCE
- Wild Weasel

The JTLS Change Air Mission Parameter order is used in JTLS to submit the Air Mission location changes. This order does not contain a order submission time field, which means that all orders are effective immediately when the CEP receives them. For this reason the Order Entry Client (OEC), which is written for a off-map ProC environment, is used to control the submission time of the orders to the CEP. This process involves the ATO-T, and creates and stores the Change Air Mission Parameter order as a set of off-map tables. The required submission time field is stored in the OEC, which monitors the current game time and submits orders from the off-map tables to the CEP on schedule. Therefore, a off-map ProC environment and the OEC are required to process the second and subsequent AMSLOC records from a ATO.

Processing and submission of the primary mission order is unchanged; the orbit information is obtained from the first Air Mission Location (AMSNLOC) record. The new logic requires saving and processing the second and subsequent AMSNLOC records. After each primary mission order is created, the program processes each of the subsequent AMSNLOC records by creating a Change Air Mission Parameter order. Each Change Air Mission Parameter order, including the order submission time, is written to an off-map table; the OCE submits the order to the CEP. As a minimum, the order must contain the time of submission and new location information. As needed, the order can also modify the mission off-station time to reflect the new times specified in the AMSNLOC records.

The order submission time must be specified as the off-station time of the current location.

- Example 1: Two AMSNLOC records. Record 1 covers the period 0600-0900 at location ALPHA and Record 2 covers the period 1000-1300 at location BRAVO. This mission will leave at 0900 for its new location BRAVO and arrive early.
- Example 2: Two AMSNLOC records. Record 1 covers the period 0600-0900 at location CHARLIE and Record 2 covers the period 0900-1200 at location DELTA. This mission will leave at 0900 for its new location DELTA and will arrive late, but ASAP.

Orbit location information is processed and submitted as described in the ACO or on the AMSNLOC record using the current ATO-T rules. While processing each AMSNLOC record, the ATO-T submits with each change the required modification to the mission off-station time that satisfies mission requirements.

### 2.33.3 Data Changes

No data changes are required to implement this enhancement.

### 2.33.4 Order Changes

No order changes are required to implement this enhancement.

### 2.33.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.34 JTLS-2005-1483 Fillup Refuel Chit

### 2.34.1 Summary of Model Change Request

A JTLS Air Mission determines its need for fuel according to its current location and its next planned refuel location. If the mission cannot reach its next planned refuel location, considering its current fuel load, altitude, and speed, the mission automatically searches for a fuel source. If the aircraft can be refueled while airborne, the mission gives priority to locating an airborne tanker from which to obtain fuel and continue its planned mission. Previously, JTLS refueling logic applied the principle that the Air Mission should load only as much fuel as required to complete its assigned task and reserve fuel for other aircraft in the area that may have similar needs.

Further model development to provide additional mission flexibility for Air Players has made accurate computation of fuel requirements more difficult. For example, an Orbiting Offensive Air Support (OAS) mission sent as an intercept can complete that task and return to its orbit location for assignment to attack a target. In such situations, current JTLS Air Missions were frequently low on fuel, due to the conservative fuel assignment algorithm.

The previous fuel requirement computation is removed from an Air Mission's refueling logic. Instead of minimizing the refueling load to conserve fuel at the source, the mission loads fuel to its maximum capacity when it determines that refueling is necessary.

### 2.34.2 Design Summary

Two basic fuel allocation principles support this model enhancement:

- **Accurate Tanker Reserved Fuel Requirement.** A JTLS Air Mission holds a Refuel Chit object when it heads to a tanker to refuel. This Refuel Chit indicates the amount of fuel that should be taken from the tanker. The tanker providing the fuel holds an identical Refuel Chit, which enables the tanker compute its non-reserved fuel as a sum of the fuel allocated by its Refuel Chits and subtracting that sum from its current onboard fuel supply. Accurate computation of the available non-reserved fuel is critical.

If the tanker determines a greater non-reserved fuel supply than actually exists, other Air Missions anticipate using this non-reserved fuel, but will not receive their full requirement when they arrive at the tanker. Such missions will experience a non-recoverable fuel problem. If no other tankers are present in the area, the mission may not have sufficient fuel to recover from the shortfall and crash. If an Air Mission overestimates its refuel requirement and reserves excess fuel, other missions may cancel their operations due to their inability to obtain fuel.

- **Accurate Mission Minimum and Allowable Fuel Requirement.** Considering the new logic that missions will refuel to capacity, the difference between the mission's requirement and its capacity may be significant when the mission determines which tanker should provide fuel and may affect the mission's decision when to head home.

In such a situation, a decision must be made to refuel from an available tanker according to the previous Fuel Required algorithm, or cancel the mission because the tanker does not satisfy the Fill to Capacity algorithm. Both fuel requirements are computed. A tanker that is available and can satisfy the Fill to Capacity requirement is used as a priority. Otherwise, the Fuel Required tanker is selected. If neither tanker is available, the mission applies the existing JTLS logic that either requires the mission to be canceled or allows the mission to search for an airbase or naval unit to obtain fuel, depending on the mission type.

2.34.2.1 Air Refueling Logic Summary

When an Air Mission with air-refuel capable aircraft determines that it needs fuel, the model applies the logic depicted by the **Figure 32** flowchart. This summary describes each component of this algorithm.

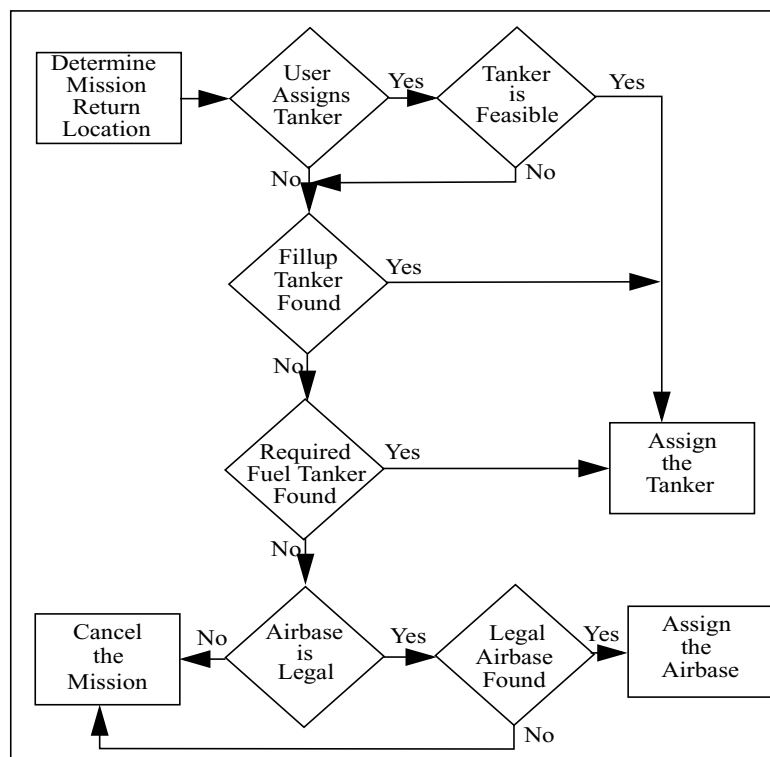


FIGURE 32. New Tanker Selection Logic

2.34.2.2 Determine Mission Return Location

The existing logic was retained for this design. This algorithm component is intended to determine the location at which the mission should resume its planned route after obtaining needed fuel. While determining the most suitable tanker to satisfy the mission’s fuel requirements, the model will select the legal tanker that is nearest this point to minimize the mission’s retracing of a route to obtain fuel.



### 2.34.2.3 Determining Feasibility of a User-Assigned Tanker

The existing logic is retained. First, the model applies several criteria to determine which assigned tanker is feasible.

The mission from which fuel will be obtained has reached its assigned orbit location. The refueling mission must already obtain fuel enroute to its next task location. A tanker that leads the mission closer to its return point assists the mission to complete its planned route, and is therefore considered feasible. The refueling mission has sufficient fuel to meet the tanker at its most fuel efficient altitude and speed. The tanker must carry the user-ordered fuel available for the mission.

After compiling a list of feasible assigned tankers, the model chooses a tanker nearest the mission's return location. As [Figure 32](#) depicts, the model does not consider further options if a user-assigned tanker is found and the mission is directed to head toward the selected tanker.

### 2.34.2.4 Determine Best Fillup Tanker

If no user-assigned feasible tanker is found, the tanker selection process applies similar rules to locate a feasible tanker from which sufficient fuel can be obtained to refuel the mission to capacity. Only tankers currently at their orbit location and prepared to provide fuel are considered. All other tankers are not considered, regardless of their current or pending status. Thus, a tanker a few miles distant from its orbit location will not be considered by this algorithm. This restriction is a legacy of the JTLS tanker selection algorithm and altering this basic selection assumption is beyond the scope of this design.

To determine the fuel quantity that will be required from the tanker, the model must accurately compute the amount of fuel needed when the mission arrives. This is done by computing the amount of fuel needed to fly the mission to the tanker at the mission's most fuel-efficient speed and altitude. The tanker must carry the fuel required to supply the mission to its capacity and computes the amount of fuel that it has available. If the fuel available is greater than or equal to the fuel requirement computed in the previous step, the tanker is considered feasible. Otherwise, the tanker is not considered feasible.

After compiling a list of feasible assigned tankers, the model chooses a tanker nearest the mission's return location. As [Figure 32](#) depicts, the model does not consider further options if a user-assigned tanker is found and the mission is directed to head toward the selected tanker.

### 2.34.2.5 Determine Best Required Fuel Tanker

If no fill-up tanker is found, the model applies the existing logic to find a feasible tanker. Although users contend that the current logic underestimates the amount of fuel that a mission may need, the algorithm has been useful for several years. Not considering a tanker because it cannot provide a full load of fuel to a mission when the mission may be accomplished with less fuel seems unreasonable. For this reason, the existing logic is retained in the model as a final fueling option.

Only tankers that are currently orbiting and available to provide fuel are considered. The amount of fuel required to complete the basic mission types—multiple trip missions, orbiting missions, or path missions—is determined. The algorithms used to compute the fuel required to complete each mission type are different, as summarized in [Table 42](#).

**TABLE 42. Fuel Required Computation**

MISSION TYPE	ALGORITHM
Long-distance missions, including Airlift, Air Transport, Insert/Extract, and Strategic Lift	The mission always orders the maximum fuel load. Since this is not feasible, these missions do not apply this logic.
Orbiting missions, including CAP, EC, AWACS, Mine Warfare, Orbiting OAS, Reconnaissance, Armed Reconnaissance, Wild Weasel, and Patrol.	Compute the fuel required to complete the mission’s current planned route to either its home base or designated alert location. If the mission has not reached its orbit location, add the fuel required to complete its full orbit time. If the mission is already orbiting, compute the amount of orbit time remaining, then compute the fuel required to complete its full orbit time. Translate the Aircraft Class spare fuel distance parameter to an amount of fuel required, using its most fuel-efficient fuel consumption data. Add the computed spare fuel required to the amount of fuel needed to complete the mission.
Path missions, including CAS, Air Attack, Transfer, and escorting missions. An escorting mission is any Escort mission, Wild Weasel mission, or Reconnaissance mission that is flying as part of an Air Mission Package.	Compute the fuel required to complete the mission’s current planned route to either its home base or designated alert location. Only CAS missions can possibly have an alert location. Add the computed spare fuel required to the amount of fuel needed to complete the mission.
Air Refuel Tankers	These missions are not allowed to automatically search for other tankers. The user may order these mission to proceed to a tanker for fuel, but the model will not automatically issue this order. Consequently, these missions are not allowed to find feasible tankers, as described in this section and <a href="#">Section 2.34.2.4</a> .

After compiling a list of feasible assigned tankers, the model chooses a tanker nearest the mission’s return location. As [Figure 32](#) depicts, the model does not consider further options if a user-assigned tanker is found and the mission is directed to head toward the selected tanker.

2.34.2.6 Airbase Legality Rules

JTLS prohibits certain Air Mission types from landing at an airbase to refuel while conducting their missions, unless the user orders the landing. The rules that allow the model to generate a Land for Fuel order are retained for this design. A summary of these rules is provided.

While conducting their missions, all aircraft capable of refueling while airborne determine whether they are allowed to land for fuel according to their mission type. [Table 43](#) summarizes the mission

types that are allowed or prohibited landings for fuel while conducting operations. All Air Missions heading home are allowed to land to obtain fuel.

**TABLE 43. Mission Types Allowed Landings For Fuel During Missions**

LANDING PROHIBITED	LANDING ALLOWED
Airborne Warning And Control System (AWACS)	Airlift
Air Refuel Tankers	Air Transport
Close Air Support	Transfer
Escort	Insert/Extract
Reconnaissance	Strategic Lift
Armed Reconnaissance	
Electronic Combat	
Air Attack	
Suppression of Enemy Air Defense (SEAD) or Wild Weasel	
Combat Air Patrol (CAP)	
Mine Warfare	
Orbiting Offensive Air Support (OAS)	
Anti-Submarine Warfare (ASW) Patrol	

**2.34.3 Data Changes**

No data changes are required to implement this enhancement.

**2.34.4 Order Changes**

No order changes are required to implement this enhancement.

**2.34.5 JODA Changes**

No JTLS Object Distribution Authority changes are required to implement this enhancement.

**2.35 JTLS-2005-1558 PRISIM Worksheet**

**2.35.1 Summary of Model Change Request**

Processing the PRISIM worksheet is limited to converting selected data to JTLS Directed Search Area (DSA) orders. This model enhancement automates the entire manual process of transferring Intelligence collection information from the PRISIM worksheet to the JTLS model and significantly augments the collection of Intelligence information within JTLS.

### 2.35.2 Design Summary

Previously, PRISIM worksheet processing involved manually creating a DSA spreadsheet, which was processed to create JTLS DSA orders that were then input to the simulation. Afterward, the Intelligence operators coordinated with the Air operators and Senior Control to task the appropriate asset to collect on the DSAs.

The enhanced PRISIM processing automates the entire procedure in two phases. First, the PRISIM spreadsheet is read and a JTLS Read Order file is generated and read in to create DSAs within the model. Next, the generated DSA areas are assigned to a National or Theater Collection Asset and the collection is scheduled.

The PRISIM data forwarded from the Intel response cell consist of separate files for Tactical and National DSA collections. Both data files are provided as Excel spreadsheets. The data fields used by the ATO-T include Target Name, Target Type, Target, ID, and Location. The Target type field contains P, L, or D values to indicate Point, Line of Communication (LOC), or DSA collection, which determines the type of JTLS DSA that are created. The location data consist of latitude and longitude pairs that correspond to the collection type.

The JTLS operators that perform the file conversion must know whether the worksheet is intended for a Tactical or National DSA, and are responsible for reformatting the worksheet from a spreadsheet to a comma-delimited ASCII text format and reading this file into the automated PRISIM processing function of the ATO-T. During this read phase, the operator is prompted to select an appropriate check box option (**Figure 33**) to create either Tactical or National DSA orders.

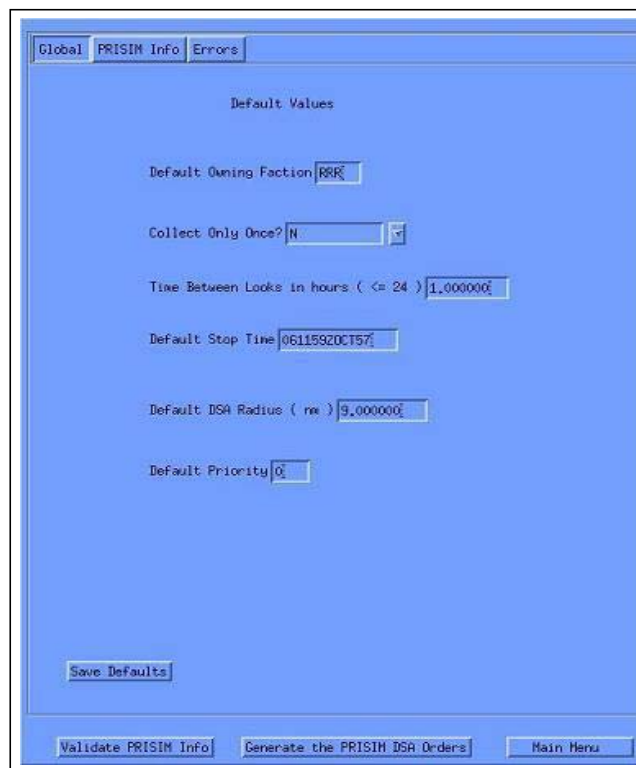


**FIGURE 33. DSA Order Type Prompt**

Each record is interpreted as it is subjected to the automated order creation process. The first phase determines and creates a National or Tactical DSA order to be read into the JTLS model. The DSA order is created according to the record subtype, which includes Point, DSA, and Line of Communication. Each of these record subtypes correspond to the most appropriate matching JTLS DSA subtype: Circle, Polygon, or Swath, as agreed by the Intel representative.

The DSA order requires more information than is available on the PRISIM spreadsheet. The operator is initially provided a DEFAULT VALUES screen (**Figure 34**). Examples of default values are the radius for a Circle DSA or the swath width for a Line of Communication DSA. In addition to range default values, National DSAs require information about whether to collect more than once and how frequently to collect. The information for these fields is completed on the DEFAULT VALUES screen. As each DSA is processed, the appropriate default values are inserted. The fields Collect Only Once, Time Between Looks, and Default Stop Time, apply only to National DSA collection.

After reading in a file, the user should review the defaults screen, make any necessary changes, and save the changes to the ATO-T configuration file. A user who has made changes to the defaults may optionally select the APPLY DEFAULTS button to apply these changes.



**FIGURE 34. DSA Order Default Values Screen**

After applying any default value changes, the operator may proceed to the detailed PRISIM data screen (**Figure 35**). For each of the PRISIM records, the operator may change each of the data items and update each record. The main PRISIM data form contains two other buttons, Validate PRISIM Info and Generate the PRISIM DSA Orders. The Validate PRISIM data function performs basic checks of latitude and longitude formats as well as ensures that all points of the DSA are on the game board. The Generate PRISIM DSA Orders function creates a file of orders formatted for the CEP that may be read in by the Player using the READ ORDER order.

Both the Validate and Generate options may produce errors that may be reviewed on the ERROR tab of the ATO-T PRISIM screen.



FIGURE 35. PRISIM Data Screen

The final phase of this automated procedure will create the orders to assign the search area to the appropriate National or Tactical collection asset. This processing phase is still being researched, pending receipt of real-world data for final evaluation.

[It is not expected that this function will be available for the final JTLS 3.2.0.0 Acceptance test, but may be provided as a maintenance update after the initial release. *Resolve before delivery.*]

### 2.35.3 Data Changes

No data changes are required to implement this enhancement.

### 2.35.4 Order Changes

No order changes are required to implement this enhancement.

### 2.35.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.36 JTLS-2006-1660 Integerized Lanchestrian Combat

### 2.36.1 Summary of Model Change Request

The determination of force-on-force combat results, known in JTLS as Lanchestrian attrition, is a significant capability of JTLS that is closely linked to its current hexagon-based terrain representation. Force-on-force combat within JTLS uses an approximation (known as difference equations) to Lanchester's Direct Fire and Indirect Fire partial differential equations. The US Government has established the long-term goal of altering this Lanchestrian attrition capability within JTLS to reduce the dependence of the Joint Theater Level Simulation (JTLS) upon the hexagon-based terrain modeling assumptions and to support a high-resolution rectangular terrain model.

This enhancement has evolved as an interim development effort to address the following Lanchestrian attrition issues identified in the original terrain modification design:

- Lanchester combat results were previously computed periodically according to a predetermined time interval based on the database parameter ASSESS COMBAT TIME, which was conventionally set to a value of one hour. Modifying this value was not feasible due to the abundance of other data parameters that were dependent upon ASSESS COMBAT TIME. Removing the link between this database parameter and all other dependent parameters, including the coefficients for the Lanchester difference equations, was required.
- When Lanchestrian attrition was computed, this damage assessment was simultaneously completed for all units in the game during the Assess Combat event. In a large scenario, computing the Assess Combat event can require several minutes. This extended computation period with no time advance causes problems for other federates of the Joint Multi-Resolution Model (JMIRM) federation. Dividing the assessment procedure into smaller elements was required to prevent the model from entering an extended computation state and halting the advancement of time for other JMIRM federates.
- Lanchester combat attrition results caused fractional Combat System losses within units. Although the concept of fractional losses is appropriate within the Lanchester differential equation paradigm and the JTLS aggregate unit representation, problems are introduced when JTLS links to entity-level models and virtual simulators.

### 2.36.2 Design Summary

Lanchester combat results are stochastically rounded to represent losses of whole Combat Systems only. All other methods of damaging, repairing, and replacing Combat Systems are modified as necessary to ensure that a unit always owns complete, undivided Combat Systems.

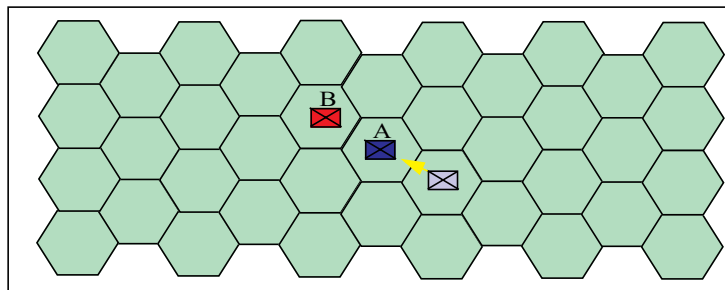
#### 2.36.2.1 Lanchester Battle Sets

The single Assess Combat event for all units is replaced. Units that satisfy the model’s In Combat requirements as the game progresses become members of a combat set, known as a Lanchester Battle Set (LBS), and an Assess Combat event is scheduled for that LBS at a future ASSESS COMBAT TIME.

A specific unit may be a member of only one LBS at any time. An LBS consists of units that can trace an In Combat link to each other through other units in the same LBS. Lanchester Battle Sets may be created, merged, or divided as necessary.

#### 2.36.2.2 Two Independent Units Meet

**Figure 36** illustrates that Unit A moves into a new hex and experiences contact with foreign Unit B. The model must verify whether combat is initiated. If combat is expected to occur according to the checks described in **Table 44**, an LBS is created and both units are placed in the set. The checks must be accomplished from the moving unit’s point perspective as the  $Unit_{Firer}$  and the stationary unit’s perspective as  $Unit_{Receiver}$ .



**FIGURE 36. Two Units Meet**

**TABLE 44. Check Combat Rules for Units In Contact**

RULE	IN-COMBAT REQUIREMENT
1	Is $Unit_{Firer}$ within maximum fire distance of $Unit_{Receiver}$ ?
2	Does $Unit_{Firer}$ have ROE against $Unit_{Receiver}$ ?
3	Is $Unit_{Firer}$ posture as Firer against $Unit_{Receiver}$ as Receiver a Lanchester Combat Case?



**TABLE 44. Check Combat Rules for Units In Contact (Continued)**

RULE	IN-COMBAT REQUIREMENT
4	Does Unit <sub>Firer</sub> have Combat Systems with which to fire on Unit <sub>Receiver</sub> ? The unit does not need to own functioning systems to pass this check, which simply requires that the unit has a TO&E for either all systems, available systems, unavailable systems, or systems in maintenance.

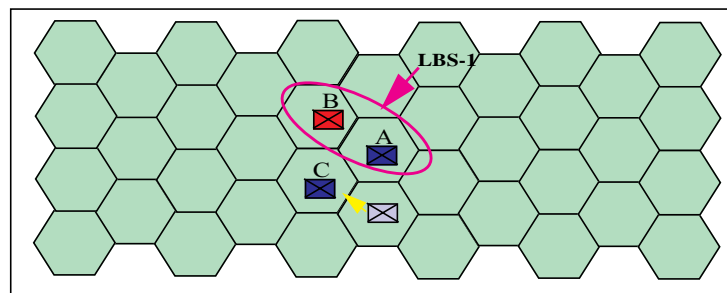
If the reply to all of these rules is True when the unit that moved into contact is considered to be Unit<sub>Firer</sub>, an LBS is created, both units are placed in the set, and an Assess Combat event is scheduled to assess the results of combat.

If the reply to at least one rule is False, the same checks are accomplished as the unit that moved into contact is considered in the role of Unit<sub>Receiver</sub>. If all replies to this sequence of rules are True, an LBS is created, both units are placed in the set, and the Assess Combat event is scheduled. If the reply to at least one of these rules is False, the units does not engage in combat, no LBS is created, and no Assess Combat event is scheduled.

When any of the units’ characteristics change, the model determines whether combat begins or ends and must adjust the LBS accordingly. At this point, assume that combat is expected to begin and both Unit A and Unit B are members of an LBS.

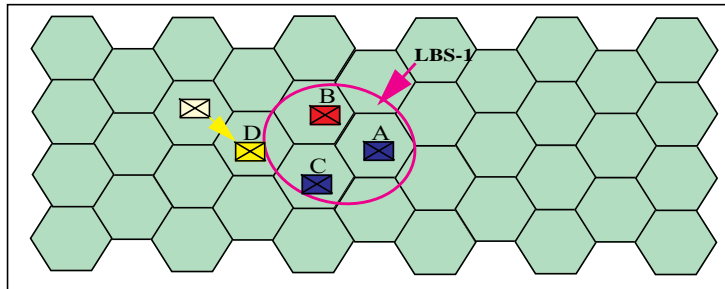
Now consider that Unit C moves into contact with foreign Unit B, as shown in **Figure 37**. Since contact is established, the model again proceeds through the checks listed in **Table 44**. The arriving unit begins by assuming the role of Unit<sub>Firer</sub> and considers all four rules against each foreign unit with which it has contact—in this case, Unit B only. If all four rules are passed, Unit C joins an LBS. If all four rules are not passed, the same checks are performed for each foreign unit with which Unit C has contact. During this second iteration, Unit C is considered to be Unit<sub>Receiver</sub>.

It is inconsequential whether all rules are passed when Unit C is considered to be Unit<sub>Firer</sub> or Unit<sub>Receiver</sub>. If each of the four rules are passed, Unit C must join an LBS. In this specific case, assume that all four rules are passed. Since Unit B is already in an LBS, Unit C joins the existing LBS called LBS-1. Prior to *any* change in the status of a LBS, the model assesses the battle to date.



**FIGURE 37. Unit Contacts LBS**

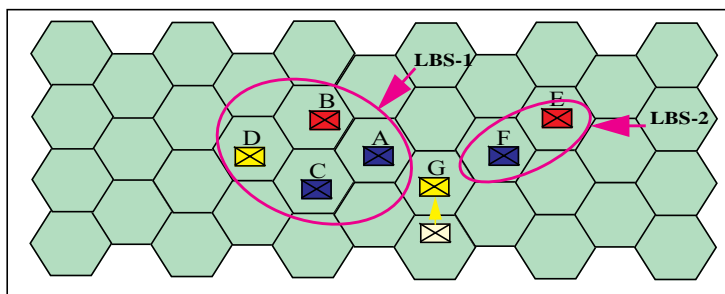
Next, assume that Unit D moves into contact with Unit B and Unit C, as shown in **Figure 38**. The In Combat rule checks must be performed for all units with which the moving unit has contact. Assume that Unit D completes the checks as  $Unit_{Firer}$  and  $Unit_{Receiver}$  with Unit B, and fails one or more of the **Table 44** rules. Unit D has also contacted Unit C; therefore, the same checks must be performed with respect to Unit C. Assume that all four rules are passed when Unit D is considered as the  $Unit_{Receiver}$  with Unit C as the  $Unit_{Firer}$ . Since all rules are passed, Unit D must join an LBS, and since Unit C already belongs to an LBS, Unit D joins LBS-1.



**FIGURE 38. Additional Unit Contacts LBS**

### 2.36.2.3 Merging Lanchester Battle Sets

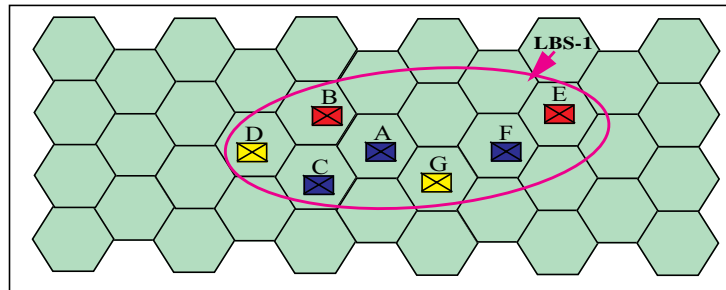
Next, consider the situation depicted in **Figure 39**. The model is currently executing two separate battles, LBS-1 and LBS-2. Also, assume that Unit G moves into proximity and determines that it has contact with both Unit A and Unit F. The rules in **Table 44** are applied. Assume that all four rules pass when Unit G is the  $Unit_{Receiver}$  and Unit A is the  $Unit_{Firer}$ . Unit G must join the existing LBS named LBS-1.



**FIGURE 39. Situation Leading to Merging Two LBSs.**

The algorithm must continue, and the model must proceed to check all units with which Unit G has experienced contact. In this case, depicted in **Figure 39**, Unit G must determine whether it is also in combat with Unit F. Again, assume that when Unit G is the  $Unit_{Receiver}$  and Unit F is the  $Unit_{Firer}$ , all four combat rules are true. Since Unit G and Unit F are each a member of an LBS and not in the same LBS, a situation exists for which the two Lanchester Battle Sets must be merged. It is inconsequential which LBS is dissolved and which set accepts the released units. The battle to date for each battle set

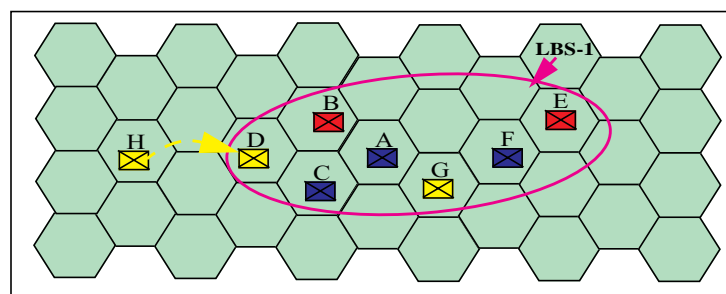
must be assessed. Then, the two sets are merged to one set. **Figure 40** shows that all units have become members of a single LBS. LBS-1 is assumed to absorb the units from LBS-2, which has been removed from the game.



**FIGURE 40. Merged Lanchester Battle Sets**

Reinforcing units are never automatically considered to be included in the reinforced unit’s LBS. While battle results are assessed for a specified LBS, the member units of the LBS point to the units that are assisting them with Direct Support reinforcing fire. These reinforcing assets are accessed for the battle computation by means of this link and not through the presence of the reinforcing unit in the LBS.

Consider the example provided in **Figure 41**. Assume that Unit H has been ordered to provide Direct Support to Unit D. Unit H does not join the LBS because it does not have direct contact with any of the foreign units contained in LBS-1. Unit H joins the LBS only if it has contact with a foreign unit and passes all In Combat rules outlined in **Table 44**. If these conditions are satisfied, the Direct Support relationship is not severed, but Unit D is not permitted to use Unit H’s Direct Support assets, since Unit H is then considered to be in combat. Applying a convention in JTLS, Unit H uses all of its assets to protect itself.



**FIGURE 41. LBS Reinforcing Fire Unit Representation**

Now, assume that Unit I moves into contact with the reinforcing Unit H, and all In Combat rules are passed when Unit I is considered the  $Unit_{Firer}$  and Unit H is considered the  $Unit_{Receiver}$ . Since neither unit is a member of an LBS, a new LBS is created and identified as LBS-3 in **Figure 42**. Again, the Direct Support reinforcing relationship is not severed, but when the LBS-1 battle is assessed, the

model determines that Unit H is engaged in its own battle because it is a member of an existing LBS. Unit D does not receive the use of Unit H’s assets during the LBS-1 battle assessment.

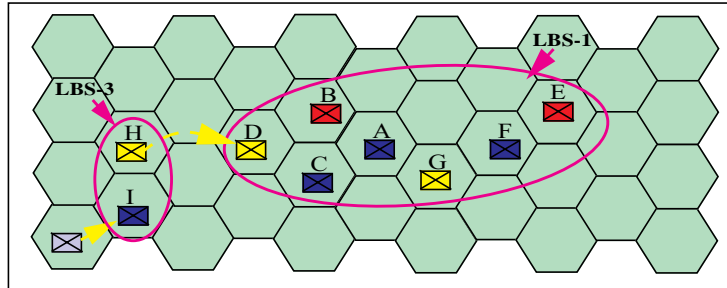


FIGURE 42. Reinforcing Unit Joins New LBS

Next, assume that Unit I moves to the position indicated in Figure 43 instead of the position identified in Figure 42. In this case, Unit I verifies whether it is in combat with each of the foreign units, Unit D and Unit H, with which it has contact. Assume that Unit I concludes that it is engaged in combat with each of these two units. Depending on the order in which the contacted foreign units are considered, the model accomplishes the task differently, but achieves the same result. Table 45 compares the logic applied when Unit D is considered first or when Unit H is considered first.

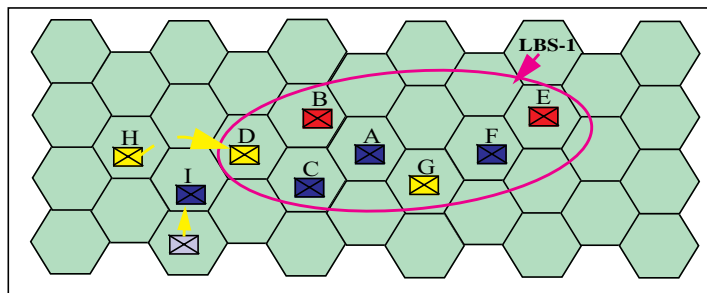


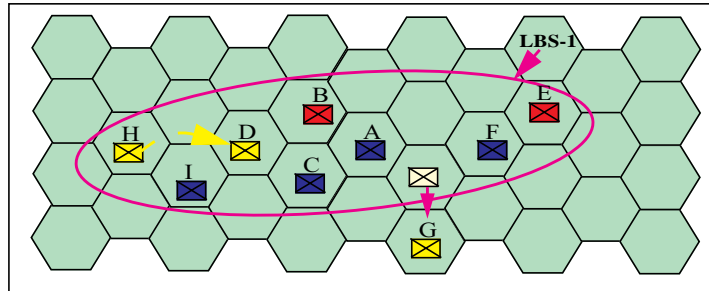
FIGURE 43. Reinforcing Unit Joins Existing LBS

TABLE 45. Comparison Of Unit Check Order

STEP	UNIT D PROCESSED BEFORE UNIT H	UNIT H PROCESSED BEFORE UNIT D
1	Unit I is in combat with Unit D. Unit I joins LBS-1.	Unit I is in combat with Unit H. Unit I and Unit H are not in an LBS. A new LBS is created, named LBS-4.
2	Unit I is in combat with Unit H. Unit H joins LBS-1.	Unit I is in combat with Unit D. Since Unit I (in LBS-4) and Unit D (in LBS-1) are in different Lanchester Battle Sets, these sets must be merged to one LBS.
Result	All units shown in Figure 43 join LBS-1.	All units shown in Figure 43 join the same LBS, LBS-1 or LBS-4. For the purposes of assessment, this choice is not significant. What matters is that all units are in the same LBS.

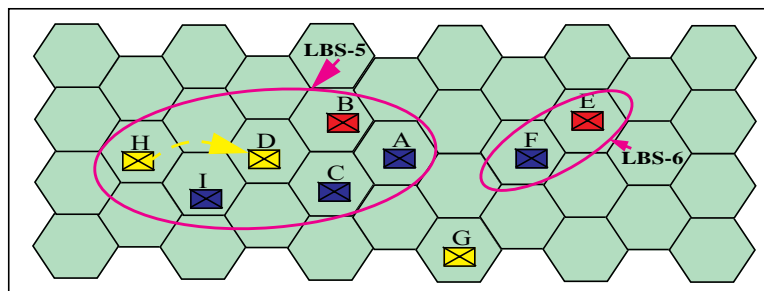
### 2.36.2.4 Separating Lanchester Battle Sets

Consider the situation shown in **Figure 44**, in which Unit G moves away from the battle. This action produces two separate battle sets: one set contains Units A, B, C, D, H, and I; another set contains Units E and F.



**FIGURE 44. Situation Leading to the Separation of an LBS**

The mathematical representation of this apparently simple situation is complex. All remaining units are flagged and removed from the original LBS, which is then dissolved. Then, one or more new Lanchester Battle Sets are created from the flagged units (**Figure 45**).



**FIGURE 45. Separation of an LBS**

### 2.36.2.5 Lanchester Battle Set Attrition Computation

#### 2.36.2.5.1 When Attrition Is Computed

When an LBS is created, an Assess Combat is scheduled for that LBS at a future ASSESS COMBAT TIME. If no changes occur to units in the LBS before this scheduled time, the Assess Combat is executed only for the units in the LBS, and the event reschedules itself.

If a change that affects Lanchester combat occurs to a unit in the LBS prior to the scheduled Assess Combat, or a new unit is added to an LBS, the model determines whether sufficient time has elapsed since the attrition to the units in the LBS was computed. A new MINIMUM ASSESS COMBAT INTERVAL data parameter is added to the database for this purpose. If the LBS has not been in

existence at least this duration or if the time since the LBS was last assessed is less this interval, the change to the unit in the LBS or the addition to the LBS is not considered significant and the Assess Combat event is not executed. The value of this assessment interval parameter can be modified during a game.

**Table 46** lists the events that cause the model to verify whether attrition must be computed. When the listed situation occurs for a unit that is a member of an LBS, the model determines whether the unit should remain in the LBS. When the listed situation occurs for a unit not in an LBS, the model determines whether the unit should be added to an LBS.

**TABLE 46. Initiate Attrition Computation**

SITUATIONS INITIATING ATTRITION COMPUTATION
Unit changes sides
Unit moves
Unit ROE changes
Unit posture changes
Controller changes the range of existing Combat Systems.

2.36.2.5.2 Time Weighted Total

Changes in the availability of Combat Systems are omitted from the initiating attrition computation list. The number of Combat Systems that a unit has available and manned can change, due to a variety of events such as explicit damage, arrival of replacement systems, sending systems on a mission, or magic Controller actions. Changes to the numbers and types of Combat Systems are considered during the attrition computation phase using the existing concept of Time Weighted Total.

The actual computation associated with maintaining a unit’s Time Weighted Total has been modified, but the concept is maintained. The computation is performed only for those units that currently belong to an LBS. A unit not included in a battle set cannot be subject to Lanchestrian force-on-force attrition; thus maintaining a Time Weighted Total of available systems for the Lanchestrian attrition computation is unnecessary. Thus, as units have their Combat Systems altered, the Time Weighted Total computation is omitted if the unit is not included in an LBS. When a unit is added to an LBS, its Time Weighted Total is initialized.

At the end of each Assess Combat event and after all damage has been computed, the unit knows exactly how many systems of each type it currently has manned and available. This number is multiplied by the ASSESS COMBAT TIME to obtain the number of system days the Combat System was available to fight as a Firer. While computing the number of systems that should be considered as Firers for the assessment period, the model converts the Time Weighted Total back to an average number of systems available for the entire period.

### 2.36.2.5.3 How Attrition Is Computed

The Lanchester Direct Fire attrition coefficients have a unit of measure equal to the number of victim systems killed per killer Combat System per ASSESS COMBAT TIME. Similarly, the Indirect Fire attrition coefficients are based on the ASSESS COMBAT TIME. This has always realistically prevented users from using any value except one hour for the ASSESS COMBAT TIME, since any other duration would require them to produce completely new sets of Lanchester coefficients. Considering this problem, and the problem that assessment periods are no longer constants because they can occur whenever the situation of a battle changes, an alteration of the method used to compute the force-on-force attrition is implemented.

A new LANCHESTER COEFFICIENT BASE TIME database parameter is the time duration for which the Lanchester coefficients are created in the database. While computing attrition, the model multiplies each Lanchester attrition coefficient by the fraction of the base time period for which the assessment is conducted.

Implementing this method is an approximation that does not reflect exactly the same damage. If the Lanchester coefficients were built based on a one-hour time period, the damage assessed would not be identical for two 30-minute assessment periods, in which the coefficients are multiplied by 0.5 (30 minutes / 60 minutes), as compared to a single 60 minute assessment period in which the coefficients are multiplied by 1.0 (60 minutes / 60 minutes). Due to the approximation of the Lanchester differential equations as discrete difference equations, this inaccuracy is acceptable.

During the database conversion process to Version 3.2, the new LANCHESTER COEFFICIENT BASE TIME parameter is set to the database's ASSESS COMBAT TIME.

Besides the adjustment of the attrition coefficients based on the percentage of the LANCHESTER COEFFICIENT BASE TIME for which the assessment is being accomplished, the force-on-force attrition computation methodology is otherwise unchanged. There are several changes after the system attrition has been computed, but the computation for determining which systems and the number of systems that are killed is not changed for this implementation.

### 2.36.2.6 Attrition Levels

A unit's attrition for the previous ASSESS COMBAT TIME is compared to the data parameters SP TU UNIT LEVEL ATTRITION MODERATE and SP TU UNIT LEVEL ATTRITION SEVERE. Since the assessment period is no longer a constant, the model links this process to the Hourly Unit Processing event instead of the end of Assess Combat.

During the Hourly Unit Processing event, the model records the unit's current weighted strength. At the completion of each assessment calculation, the model determines whether the moderate or severe attrition level has been breached, based on the losses since the previous Hourly Unit Processing event. If the loss is greater than SP TU UNIT LEVEL ATTRITION SEVERE, the unit is stopped. If the loss

is between the SP TU UNIT LEVEL ATTRITION MODERATE and the SP TU UNIT LEVEL ATTRITION SEVERE, the unit is penalized in performance, as was previously customary.

This attrition level comparison is also performed during the Hourly Unit Processing event, in case the unit has received damage from causes other than force-on-force attrition. Stopped units are also restarted during the Hourly Unit Processing event if the excessive attrition level has not been breached again. This means that stopped units remain stopped for at least one hour.

#### 2.36.2.7 Explicit Fire Missions

Previously, Explicit Fire missions were divided immediately prior to the Assess Combat event so that appropriate damage from the fire mission could be applied and the Time Weighted Totals for the firing systems could be adjusted before the Assess Combat is executed. This design does not allow certain prediction as to when a specific LBS may be assessed; therefore, the Time Weighted Totals of the firing systems cannot be adjusted to prepare for the assessment procedure.

Fire missions are divided into volleys; each volley is fired and assessed individually. A volley assumes that all of the unit's manned and functioning Combat Systems capable of firing the desired projectile participate in the Explicit Fire mission. Thus, if five systems are available to fire, then five projectiles are fired at a specified time and assessed.

The complex computation developed for Explicit Fire involves the ability to accurately track the systems that are unavailable for the force-on-force Lanchestrian attrition computation because they were used to support an Explicit Fire mission. This is done by expanding the logic supporting the Time Weighted Average computation described previously. The basis for this computation is the necessity for each unit in the game to have access to its pending Fire Missions (as was previously done using the UT PENDING FIRE MISSION SET), as well as access to its active Fire Missions, which is accomplished by creating a UT ACTIVE FIRE MISSION SET.

#### 2.36.2.8 Hourly Computations

These computations are transferred from the Assess Combat event to the Hourly Unit Processing event, because the Assess Combat period is no longer a constant:

- Filling pipelines
- MHE serial processing
- Updating psychological operations effects and resetting jammed time
- \BDA Reports

CAS continues to be scheduled during the Assess Combat event.

Catastrophic kills are placed on the game board when they occur. This occurs whenever a system is killed by any Explicit Fire event: artillery, air strike, Surface-to-Surface Missile (SSM) impact, or



minefield explosion. Catastrophic kills are also placed on the game board immediately when they occur in Assess Combat. The increased frequency of Assess Combat events is advantageous, and the placement of these catastrophic kills appears to be more responsive to external models.

#### 2.36.2.9 Combat Power Distribution

The existing methodology to distribute a unit's Combat Systems in response to the location of enemy units is modified to properly reallocate longer-range systems as needed. Previously, a JTLS Combat System (CS) capable of killing was listed as either a DIRECT or INDIRECT fire system. INDIRECT fire systems are typically longer-range systems, but are still distributed to the unit's six hexagon sides using the same algorithm as DIRECT fire systems. Some INDIRECT systems have a limited range for which this paradigm is most appropriate. However, the longer-range systems must be allocated against units facing their allocated side, but if no units are facing the hexagon side, these systems must be allowed to fire where they are needed.

A new CSP CS ATTRITION TYPE designator, LONG-INDIRECT, is added to allow the Combat System to be used against forces facing any hexagon side, provided that these systems are not required to fight enemy units on the side to which they have been allocated as part of the Combat System distribution algorithm. The allocation computation allows fractional Combat Systems that are acceptable for the Assess Combat calculation. However, the kills are intergeized after they have been computed.

Previously, a unit in the Attack posture and located at its attack destination would not reorient its combat power in response to nearby enemy units that were not also attacking the unit. To resolve this problem, these new options are added to the Attack Order:

- Attack Unit by Name and Defend. The attacking unit remains in the Attack posture until the named unit is Wiped Out or leaves the LBS. As soon as this occurs, the attacking unit assumes the Defend posture, in which the formerly attacking unit is able to properly reorient its Combat Systems to respond to other units in the area.
- Attack Unit by Name and Clear Hex. The attacking unit remains in the Attack posture until the named unit is Wiped Out or leaves the LBS. The attacking unit then attacks by name the next nearest unit in the LBS. The attacking unit continues attacking until it leaves the LBS, because it no longer satisfies the participant rules established in [Table 44](#).
- Attack Location and Defend. The attacking unit enters the Defend posture as soon as it arrives at the specified location, whether or not it joins an LBS.
- Attack Location and Clear Hex. The attacking unit attacks to the specified location. If the unit enters an LBS, the attacking unit then attacks by name the nearest enemy unit in the LBS. The attacking unit continues to attack until it leaves the LBS, because it no longer satisfies the participant rules established in [Table 44](#).

#### 2.36.2.10 Whole Combat System Representation

The integer-based representation that replaces the fractional Combat System kill results discussed previously adapts the fractional computation model.

#### 2.36.2.11 Killing Using Lanchestrian Attrition Results

Since the Lanchester attrition computation remains unchanged, its force-on-force results reflect fractional Combat system kills. The translation of this fractional model to represent integerized whole system kills is accomplished by means of a stochastic rounding algorithm.

As an example, assume that the Lanchestrian attrition computation results in killing 0.3 Howitzers. The model interprets this result as a 30% chance that one Howitzer was killed due to the attrition that occurred during the assessment period. A random variate is drawn from a Uniform (0.0, 1.0) distribution. If this variate is less than or equal to 0.3, the Howitzer is considered killed. If the variate is greater than 0.3, the Howitzer is not killed and this Combat System is considered to be fully functional.

During the Lanchestrian attrition computation, the model maintains a Killer Victim Table, which holds the number of Victim Combat Systems that were killed by each Killer Combat System. This table holds the fractional kills as computed using the Lanchestrian methodology to support its primary use as a debugging tool. The Killer Victim Table should not be provided to the training audience because it conflicts with the casualty reporting received from the model.

#### 2.36.2.12 Killing Using Explicit Combat Results

In addition to Lanchestrian attrition, Combat Systems can be damaged within JTLS by other means, which include artillery fire, air-delivered munitions, Surface-to-Surface Missiles (SSMs), and minefields. These damage algorithms function in a similar manner. Once a kill has been determined, either by means of an Area Effects algorithm or a Probability of Kill algorithm, the model uses the Combat System packet size data to determine the number of systems that should be killed. In the majority of cases, the Combat System packet size is set to 1.0, but for personnel Combat Systems, values such as 5.0 are typical.

The Combat System packet size data, held in the database parameters SP CS PACKET SIZE and SP CS HRU PACKET SIZE and previously defined as real variables, allow the database developer to indicate fractional Combat Systems killed as the result of explicit combat results. This existing packet size data type is changed to integer. The Modify program rounds existing database values and replaces any resulting zero value with a value of 1. The appropriate Controller SET screens are modified to limit entries for this database parameter to integer values.

### 2.36.2.13 Repairable and Catastrophic Kills Algorithm

Previously, the data parameter CSP CS FRACTION RECOVERABLE was used to place a fraction of the killed systems in maintenance and the remaining fraction of these killed systems were considered to be catastrophic kills lost to the unit for the remainder of the game. Since an integer representation for a unit's Combat Systems must be maintained, this method has been replaced.

The attribute CSP CS FRACTION RECOVERABLE is changed to CSP CS PROB SYSTEM RECOVERED. After the algorithm determines the number of whole Combat Systems killed, the model determines which of the killed systems are repairable and which systems are considered as catastrophic kills by drawing a variate from a Uniform (0.0, 1.0) distribution for each killed system. If this random variate is less than or equal to CSP CS PROB SYSTEM RECOVERED, the system is placed in maintenance and the crew is moved from the crew unavailable count to the crew available count. If the variate is greater than CSP CS PROB SYSTEM RECOVERED, the system is identified as a catastrophic kill and the Catastrophic Kill object, commonly known as a "burning hulk", is placed on the game board. For these catastrophically killed systems, the existing stochastic method, which determines whether the crew is also killed, is modified.

Although not required for this capability, aircraft Combat Systems damaged while in the Squadron unit and not while assigned to a mission are no longer placed in the Maintenance column of the Squadron unit's Combat System array. The aircraft Combat System is subjected to the CSP CS PROB SYSTEM RECOVERED algorithm. Once the model has determined that the aircraft Combat System can be repaired, the aircraft is not processed by the conventional Combat System repair algorithm. Instead, the Aircraft Class data and the existing aircraft maintenance algorithm are applied. Thus, aircraft damaged as part of the unit are treated in the same manner as battle-damaged flying aircraft returning from a mission. Additionally, the user is able to view data pertaining to aircraft released from maintenance.

### 2.36.2.14 Evacuation Policy Changes

A new algorithm determines which hospital-bound personnel should be evacuated as CASUALTIES, based on the theater evacuation policy held by the Faction attribute FC WIA MAX TREAT UNIT TIME. For each recovered personnel Combat System loss, a random draw determines a repair time using CSP CS MEAN TIME BETWEEN REPAIR. Personnel Combat Systems with a random draw greater than the FC WIA MAX TREAT UNIT TIME are treated as CASUALTIES.

### 2.36.2.15 Non-Battle Casualties

The manner in which Non-Battle Casualties are determined is also modified.

Each Combat System owned by the unit is checked to determine whether it has failed on arrival. The new data parameter CSP CS PROB NON COMBAT FAILURE replaces CSP CS FRACTION FAIL ON ISSUE only when a unit arrives in theater, is resurrected, or the Controller resets the unit to 100%

capability, and is used to determine whether each Combat System owned by the unit has failed on arrival. If true, a maintenance procedure is initiated for the failed systems.

Since the model can no longer repair fractional Combat Systems, an exponential whole-system repair time model is applied. When a system is added to maintenance, a random repair time CSP CS MEAN TIME BETWEEN REPAIR is drawn for each system. This new parameter replaces CSP CS FRACTION REPAIRED PER PERIOD. Each instance a repair event is executed and a whole system is moved from maintenance to the available system count, a new repair event is scheduled. For each remaining Combat System of the repaired type, a new random maintenance time is generated. The minimum maintenance time is saved and the repair event is scheduled to occur at that minimum time. This algorithm reflects the characteristic of exponentially distributed events: the time interval between events is also exponentially distributed with the same mean.

This means that each unit has one and only one repair event for each of its Combat System types that are in maintenance. These data are displayed on the Combat System status screen of the Information Management Tool (IMT) to assist the user to determine when the next system is due out of maintenance.

Once the initial systems have been placed in maintenance using the new CSP CS PROB NON COMBAT FAILURE data parameter, processing the remaining non-combat failures continues. After the initial failures have been computed, an exponential distributed random variate with the mean CSP CS MEAN TIME BETWEEN FAILURE is drawn for each system that is currently manned and operational. Unmanned systems are counted for the initial failure, but are not counted for the continued non-combat failure algorithm. The minimum of these random variates represents the next non-combat failure for this Combat System within the unit.

#### 2.36.2.16 Reissuing Combat Systems

Units that have available supplies to replace lost Combat Systems reissue whole Combat Systems instead of fractional Combat Systems, due to a modified algorithm. All supplies available for issue are issued as Combat Systems; no supplies are saved toward the later issue of a heavier Combat System.

The data parameter MIN TONS CL VII TO DISTRIBUTE previously used to ensure that small fractional Combat Systems were not unrealistically issued is removed from the database. Since the model issues only whole Combat Systems, the concept of a minimum weight for a supply issue is not applicable.

#### 2.36.2.17 Changes To Controller Actions

Several methods are available to the Controller to alter the current status of a unit. The Controller can submit a Damage Combat System order or submit a direct access change order for the unit's available or in-maintenance Combat Systems. Each of these capabilities are altered to ensure that the Controller is not allowed to create fractional Combat Systems and that all of the new repair events and non-combat damage events are properly adjusted.

### 2.36.2.18 Representation of Communications Capability

To achieve the goal to use whole numbers with respect to units' Combat Systems arrays, C3I is removed as a Combat System because its expected value ranges between 0 and 1. The ECP **JTLS-2006-1827 New Command Control Model** implements this requirement.

### 2.36.3 Data Changes

These new parameters are added to the database:

- LANCHESTER COEFFICIENT BASE TIME
- MINIMUM ASSESS COMBAT INTERVAL
- CSP CS PROB NON COMBAT FAILURE
- CSP CS PROB SYSTEM RECOVERED
- CSP PROB REMAINS RECOVERED
- CSP CS MEAN TIME BETWEEN FAILURE
- CSP CS MEAN TIME BETWEEN REPAIR

The following parameters are removed from the database and their data are referenced by the new parameters as indicated:

- CSP CS FRACTION FAIL ON ISSUE. All references currently apply to CSP CS PROB NON COMBAT FAILURE.
- CSP CS FRACTION REPAIRED PER PERIOD. All references currently apply to CSP CS MEAN TIME BETWEEN REPAIR.
- CSP CS FRACTION RECOVERABLE. All references currently apply to CSP CS PROB SYSTEM RECOVERED.
- CSP FRACTION REMAINS RECOVERABLE. All references currently apply to CSP PROB REMAINS RECOVERED.
- MIN TONS CL VII TO DISTRIBUTE

The definitions of these data parameters are modified and their *JTLS Data Requirements Manual* documentation is revised:

- SP CS PACKET SIZE
- SP CS HRU PACKET SIZE
- SP TU UNIT LEVEL ATTRITION MODERATE
- SP TU UNIT LEVEL ATTRITION SEVERE
- TUP CS TOE

- CSP CS ATTRITION TYPE
- CSP CS SUPPLY USAGE PER DAY

#### 2.36.4 Order Changes

These new data fields are added to the Attack order panel:

- Attack Unit by Name and Defend
- Attack Unit by Name and Clear Hex
- Attack Location and Defend
- Attack Location and Clear Hex

The Controller Set and Show orders are modified to include the new database parameters and delete the obsolete parameters.

Orders that enable the Controller to damage or alter a unit's Combat Systems are modified to allow the entry of integer values only.

#### 2.36.5 JODA Changes

Next Repair Time data for each unit's Combat Systems are held by the JTLS Object Distribution Authority.

### **2.37 JTLS-2006-1736 FOM Representation of Fuel for Air Missions**

#### 2.37.1 Summary of Model Change Request

External JTLS programs require knowledge of the quantity of fuel held by a JTLS Air Mission. This measurement is provided to the JODA from the CEP in two forms: a total number of gallons and a percent. These values are interpreted in two ways. If the mission is an Air Refueler, the client program must consider the total number of gallons as representing the amount of fuel committed and available for distribution to refuelees. The percent value, also for Air Refuelers, is considered the amount of fuel uncommitted to any refuelee. If the mission is not a Refueler, these values are interpreted as expected: the gallon value is the amount of fuel each mission aircraft currently carries, and the percent value is a fraction of the mission's total capacity. Handling the fuel values differently for Air Refueler missions allows better insight of fuel management for Air Mission modeling.

Contrary to this convention, the JTLS High Level Architecture Interface Program (JHIP) provides two fuel attributes for each Air Mission: Fuel\_Available as a percent representing a decimal ratio of available to total capacity and Fuel\_Capacity represented as decimal gallons. The Fuel\_Available attribute is defined in the FOM as the percentage of the total fuel capacity of each aircraft in the

mission. This definition is retained, although a data type change from Float to Unsigned Short is necessary because the CEP limits the resolution of this value to that of an Unsigned Short data type.

The Fuel\_Capacity attribute has limited usefulness among the JMIRM federates and requires an unnecessary calculation after each update because its data are not provided in the raw format by the JODA.

Assuming that the total fuel capacity is held consistently among all models in the JMIRM federation and for all aircraft classes, updating the fuel capacity more than once is unnecessary, since this value typically remains constant. Providing the gallon quantity currently held by the mission within each update is more useful for the purpose of monitoring available fuel. This value will almost always be changing.

### 2.37.2 Design Summary

This enhancement includes JMIRM FOM changes that provide federates a more useful pair of fuel attributes for Air Missions. All federates subscribing to these fuel attributes also must be able to differentiate Air Refueler missions from the other mission types, i.e., subscribe to the Mission attribute.

Fuel calculations within the CEP are performed using the number of gallons of fuel an Air Mission currently has on board. For example, after the mission completes a segment of its flight of a specified distance, the fuel held by the mission is reduced by the amount of fuel the mission consumes in gallons per kilometer for the number of kilometers in the segment. Therefore, the amount of fuel onboard an Air Mission at any time during the game is the primary fuel attribute, and all fuel updates to or from the CEP are based on this metric. The percent of fuel capacity available for a mission is a convenient value for users, but should not be used to translate fuel quantities between models. Regardless of which model owns an Air Mission, the mission's endurance should be represented consistently. Separate models should represent approximately the same amount of fuel remaining after owning and flying the Air Mission over the same segment of airspace. Any other result would appear to be unrealistic, as viewed from the reflecting model.

Ownership of an Air Mission currently requires the owning model to acquire all attributes of the Air Mission. Maintaining ownership of an attribute necessarily requires appropriate update of these attributes. Thus, any model that owns an Air Mission must update the Fuel\_Available percent concurrently with the Fuel\_Remaining attribute, even though the values may be of no computational use internally for the controlling model.

As mentioned previously, the interpretation of fuel available to a JTLS Air Mission is dependent on the mission's type. For Tanker missions, the fuel remaining and the fuel available refer to the reserve of dispensable fuel, not the fuel available to the mission itself. The primary function of a Tanker is to deliver fuel to scheduled and unscheduled refuelees. When this is no longer practical, the Tanker mission's own fuel requirement for returning home is insignificant. Therefore, monitoring the Tanker mission's own fuel is less important, and the two available fuel attributes are of greater use for

tracking dispensable fuel. Federates capable of acquiring ownership of a Tanker Air Mission in the JMIRM federation must manage a tanker's fuel load in the same manner.

### 2.37.3 Data Changes

No data changes are required to implement this enhancement.

### 2.37.4 Order Changes

No order changes are required to implement this enhancement.

### 2.37.5 JODA Changes

The required JTLS Object Distribution Authority changes are described in **Table 47**.

**TABLE 47. Summary of Required JODA Changes**

CHANGE	OBJECT	ATTRIBUTE	DATA TYPE
Delete	Air_Mission	Fuel_Capacity	float: gallons
Delete	Air_Mission	Fuel_Available	float: percent
Add	Air_Mission	Fuel_Remaining	unsigned long: gallons
Add	Air_Mission	Fuel_Available	unsigned short: percent

## 2.38 JTLS-2006-1752 Improve Fuel Usage Flexibility

### 2.38.1 Summary of Model Change Request

The Joint Logistics Planning Enhancement (JLOG / PE) program is designed to investigate improvements to the logistics information and management processes that allow a Joint Force Commander to mitigate the risks associated with planning, executing, and managing the sustainment of in-theater forces. JLOG / PE has selected the Joint Theater Level Simulation (JTLS) model as a tool to support the evaluation of various new and improved logistics concepts.

To accomplish this task, JLOG / PE indicated that the JTLS logistics consumption algorithm required enhancement to track supply consumption according to the type and number of Combat Systems owned by a particular unit. This enhancement fulfills that request.

### 2.38.2 Design Summary

#### 2.38.2.1 Review of Existing Algorithm

The JTLS Standard Database, which is the basis for all Joint Warfighting Center (JWFC) exercises, supports 178 Supply Categories. Other databases have many more. Each of these Supply Categories is specified, as part of the initialization data, to use one of the three legal consumption methods:



- Per Day
- Per Person Per Day
- As Used

JTLS Ground and Naval units own, use, and consume supplies according to five distinct consumption modes: As Used, Background, Unit Movement, Posture, and Combat.

#### 2.38.2.2 As Used Supply Usage

The supplies are used for a specific purpose or objective, such as when the unit explicitly fires artillery or sends an aircraft on a mission. As supplies are used or committed for use, the model immediately subtracts the supplies from the consuming unit's On Hand supply list.

#### 2.38.2.3 Background Consumption Supply Usage

Every unit has its own Adjust Supply event. The database indicates the time the unit should execute this event for the first instance and the periodic interval the event should be repeated. For example, a unit can be directed to execute the Adjust Supply event at 0400 and every six hours thereafter. This unit computes its background consumption at 0400, 1000, 1600, and 2200 each day. The computed supply consumption is subtracted from the unit's On Hand supply list. As the term implies, background consumption is continuous, regardless of the unit's activities or location in the game.

Each TUP and SUP holds data indicating the amounts and types of supplies expected to be expended as part of background consumption. This data parameter represents either the amount of supplies that should be consumed Per Day or the amount that should be consumed Per Person Per Day.

The Supply Category Name and SC Type Consumption columns of data are held on the Supply Category (SC) structure. All units in the game must consume a given Supply Category using the same algorithm. If a Supply Category is labeled as an As Used category, no background consumption is computed for that Supply Category.

#### 2.38.2.4 Unit Movement Supply Consumption

Naval units do not currently consume supplies as a result of movement. On the other hand, supplies are consumed for each kilometer (KM) a Ground unit moves. This quantity is a database parameter associated with each TUP.

For example, additional Food might not be consumed as the unit moves, but Fuel, Water, and Repair\_Parts might be assessed additional usage. Again, any supply category that is designated as As Used, such as Ammunition, is not considered in the movement consumption algorithm.

This example is an illustration only. Within JTLS, additional supplies consumed during unit movement are considered data. If the database builder intends additional Food to be consumed during

movement, a simple alteration of the TUP consumption parameter per KM for the Food Supply Category is required. Assigning a value of zero to this data parameter stops the additional consumption of the supply when the unit moves.

#### 2.38.2.5 Posture-Based Supply Consumption

During each Combat Assess period, JTLS Ground units consume additional supplies according to their Posture. This consumption mode is designed to represent the additional supply usage the unit would incur while experiencing various represented combat situations. Computations of this posture-based consumption apply the same methodology demonstrated for the background and movement consumption.

Naval units also experience posture-based consumption, but these units cannot assume the Attack, Defend, Delay, and Withdraw posture sequence. Instead, two data parameters are used for this purpose, representing the extra supplies consumed in the Air Operations posture, or while actively providing reinforcement naval gunfire support. Similar to Ground unit computations, this posture-based consumption is calculated and assessed against the Naval unit each Combat Assess period.

#### 2.38.2.6 Combat Supply Consumption

During every assessment period a unit is engaged in combat, and regardless of its posture, the unit also consumes a single Supply Category for each Combat System capable to fight. Supplies expended under combat consumption are designed to represent the ammunition that the Combat System uses. Data required to compute this ammunition usage are not entered for each TUP, but are entered for each Combat System Prototype (CSP), since this data structure is designed to define the Combat System capabilities for each Faction represented in a JTLS scenario.

The computation is similar to all of the previous consumption calculations. During the JTLS combat assessment period, the model determines whether a unit is actively involved in a battle. If true, the combat consumption for the unit's Combat Systems that are participating in combat activity is computed and assessed against the unit. The first step is to determine the number of Combat Systems of each type that are currently fighting, which requires two checks:

- In the case of a system that requires a crew to fight, the existence of the Combat System is not sufficient. A full crew must exist for the system to inflict damage on the enemy and be assessed with ammunition usage.
- The Combat System must be considered a "shooter" system and be oriented in a direction to confront enemy forces. According to the unit's combat power distribution and the direction of the oncoming enemy forces, not all systems participate in a battle.

The combat supply assessment is computed prior to the combat results computation, since a Combat System without ammunition is assumed to have no killing capability.

### 2.38.2.7 Analysis of Previous Algorithm Deficiencies

As this modeling logic represents, ammunition usage is a function of the number of Combat Systems fighting, but the Combat System ammunition usage is not a function of the unit's combat posture. Therefore, a unit in combat in the Attack posture uses the same amount of ammunition as a unit that is in combat in a Defend posture. This problem is corrected as a part of this design.

In our sample database, fuel was represented as a Per Day logistics supply category. Consequently, as the unit is reduced in size, either as a result of attrition or Player task reorganization, the unit's fuel usage does not change. There is no technical reason why Fuel is designated as a Per Day logistics supply in our example. As a Per Person Per Day Supply Category, as is typically specified for JWFC databases, the unit's fuel usage would also be adjusted as the unit loses personnel, either through attrition or task reorganization. As the unit loses strength, its supply usage should decrease. The assumption that personnel count is directly correlated to other Combat System counts justifies this decision. For example, a unit that has only 75% of its personnel remaining, would on the average have the same percentage of all of its other Combat Systems available, and therefore would reduce its fuel supply usage by 25%. JLOG / PE does not consider this assumption sufficiently accurate for their application of JTLS as a supply analysis tool. Modeling a more explicit representation of Combat System fuel usage within the JTLS consumption algorithm is preferred.

Finally, an existing ECP, **JTLS-0018 Naval Fuel Usage**, specifically requests that Naval Units, use fuel as they move in a manner similar to the manner in which Ground units use fuel. Because of the close relationship between this ECP and this design, both enhancements are implemented simultaneously to address the JLOG / PE fuel usage and maritime fuel issues.

### 2.38.2.8 Summary of the Implementation

Implementing this improvement involved adding several new data parameters and retaining all current data in the JTLS database. Database builders can elect to use any or all available consumption parameters. Zero values for either the new or existing data parameters would result in that type of consumption not being represented in the JTLS scenario.

Basically, much of the data is now specified by the Prototype (CSP, SLP, TUP, or SUP), and Combat System (or Supply Category) combination. For example, CSP CS NON COMBAT FUEL USAGE represents the amount of fuel that a unit in a Faction that uses the CSP would consume for each Manned CS each day the unit is in a non-combat mode. Similarly, SUP SC PER KM USAGE represents the amount of the specific SC that a ship of the SUP class uses for every kilometer of movement. This parameter existed, but was not used in the past. It is used as part of this change.

### 2.38.3 Data Changes

The new and modified data parameters that support this enhancement are listed and summarized in [Section 1.5.3](#) of this document and detailed definitions are provided in the *JTLS Data Requirements Manual*. Note that some parameters indicate "Per Day" instead of "Per Period".

The supply consumption calculation will become more complex as a result of implementing this ECP. The detailed example intended to clarify the computational implications of this design is presented in the *JTLS 3.2.0.0 Design Plan* description of this enhancement.

One result of this change is that the supply calculation will occur more frequently. This computation overhead will be offset by a more centralized supply consumption algorithm that will reduce the overall size of the model. If a significant reduction in the maximum attainable game speed is observed after implementation, an option for further enhancement would be to hold onto several recent supply computation times and revert to background consumption only being accomplished at the Supply Adjust events.

Other events affecting a unit's status will trigger the supply consumption computation:

- Loss of a Combat System from either air-to-ground fire, SSM impact, artillery fire, or controller action
- Increase in Combat Systems from Controller action
- Attachment of two aggregate units or an HRU rejoining its parent aggregate unit
- Detachment of an aggregate unit or an HRU.

The model will not compute fuel, combat, or movement supply consumption under the following circumstances. A unit conducting these operations will continue to consume using the background consumption algorithm:

- Magic Moving from one location to another
- Transport by Airlift
- Embarked on a moving Naval formation
- Transport by Convoy. The model assumes that all unit assets are carried by the convoy assets. This capability *does not* consider Convoy fuel usage.

### 2.38.3.1 Naval Unit Fuel Consumption

The enhancements required by **JTLS-0018 Naval Fuel Usage** are incorporated within this design. The existing data parameter SUP SC PER KM USAGE has been implemented in the same manner as the TUP SC PER KM USAGE. Naval units, as is currently done, will be assessed Background consumption, using the new fuel consumption data. Naval units will not access or use the new CSP CS FUEL PER KM data. These data are reserved only for the movement of ground units.

Prior to moving a naval unit, the model will check whether the ship has the needed fuel to accomplish the move. This check will only be done if the SUP SC PER KM USAGE data element for CATEGORY CLASS III NAVAL is greater than zero. If the data element indicates that fuel should be used as the ship moves, the model will determine how much fuel is needed to accomplish the next schedule move. There are three possible answers to the check:

1. If the ship has absolutely no CATEGORY CLASS III NAVAL supplies available, the unit moves is not scheduled. The naval unit will not lose its mission, but it will be stopped and a message supplied to the user concerning its status. When the unit receives fuel, its movement and task will be continued.
2. If the ship has some fuel, but not enough to accomplish the next planned move (full hex), the model will calculate how far the unit can move and will schedule the move to move the allowable distance. When the unit finishes the partial move, the fuel will be used which presumably will set the ship's CATEGORY CLASS III NAVAL on hand value to zero. When attempting to schedule the next move, the ship will follow Rule 1 stated above. Note that it is possible that the ship received fuel from some source prior to executing the scheduled move. In this case, the ship will have a positive value for CATEGORY CLASS III NAVAL fuel available and when it schedules its next move and full move will be possible.
3. The third possibility is that the unit has enough fuel to accomplish the full move and a full move will be scheduled for the unit.

Finally, it is possible that a unit loses fuel while in the middle of a move. for example, it could be attacked and the resulting hull hit could cause the unit to lose fuel. If this happens, the model makes no attempt to stop an existing scheduled move for the unit. When the move is executed, the model will realize that there is not enough fuel to accomplish the move. The current move is allowed and finalized, but the unit will stop moving at that time. This enhancement does not link the speed of a moving Naval unit and its fuel usage.

If these units also provide reinforcing fire for Lanchestrian combat, their Combat consumption will be assessed separately.

### 2.38.3.2 Automatic Supply Calculation Tool

In addition to the numerous data parameter changes, this change required modifications to JTLS Automatic Supply Calculation (ASC) tool. To allow database builders to compute accurate supply levels, the computation method used by the ASC must reflect all other JTLS supply computations. The user community has expressed ambivalence regarding the current ASC capability. Some database developers believe that its computation algorithm produces unrealistically high ammunition supply requirement that severely restrict the model's ability to move units within the theater by means of naval or airlift assets. Although enhancing the ASC to fulfill all possible requirements is beyond the scope of this ECP, certain minor improvements will be implemented.

An overview of the ASC functionality illustrates the need for these improvements. Complete details regarding the operation of the ASC and its logic can be found in the Database Development System (DDS) Users Guide.

Currently proposed ASC improvements can be organized to address two purposes:

- Correct JTLS 3.1.0.0 errors. The design concept of hard-coded symbols is not supported in JTLS 3.1.0.0. The ASC used hard-coded symbols to identify certain unit capabilities. For

example, the ASC logic queried the TUP symbol and assessed mine-laying supplies to a unit whose TUP was assigned the Engineering symbol. JTLS 3.1 supports an Engineering symbol, but since the development of the symbol is a database task, the ASC can no longer rely on the Engineering symbol to be hard-coded as symbol 31.

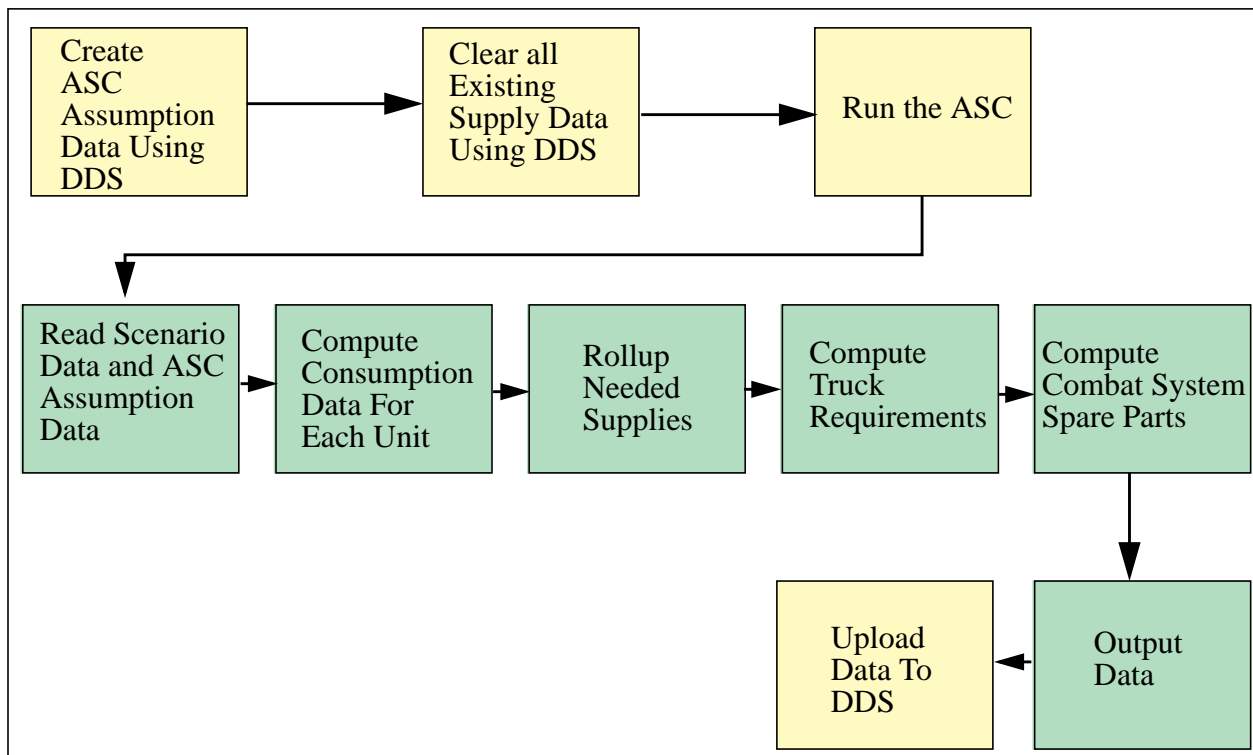


FIGURE 46. ASC Logic Flow

The ASC also used a TUP’s Graphic Symbol to determine the type of unit (Airbase, Squadron, Ground, Support, or FARP) to which the TUP would be assigned. This methodology was used only when the TUP was unused (no unit existed in the database that referenced the TUP). The ASC was responsible for developing supply data for these unused TUPs, in case the Controller created a new unit using the TUP during game play.

Neither of these tasks—determining whether a unit is an engineering unit or determining the basic type of an unused TUP—can be accomplished by the ASC using the newly defined Graphics Symbol data object. This problem has been temporarily corrected in JTLS 3.1 by requiring the user to interactively provide the required data. Specifically, the ASC tool begins by querying the user for the specific graphics symbol to be used to indicate that mining supplies should be included in the computation. Additionally, the user is queried to identify the unit type to which an unused TUP would most likely be applied. This

temporary JTLS 3.1 solution provided a non-optimal resolution of the immediate problem. This ECP includes a proper correction of this issue without requiring interactive data input.

This remedy requires adding a new ASC GS table (**Table 48**) to the ASC assumption data. The user will enter a name of a graphics symbol and an indicator whether that symbol will be used for units capable of laying mines, conducting bridging tasks, or conducting combat engineering tasks, such as destroying or repairing targets. The cells highlighted green indicate the allowable seven task assignment values.

**TABLE 48. Example ASC GS Table**

SYMBOL	TASK
ENGINEER	ENGINEER_CAPABLE
ENGINEER	BRIDGE_CAPABLE
P_ENGINEER	ENGINEER_CAPABLE
HQ_ENGINEER	ENGINEER_CAPABLE
HQ_ENGINEER	MINE_CAPABLE
HQ_ENGINEER	GROUND_COMBAT_CAPABLE
BRIDGING	BRIDGE_CAPABLE
AIRBASE	AIRBASE_CAPABLE
SQ_FIXED	SQUADRON_CAPABLE
SQ_ROTARY	SQUADRON_CAPABLE
FARP	AIRBASE_CAPABLE
HEADQUARTERS	GROUND_COMBAT_CAPABLE
NAVAL_BASE	SUPPORT_CAPABLE

A used TUP of symbol type Engineer will add engineering task supplies and bridging task supplies to their needed supply list. A used TUP of symbol type HQ\_ENGINEER will add engineering task supplies and mine laying supplies to their needed list. An unused TUP of symbol type HQ\_ENGINEER will assume that it will be used for a Ground Combat unit and will accomplish the supply calculation accordingly. That computation will also include the supplies needed for engineering tasks and the mine laying tasks that the **Table 48** data indicate.

- Alter consumption computation to accommodate the new JTLS data parameters. **Table 49** outlines the methodology used to compute the types of consumption that are considered. A green highlight indicates that the computation currently exists in the ASC and is not altered.

A yellow highlight indicates that the computation is either new or will be modified for this design.

**TABLE 49. ASC Supply Consumption Computation**

TYPE CONSUMPTION	SUMMARY OF COMPUTATION
Normal Consumption	Based on 24 hours. This computation uses the data held in the database parameters TUP SC NORMAL CONSUMPTION PER DAY and SUP SC NORMAL CONSUMPTION PER DAY.
Movement Consumption	The computation is modified to be more specific. Only Ground Combat units and Naval units will have Movement Consumption added.
	Ground Combat Units: Assume the units move for their maximum allowed movement time (TUP MAX MOVE HOURS PER DAY) over Open Terrain. Using the TUP AVERAGE SPEED, and the TT MOVE TIME MULT for Open Terrain, the ASC estimates the number of kilometers (KM) the unit will travel each day. The resulting movement distance is combined with the data parameter TUP SC PER KM USAGE and CSP CS FUEL PER KM.
	Naval Units: Assume the units move for a full 24-hour period in full speed (non-depth restricted) ocean hexes at their maximum speed (SUP MAXIMUM SPEED). The resulting movement distance is combined with the data parameter SUP SC PER KM USAGE. Naval units are not charged the CSP CS FUEL PER KM data.
Lanchestrian Ammunition Usage	The algorithm used is different for each of the basic JTLS units types.
	Ground Combat Unit: Compute the amount of ammunition needed per day for each Combat System ( $Ammo_{CS}$ ) owned by the unit. This computation uses the CEP data parameters CSP CS AMMUNITION SUPPLY USAGE PER DAY ( $Ammo_{Per\ Day}$ ) data and CSP UP AMMUNITION MODIFIER ( $M_{UP}$ ). the ASC specific data parameter FLP UP GROUND HOURS IN COMBAT PER DAY (Hours Combat Per Day) is also needed.
	$Ammo_{CS} = \sum_{UP = Attack}^{Amphib} Ammo_{Per\ Day} \times M_{UP} \times \left( \frac{Hours\ Combat\ Per\ Day}{24.0} \right)$ <p>The resulting ammunition needed for each Combat System is then multiplied by the Table of Organization and Equipment (TO&amp;E) value for the Combat System resulting in the amount of ammunition needed by the unit per day for the Combat System. The ammunition supply category is specified in the database parameter CS SUPPLY CATEGORY TO FIGHT</p>
Lanchestrian Ammunition Usage	Airbase, Forward Arm and Refuel Points (FARPs), and Squadron Units: The same computation as for ground units, except the ASC specific data parameter FLP UP OTHER HOURS IN COMBAT PER DAY is used for the variable Hours Combat Per Day shown in the equation.
	Support Units: The same computation as for ground units, except the ASC specific data parameter FLP UP OTHER HOURS IN COMBAT PER DAY is used for the variable Hours Combat Per Day shown in the equation. Additionally, the posture Air OPS is skipped.  Naval Units: The same computation as for Airbase Units, except the computation is not done for each Combat System. The computation is only done for the Combat System marked as indirect fire Combat Systems and only for the unit postures of Defend, Moving, Air Operations, and Incapable.



**TABLE 49. ASC Supply Consumption Computation**

TYPE CONSUMPTION	SUMMARY OF COMPUTATION
Posture-Based Consumption	The algorithm applied is different for each of the basic JTLS units types.
	<p>Ground Combat Units: Compute the supplies consumed (<math>Posture_{SC}</math>) based on the unit's combat posture. This computation uses the CEP data parameters TUP SC USAGE ATTACK, TUP SC USAGE DEFEND, TUP SC USAGE DELAY, and TUP SC USAGE WITHDRAW (<math>Usage_{UP}</math>). It also uses the ASC data FLP UP GROUND HOURS IN COMBAT PER DAY (<math>Hours_{UP}</math>) but only for the four direct combat related Unit Postures (Attack, Defend, Delay, and Withdraw).</p> $Posture_{SC} = \sum_{UP = Attack}^{Withdraw} Usage_{UP} \times \left( \frac{Hours_{UP}}{24.0} \right)$
	Airbase, Forward Arm and Refuel Points (FARPs), and Squadron Units: The same computation as for Ground units, except the ASC specific data parameter FLP UP OTHER HOURS IN COMBAT PER DAY is used for the variable Hours UP shown in the equation. Additionally, the Unit Posture of Air Ops is included in the computation.
	Support Units: The same computation as for Ground units, except the ASC specific data parameter FLP UP OTHER HOURS IN COMBAT PER DAY is used for the variable Hours UP shown in the equation.
	<p>Naval Units: The naval unit computation uses different data. It uses the CEP data parameters SUP SC USAGE AIR OPS (<math>Usage_{Air Ops}</math>) and SUP SC USAGE GUNFIRE (<math>Usage_{Gunfire}</math>). The ASC specific data parameter FLP UP OTHER HOURS IN COMBAT PER DAY (Hours Combat Per Day) is also used. The FLP UP OTHER HOURS IN COMBAT PER DAY for the ATTACK posture is used as the planning factor for gunfire support per day. The AIR.OPS posture is used as the air operations planning factor.</p> $Posture_{SC} = \left( Usage_{Air Ops} \times \frac{Hours_{Air Ops}}{24.0} \right) + \left( Usage_{Gunfire} \times \frac{Hours_{Attack}}{24.0} \right)$
Explicit Fire Usage	Computation unchanged.
High Resolution Combat Usage	Computation unchanged.
Air Defense Target Usage (SAM / AAA)	Computation unchanged.
SSM Usage	Computation unchanged.
Squadron Air Mission Consumption	Computation unchanged.
Minimum Airbase Supplies	Computation unchanged.

**TABLE 49. ASC Supply Consumption Computation**

TYPE CONSUMPTION	SUMMARY OF COMPUTATION
Engineering Tasks	<p>The symbol that will be used for each unit is accessed. The ASC will then look in the graphics symbol table and determine if there are any special engineering task requirements for the symbol. There are three special engineering task requirements. Each of these are discussed individually. A given symbol, can be assigned more than one special engineering capability and each resulting supply requirement would be added to the units daily supply requirement.</p>
	<p>MINE_CAPABLE: For each Targetable Weapon that is labeled as a mine, has a caliber matching the caliber unit, and for which the unit has a Combat System that can fire the given Targetable Weapon, the ASC will add the Targetable Weapon to the unit’s supply array.</p> <p>The amount of the supply that will be added to the unit’s supply requirement (<math>Usage_{SC}</math>) is computed using FLP TW ROUNDS PER DAY (<math>Rounds_{TW}</math>), the weight of the weapon (<math>Weight_{TW}</math>), and the supply category from which the Targetable Weapon is drawn (<math>SC_{TW}</math>).</p> $Usage_{SC} = Rounds_{TW} \times Weight_{TW} \times SC_{TW}$
	<p>BRIDGE_CAPABLE: The ASC ensures that these units have at least 0.09 tons of CATEGORY BRIDGING supplies in their requirement.</p>
	<p>ENGINEER_CAPABLE: The ASC ensures that these units have at least 0.09 tons of CATEGORY CLASS IV supplies in their requirement.</p>

2.38.4 Order Changes

No new Player orders are required to implement this capability.

These Controller order changes are implemented:

- Create new Controller orders to Set and Show the new tabular data for SLP UP FUEL MODIFIER and CSP UP AMMUNITION MODIFIER.
- Alter existing Controller orders to Set and Show the new data parameters CSP CS NON COMBAT FUEL USAGE, CSP CS COMBAT FUEL USAGE, CSP CS FUEL PER KM.
- Alter the Help fields associated with the following data parameters to reflect the changes in the meaning of the data: CSP CS AMMUNITION SUPPLY USAGE, TUP SC USAGE ATTACK, TUP SC USAGE DEFEND, TUP SC USAGE DELAY, TUP SC USAGE WITHDRAW, SUP SC USAGE AIR OPS, SUP SC USAGE GUNFIRE, SUP SC PER KM USAGE.

2.38.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this capability.

## 2.39 JTLS-2006-1827 New Command Control Model

### 2.39.1 Summary of Model Change Request

Previous JTLS versions represented the Command, Control, and Communications (C3) capability of a unit as a reserved Combat System named COMBAT SYSTEM C3 and was assigned the generic name C3I Combat System within the JTLS Standard Database. The number of C3I systems owned by a unit was used as a modifier to message delay and combat power reorientation.

The C3 capability is a combination of equipment, personnel, and procedures, and is a unit capability rather than a Combat System. Typically, Combat Systems represent separate objects, such as personnel or items of equipment. The definition of a complex capability as such an object caused problems with the C3 representation. This enhancement redefines the C3 representation as a unit capability rather than a Combat System.

### 2.39.2 Design Summary

All references to C3I are changed to C3, since the intelligence aspects are represented by other parts of the simulation. The variable COMBAT SYSTEM C3 is removed from the database and the Combat System to which it points is also be removed as part of the database conversion process. Additionally, the existing data item CP TIME DELAY PER 100 KM is removed. Several new data parameters are added to more logically model the C3 capability of a unit and the message delay times encountered when the unit receives or sends communications.

Each unit is assigned a UT C3 EFFECTIVENESS value between 0 and 1. This unit data parameter replaces the number of available C3I Combat Systems as the modifier for message delay times and TUP PERCENT ALLOWED TO REORIENT, and is not a perceived data item. The value of a unit's UT C3 EFFECTIVENESS can either increase or decrease as a result of game actions.

Each Aggregate Resolution Unit (ARU) is assigned a UT C3 QUALITY RATING, which points to a new permanent entity database object named C3 QUALITY RATING (CQR). To maintain consistency with all JTLS object classes, this object has a short identifier CQR to simplify referencing the C3 QUALITY RATING object data. A unit's assigned CQR can change as a result of game actions.

The attributes or data specified for each created CQR object are summarized in [Table 50](#). The database conversion process automatically creates a single CQR object. Thus, after an existing database is converted, contains a single CQR object with the indicated data. Database developers can

create additional CQR entities to properly model various represented communication capabilities. The JTLS 3.2.0.0 Standard Database is delivered with a robust set of CQR entities.

**TABLE 50. New Permanent Quality Rating Attributes**

ATTRIBUTE NAME	DEFINITION	CONVERSION VALUE
CQR NAME	This 15-character unique identifier is not allowed to contain characters currently prohibited in JTLS.	NORMAL
CQR EFFECTIVENESS MULTIPLIER	This multiplier is used to determine the number of Combat Systems that can be reoriented during an assessment period. The algorithm is described in <a href="#">Section 2.39.2.3</a> .	1.0
CQR MINIMUM C3 EFFECTIVENESS	The minimum value of a unit’s UT C3 EFFECTIVENESS. A unit’s UT C3 EFFECTIVENESS attribute can equal zero, but when this attribute is required to compute message delay or the Combat System reorientation, this minimum value is used.	0.01
CQR MEAN MSG DELAY HIGHEST HQ	The mean time required for a unit to communicate with the highest unit on its Side when it is not jammed. The actual message delay is computed using an exponentially-distributed random variate with this mean. <a href="#">Section 2.39.2.1</a> describes the message delay algorithm.	15 minutes
CQR MEAN MSG DELAY NEXT HIGHER	The mean time required for a unit to communicate with its next higher unit on its Side when it is not jammed. The actual message delay is computed using an exponentially-distributed random variate with this mean. <a href="#">Section 2.39.2.1</a> describes the message delay algorithm.	7 minutes
CQR MAX MSG DELAY HIGHEST HQ	Since this design uses an exponential distribution to determine message delays, it is necessary to specify a maximum actual message delay. The long “tail” of the exponential distribution curve indicates that generating extremely large random variates is possible. Avoiding unrealistically long delays in a non-jammed environment is desirable. Therefore, after the randomly-generated message delay between a unit and its highest headquarters is computed, the resulting value is not allowed to exceed the value held in this data parameter.	2 hours
CQR MAX MSG DELAY NEXT HIGHER	The maximum amount of time required for a unit to communicate with its next higher headquarters in a non-jammed environment.	1 hour
CQR JAMMING DELAY TIME MEAN	If a message is jammed, the communication delay time increases to reflect the amount of time for the jamming to stop, or for the unit to work around the interference. Currently, this data parameter is associated with the Communication Prototype (CP) entity. The data parameter CP JAMMING DELAY TIME MEAN is removed from the database and transferred to the new CQR object to maintain consistency.	2 hours
CQR JAMMING DELAY TIME MAX	The actual jam time is an exponentially-distributed random variate that has a mean equal to CQR JAMMING DELAY TIME MEAN. For the same reasons explained previously for the communications delay time, the actual jam time is limited by a maximum value. Previously, this data parameter was associated with the CP entity. The data parameter CP JAMMING DELAY TIME MAX is removed from the database and transferred to the new CQR object to maintain consistency.	4 hours
CQR PRIORITY	This integer variable is used to compare two CQRs. Increasing values represent greater capability. <a href="#">Section 2.39.2.1</a> describes the use of this attribute.	1

**TABLE 50. New Permanent Quality Rating Attributes (Continued)**

ATTRIBUTE NAME	DEFINITION	CONVERSION VALUE
CQR NEXT LOWER QUALITY RATING	A unit assumes this CQR when its UT C3 EFFECTIVENESS is reduced to zero, and the unit can no longer sustain its current CQR. <a href="#">Section 2.39.2.4</a> describes the use of this variable.	NONE
CQR LOWER RATING EFFECTIVENESS	A unit assumes this UT C3 EFFECTIVENESS level when the unit must accept the next lower CQR. <a href="#">Section 2.39.2.4</a> fully describes the use of this variable.	0.0
CQR NEXT HIGHER QUALITY RATING	A unit assumes this CQR when its UT C3 EFFECTIVENESS exceeds 1.0 and the unit can sustain a better CQR than its current CQR. <a href="#">Section 2.39.2.8</a> describes the use of this variable.	NONE
CQR HIGHER RATING EFFECTIVENESS	A unit assumes this UT C3 EFFECTIVENESS level when it can sustain the next higher CQR. <a href="#">Section 2.39.2.8</a> fully describes the use of this variable.	0.0
CQR C3 LOSS MULT	This variable is used to determine the proportion of a unit's damaged weighted strength that should be subtracted from the unit's UT C3 EFFECTIVENESS attribute. <a href="#">Section 2.39.2.4</a> describes the use of this variable.	0.5

2.39.2.1 Message Delay Algorithm

When a unit attempts to pass information to superiors in its chain of command, the model determines the message's destination. In a similar manner, when the user passes an order to a unit, the model's order database indicates whether the order is being passed from the Side's highest headquarters, the unit's next higher headquarters, or whether no delay is associated with the receipt of the order. [Table 51](#) summarizes the types of message traffic that a unit can produce and receive, and also includes the basic communication delay data parameters that are used by the message delay algorithm to compute the delay time.

**TABLE 51. Message and Order Options**

MESSAGE TYPE	ORDER TYPE	MEAN MESSAGE DELAY $D_{MEAN}$	MAX MESSAGE DELAY $D_{MAX}$
From Unit To Highest Unit On A Side	Order From Highest Unit On A Side	CQR MEAN MSG DELAY HIGHEST HQ	CQR MAX MSG DELAY HIGHEST HQ
From Unit To Next Higher HQ	Order From Next Higher HQ	CQR MEAN MSG DELAY NEXT HIGHER	CQR MAX MSG DELAY NEXT HIGHER
From Unit To Its Support Unit (Requisitions)	The Support Unit is receiving an order from its Supported Unit. How the communication is viewed is irrelevant; the two units proceed to communicate and the indicated data are used to compute the delay.	CQR MEAN MSG DELAY NEXT HIGHER	CQR MAX MSG DELAY NEXT HIGHER
From Unit To Model Operator	Order From Unit Commander to Unit's Sub-entities	No communications delay	

The model designates each order and message to be sent or received by a unit’s higher headquarters or highest headquarters on the Side, which determines the data parameters to be accessed. Therefore, if a unit attempts to communicate with its next higher headquarters that is also the highest unit on the Force Side, or conversely, the unit communicates with the highest unit on the Side that is also its next higher headquarters, identifying the highest unit on the Side as the communicating unit’s highest headquarters is irrelevant.

In each case listed in **Table 51**, two units are attempting to communicate. The amount of time required for the units to complete the required communications must be a function of each unit’s CQR and each unit’s current UT C3 EFFECTIVENESS ( $U_{C3}$ ) value. This reflects the concept that communications can only be completed based on the capability of the least effective unit. Since the two units can have different CQRs, the various CQRs are compared by means of the CQR PRIORITY attribute. The higher the priority, the better the CQR capability. Thus a CQR named GOOD with a priority of 10 is considered a better capability than a CQR named MEDIUM with a priority of 5.

The CQR PRIORITY attribute is not considered to be a quantitative measurement of capability. The model considers only the comparison that CQR GOOD is a better capability than CQR MEDIUM.

Two CQR objects may have the same priority rating, but represent different capabilities. A unit’s UT C3 EFFECTIVENESS increases or decreases as its capability is damaged or repaired. A unit’s capability may be damaged to the extent that the model automatically alters the unit’s assigned CQR to a lower priority (less capable) CQR. When this occurs, the unit’s UT C3 EFFECTIVENESS rapidly increases to indicate that it is more capable at using the remaining less capable equipment associated with its new CQR.

The rules associated with this variability of a unit’s CQR and its UT C3 EFFECTIVENESS value are described in detail in **Section 2.39.2.4** and **Section 2.39.2.8**. The essential concept is that UT C3 EFFECTIVENESS alone does not provide a measure of a unit’s communication capability. A UT C3 EFFECTIVENESS of 0.5 for a GOOD CQR may or may not be better than a UT C3 EFFECTIVENESS of 0.8 for the MEDIUM CQR. To assist this comparison, the CQR attribute CQR EFFECTIVENESS MULTIPLIER is required. A unit’s UT C3 EFFECTIVENESS ( $U_{C3}$ ) is multiplied by its CQR EFFECTIVENESS MULTIPLIER ( $CQR_{Effect}$ ) to obtain its current effectiveness level.

This background discussion leads to the first step of the algorithm, which involves determining which unit has the least effective communication capability. **Table 52** summarizes the rules that are used to make this determination. The variable  $D_{MEAN}$  is selected according to whether the algorithm for Next Higher HQ or Highest HQ is being used and the rules established in **Table 51**.

**TABLE 52. Rules Determining Which Unit Computes Delay Time**

RULE 1	RULE 2	RULE 3	USE
CQR PRIORITY <sub>A</sub> < CQR PRIORITY <sub>B</sub>			Unit A

**TABLE 52. Rules Determining Which Unit Computes Delay Time (Continued)**

RULE 1	RULE 2	RULE 3	USE	
CQR PRIORITY <sub>B</sub> < CQR PRIORITY <sub>A</sub>			Unit B	
CQR PRIORITY <sub>A</sub> = CQR PRIORITY <sub>B</sub>  Compute each unit's C3 Effectiveness  $Effect = U_{C3} \times CQR_{Effect}$	Effect <sub>A</sub> < Effect <sub>B</sub>		Unit A	
	Effect <sub>B</sub> < Effect <sub>A</sub>		Unit B	
	Effect <sub>A</sub> = Effect <sub>B</sub>	D <sub>MEAN(A)</sub> > D <sub>MEAN(B)</sub>		Unit A
		D <sub>MEAN(B)</sub> > D <sub>MEAN(A)</sub>		Unit B
D <sub>MEAN(A)</sub> = D <sub>MEAN(B)</sub>			Unit A	

Once the restricting unit is determined, the computation of the non-jammed message delay is straightforward. This formula is used to calculate an adjusted mean delay time:

$$Mean\ Delay_{Adjusted} = \frac{D_{Mean}}{U_{C3}}$$

Next, a proposed delay time is obtained by generating an exponentially-distributed random variate with a mean equal to the adjusted mean delay time, expressed as:

$$Delay_{Proposed} = Exp(\mu = Mean\ Delay_{Adjusted})$$

Since the exponential distribution can generate very long times, a limiting or maximum value is imposed using the appropriate CQR MAX MSG DELAY parameter, denoted as D<sub>MAX</sub> in [Table 51](#). The actual delay time is obtained from this equation:

$$Delay_{Actual} = Minimum(Delay_{Proposed}, D_{MAX})$$

A final language translation adjustment is required if the two communicating units are members of different Factions. This multiplicative translation adjustment is held by the existing JTLS data parameter CP TRANSLATION MULTIPLIER. After the actual communications delay is computed, the translation multiplier is applied. This adjustment may increase the delay time to a value greater than D<sub>MAX</sub>:

$$Delay_{Adjusted} = Delay_{Actual} \times Translation\ Multiplier_{CP}$$

If both units are not being jammed, Delay<sub>Adjusted</sub> provides the amount of time the message should be delayed prior to delivery to the user or the tasked unit.

### 2.39.2.2 Additional Delay Due To Jamming

JTLS represents two types of jamming, explicit and implicit:

- The determination whether a unit is explicitly jammed has not changed. Explicit communications jamming can be caused by the presence of a ground-based or air-platform communication’s jammer, which can be directed to jam a Force Side, a specific unit’s command communications capability, or a unit’s tactical communications capability. Jamming of a Force Side or jamming a unit’s command communication network can cause a further delay in the message or order delivery time.
- The CP PROB BACKGROUND MESSAGE DELAY, which represents implicit jamming or naturally-occurring communications obstacles, has been changed to CP CQR PROB MSG DELAY, and is now a function of a unit’s quality rating as well as the unit’s Faction communications prototype. Since the probability of implicit jamming is now an attribute of a unit’s CQR, drawing a single random number to determine whether a message is jammed, as is currently done in JTLS, is no longer appropriate. Instead, the model uses each unit’s CP CQR PROB MSG DELAY to determine independently whether the sending or receiving unit is implicitly jammed.

Once it is determined that a unit is explicitly or implicitly jammed, the additional delay is determined from an exponential distribution with a mean of CQR JAMMING DELAY TIME MEAN for the unit that is being jammed, which is not necessarily the unit used to determine the actual message delay.

**Table 53** describes the process that is used to determine the  $Delay_{Jammed}$  time.

**TABLE 53. Jam Delay Time Computation Rules**

STEP	RULE
If the sending unit is explicitly jammed, compute the explicit jam time.	$Explicit_S = Exponential(\mu = \text{Jam Mean}_{\text{Sending CQR}})$
If this relation is true, then the sending unit is implicitly delayed.	$Uniform(0,1) \leq \text{Prob Message Delay}_{\text{Sending CP and CQR}}$
If the sending unit has an implicit delay, compute the implicit jam time.	$Implicit_S = Exponential(\mu = \text{Jam Mean}_{\text{Sending CQR}})$
Determine the sending unit additional time.	$Delay_{\text{Sending}} = Minimum(\text{Jam Max}_{\text{Sending CQR}}, Maximum(Explicit_S, Implicit_S))$
If the receiving unit is explicitly jammed, compute the explicit jam time.	$Explicit_R = Exponential(\mu = \text{Jam Mean}_{\text{Receiving CQR}})$



**TABLE 53. Jam Delay Time Computation Rules (Continued)**

STEP	RULE
If this relation is true, the receiving unit is implicitly delayed.	$Uniform(0,1) \leq \text{Prob Message Delay}_{Receiving\ CP\ and\ CQR}$
If the receiving unit has an implicit delay, compute the implicit jam time.	$Implicit_R = Exponential(\mu = \text{Jam Mean}_{Receiving\ CQR})$
Determine the receiving unit additional time.	$Delay_{Receiving} = Minimum(\text{Jam Max}_{Receiving\ CQR}, Maximum(Explicit_R, Implicit_R))$
Compute the message delay time.	$Delay_{Jammed} = Maximum(Delay_{Sending}, Delay_{Receiving})$

The final delay time for the message or the order ( $Delay_{Final}$ ) is simply the sum of the actual delay Time ( $Delay_{Actual}$ ) and the delay due to jamming ( $Delay_{Jammed}$ ):

$$Delay_{Final} = Delay_{Actual} + Delay_{Jammed}$$

### 2.39.2.3 Computation of Combat System Reorientation

Previously, the percentage of a unit’s systems allowed to reorient per assessment period ( $Reorient_{Percent}$ ) were computed using the Tactical Unit Prototype (TUP) database parameter TUP PERCENT ALLOWED TO REORIENT ( $TUP_{Percent}$ ) and the fraction of the unit’s original C3I Combat Systems currently available:

$$Reorient_{Percent} = TUP_{Percent} \times \frac{C3I_{Available}}{C3I_{TOE}}$$

The previous equation is modified to use the unit’s UT C3 EFFECTIVENESS value ( $U_{C3}$ ) and the CQR EFFECTIVENESS MULTIPLIER ( $CQR_{Effect\ Mult}$ ) of the unit’s current assigned CQR:

$$Reorient_{Percent} = TUP_{Percent} \times U_{C3} \times CQR_{Effect\ Mult}$$

### 2.39.2.4 Damaging Unit Communication Capability

A unit’s UT C3 EFFECTIVENESS can be reduced by killing some of its Combat Systems or some of the Communication Site targets owned by or associated with the unit.

2.39.2.5 Decrease Due To Combat System Loss

A direct correlation exists between the unit’s weighted strength and the unit’s ability to communicate; therefore, this design proposes to decrease a unit’s UT C3 EFFECTIVENESS value as a unit’s Combat Systems are killed.

When a unit suffers a loss of Combat Systems, a new Weighted Unit Strength (WUS) is computed. The percentage of the weighted unit strength lost is used as the basis for determining the decrease in the unit’s UT C3 EFFECTIVENESS value. The actual decrease is a stochastic or random function.

**TABLE 54. Combat System Decrease of UT C3 EFFECTIVENESS Computation**

STEP	COMPUTATION
Compute the WUS decrease.	$WUS_{Loss} = WUS_{Before} - WUS_{After}$
Determine the proportion of this loss that contributes to a unit’s ability to communicate.	$Prop_{C3} = C3 \text{ LOSS MULTIPLIER}_{CQR}$
Determine the mean C3 loss.	$C3 \text{ Loss}_{Mean} = WUS_{Loss} \times Prop_{C3}$
Determine the actual C3 loss.	$C3 \text{ Loss}_{Actual} = Uniform(0.0, 2.0 \times C3 \text{ Loss}_{Mean})$
Determine the unit’s new UT C3 EFFECTIVENESS value.	$U_{C3} = U_{C3} - C3 \text{ Loss}_{Actual}$

2.39.2.6 Decrease Due To Communications Target Destruction

Destroying a Communications Site target owned by or associated with the unit is another means to reduce a unit’s UT C3 EFFECTIVENESS. To implement this capability, a new legal value for the Communication target’s subcategory attribute CC TYPE is added to the model. Some of the existing Communication Center (CC) types previously not used within the model are removed. These changes are described in **Table 55**. During data conversion, any CC prototypes that have a CC TYPE of DIGITAL or VOICE, are changed to a CC TYPE of COMMAND.

**TABLE 55. Communication Center Attribute CC TYPE Values Comparison**

PREVIOUS JTLS VALUES		REVISED JTLS 3.2 VALUES	
VALUE	USE	VALUE	USE
AIR DEFENSE	Part of the Integrated Air Defense Network (IADS)	AIR DEFENSE	Part of the Integrated Air Defense Network (IADS) that has no effect on a unit’s C3 effectiveness.

**TABLE 55. Communication Center Attribute CC TYPE Values Comparison (Continued)**

PREVIOUS JTLS VALUES		REVISED JTLS 3.2 VALUES	
VALUE	USE	VALUE	USE
DIGITAL	Not used	COMMAND	Part of a unit's implicitly modeled communications network. Damage to this type of target decreases a unit's C3 effectiveness.
VOICE	Not used		

The TG NUMBER for a Communication Site target was previously not used. This data parameter for a Communication Site target is referenced when its subcategory has a CC TYPE of COMMAND. This parameter represents percentage points of capability to be subtracted from the owning or associated unit's UT C3 EFFECTIVENESS when the target is destroyed. The target must be completely destroyed to reduce the UT C3 EFFECTIVENESS. If the target is only partially damaged, the reduction does not occur.

To avoid confusion regarding which unit is affected by the loss of the communications capability, a new restriction is imposed on Communication Site targets. These objects are assigned either an owning unit or an associated unit, but not both. To ensure that this restriction is maintained, checks are added to the Scenario Verification Program (SVP) and the Create Communications Target order logic.

A specified unit may own or be associated with more than one COMM SITE target whose subcategory CC TYPE is COMMAND. The sum of these targets' percentage points may be less than, equal to, or greater than 100. If an owning unit moves away from a stationary Communications Site target whose subcategory CC TYPE is COMMAND, the owning unit ceases to own the target and becomes the associated unit of the target. The unit does not lose any of its C3 Effectiveness when this occurs.

The only feasible strategy to specifically impact a unit's C3 capability is to target its COMMAND type Communication Sites. These should be built in the database, possibly as Prototype Owned Targets (POTs), if this targeting capability is desired.

#### 2.39.2.7 Unit Quality Rating Change - Decrease

A unit's UT C3 QUALITY RATING may change during the game. When a unit's UT C3 EFFECTIVENESS is reduced to zero due to damage, the unit's UT C3 QUALITY RATING is changed to the value of CQR NEXT LOWER QUALITY RATING. The UT C3 EFFECTIVENESS is changed to the value of CQR LOWER RATING EFFECTIVENESS, which resets the value between zero and 100%. Any remaining percentage points to be lost would be applied to the new value for the object's C3 effectiveness.

### 2.39.2.8 Repairing Unit Communication Capability

A unit's UT C3 EFFECTIVENESS can be increased by repairing the implicitly modeled communication capability or by repairing a damaged Communication Site target.

#### 2.39.2.8.1 Repairing Implicit Communication Capability

As discussed previously, a unit's UT C3 EFFECTIVENESS is reduced as the unit's weighted strength is reduced. This weighted strength can be reduced only when a Combat System is killed or damaged. However, the UT C3 EFFECTIVENESS value does not simply represent hardware, but also represents the confusion or efficiency that influences the unit's ability to communicate effectively. The reduction of UT C3 EFFECTIVENESS immediately following the loss of Combat Systems attempts to model this situation during which unit commanders may experience difficulty communicating with their superiors. However, this "confusion" factor should not always be maintained in the unit until the damaged systems are repaired.

For these reasons, the repair of UT C3 EFFECTIVENESS is not linked to the repair of damaged systems or the delivery of replacement systems. Instead, the repair function is linked to the unit's Faction-based Communications Prototype (CP) and the unit's Communications Quality Rating (CQR). Units recover C3 effectiveness during the Hourly Unit Processing event. The rate of recovery is held in a new database array named CP CQR PERCENT RECOVERED PER DAY.

As this variable name indicates, the data are held as a Per Day value. During the Hourly Unit Processing event, the database value is divided by 24, since it is being applied hourly. The value of CP CQR PERCENT RECOVERED PER DAY can exceed 1.0; in this case, the unit could recover 100 percentage points in less than one day.

The effect of a unit's recovery to a UT C3 EFFECTIVENESS of 1.0 or greater is discussed in the following section.

### 2.39.2.9 Repairing Communication Site Targets

Repairing a COMM SITE target owned by or associated with a unit is another means to increase a unit's UT C3 EFFECTIVENESS. The COMM SITE target subcategory must have a CC TYPE of COMMAND. As discussed in the context of damage to these targets, the TG NUMBER is the number of percentage points added to the owning or associated unit's UT C3 EFFECTIVENESS after the damaged target is repaired.

### 2.39.2.10 Unit Quality Rating Change - Increase

A unit's CQR can decrease when the UT C3 EFFECTIVENESS value is reduced to zero, but the unit also has the ability to increase its CQR. If this increase would result in a UT C3 EFFECTIVENESS greater than 1.0, the unit's UT C3 QUALITY RATING *may* be changed to the quality rating in CQR NEXT HIGHER QUALITY RATING.

When a unit's UT C3 EFFECTIVENESS is greater than or equal to 1.0, the unit's CQR is changed to the CQR NEXT HIGHER QUALITY RATING and assumes a UT C3 EFFECTIVENESS equal to the attribute CQR HIGHER RATING EFFECTIVENESS. Two restrictions apply to this increase:

- A unit can never assume a CQR that has a CQR PRIORITY higher than the priority assigned to the unit's attribute UT HIGHEST C3 QUALITY RATING.
- The additional restricting rule applies to the status of the unit's owned or associated Communication Site targets. This rule does not allow a unit's UT C3 EFFECTIVENESS to exceed 1.0 minus its damaged Communication Site targets when the unit has a CQR with a CQR PRIORITY equal to the CQR PRIORITY of its UT HIGHEST C3 QUALITY RATING.

### 2.39.2.11 Unit Detach and Attach Modeling Considerations

These rules apply when a unit detaches from an existing JTLS unit, or two units attach:

- A detached unit receives the same UT C3 EFFECTIVENESS value, UT C3 QUALITY RATING, and UT HIGHEST C3 QUALITY RATING assigned to its parent unit.
- A unit that accepts the attachment of another unit for purposes of Reconstitution retains its own UT C3 QUALITY RATING and UT HIGHEST C3 QUALITY RATING, but its UT C3 EFFECTIVENESS is increased by the difference between its pre-attachment weighted unit strength ( $W_{Before}$ ) and its post-attachment weighted unit strength ( $W_{After}$ ) multiplied by the CQR C3 LOSS MULT ( $Prop_{C3}$ ) of the unit's current quality rating. Let  $U_A$  represent the unit that is attaching to unit  $U_R$ , which represents the unit receiving the attachment.

$$CQR_{After}(U_R) = CQR_{Before}(U_R)$$

$$Effect_{After}(U_R) = Effect_{Before}(U_R) + [Prop_{C3} \times (W_{After} - W_{Before})] + \sum TG\ Number(U_A\ Comm\ Tgts)$$

The UT C3 EFFECTIVENESS may increase to a value greater than 1.0. In this case, the unit would obey the increase rules described previously, and be assigned the CQR NEXT HIGHER QUALITY RATING, if available and permitted by the corresponding restriction rules. Any Communication Site targets transferred as a result of the attachment are considered in the restriction computation:

$$Effect_{After}(U_A) = Minimum \left( Effect_{After}(U_A), 1.0 - \sum_{\substack{Damaged \\ Comm \\ Targets}} TG\ Number \right)$$

- A unit that accepts the attachment of another unit for Task Organization purposes maintains its own UT C3 EFFECTIVENESS value, UT C3 QUALITY RATING, and UT HIGHEST C3 QUALITY RATING. The accepting unit's UT C3 EFFECTIVENESS attribute obtains

the benefit of the attaching unit’s Communication Site targets, which may increase the unit’s quality rating. Similarly, if the attaching unit’s Communication Targets are destroyed at the time of the attachment, the receiving unit’s UT C3 EFFECTIVENESS value is restricted.

2.39.2.12 Explicit Communications Jamming Model Changes

A unit’s susceptibility to jamming is a function of the unit’s CQR as well as its Faction-based Communication Prototype (CP). Therefore, all communications jamming factors listed in **Table 56** are altered and defined as attributes of the new CP CQR compound object. The function of these variables does not change, but the database builder has the capability to represent differences in a unit’s susceptibility to jamming in terms of its current CQR.

**TABLE 56. Communications Jamming Variable Changes**

PREVIOUS VARIABLE	NEW VARIABLE
CP COMM JAM ADA ENGAGE EFFECTIVENESS	CP CQR COMM JAM ADA ENGAGE MULT
CP COMM JAM COMBAT EFFECTIVENESS	CP CQR COMM JAM COMBAT MULT
CP COMM JAM COMM SITE EFFECTIVENESS	CP CQR COMM JAM COMM SITE MULT
CP COMM JAM INDIRECT FIRE DELAY FACTOR	CP CQR COMM JAM FIRE DELAY MULT
CP COMM JAM INTERNAL DELAY FACTOR	CP CQR COMM JAM INTERNAL MULT
CP COMM JAM MOVE DELAY FACTOR	CP CQR COMM JAM MOVE DELAY MULT

2.39.2.13 HRU Message Delay Time

A JTLS High Resolution Unit (HRU) communicates with its parent unit under all circumstances. The method used to determine the duration of time required to establish this communication must also be modeled. The Next Higher HQ algorithm, described in **Section 2.39.2.1**, is applied to this communication. Similarly to communications between ARUs, the algorithm begins by determining whether the HRU or the HRU’s parent unit is the least effective communicator. To accomplish this task, the HRU must also be assigned a CQR and a C3 effectiveness value.

Unlike new units, new HRUs can be created by a Side Player at any time during game play. Consequently, it is inappropriate to place the initial CQR and C3 effectiveness value for an HRU as HRU attributes. If these initial values are modeled as HRU characteristics, a Player creating a new HRU would be required to specify these parameters. Intelligent Players would likely and inappropriately specify the most effective CQR and the maximum C3 effectiveness value as 1.0 for every HRU they create.

Therefore, the design team has defined an HRU’s initial CQR and C3 effectiveness value as separate High Resolution Unit Prototype (HUP) data parameters. The database parameter HUP C3 QUALITY RATING holds the name of the CQR that all HRUs using the HUP are assigned when they are created. The database parameter HUP STARTING C3 EFFECTIVENESS holds the initial value for the HRU’s C3 effectiveness attribute.

A newly-created HRU is automatically assigned the CQR and C3 effectiveness value specified by its HUP. These values are held by the HRU object and change in the same manner as the corresponding ARU parameters. Thus, the HRU has attributes named HRU C3 QUALITY RATING and an HRU C3 EFFECTIVENESS, which are equivalent to these parameters.

Unlike ARUs, the HRU does not have an HRU HIGHEST C3 QUALITY RATING. This is justified because HRUs have no ability to repair lost Combat Systems, unlike aggregate units; therefore, they cannot repair their damaged CQR or C3 effectiveness. Although a Controller can repair an HRU, this event does not occur within the model. For this reason, the model assumes that a Controller-repaired HRU can be restored to its original CQR. Thus, an HRU's original CQR is equivalent to the unit's maximum repairable CQR.

**Table 57** summarizes how each element of the previously described design applies to HRUs.

**TABLE 57. High Resolution Unit C3 Capability Summary**

FUNCTION	HRU ALGORITHM METHODOLOGY
Message Delay	The message delay algorithm functions in the same manner as the message delay algorithm for units, described in <a href="#">Section 2.39.2.1</a> .
Message Jamming	The message jamming algorithm functions in the same manner as the message jamming algorithm for units, described in <a href="#">Section 2.39.2.2</a> .
Combat System Reorientation	HRUs do not reorient their Combat Systems. This portion of the design does not apply to HRUs.
Damage Combat Systems	An HRU has a weighted strength that is computed differently than ARU strength. HRU weighted strength is valued by calculating the ratio of an HRU's current personnel count to its Table of Organization and Equipment (TO&E) for personnel. As the HRU's weighted strength decreases (as it loses personnel), its HRU C3 EFFECTIVENESS value is decreased according to the algorithm described in <a href="#">Section 2.39.2.4</a> .
Damage Communication Targets	An HRU can own Communications Site targets, but the Scenario Verification Program (SVP) ensures that the Communication Site targets with a CC TYPE of COMMAND are magically created targets. An HRU is not allowed to take ownership of these targets from an ARU. Thus, when an HRU is created, the parent unit's communication is not affected. If the HRU-owned target is damaged, the HRU's communication capability is adjusted in the same manner as the loss of such a target is handled for an ARU.
CQR Decrease	The CQR of an HRU can decrease in the same manner as the CQR can be reduced for an ARU.

**TABLE 57. High Resolution Unit C3 Capability Summary (Continued)**

FUNCTION	HRU ALGORITHM METHODOLOGY
Repair Combat Systems	<p>As mentioned previously, HRUs have no means to automatically repair their own Combat Systems. For this reason, the design team concluded that the HRU should not be able to repair its communication capability. From certain perspectives, this is inconsistent with the repair algorithms used for ARUs. Recall that ARU communications capability is repaired according to an algorithm that is independent of Combat System repairs. Not providing HRUs with an independent repair capability is a justifiable design decision because HRUs have no inherent repair capability, unlike ARUs. The design team has applied the premise that without this inherent capability, nothing associated with the HRU should be repaired automatically.</p> <p>If the Controller repairs an HRU's personnel Combat Systems, the appropriate amount of C3 effectiveness is restored to the unit. Thus, unlike ARUs, the HRU C3 effectiveness repairs are directly linked to the Controller repairs to the unit's personnel. The Controller repairs are considered to be magic; therefore, the magic repair of the associated C3 effectiveness is justified.</p>
Repair Communication Targets	<p>If a Player sends an Engineering unit to repair an HRU Communications Site target, the HRU receives the benefit of the repair. Once the repair is complete, the HRU has its HRU C3 EFFECTIVENESS attribute increased by the TG NUMBER of percentage points.</p>
Increase CQR	<p>If an HRU's C3 effectiveness attribute exceeds 1.0, the unit's quality rating is upgraded according to the same procedure and rules defined for an ARU.</p>
Attach	<p>When an HRU rejoins its parent, no adjustment is necessary. The HRU is removed from the game. Since all HRU-owned Communication Site targets are magically created, they are not transferred to the parent unit. Consequently, no effect that the rejoin procedure accomplishes can cause a change to the ARU.</p>
Detach	<p>When the HRU is created or detached from its parent unit, no adjustment is necessary. All Communication Site targets are magically created, and therefore are not removed from the parent unit. All Combat Systems transferred to the HRU are not removed from the parent ARU. Instead, these systems are listed as Unavailable and still contribute to the parent unit's weighted strength. Consequently, no effect that the Create HRU procedure accomplishes can cause a change to the ARU.</p>

2.39.3 Data Changes

These data items are removed from the database and their corresponding documentation is revised as indicated:

- CP TIME DELAY PER 100 KM. Communications are no longer be a function of the distance between units, and are based solely on the communication capability of the two units that attempt contact.
- CP JAMMING DELAY TIME MAX. All references are changed to CQR JAMMING DELAY TIME MAX.
- CP JAMMING DELAY TIME MEAN. All references are changed to CQR JAMMING DELAY TIME MEAN.



- CP PROB BACKGROUND MESSAGE DELAY. All references are changed to CP CQR PROB MESSAGE DELAY.
- CP COMM JAM ADA ENGAGE EFFECTIVENESS. All references are changed to CP CQR COMM JAM ADA ENGAGE MULT.
- CP COMM JAM COMBAT EFFECTIVENESS. All references are changed to CP CQR COMM JAM COMBAT MULT.
- CP COMM JAM COMM SITE EFFECTIVENESS. All references are changed to CP CQR COMM JAM COMM SITE MULT.
- CP COMM JAM INDIRECT FIRE DELAY FACTOR. All references are changed to CP CQR COMM JAM FIRE DELAY MULT.
- CP COMM JAM MOVE DELAY FACTOR. All references are changed to CP CQR COMM JAM MOVE DELAY MULT.
- CP COMM JAM INTERNAL TIME DELAY FACTOR. All references are changed to CP CQR COMM JAM INTERNAL MULT.
- COMBAT SYSTEM C3. The Combat System specified by COMBAT SYSTEM C3 is removed from the Combat System list when the Modify program is executed.

The definitions of these existing data items are revised as described in the *JTLS Data Requirements Manual*.

- CC TYPE
- CC DATALINK RANGE
- CC JAMMING FACTOR
- CP JAMMING THRESHOLD
- TG NUMBER
- TG ASSOCIATED UNIT
- TG OWNING UNIT

The new C3 QUALITY RATING object requires the attributes described in **Table 50**.

The Communication Prototype (CP) entity exists in the initialization database. A new sub-entity table is added to hold these data elements required for each CP and CQR combination:

- CP CQR PERCENT RECOVERED PER DAY
- CP CQR PROB MESSAGE DELAY
- CP CQR COMM JAM ADA ENGAGE MULT
- CP CQR COMM JAM COMBAT MULT

- CP CQR COMM JAM COMM SITE MULT
- CP CQR COMM JAM FIRE DELAY MULT
- CP CQR COMM JAM INTERNAL MULT
- CP CQR COMM JAM MOVE DELAY MULT

These data items are added to unit definition in the initialization database:

- UT C3 EFFECTIVENESS
- UT C3 QUALITY RATING
- UT HIGHEST C3 QUALITY RATING
- HUP C3 QUALITY RATING
- HUP STARTING C3 EFFECTIVENESS

#### 2.39.4 Order Changes

The SET and SHOW orders are modified to accommodate the data changes.

The Create Unit order is modified to allow the Controller to specify the three new unit parameters: UT C3 QUALITY RATING, UT HIGHEST C3 QUALITY RATING, and UT C3 EFFECTIVENESS.

The Reactivate Unit order is modified to allow the Controller to specify the new UT C3 QUALITY RATING and UT C3 EFFECTIVENESS parameters. A reactivated unit retains its current UT HIGHEST C3 QUALITY RATING, unless the new UT C3 QUALITY RATING is greater than the UT HIGHEST C3 QUALITY RATING. In that case, the new CQR becomes the new UT HIGHEST C3 QUALITY RATING.

#### 2.39.5 JODA Changes

These data are made available to client programs through both the JTLS Object Data Authority (JODA) feed and the High Level Architecture (HLA) feed:

- UT C3 EFFECTIVENESS
- UT COMMAND QUALITY RATING
- UT COMBINED EFFECTIVENESS
- HRU C3 EFFECTIVENESS
- HRU COMMAND QUALITY RATING

## **2.40 JTLS-2006-1837 Remove USMTF 1998 Code From ATO-T**

### 2.40.1 Summary of Model Change Request

Code that relates to reading or processing ATO messages formatted according to 1998 USMTF specifications needed to be removed from the Air Tasking Order Translator (ATO-T).

### 2.40.2 Design Summary

The original ATO-T was designed to translate messages formatted in USMTF 1998 format. Several years ago, the USMTF format for ATO and ACO messages was modified. This version is known as USMTF 2000 format. To support all the major commands during the transition period, the ATO-T was enhanced to be capable of reading messages in either the 1998 or 2000 format. The user was prompted to select the appropriate message format at the beginning of the ATO-T process.

With the removal of all code related to the processing of 1998 formatted ATOs and ACOs, the new ATO-T processing is designed to function with only one modification that is noticeable to the user. Since only USMTF 2000 messages are processed, selecting the message format to be read is not required.

### 2.40.3 Data Changes

No data changes are required to implement this enhancement.

### 2.40.4 Order Changes

No order changes are required to implement this enhancement.

### 2.40.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.41 JTLS-2006-1846 OPM Targetable Weapons Combat Systems Link**

### 2.41.1 Summary of Model Change Request

The Online Player Manual OPM Combat Systems page did not include a link to the Combat Systems Targetable Weapon Can Fire data. This is useful information to fully describe all Combat Systems that have Targetable Weapons.

2.41.2 Design Summary

The link addition, named Allowable TW Data, is appended to the table that lists all Combat System names, as shown in **Figure 47**. Only the Combat Systems with Targetable Weapons that Can Fire will have this associated link. All other non-Allowable Targetable Weapons are not assigned a link.

The screenshot shows a web browser window titled 'sdbv32 COMMON Combat System Data - Mozilla Firefox'. The address bar shows 'file:///home/jtsdev/gam'. The page content includes a header '\*\*\* UNCLASSIFIED \*\*\* UNCLASSIFIED \*\*\* UNCLASSIFIED \*\*\*' and 'sdbv32 COMMON Online Player Data'. Below this is the section 'Combat System Data' with a list of links and their descriptions:
 

- [AMPHIB-LA-TW](#) Represents A Unit's Amphibious Landing Vehicles
- [TRUCK-CARGO](#) Represents A Unit's Cargo Trucks
- [TRUCK-TANKER](#) Represents A Unit's Tanker Trucks
- [TRUCK-UT-COO](#) Represents A Unit's Utility Trucks
- [TRUCK-HET](#) Represents A Unit's Heavy Equipment Transporters (HET)
- [ALBCHAIT](#) Represents A Unit's Mission Capable Aircraft
- [CREW](#) Represents A Unit's Crew

 Below this is the section 'Combat System Names/Index' which contains a table with the following data:
 

Index	Name	Personnel Flag	Terrain Visibility	Allowable TW Data
1	AG5105-LF-HA	NO	Terrain Visibility	No Allowable TW Data
2	AG590-LA	NO	Terrain Visibility	No Allowable TW Data
3	AIRCRAFT	NO	Terrain Visibility	No Allowable TW Data
4	AMPHIB-LA-TW	NO	Terrain Visibility	No Allowable TW Data
5	APC-BA-OW	NO	Terrain Visibility	No Allowable TW Data
6	APC-BA-TW	NO	Terrain Visibility	No Allowable TW Data
7	APC-LA-OW1	NO	Terrain Visibility	No Allowable TW Data
8	APC-LA-OW2	NO	Terrain Visibility	No Allowable TW Data
9	APC-LA-OW3	NO	Terrain Visibility	No Allowable TW Data
10	APC-LA-TW1	NO	Terrain Visibility	No Allowable TW Data
11	APC-LA-TW2	NO	Terrain Visibility	No Allowable TW Data
12	APC-NHA-OW	NO	Terrain Visibility	No Allowable TW Data
13	ARTYSP-HV-O	NO	Terrain Visibility	Allowable TW Data
14	ARTYSP-LT-O	NO	Terrain Visibility	Allowable TW Data
15	ARTYSP-LT-T	NO	Terrain Visibility	Allowable TW Data
16	ARTYSP-HHV-O	NO	Terrain Visibility	Allowable TW Data
17	ARTYSP-HHV-T	NO	Terrain Visibility	Allowable TW Data
18	ARTYSP-HET	NO	Terrain Visibility	Allowable TW Data
19	ARTYOW-HVV	NO	Terrain Visibility	Allowable TW Data
20	ARTYOW-LT	NO	Terrain Visibility	Allowable TW Data
21	ARTYOW-HHV	NO	Terrain Visibility	Allowable TW Data
22	ARTYOW-HLT	NO	Terrain Visibility	Allowable TW Data
23	ARTYOW-VLT	NO	Terrain Visibility	No Allowable TW Data
24	AT-HAW-LR-HL	NO	Terrain Visibility	No Allowable TW Data

FIGURE 47. OPM Combat System Data Table

These links direct the user to tables that list the names of the Can Fire Targetable Weapons owned by the Combat System. An example is provided in [Figure 48](#).

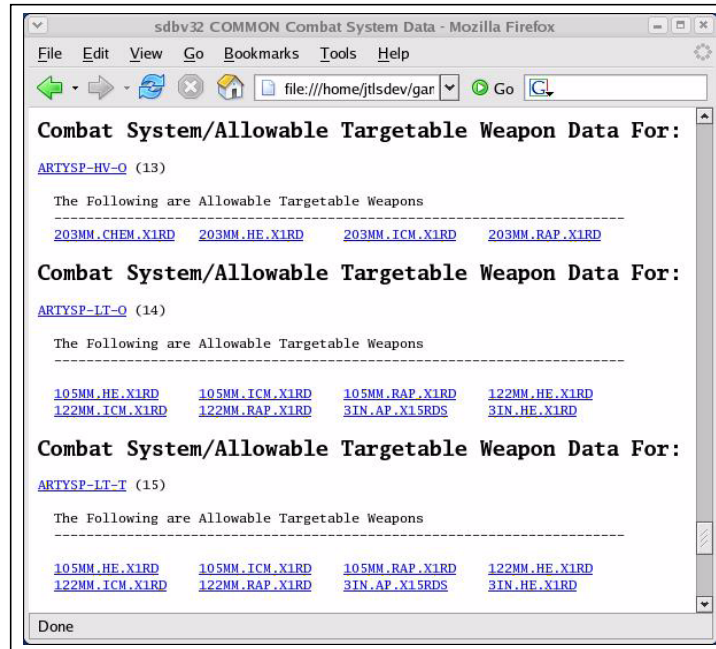


FIGURE 48. OPM Targetable Weapons List

Additionally, each Targetable Weapon entry is a link to its data page, which provides the weapon information. An example is depicted in [Figure 49](#).

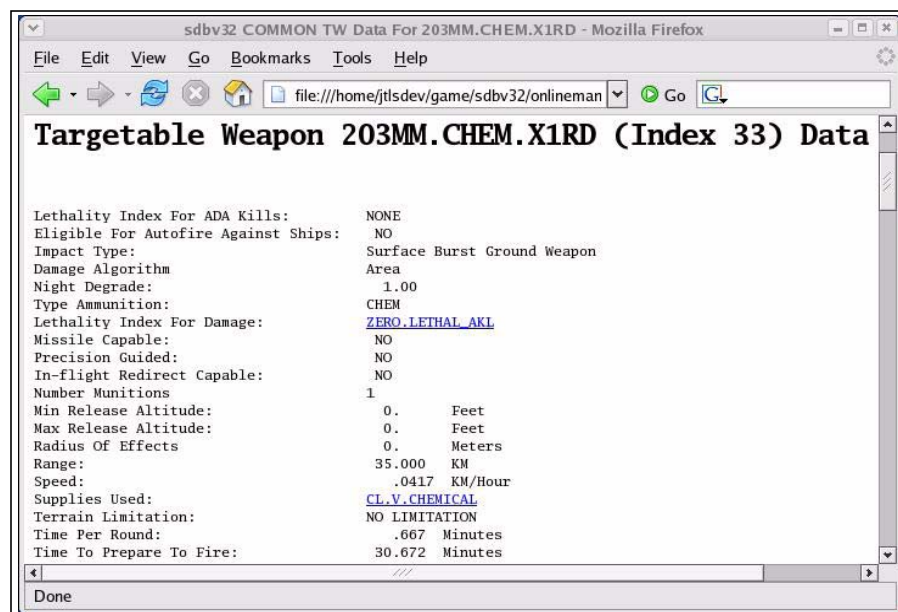


FIGURE 49. OPM Targetable Weapon Data Page

This feature allows a user to easily access all corresponding data of each Combat System and its Targetable Weapons.

2.41.3 Data Changes

No data changes are required to implement this enhancement.

2.41.4 Order Changes

No order changes are required to implement this enhancement.

2.41.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

**2.42 JTLS-2006-1865 TUP Special Capabilities**

2.42.1 Summary of Model Change Request

In previous versions of JTLS, a unit’s identifying graphic symbol was used to determine certain specialized unit capabilities. Currently, all graphic symbols are user-defined and therefore not necessarily consistent between databases. A new methodology was required to indicate that some units have certain special capabilities.

2.42.2 Design Summary

**Table 58** lists the JTLS functions that previously incorporate unit graphic symbols within the modeling logic. Since these symbols will no longer be used to determine certain unit capabilities. This design establishes a new method, indicated by a green colored highlight.

**TABLE 58. Graphics Symbol Modeling Requirement Summary**

GRAPHIC SYMBOL	MODELING USAGE
Civilian	<p>When a unit moves through a hex, its speed is adjusted according to traffic congestion in the hex. A Force Side that places traffic control assets in a hex has the ability to control non-enemy civilian movement through the hex. To support this capability, the model requires a method to determine whether a unit should be considered a Civilian unit.</p> <p>The existing JTLS Faction data parameter FC AFFILIATION specifies either MILITARY or CIVILIAN. If a unit belongs to a civilian-affiliated Faction that is not considered an enemy, the model assumes that the traffic control assets have the ability to control the unit’s movement. This means that this Faction’s units do not interfere with the movement of the units that have the assistance of the traffic control assets.</p>

**TABLE 58. Graphics Symbol Modeling Requirement Summary (Continued)**

GRAPHIC SYMBOL	MODELING USAGE
Medical	After a convoy has delivered supplies to a unit, the convoy determines whether any personnel wounded in action (WIA) or killed in action (KIA) must be evacuated from combat. The model avoids automatically evacuating these personnel from Medical units. The Medical graphic symbol was previously used to make this determination.
	A new TUP attribute, TUP CAPABILITIES TYPE, is added to the model. This attribute can be set to MEDICAL, which indicates that the primary purpose of the unit using this TUP is as a medical unit, and WIAs and KIAs are not be automatically evacuated by the model.
Civil Affairs	All JTLS units have the capability to collect tactical intelligence concerning other units within their immediate vicinity. The Tactical Intelligence Report passes this information to a JTLS Player. The model assumes that Civil Affairs units have a greater ability to collect information due to their relationship with the civilian population in the area. The model also assumes that more information is available in proportion to the amount of time such a unit is located within an area. The Civil Affairs graphics symbol was previously used to determine whether a unit had the ability to create this relationship to gather extended tactical information.
	The TUP CAPABILITIES TYPE attribute is used to identify Civil Affairs units. A unit that the TUP identifies as a Civil Affairs unit is allowed to collect extended tactical information while it remains within a specific area.

As described in [Table 58](#), the same TUP attribute is used to indicate that a unit is either Medical or Civil Affairs, but cannot be designated as both. For these unit types, this attribute functions in the same manner as the graphic symbol it replaces. However, a different attribute identifies Civilian units. Thus, the capability to represent Civilian Medical units, such as civilian hospitals, or Civilian Civil Affairs units, such as news agencies, is available. This modeling distinction was not possible in previous JTLS versions.

No other functional changes are implied by this design.

#### 2.42.3 Data Changes

The TUP CAPABILITIES TYPE data parameter, an attribute of the TUP permanent entity that holds the name value of the TUP's special capability, is added to the database. Its values may be MEDICAL, CIVIL\_AFFAIRS, or NONE

#### 2.42.4 Order Changes

The TUP CAPABILITIES TYPE data parameter is added to the existing SET and SHOW orders.

#### 2.42.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.43 JTLS-2006-1900 Improve Map Entry of Units and Targets

### 2.43.1 Summary of Model Change Request

This improvement of the WHIP Map unit selection feature enables the WHIP user to choose between highlighting all units for selection or highlighting only those units made visible according to the current unit filter settings.

### 2.43.2 Design Summary

The user can enter a unit or target in an order panel field by selecting the unit from the Map, IMT, or Command Tree. The user performs this action by clicking on the Map button of a unit or target order field. This button can be identified by its icon, which resembles the mouse cursor pointer. The Map highlights units that can be selected for a specific order field, based on the constraints of the order field as defined within the model logic. Before this improvement, the Map would highlight only those units and targets that were made visible by the current unit filter settings. For example, if the user had configured the unit filters to hide Support units and attempts to select a Support unit from the Map as an order field entry, no units would be highlighted.

The map selection of units or targets is enhanced to allow the user to choose between Filtered and Unfiltered highlighting of the units or targets on the map. Filtered highlighting is the default display behavior when the user clicks the Map button. This button’s default behavior continues to use the filter settings to highlight the units or targets.

The Unfiltered highlighting is available and is accessed as described in [Table 59](#). Two methods to highlight all eligible objects and two methods to highlight only visible objects are available to the user. New features implemented within this design are indicated by yellow cells. Cells highlighted green indicate existing JTLS functionality that is retained for this enhancement.

**TABLE 59. User Interface Actions**

FUNCTION	UI ACTION	DESCRIPTION
Unfiltered map unit or target selection	Left mouse click with ALT key	The user selects the Unfiltered selection mode by pressing the ALT key while performing a left mouse click on the Map button. All eligible units are highlighted on the Map.
	Right mouse click to access popup menu	The user performs a right click on the Map button. A menu displays two items, Filtered and Unfiltered. The Unfiltered menu option performs no filtering, which causes all eligible objects to be highlighted on the Map.
Filtered map unit or target selection	Left mouse click	The user selects the Filtered selection model. Only those eligible units that are currently visible on the Map are highlighted on the Map.
	Right mouse click to access popup menu	The user performs a right click on the Map button. A menu will display two items, Filtered and Unfiltered. The Filtered menu option displays the highlighted units according to the unit Map filter settings.



### 2.43.3 Data Changes

No data changes are required to implement this enhancement.

### 2.43.4 Order Changes

No order changes are required to implement this enhancement.

### 2.43.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.44 JTLS-2006-1901 Spaces Within Unit Long Names**

### 2.44.1 Summary of Model Change Request

The UT LONG NAME is a text string Unit attribute that holds a maximum of 40 characters, previously excluding the prohibited characters #, ", & and /. Space characters were not allowed in this unit name. The format of the UT LONG NAME attributes must accept spaces characters.

### 2.44.2 Design Summary

A unit's long name (UT LONG NAME) is included in some messages, displayed in the Online Player Manuals, and used by certain external programs. This name is either created by the Database Builder using the DDS, automatically created under certain circumstances such as unit Detaches or Squadron Detachments, or can be created by a Controller as part of an order, such as Create New Unit. Unlike the UT SHORT NAME, the long name is intended to reflect the actual name of a real-world unit that is represented in the game. Therefore, the name text string needs to contain spaces to be consistent with representations of the unit name by other real-world systems and databases.

These JTLS program elements are modified to support this enhancement:

- UT LONG NAME format
- SIP read and write code
- CEP read, checkpoint write, and functional code
- the Create Unit order
- some message types

The UT LONG NAME will remain a text string with a length limit of 40 characters, including its spaces. Several CEP routines were modified to allow this string be held as a text variable with imbedded spaces. The DDS was modified to allow the entry of spaces during database build process.

The SIP is also modified to read long names containing spaces, and to ensure that this data item is properly held as the SIP performs its various functions. No OPM printing code changes were required; the existing code supports printing long names that include spaces. No changes to the SIP Verify or Reports code were required. Finally, no changes to SIP writes of data files designed for use by external programs were required.

The CEP uses the new name format to read long names, hold the names in memory, and to write the names to checkpoint files. Also, the CEP correctly reads those names within the data stream of the Create Unit order. Finally, when a new unit is automatically created, as occurs when a Squadron Detachment is built, the new long name is constructed correctly.

The Create Unit Order order requires that the Controller enter a new Long Name before the unit is created. The order panel allows spaces in this name and the CEP must correctly read the resulting text entry as a value that may contain spaces.

Some messages, generated automatically or in response to Player queries, include the Long Name of an appropriate unit. For these, the CEP sends correctly formatted message data that indicates to the Message Browser where to begin and stop reading an individual text item that may contain spaces. Examples of such messages include: Mission Reports, reports from successful Create Unit orders, and one of the Periodic Summary reports.

#### 2.44.3 Data Changes

The definition of the UT LONG NAME data parameter is modified. Several prohibited characters were added to the existing Range limitations of this data item. The prohibited list currently consists of the following items: #, ", &, \$, @, ', {, }, <, and >.

#### 2.44.4 Order Changes

The Unit Long Name field of the Create Unit order allows entry of a name that includes spaces. The Help text for that field will reflect this change, and also states that spaces should be single blank spaces and not be positioned at the beginning or end of the name. The model allows the use of multiple spaces in unit long names. However, since the long name is intended to represent the real-world unit name, the Help text states that the use of sequential multiple spaces is not recommended.

#### 2.44.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.45 JTLS-1006-1902 Standardize Context-Sensitive Order Menus

### 2.45.1 Summary of Model Change Request

This enhancement extends the ECP entitled **JTLS-0004 Display Range Rings**, also delivered with this release. The Range Rings ECP addresses a requirement to render range data for Units, Targets, and Air Missions on the Web Hosted Interface Program (WHIP) Map display.

Context-sensitive orders are presented when a Player or Controller uses a right-click mouse action to select an object (Unit, Target, HRU, Air Mission, Convoy, or UI Object) name or symbol on the WHIP display. This updates and standardizes, to some degree, the lists of orders displayed for various types of objects when the WHIP user selects them.

### 2.45.2 Design Summary

The initial capability to access orders by using the right-click action provided an initial selection of available orders. This enhancement updates each of these initial order sets.

During development of these order lists, the maximum number of orders to be displayed by means of this feature was considered for each object type. This feature is not intended to replace either the complete order menu structure accessible on the WHIP or the Quick Order access function.

The right-click action displays orders for each of these object types:

- Units
- Targets
- HRUs
- Air Missions
- Supply Runs
- Unidentified Objects

These objects may be displayed on a:

- Map Window
- IMT Screen
- Hierarchy Tool

The selection of displayed orders is determined by:

- Object type
- Force Side: Object or WHIP
- WHIP Type: Player or Controller

- Unit Type: Ground, Airbase, Squadron, FARP, Support, or Naval
- Target Type: SAM.AAA, SSM, Supply Storage, etc.

2.45.2.1 Controller Context-Sensitive Orders

The orders that will be accessed by a Controller WHIP are listed in [Table 60](#) through [Table 65](#) according to object type.

**TABLE 60. Controller, Unit, and Context Orders**

UNIT TYPE	ORDERS
Ground	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD
Airbase	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD
Squadron	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD Controller Change Maintenance Aircraft Time

**TABLE 60. Controller, Unit, and Context Orders (Continued)**

UNIT TYPE	ORDERS
FARP	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD
Support	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD Query Convoy Status Show Pushes
Naval	Magic Move Set Individual Parameters Set Unit Combat Systems Set Unit Supply Categories Set Unit Small Boats Set Unit Disease/Failures Controller Change Unit Damage Combat Systems Damage Supplies Manage TPFDD

**TABLE 61. Controller, Target, Context Orders**

TARGET TYPE	ORDERS
All 21 Target Categories	Controller Change Target Set Target Parameters

**TABLE 62. Controller, HRU, Context Orders**

HRU TYPE	ORDERS
All, performing any mission	Magic Move Set High Resolution Unit Parameters

**TABLE 63. Controller, Air Mission, Context Orders**

MISSION TYPE	ORDERS
All Air Mission Types	Damage Air Track Magic Replenish

**TABLE 64. Controller, Supply Run, Context Orders**

CONVOY POSTURE	ORDERS
Any Posture	Cancel Convoy

**TABLE 65. Controller, Unidentified Objects, Context Orders**

UI TYPE	ORDERS
Unidentified Unit	Controller Fusion Remove Unidentified Object
Unidentified Target	Controller Fusion Remove Unidentified Object

#### 2.45.2.2 Player Context-Sensitive Orders

The orders that will be accessed by a Player WHIP are listed in [Table 66](#) through [Table 71](#) according to object type.

**TABLE 66. Player, Unit, Context Orders**

UNIT TYPE	ORDERS
Ground	Withdraw Fire Artillery Clear Minefield Rules of Engagement Create HRU Attach Detach Mandatory Transfer Situation Report Move Attack Defend CAS Request SOF Alert Bridge Operations
Airbase	Fire Artillery Rules of Engagement Attach Detach CAS Request SOF Alert Tenant Activity Eviction Notice Logistics Report Situation Report
Squadron	Orbiting OAS Combat Air Patrol RECCE Air Refuel Airlift/Airdrop Insert/Extract Armed RECCE SOF Alert Situation Report Mission Report Air Unit Report
FARP	Fire Artillery Clear Minefield Rules of Engagement Create HRU Attach Detach CAS Request SOF Alert Logistics Report Situation Report

**TABLE 66. Player, Unit, Context Orders (Continued)**

UNIT TYPE	ORDERS
Support	Fire Artillery Attach Detach Transport Unit Directed Resupply Query Convoy Status Alter Requisition Parameters Mandatory Transfer CAS Request SOF Alert Port Report Bridge Operations
Naval	Fire Artillery Fire Missile Emission Control Patrol Naval Move Rules of Engagement Cancel Naval Mission Create Formation Change Naval Movement Situation Report Naval Shadow Change Station Join Formation
Foreign Unit	Attack Assign Target Fire Artillery Fire Missile

**TABLE 67. Player, Target, Context Orders**

TARGET TYPE	ORDERS
SAM / AAA	Repair Target Change AD Support
SSM	Repair Target Change Launcher Status
Bridge	Repair Target Bridge Operation
Supply Storage	Repair Target Target Log Report
Sensor Site	Repair Target Emission Control



**TABLE 67. Player, Target, Context Orders (Continued)**

TARGET TYPE	ORDERS
Jammer	Repair Target Emission Control
All Other Categories	Repair Target
Foreign Targets	Air Ground Attack Assign Target Destroy Target HRU Raid Fire Artillery

**TABLE 68. Player, HRU, Context Orders**

HRU MISSION	ORDERS
All, performing any mission	HRU Move HRU Task HRU Set Ambush HRU Patrol HRU Raid HRU Overwatch Fire Missile

**TABLE 69. Player, Air Mission, Context Orders**

MISSION TYPE	ORDERS
All 18 Air Mission Types	Rules of Engagement Manual Pair Break Off Assign Target Cancel Air Mission Air Movement Report Assign Target Assign Multi-Target Manual Pair Break Off Change Air Mission Parameter Cancel Air Mission
Foreign Air Missions	Manual Pair Break Off

**TABLE 70. Player, Supply Run, Context Orders**

CONVOY POSTURE	ORDERS
All, regardless of Posture	Query Convoy Status
Foreign Convoys	None

**TABLE 71. Player, Unidentified Objects, Context Orders**

UI TYPE	ORDERS
Unidentified Unit	Fuse Unidentified Object, Remove Unidentified Object
Unidentified Target	Fuse Unidentified Object, Remove Unidentified Object

### 2.45.3 Data Changes

No data changes are required to implement this enhancement.

### 2.45.4 Order Changes

No order changes are required to implement this enhancement.

### 2.45.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## 2.46 JTLS-2006-1904 Transparent Hex Terrain Overlay

### 2.46.1 Summary of Model Change Request

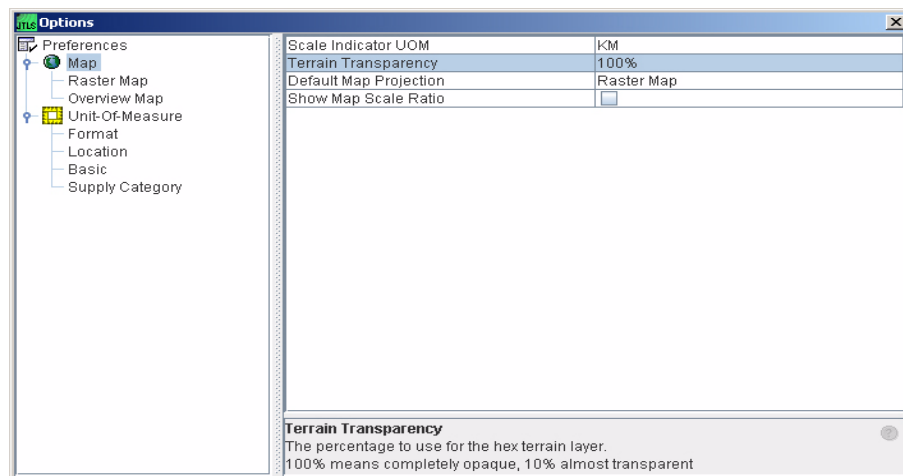
This design separates the requirement for transparent overlay of the JTLS hex terrain from the digital map feature addressed by the ECP entitled *JTLS-0307 Digital Maps with Hex Overlay*. This initial interface design provides for the WHIP display of digital maps simultaneously with the JTLS hex terrain model. However, the display of hex terrain as a transparent overly is currently considered to be a distinct imaging feature.

### 2.46.2 Design Summary

The JTLS hex terrain display in the WHIP Map window included with the initial Web-hosted interface prototype was previously rendered as an opaque layer. When the hex terrain is visible, all

map data beneath this layer is obscured. This enhancement provides a user-managed preference that controls the degree of transparency with which the hex terrain layer is rendered.

A Terrain Transparency property is now available in the WHIP Preferences Manager that provides the user with ten levels of transparency from 10% to 100%. Changes in the terrain transparency value are immediately reflected in the Map display. As a user Preference, the terrain transparency property is saved and restored with all other Preference data. When the WHIP is started, the hex terrain layer uses the previously saved terrain transparency value set by the user. **Figure 50** depicts the Terrain Transparency preference field as it is displayed in the Preferences Manager.



**FIGURE 50. Terrain Transparency Preference Field**

**Figure 51** depicts a map window with no terrain visible. The littoral boundary is visible. **Figure 52** depicts the same map view with the hex terrain displayed at 100% transparency. Note that the littoral boundary is not visible. **Figure 53** depicts the same view with the hex terrain displayed at 80% transparency. Note that the underlying littoral boundary is visible beneath the hex terrain layer.

Transparent rendering requires intensive computation. Hardware-accelerated graphics drivers are required for workstations in both Linux and Windows environments to provide satisfactory performance and user interface response. Most Windows-compatible graphics drivers provided with current graphics adapters utilize hardware acceleration. A hardware-accelerated graphics driver and X-Windows server must be used in the Linux environment. Otherwise, WHIP performance on this platform will be inadequate.

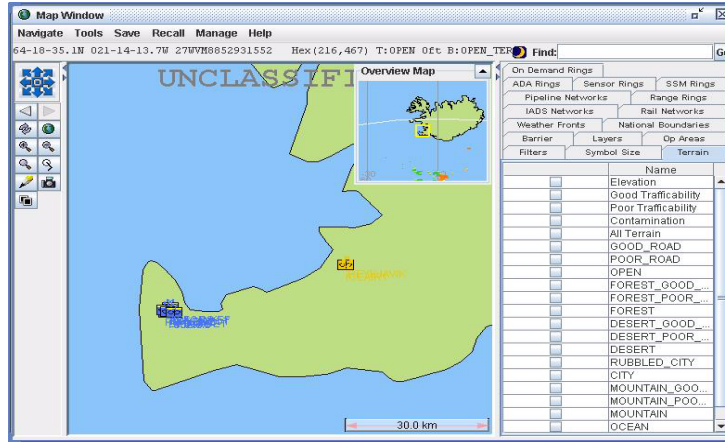


FIGURE 51. Hex Terrain Not Displayed

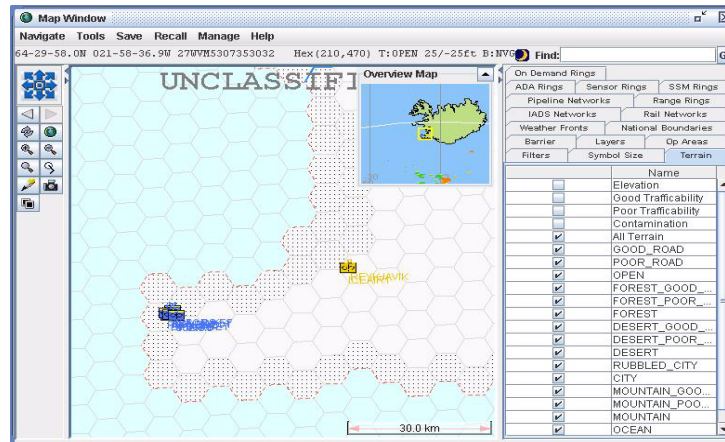


FIGURE 52. Terrain Visible at 100%

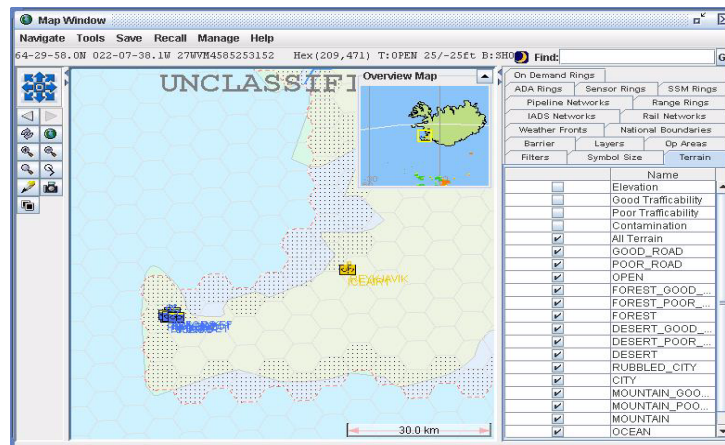


FIGURE 53. Terrain Visible at 80%

### 2.46.3 Data Changes

No data changes are required to implement this enhancement.

### 2.46.4 Order Changes

No order changes are required to implement this enhancement.

### 2.46.5 JODA Changes

No JTLS Object Distribution Authority changes are required to implement this enhancement.

## **2.47 JTLS-2007-1973 JTLS Feed To Common Operational Picture (COP)**

### 2.47.1 Summary of Model Change Request

Many users have created their own programs to pass current JTLS force status information to real-world Command, Control, Communications, Computers, and Intelligence (C4I) systems. Although all JTLS exercises conducted by the United States Government fed real-world (C4I) systems, the JTLS system did not include a configuration-managed capability. This enhancement delivers this capability within the JTLS software suite.

### 2.47.2 Design Summary

The program developed to provide communication with (C4I) systems is known as the JTLS Operational Interface (JOI). JTLS 3.1.3.0 provided the initial delivery of this ongoing JOI project, which is continuing for the JTLS 3.2 release series. The currently developed capability allows all JTLS 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.

The JOI is a JTLS Object Distribution Authority (JODA) client that has the capability to easily start and stop the feed of these OTH-Gold messages according to the status of the JTLS game. The JOI has the capability to alter the naming data passed to the real-world systems. Consequently, any database object naming errors can be corrected independently of the model to allow the exercise audience to view correct names while monitoring the real-world system that is populated by the JOI.

The JOI has a complete checkpointing capability and can be restarted from any of its checkpoint files without losing information. Although this JTLS release provides limited JOI documentation, future releases will describe the capabilities and limitations of this new software component.

### 2.47.3 Data Changes

No data changes were required to implement this enhancement.

### 2.47.4 Order Changes

No order changes were required to implement this enhancement.

### 2.47.5 JODA Changes

No JODA data structure changes were required to implement this enhancement; however, a model change was implemented to support the JOI capability. JTLS now updates an object's Last Detection Time attribute for the owning Side. This JODA data field was not updated for the objects's owning Side in previous model versions, since detection of a user's own forces is not required within JTLS. This data attribute was updated for all other Sides, excluding the owning Side. Within JTLS 3.1.3.0, the Last Detection Time for the Owing Side attribute represents the most recent instance the object's location was passed to the JODA. These data are required to properly input the position time required by the OTH-Gold message format.

## 3.0 SOFTWARE TROUBLE REPORTS

### 3.1 INTRODUCTION

This chapter describes the software error corrections implemented for this release.

### 3.2 ERRORS CORRECTED FOR THIS RELEASE

Software Trouble Reports (STRs) describe code errors that were discovered and corrected for this release. Code corrections completed for the JTLS 3.1 series of releases have been tested with the model enhancements delivered with JTLS 3.2.0.0 and are included. STRs that are still outstanding are listed and described in Chapter 4. The errors described herein were corrected as part of JTLS 3.2.0.0 and have not been corrected in any previous versions.

#### 3.2.1 JTLS-1386 Accept Ownership And Use For New Runway

*If you create a new runway during the game, the runway cannot be assigned to an airbase and used by the airbase. The Controller must Magic Move the airbase in and out of the hex to accomplish the task*

Solution: When creating the new runway, the user must specify that the runway is to be owned by a specific airbase. When this is done, the new runway is given to the specified airbase and is available for its use. Once the airbase owns the runway, the user may have the airbase give permission to other units to use the new runway.

#### 3.2.2 JTLS-2007-1993 Zero Used As Invalid Detection Time

*In the JODA protocol, -1.0 detection time was customarily sent to indicate no detection. This value was intended to distinguish between no detection and a time zero detection. Since the delivery of the JTLS 3.0 series, the CEP code was modified to use a variable named RL.NEGATIVE.ONE, to replace hard-coding this value. This variable was never initialized, and thus held a value of 0.0. Therefore, distinguishing between a time zero detection and no detection based solely on the detection time was not possible.*

Solution: The variable was switched to a define to mean and assigned a value of -1.0. This change may affect JODA clients that receive and process detection times of Units, HRUs, Targets, and Cruise Missiles.





## 4.0 REMAINING ERRORS

### 4.1 INTRODUCTION

Every effort has been made to correct known errors in the model. All reproducible errors that resulted in a CEP catastrophic software failure (Crash) have been corrected. Other corrections were prioritized and completed according to their resource cost-to-benefit relationship.

Correction of the remaining STRs, however, must be postponed to a later version due to time and resource constraints. These problems may be corrected prior to the next release of JTLS. If an immediate need arises for a code correction to any of these outstanding STRs (i.e., for an exercise planned to occur before the next release), contact the JTLS Configuration Management Agent. (Refer to the Abstract of this document for the current address.)

### 4.2 REMAINING ERRORS

The errors described in this section should be noted specifically because they affect the basic functionality of JTLS. Information is provided regarding the extent of the error, as well as suggestions to avoid or minimize the effects of the problem.

#### 4.2.1 JTLS-0639 Error Determining When Engineering Task Completed

When a Unit starts a directed Engineering Task, the time to complete the task is based on the Unit being at 100%. The time to complete a task is adjusted for the Unit's COMBINED EFFECTIVENESS. Stronger units complete tasks faster than do weaker units. The task completion event is then scheduled at the computed time. At this scheduled completion time, the code checks whether enough time has actually elapsed to complete the task. If the Unit was at more than 100% COMBINED EFFECTIVENESS when the task started (meaning the task completed earlier than if the Unit were at 100%), it appears to the model that not enough time has passed and the task is not credited as complete.

#### 4.2.2 JTLS-0695 Shadow Distance Of Zero Overriding Protection Radius

In the routine SEND INTERCEPTOR, the model is determining which interceptor to send. If this is a protection radius CAP mission, it gets the minimum of PROTECTION RADIUS and SHADOW DISTANCE. If this is zero, then the logic says there is really an infinite protection radius. This seems odd. If someone forgets to set SHADOW DISTANCE, then protection radius is ignored. As a minimum, this needs to be either documented or changed so that a zero SHADOW DISTANCE means ignore shadow, not make protection radius infinite.

#### 4.2.3 JTLS-0696 Missions Ignoring Assigned Altitude on Egress

Why aren't missions observing their assigned altitudes on a egress path? Somewhere the posture of

the mission was changed to HEADING HOME when it is on its egress route. This causes the mission to automatically set its altitude to avoid air defense.

#### 4.2.4 JTLS-0697 Missions On The Ground With Invalid Destination

Missions on strip alert report a next destination latitude/longitude on the IMT. The destination coordinates should be cleared for missions on strip alert.

#### 4.2.5 JTLS-0698 Cannot Re-Activate Destroyed Targets

Some facility targets are 0% capable and not displayed on the GIAC. They need to be reactivated for the ATO. Activation cannot be done with Controller Change Target because their GDS active flag is set to zero.

#### 4.2.6 JTLS-0699 Targets That Require An Owner Are Disassociated

Targets owned by an HRU that die in combat are disassociated from the HRU and from their associated unit. When a checkpoint is taken, both fields are written as NONE. On restart, this causes a crash for ADA targets.

#### 4.2.7 JTLS-0700 GIAC Not Displaying Current Runway Length

A runway has 21% strength, but the GIAC displays the maximum length and current length as equal to the maximum length. In the GENIS, the percent capable is reduced, but the range and current length values are the same. The model does not appear to update the current length to the GDS when it changes.

#### 4.2.8 JTLS-0701 Air Movement Report Does Not Consider Hold Points

When an air movement report is requested, it does not take into consideration scheduled delays in the delivery instructions. As a result, it indicates an earlier departure time at each point, and an earlier completion time for the mission.

#### 4.2.9 JTLS-0702 Mission Waiting For Delayed Mission

An air mission package had an attack mission that went into weapons delay. The user told another attack mission to join the package, but did not cancel the old mission. The new mission launched, dropped its weapons, and then turned into an Escort and waited for the old Attack mission that was still in Weapons Delay. The logic needs to be improved.

#### 4.2.10 JTLS-0703 Periodic Report Other Side Airbases Lists No Activity

The Periodic Report Other Side Airbase Summary lists all the airbases but for each one says there are no squadrons operating there. On the GIAC, you can click on the enemy airbase and see squadrons there. Click on the squadron and it says that the home base is the expected home base. Discrepancy is

that the periodic report in BUILD FOREIGN BASE SQUADRON REPORT looks for squadrons at the airbase, and perceived combat system aircraft for that squadron. If no aircraft have been perceived, then it does not count as an operational squadron. There is no check whether the squadrons are actually perceived to be associated with the airbase; truth is used instead. This provides free intelligence. The discrepancy is that GIAC reports the home base but it does not show on the periodic report.

#### 4.2.11 JTLS-0704 Immediate Cancel Of Air Mission in Delay Status

During a recent exercise, the air cell sent an Air Transport Order in which the aircraft was directed to remain on the ground at its home base until a certain time. This was a error, and the controller cancelled the mission. The mission did not cancel immediately, but waited until the “holding posture” time was complete and then cancelled. The Controllers stated that the mission should have cancelled immediately.

#### 4.2.12 JTLS-0705 Missions Launching With Fewer Aircraft Than Available

A mission that cannot get its resources goes into the UT AWAITING LAUNCH SET CAN YOU LAUNCH looks only at missions in this set. If CAN YOU LAUNCH assigns enough aircraft to meet the acceptable launch fraction, the mission is removed from the UT AWAITING LAUNCH SET and a launch event is scheduled. Thus, once a mission gets the aircraft to launch, it will not fill up to its full complement even if aircraft become available.

#### 4.2.13 JTLS-0843 Error 427

When a ship and formation was in a dual capable hex, this error message appeared in the verify: “Error 427: Formation, <name>, has been placed at hex location ###,###. This location is not specified as water.” No error was recorded for the ship, which was located in a dual capable hex. An error message should not be generated if the ship and formation are in a water, dual capable, or small island hex.

#### 4.2.14 JTLS-0846 Naval Unit Distance Calculation

A Player ordered naval Unit A to arrive at a point due west 100 nautical miles away at a time 12 hours later with a speed of 10 knots. Naval Unit B was ordered at the same speed and direction to arrive 24 hours later at a destination 200 nautical miles away. Unit A arrived 1.5 hours late and Unit B arrived 3.0 hours late. The orders were repeated for both units to arrive at points 100 and 200 nautical miles due north. The units arrived within 15 minutes of their expected arrival time. Although a speed of 10 knots was ordered, the speed displayed for each unit in the SITREP window was 9.7 knots. The model appears to not calculate the additional distance required when a unit follows an irregular path from hex center to center. The problem does not appear when a unit follows a direct path from hex

center to center in any direction.

#### 4.2.15 JTLS-0865 Incorrect External Program Order

If a non-GIAC program sends an incorrect order to the CEP, the CEP attempts to detect the error and generate a Player message reporting it. The model crashed generating this message while executing an order generated by the JTLS HLA Interface Program (JHIP).

The CEP code was modified to be stable under this specific circumstance. This does not guarantee that another erroneous order sent to the model will not cause a different problem in another portion of the code. Processing an order through the Order Verification Tool before submitting it to the model is the only procedure which assures that such errors and crashes will not occur.

The JHIP condition which initially caused the problem was not a code error, but a mismatch between the JHIP version in use and the version of the External Update order used by the CEP. The order version was updated to match the JHIP version. This problem is not considered an STR because it was discovered in a delivered non-official interim release of JTLS.

#### 4.2.16 JTLS-0869 Continue Engage Determination

The A CONTINUE ENGAGE parameter is not used in JTLS 3.0. Due to the complete change of the air-to-air algorithm in this version, the determination of when and how an air mission decides to continue the engagement needed to be redone. This was not completed prior to the release of v3.0. It is the desire and intent of the design team to restore this capability to the model.

#### 4.2.17 JTLS-0870 Number of Air-to-Air Combat Kills Allowed

The code allows the weapons from a firing aircraft to kill only one enemy aircraft. A specific aircraft should be able to target and kill multiple enemy aircraft up to its weapon control capability. This is calculated as the number of weapons fired by the aircraft divided by the maximum number of weapons allowed per enemy.

#### 4.2.18 JTLS-0871 AC Mission Weapon Drop Determination

Currently, an air mission drops all of its air-to-ground weapons when an aircraft is killed in air-to-air combat if the AC Weapon Drop Flag is YES. This flag value should also allow a mission to drop non-precision guided weapons when it is fired upon in air-to-air combat.

#### 4.2.19 JTLS-0906 Change ADA pE To Per-Element pE

An Air Defense Class has a Probability of Engagement (pE) against each of the Aircraft Target Classes. If detection by a sensor on an IADS network is prompting the engagement, then the pE is assumed to be 1. The following applies only to non-IADS detection and engagement attempts. Each time an air mission enters a hex within the SAM-AAA target altitude-range criteria, the SAM-AAA target attempts to detect the air mission with its fire control sensor. If the detection is successful then

the SAM-AAA target makes a pE attempt. It doesn't matter how many elements are in the target, only one detection attempt and one pE attempt are made per hex. But each element, by definition, has an independent fire control ability.

Each fire control sensor in the multi-element target should conduct a detection attempt. For each successful attempt, a separate pE attempt should be made. Assuming there is some form of command and control within the elements of a specific SAM-AAA target, the actual firing can still be limited to one element.

#### 4.2.20 JTLS-0907 Scud-Like SSM Representation

It is difficult to represent the effects of long-range ballistic missiles. Different missile types have various levels of accuracy in the CEP. However, in JTLS the missile will always hit its aimpoint. To reflect the inaccuracy of these missiles, it is typical to assign them an unrealistically large TW Radius of Effects. This usually results in very low damage effects from these weapons.

A new measure of the missile's accuracy could be added to the CEP as a new database value, and used to randomly determine the impact point of the weapon in a region surrounding the aimpoint. Thus, the actual weapon impact effects could be properly represented within the model.

#### 4.2.21 JTLS-0908 Naval IADS Link Representation

The IADS network for ship units is computed during the exercise as needed, based on the current location of ships which have Comm Sites. In some cases this can be CPU-intensive. Currently, all ship-owned Comm Sites can serve as hubs, i.e., these sites can send and receive all information. In reality, only a few ships serve as hubs or air defense control centers for the Task Force. The other ships' Comm Sites are used only to pass detection information to the hubs, and receive detection information and fire guidance.

A new Comm Site data parameter should be added to designate that a Comm Site subcategory is a hub. A ship with a Comm Site target that is not hub-capable can link only to a ship with a Comm Site target that is hub-capable. A ship with a hub-capable Comm Site target can link to any other ship with any Comm Site target, within current side and distance restrictions.

#### 4.2.22 JTLS-0909 Display Moderate And Severe Attrition Level

There is no capability to query whether a unit is suffering Moderate or Severe Attrition Level effects. This capability should be added to the Unit Situation Report.

#### 4.2.23 JTLS-0910 HRU Patrol Intel Reports

Typically, many HRUs are conducting intelligence gathering patrols simultaneously during an exercise. Too frequently, they are collecting on "ANY UNIT". These messages are all broadcast messages, controlled by the Intelligence selection of the Broadcast Options menu. A workstation operator has no capability to limit received intelligence reports to only those of interest. The HRU

Patrol Intelligence message should be modified from a Broadcast message to a Sending Workstation message.

#### 4.2.24 JTLS-0911 Fire Artillery Wait Time Between Missions

Artillery can be fired continuously within the simulation. Ammo constraints can be played through supply category quantities, but frequently aren't because logistics is not a training objective. Artillery cannot realistically fire continuously without a cool-down period and maintenance time. The crew also needs to eat and rest at some point. The overuse of artillery during exercises has been an issue for several years.

Enforcing a minimum time between fire missions is a recommended capability. This could be accomplished with a fixed database value, a database percent of the previous fire mission time, or a FLP value. As a fixed value, 10 minutes would mean no new fire mission could start until at least 10 minutes after the completion of the previous fire mission. As a percentage, 25% would mean waiting 2.5 minutes if the previous fire mission time was 10 minutes, or waiting 15 minutes if the previous fire mission time was one hour. Fire missions that are broken up because of the combat assess or the max fire mission time should not be subject to the wait time between the split parts of the mission. Priority Counter-battery missions should not be subject to the wait time because they are priority missions and very time-dependent. Just as the number of hours a day that a unit can move is limited, a similar limit could be put on the number of hours a day that a unit can fire.

#### 4.2.25 JTLS-0929 Ship Changes Sides

A Thailand ship changed sides when a Mandatory Transfer order was given to a US ship. The ship (FFG-456) was ordered to join an AOE-2.f formation. The Mandatory Transfer order to AOE-2 to give FFG-456 50,000 gal of Cl.III Navy was rejected for the reason that FFG-456 appeared to have changed sides.

#### 4.2.26 JTLS-0934 HRU Overwatch

An HRU was created and assigned overwatch of a flying squadron. The model refused the overwatch and reported "Unit is already in land combat, and not eligible for new overwatchers." The flying squadron had been attacked by terrorist HRU, which was no longer present in the area, as shown on both U.S. and Controller views. Unit was at 84% strength. IMT showed flying squadron as being in combat. When HRU broke off, flying unit should have come out of "In Combat" posture. The HRU should have accepted overwatch responsibilities.

#### 4.2.27 JTLS-0942 Air Transport Cannot Combine Wet And Dry Supplies

When both wet and dry supply categories are included in the same Transport Instructions List for an Air Transport mission, they will not be transported at the same time. The first supply category shipment type will be loaded, but the second will not. If both are included in the same Supply List, the wet category is preferred. The aircraft go through the motions as if loading and delivering the denied

category, including MISREP confirmation. No pickup or delivery is made, although an empty storage area may be created. There is no documentation to support this situation, and the user is not notified of the problem.

#### 4.2.28 JTLS-0948 Lanchester Double Kills

When two opposing units' centers are within DECISIVELY ENGAGED DISTANCE of each other, 100% of the combat systems are eligible to kill each other. The combat power distribution of the units is used to determine which combat systems are eligible to kill units in the same or adjacent hexes that are not co-located. This can lead to some combat systems being allocated to kill twice in a single Assess Combat period.

#### 4.2.29 JTLS-0949 Destroyed Target SITREP Strength Incorrect

When a target is destroyed, such as a bridge or pumper station, the GIAC SITREP still has the strength of the target as 100. GENIS also displays strength as 100. Apparently, the percent capable is being updated in GENIS from JTLS, but not the strength which is used to fill the GIAC SITREP. This is a problem in both 1.85B and the 2.0 versions

#### 4.2.30 JTLS-0950 JTLS Radius Of Effects

The radius of effects for air missions is not being calculated correctly. The analyst guide states that the radius of effects is determined by the TW.RADIUS.OF.EFFECTS of the area weapons employed and the delivery altitude of the air mission. At the max altitude for the aircraft type, the covered area is the total area for all area weapons fired. Testing has shown that the max radius of effects occurs when the aircraft's mission altitude is anywhere between one half the max aircraft altitude and max aircraft altitude. In the routine, Determine Covered Radius, the area overlap calculation statement shows the max altitude multiplied by 0.5. As such, the radius of effects is not calculated correctly.

#### 4.2.31 JTLS-0952 Air Report

JTLS 1.85 provided the ability to obtain the report for one squadron or all squadrons. JTLS 2.0 only provides capability to get one unit at a time.

#### 4.2.32 JTLS-0953 All Sides Informed About Supply Dump Error

Created a supply dump using the Cache Order. Looking at the GDS shows that all sides are informed about the dump; they show up on all sides IMT. Only the controller and the side that created the dump should be initially informed about the dump.

#### 4.2.33 JTLS-0954 Multiple Supply Storage Targets

A supply storage target should not be allowed to be created in the same hex as another one on the

same side. A user was able to create several open storage supply targets right on top of each other.

#### 4.2.34 JTLS-0955 Air Lift Drop Report Message

The subject line of the message received when a player requests an air lift drop report for a mission that has completed the lift or drop, or is not conducting a lift or drop, reads “Air Order Received, <mission name>, Cannot Comply”. It should be titled, “Air Lift/Drop Report Cannot Comply”.

#### 4.2.35 JTLS-0956 MPP Messages For Canceled Missions In Error

If an airbase is magic moved with several squadrons on active missions that need to be canceled or with squadrons in the middle of a self lift, the subsequent message generated for the situation has several errors. The changes required are too risky during the exercise. The problem will not cause a crash, but will cause the MPP to incorrectly display the message contents.

#### 4.2.36 JTLS-0957 Can't Take Control Of Unowned Runways

It is impossible for anyone to take control of an unowned runway in the hex it is already in. To do this the controller must enter the order, but the order is not on the controller's menu. We have tested this on a sample menu, it doesn't crash but the runway's owner is not set.

#### 4.2.37 JTLS-0958 Withdrawing Units Cannot Destroy Supply Targets

There appears to be an error in the interface between the CEP routines DESTROY CACHES ON LEAVING and IS TARGET SAFE. The first calls for supply targets that are another side or BLACK, but the second always says BLACK targets are safe. This means that a unit withdrawing will never destroy BLACK SUPPLY TARGETS, even if they could do so. The code needs to be updated, a complicated fix.

#### 4.2.38 JTLS-0959 Logistics Report Problem

The Logistics Report will report amounts as single decimal points (e.g., “.”). This is caused by format D(8,0), and an amount smaller than 1 ton. To correct this situation, all of the Logrep files need to be checked to determine if it is feasible to change the D(N,0) format specifications to at least D(N,1).

#### 4.2.39 JTLS-0960 Can't Magic Move Airbase To Existing Airbase Location

One cannot Magic Move an airbase into a hex wherein there is a runway that is on the same side as the airbase, and is part of the initialization database. The airbase will not automatically assume control of the runway. If the runway is one that was created by Controller action, the airbase will assume control of it. If this error is causing problems for upcoming exercises, the Configuration



Manager should be contacted for a code fix to solve this problem

#### 4.2.40 JTLS-0961 Group Ground Move Delayed To Lead Unit

There is a problem when a group ground move is sent. The directive is delayed to the lead unit. When the lead unit learns about the move, it immediately tells the units in the follow-on group. This could lead to directives being received out of order. Assume the user sends a directive at 0100 and the CEP determines the lead unit should receive the message at 0200. The lead unit cannot receive any other directives until after 0200. The CEP ensures that directive receipt is in the same order as the user sent the directives. This is not true for the follow-on units. If the user sent an order at 0115 directly to one of the follow-on units, the follow-on unit could receive the 0115 directive prior to the order sent at 0100. If this error is causing problems for upcoming exercises, the Configuration Manager should be contacted for a code fix to solve this problem.

#### 4.2.41 JTLS-0962 Pass Unit Intelligence Does Not Include Update Information

Pass Unit Intelligence does not follow any of the Update Information logic, so we are not going through routines such as Alter Launch New Information procedure. This can cause Air Missions to head toward old perceived information locations if they rely totally on the information obtained through Pass Unit and Pass Target Intelligence capability. If your scenario involves a side which depends solely on this intelligence collection methodology and the side will be sending attack missions, the Configuration Management Agent should be contacted immediately to obtain a proper fix to this problem prior to your exercise.

#### 4.2.42 JTLS-0963 IMT Supply Category Line Disappears When Value Is Zero

Recommend that a Unit's IMT On-Hand Supplies (OHS) specific category line remain when supplies are gone and no Due-Ins are established.

When a unit runs out of a supply category and no Due-Ins are scheduled, the unit's IMT On-Hand supply line for that specific category disappears from the menu. This makes it very difficult for a player who is controlling 40 or more unit icons and being overwhelmed at times with MPP messages to keep track of exactly what supply categories need his attention or thwarts his attempts to troubleshoot a supply problem. The constant presence of the supply category line, even if empty, will save the Player wasted time either making early printed copies of all his unit OHS for later comparison or referring unnecessarily to the OPM TUP/SUP to determine what empty supply categories his units have that require resupply. Certain supplies (i.e. fuel/targetable weapons) are critical and unnecessarily impede game execution, if not maintained at required levels for play in an automated logistics scenario.

#### 4.2.43 JTLS-0964 Reporting Bridge Damage

When an aircraft conducts an air-to-ground mission against a highway bridge, damage reporting is not consistent. When the aircraft returns and the mission report says the bridge is at 0% capability, the

IMT and SITREP still report the bridge capability as 100%. When another aircraft is sent against the bridge, it flies over and doesn't drop any munition because, according to the mission report, the target isn't there (it's destroyed). When this aircraft returns, the IMT and SITREP still report the bridge at 100%. Much later, although not consistently, the bridge status changes in the IMT and SITREP to 0%. If the bridge is destroyed, the IMT and SITREP should reflect the information provided in the Mission Report. The problem reported is being investigated. If this is causing a problem for an upcoming exercise, the Configuration Manager should be contacted to implement a fix to the problem as soon as possible.

#### 4.2.44 JTLS-0965 Error In Time Report For SET SP CONVOY DELAYS

When a time value of 2 hours 0 minutes is entered into any field of the SET SP CONVOY DELAYS window and then sent to the CEP, the MPP returns a message that shows a time of 1 hour 0 minutes instead. This is a known round-off error. A solution is being investigated.

#### 4.2.45 JTLS-0966 Incorrect Mission Report Locations

Some mission report locations appear to be incorrect. The ADA engagement location is an example. The problem is being investigated.

#### 4.2.46 JTLS-0967 Fire Mission Not Deleted From GENIS

It appears that, in some circumstances, an Artillery Fire Mission that has been reported to the IMT is deleted from the CEP without the GENIS being informed. This happened in the case of a unit that was moving when it was supposed to fire the mission. The Fire Mission still showed on the IMT several hours later.

#### 4.2.47 JTLS-0968 Inconsistency Between Regular Run And Pusher

There is a major inconsistency between a regular run and a run created using pusher. When an order with ASAP is sent, the READ KEYWORD routine sets the data parameter to TIME.V. When pusher reads in the order, TIME.V is much earlier than it was when the order arrived in the first place. For orbiting missions and alert missions, this alters when they will go off alert by a great deal. This must be fixed and made consistent. It appears that both TIME.V and order receipt time must be saved to the ci1 file to accomplish this task.

#### 4.2.48 JTLS-0969 Changing Mission On Alert

When a ship moves, it changes the attributes of missions that are on alert. It also needs to change alert hex for those missions that are not currently on alert, but still have their alert hex pointing to the ship's

location.

#### 4.2.49 JTLS-0970 Availability Of Aircraft

When a unit loses a fraction of an aircraft to Area Fire or Lanchester combat, the whole aircraft becomes unavailable for air missions. However, the report of Available Aircraft on the IMT is expressed in whole numbers. This may result in a unit incorrectly showing a damaged aircraft as available.

#### 4.2.50 JTLS-0971 Ship Continuous Tracking Not Working

The new unidentified object design indicates that ships which are continuously tracked will not have unidentified objects created. A continuously tracked Naval unit and all of its targets are creating unidentified objects. They should not be doing this.

#### 4.2.51 JTLS-0972 Air Mission Find In Middle Of Ocean

A user does a find on a pre-launched air mission that is home based on a moving Naval unit. The X marking the location of the pre-launch mission is where the Naval ship was when the order entered the system. As the ship is moving, the new location of the pre-launch mission is not being sent to GENIS and thus GIAC.

#### 4.2.52 JTLS-0973 Periodic Report Air Supplies And Fuel Not Correct

The arrays which hold air supply usage are not being maintained correctly given the new MISSION RESOURCE ALLOCATION event.

#### 4.2.53 JTLS-0974 Submarine Detection By Ground Sensors

A moving submarine does not get full credit for coverage time by sonars on board other ships or submarines. It gets full coverage time for airborne sensors but not ground based sensors.

#### 4.2.54 JTLS-0975 GDS Target Update Error

When the CEP accomplishes a GDS Target Update, the GENIS ends up knowing about the re-initialized target, but the GIAC does not.

#### 4.2.55 JTLS-0976 Manual Pairing And Protection Radius

The JTLS 2.1 Analyst's Guide, Section 8.4.8.2, second paragraph discusses the rules for manual pairing of CAP missions. The paragraph states that the manual pair order will only check to determine if the new interceptor has enough fuel and appropriate weapons before sending it.

In the model however, a manual paired mission will do the following if the intercepted mission is out of the protection radius of the interceptor. The interceptor will move one hex towards the intercepted

mission, and then return to its orbit location.

#### 4.2.56 JTLS-0977 Slightly Inaccurate Runway Length Sometimes Used

When AIRCRAFT.CLASS data are read, the takeoff and landing lengths are read in integer format. These are then assigned to the double real attributes of AIRCRAFT.CLASS. However, sometimes the double attributes become values slightly larger than the actual version of the integer in the database.

#### 4.2.57 JTLS-0978 Air Missions Don't Completely Comply With Egress

Each assigned point on an air route has an associated altitude. The mission should climb (or descend) to that altitude upon reaching the point and attempt to maintain that altitude until another altitude is assigned. Air missions that have egress routes should fly from the last egress route point to home base at the altitude assigned for the last egress route point. They are not doing so. Instead, they fly from the last egress route point home at their Most Efficient altitude.

#### 4.2.58 JTLS-0979 Halted Helo Squadrons Show Mission As MOVING

A helicopter squadron can be ordered to conduct a ground move to a new location. A helicopter squadron that is moving will accept orders to launch aircraft. However, when it begins air operations, it stops. After the completion of air operations, the squadron does NOT resume its ordered movement. Its posture reverts to DEFEND, but its "Mission" remains "MOVING". Since the squadron does not resume its move, its "Mission" should also revert to "DEFEND".

#### 4.2.59 JTLS-0980 SVP Warning 22

SVP Warning 22 reports aircraft loads whose extra fuel exceeds the aircraft's wet carry capacity. I believe the check should be changed to see if the extra fuel (carried in pods/tanks) when added to the other weapons exceeds either the aircraft's dry carry capacity or total dry/wet carry capacity. Granted, there are other supply loads that might carry wet supplies, but in the case of extra fuel, I don't believe it should be considered wet weight.

#### 4.2.60 JTLS-0981 Formation With No Posture

The model crashed when a formation reached a Destination Two hex and the formation no longer had a posture. Therefore it did not know what to do. A Destination Two hex indicates that the Formation should conduct its assigned Amphibious Operation, drop off its Sealifted supplies or clear mines from a minefield. The posture of the formation is used to tell the formation which of these three tasks should be accomplished.

When the formation reached its Destination Two hex, the posture of the formation was zero;

therefore, the formation did not know which of the three tasks should be accomplished.

#### 4.2.61 JTLS-0982 GIAC Shows HRU Mission Moving After Move Complete

The GIAC Message Box Unit SITREP for an HRU continues to show a Mission of MOVING when movement is complete. Unit Posture changes to DEFEND. ARU SITREPs are displayed with both a Mission and Posture of DEFEND.

#### 4.2.62 JTLS-0983 IMT/GIAC Show Insert/Extract Mission Flying

IMT and GIAC show Insert/Extract Mission flying at zero feet from Insert/Extract to next Transit Point. Also between some Transit points. Radar detection reports correct altitude.

#### 4.2.63 JTLS-0984 IMT Doesn't Add Unit Names

IMT - Intelligence - Foreign Units will display the current list of identified Foreign Units and will update information about them while the Foreign Unit Information window remains open. However, if a new Foreign Unit is identified, that unit does not get added to the list in the open window. A new Foreign Unit Information Window must be selected to obtain the current list of identified units.

#### 4.2.64 JTLS-0985 PSYOP Results Multiplier

The PSYOP Results Multiplier was referred to as the PSYOP Effects Multiplier four times in the Data Requirements Manual (DRM) and three times in the Analyst's Guide. Although listed in the DRM, the PSYOP Results Multiplier could not be accessed in the DDS. It appeared to default to 1.0 in the game for all units. Controller - Set Individual Unit Parameters permitted entries from 0.00 to 1.00, but all entries below 0.50 were converted to 0.50. The DRM showed a UT.PSYOP.RESULTS.MULTIPLIER range from 0.001 to 999999.99.

#### 4.2.65 JTLS-0987 Set Periodic Report Times

The Controller has the ability to change both the frequency of Periodic Reports and the number of Periodic Reports between Summary Reports. However, there exists no ability to specify when the next Periodic Report should be, or which of the next reports should be a Summary Report. As an example, if the Controller wishes the blue side to receive Periodic Reports every 8 hours starting at 0600, and wants the Summary Report to be produced at 1400, then they must set the time between periodic reports to 6 hours, and reset it to 8 hours after the 0600 report. Additionally, the number of Periodic Reports between Summary Reports must be set to 2, and then reset to 3 after the 1400

reports. An easier method should exist to accomplish such a task.

#### 4.2.66 JTLS-0988 Can't Repair Naval Catapults

Naval Units cannot repair their catapults because they do not know they have a repair capability.

#### 4.2.67 JTLS-0989 Controller Damaged Aircraft Not In Periodic Reports

When a Controller kills an Aircraft, the model does not tally, therefore the current periodic report does not report the kill. The categories of kills do not logically cover the Controller killed aircraft. The Post Processor Reports do include the Controller killed aircraft. This improvement can be made in at least two ways. First the current Aircraft Kill Periodic and Summary Reports can be expanded to include a category for Controller killed aircraft. A second solution is to remove the Periodic and Summary Aircraft Kill Periodic and Summary reports, and get the data from the Post Processor.

#### 4.2.68 JTLS-0993 Weapons Report on Mission Report

When a Player uses the Change Air Mission Parameter order to modify a mission's weapon load prior to takeoff and the order is implemented, the Mission Report does not always reflect the change. In at least one case, when the final Mission Report was received, the only weapon listed was the new weapon that was added. The report also incorrectly showed that zero of those weapons were returned when none were actually fired. The mission fired several weapons from the original load, but none of those weapons were listed in the final report, even though they were fired.

#### 4.2.69 JTLS-0994 HRU Creation Target Requirements Assessed Incorrectly

If an HRU that is to be created and extract targets from its parent unit cannot find a target that is 100% capable, it will refuse creation, even if the parent has a 12-element target that is 97% capable and the HRU needs only one element.

#### 4.2.70 JTLS-0999 Cancel Naval Mission Fails When A Unit Is Specified

The Cancel Naval Mission order allows either a unit or a formation to be entered. However, if anything other than a formation is entered, the order is rejected on the grounds that the formation does not exist.

#### 4.2.71 JTLS-1010 Controller Cannot MM NEUTRAL Unit Onto Formation

The Controller cannot Magic Move a unit onto a Formation unless both FS FS RELATIONSHIPs are Friendly. A player can pick up a unit via AMPHIBIOUS PICKUP as long as the relationships are no worse than Neutral. The Controller should have the same capability. However, all implications must

be considered before implementing this solution.

#### 4.2.72 JTLS-1017 Airlift Mission Problem

An airlift mission was created to pick up a NEO icon. The mission did not have the lift capacity to lift the entire icon, so a second mission was created to pick up the same icon. The second mission went into unit delay when it arrived at the pickup location. The first mission picked up then dropped off the first load, then returned for the second load. The second mission should not have gone into unit delay status.

#### 4.2.73 JTLS-1260 EMCON Order Problem Subordinates of Embarked Units

If the primary Unit specified on an EMCON order is embarked on a ship, the CEP rejects the order, even if the order is supposed to apply to subordinates as well. A possible solution is to take the UNIT CHECKS off the order itself, and put them in the code that turns the emitter on and off. The only time that the order should be denied is for a unit that has been wiped out, and it has no subordinates, and is not in anyone's UT SUBORD SET. If this is done a possible problem is having the IMT show the sensor/jammer turned on while the unit is still not arrived, or is embarked on a formation. There appears to be no problem inside the CEP, but the IMT bit is the reason that it has not been fixed. The players have a work-around—Magic Move the unit ashore, send the order, and then MM back onto the formation.

#### 4.2.74 JTLS-1328 SAM/AAA Initial Issue

Currently, when a SAM/AAA target comes into the game, either at game start, TPFDD arrival after game start, or target create; the owning unit or associated unit sends the initial issue of ammo to the target site by an implicit resupply action. This implicit resupply convoy requires time to dispatch, time to travel, and time to receive. In Standard Database this means it is 2.5 to 3.5 hours after a SAM/AAA target arrives in the game before it has any ammo and is able to engage an air object; even if it's in the same hex as the owning unit. There is no reason for this restriction. A SAM/AAA target should be given its initial issue of ammo instantaneously upon arrival in the game. The owning or associated unit should still have its supply levels decremented based on the supplies that it passes to the SAM/AAA target.

#### 4.2.75 JTLS-1341 Assign Multi Attack Order

An OAS mission was assigned a set of targets using Assign Multi Attack order. After the order was sent, that set of targets was deleted and a new set was assigned. The mission proceeded to the area where the old targets were located, then headed toward the new targets. and not drop on either set of targets. The mission should have headed toward new target area immediately after targets were

assigned.

#### 4.2.76 JTLS-1351 Air Missions Refuel And Fly At Zero Altitude

When specifying ingress and egress routes for an air mission, it is possible to specify refuel points and transit points. A transit point requires an altitude. A refuel point does not have an associated altitude. However, both types of points are filed with the air mission with their associated altitudes, which is zero for the refuel point. After a mission reaches a refuel point, it will adopt the altitude of the point, zero feet, for its next leg.

When a refuel point is filed in the air mission's route set, the Player should assign it the same altitude as the previous Player-designated route point. This is only useful if such a point exists. This is a partial solution only, and this STR should not be considered closed.

#### 4.2.77 JTLS-1364 ROE Setting Unstable

During exercise TF05, nine Navy P3C squadrons were set to an ROE of HOLD FIRE. The first nine missions returned and reported launching all of their Harpoon missiles. The Player observed that the ROE appeared to reset itself to FIRE. The opposite change occurred when the Player set the ROE to FIRE, and used the IMT to confirm the setting. Thus, several attacks were required to cause the aircraft to launch a Harpoon or torpedo.

#### 4.2.78 JTLS-1368 Orbiting OAS Assign Target

During exercise TF05, an Orbiting OAS mission was assigned to strike a SAM target. The Side perception was bad, and the SAM target was not in the hex indicated by the Blue side perception. Receiving an Assign Target order, the mission went to the hex and searched for the target. It remained in the hex until almost out of fuel, then went to a tanker. After refueling, the mission returned to the hex to search for the target again. This continued until the mission off-station time. The mission should have determined that the target was not in the hex and returned to its home squadron.

#### 4.2.79 JTLS-1375 Orbit Location In Ingress Route

If an air mission is tasked by the ATOT and flies toward an orbit point, the mission cannot be diverted to a new location until the aircraft reaches its ATOT-assigned orbit point. Assigning a new orbit location should be possible at any time and the mission should immediately comply.

#### 4.2.80 JTLS-1376 Fuel Chits

During exercise TF05, fuel chit data fields for individual receiver or supplier air missions were not populated. The fuel conversion factor is incorrect, and should be 6.5 pounds per gallon.

#### 4.2.81 JTLS-1377 Attack Posture Heading Home

In several instances during exercise TF05, an air mission displayed an Attack posture while the



aircraft headed home. The aircraft received an Assign Target order, and either did not find the target and held its munitions, or released them and headed back to the base. The attack mission could not be re-flight planned, and should have displayed a Heading Home posture.

#### 4.2.82 JTLS-1378 Mission Refuel Chit Retrieval Button Does Not Work

Refuel chits do not appear when the Refuel Chit retrieval button on the IMT screen is used. However, they appear when the user requests a retrieval of all refuel chits.

#### 4.2.83 JTLS-1379 Improve Mission Splitting Capability

When the ATO-T splits missions automatically, the program changes the missions' Mode 2 and Mode 3 squawk, call sign number, and mission number. It is preferable to concatenate an alphabetic identifier to the original mission number. Also, we must develop a method to inform TBMCS that only a portion of the mission has returned to the base.

#### 4.2.84 JTLS-1380 Intercept Stopped for Refuel Chit Time

An intercepting mission will break off its intercept to refuel from a tanker on time according to its refuel plan.

#### 4.2.85 JTLS-1381 Mission Stops Moving After Break-off Intercept

An air mission stops moving after receiving a Break-off Intercept order. When a mission in this mode receives a change Orbit Location order, the missions bar points in the wrong direction.

#### 4.2.86 JTLS-1382 TBMCS ATO ID Problems

These problems arise from assigning an air mission a specific ATO ID. ATO time round-off results cause many missions designated to start immediately at the beginning of an ATO period to be assigned to the wrong ATO period. Additionally, the ATO periods were not continuous within the model. For example, when an ATO period was designated to end at 1.333 days, the following period was started at 1.334 days. Any missions designated a mission time of 1.3335 days were not included in an ATO period.

#### 4.2.87 JTLS-1383 Alert Missions Display On COP

Alert missions displayed on the GIAC causes them to display on the COP, which is inappropriate. The missions were placed on the GIAC display to solve another problem, but the implemented solution caused these unacceptable consequences.

#### 4.2.88 JTLS-1384 Area, Target, And Unit Report Documentation

Some users have indicated that the documentation of Area Report, Unit Report, and Target Report

similarities and differences are incomplete or inaccurate. A review of this documentation is needed.

#### 4.2.89 JTLS-1387 TBMCS Not Updating ATO Change Missions

If a mission exists in an ATO Change, the TBMCS Adaptor does not update the proper TBMCS record.

#### 4.2.90 JTLS-1390 Orbiting OAS

During a recent training class, an Orbiting OAS was sent to an orbit point. En route to the orbit point, the mission was assigned a target to strike. Instead of proceeding directly to the target, the mission went to the orbit first, then to the target. When an mission receives an Assign Target or Assign Multi-Target order, it should immediately head toward the target.

#### 4.2.91 JTLS-2005-1455 Changing Support Unit Via Naval Move Incorrect

A naval unit was ordered to move, and then ordered to change its support unit to another boat. The orders were accepted and the boat moved, but the designated support unit did not change. If the same move and change-support orders were used, then it worked properly when the boat was ordered to use a ground unit as its new support unit.

#### 4.2.92 JTLS-2005-1456 Improper Formation Arrive Time Message

A naval formation was ordered to follow a route to a location, and to arrive at a future time. The following message was received in reply: "Formation NAV.FORM has been ordered to move. It will start this move at Time format {15.926929} is wrong it does not contain with 'T' separator in order to comply with the specified arrival time." The message should properly report the time that the formation will depart in order to arrive at the specified time. Some message output errors were corrected in the CEP, and the WHIP message now gives the proper time, but the title of the message states that the formation cannot comply.

#### 4.2.93 JTLS-2005-1457 Target Auto Assign Errors In Orbiting OAS

An Orbiting OAS mission was created with Auto Assigned allowed and search target category as SSM. An SSM was magic moved to the area of the orbit. Perception of the SSM was given to the mission's side using the controller Target Report order. The mission saw the target and immediately attacked it. When the OAS mission returned, the Mission Report said it was assigned to attack target UI011816U but the target could not be found. It appears that mission was previously holding the target as unidentified and it was not found after it was assigned a specific target number.

#### 4.2.94 JTLS-2005-1458 CAS Damage Errors From Orbiting OAS

In this example, Ayland and Ceeland units were in combat. Ceeland attacked an Ayland Engineer unit. An order was sent for an Orbiting OAS mission with CAS allowed. This mission was ordered to

support the engineer unit that was under attack. The mission immediately attacked, but it only damaged the Ayland unit and not the Ceeland unit. In the ACP prototype, the fratricide was set to 10 percent. The fratricide was changed to 1 percent and re-tested. In this instance, it produced the same results, but another iteration of this test resulted in damage to Ceeland, but not to Ayland.

#### 4.2.95 JTLS-2005-1459 Delay Order Not Executed Properly

A unit was given a delay order time of several days in the future and 70% strength. The unit delayed at contact with an attacking unit. Unit was still at 96% strength.

#### 4.2.96 JTLS-2005-1460 Ship Heading Inconsistency

The IMT reports an incorrect ship Heading. The SITREP heading always indicates a value of 000. The Map heading is never correct; it is usually 180 degrees off.

#### 4.2.97 JTLS-2005-1463 Units in Combat While Embarked

A ground unit was embarked on a naval formation via the database build. The IMT and Command Hierarchy lists this unit as “in combat”. The naval formation was moved away from any enemy ground units, but the status still indicates “in combat”. There are two issues: units embarked on naval formations cannot be “in combat”, and the “in combat” status is never cleared when the unit is moved away from any enemy units. The “in combat” status can be forcibly changed by magic moving the unit into a legitimate “in combat” position, and then magic moving it back aboard the boat.

#### 4.2.98 JTLS-2005-1464 Location Fields Allow Invalid Location Formats

When sending or checking an order, the location fields allow invalid location formats. The user will click Send or Check and nothing will happen. The Lat/Lon class throws an error when parsing. This can be fixed by not allowing invalid formats or marking the order field as having an error.

#### 4.2.99 JTLS-2005-1466 Incoming Messages Not In Correct Order

Messages do not always appear on the message browser in the correct order. Example: a mission of two aircraft were engaged and killed by SAMs. The messages appears as follows: Aircraft from AREC-010007 Lost (ID: 359) Mission Report AREC-010007 - Completed (ID: 369) Mission Commander Trouble Report - Mission AREC-010007 (ID: 363) Aircraft from AREC-010007 Lost (ID: 359) Mission Commander Trouble Report - Mission AREC-010007 (ID: 363) The Mission Report should appear last in the sequence. In the same manner, a fire missile order responded with a “complied” message prior to the order acknowledgement. A secondary sort on the message identification number is required to resolve this issue.

#### 4.2.100 JTLS-2005-1468 Perceived Aircraft Vectors Point In Wrong Direction

The speed leaders on perceived aircraft do not point in the direction they are heading. This is true for

all sides. The controller WHIP shows all sides correctly.

#### 4.2.101 JTLS-2005-1469 Shooting Side Has No Perception Of Shot Missile

An SSM was fired by red at a blue boat, but it was never seen by the red (shooting) side. The blue side did have perception of it. All sides, based on sensor capability, should see SSMs.

#### 4.2.102 JTLS-2005-1471 Utilities Should Alter Group When Row Is Edited

When a row is selected, it is made available for editing in the utility fields. While the data is populated, the group configuration is not changed to match the row. For example, a row in an air route may be a route or refuel point. The group configuration may be changed by hand, so this has been assigned a lower priority.

#### 4.2.103 JTLS-2005-1475 Improper Depiction Of Unit Transported By Convoy

When a convoy reaches the location of a unit that it is going to ship to another location, the strength of the unit that is going to be lifted goes to zero. The SITREP window shows the lifted unit with a strength of 0%, a speed of 0 KPH and a destination of 00-00-00n 00-00-00e with a mission and posture of defend. The strength of a unit should not change, the destination of the unit should be the drop-off location of the convoy. It is suggested that an additional posture should be added to inform IC that the unit is being moved via air, rail, barge, or truck.

#### 4.2.104 JTLS-2005-1476 Aircraft Orders Allowed After JCATS Has Control

Control of an orbiting RECCE mission was transferred to JCATS. It was accepted by and was under the control of JCATS. The quick change orbit order was used to give the same mission a different orbit point after JCATS assumed control of it. JTLS accepted the order and the MPP delivered a message stating that the mission would optimize a route to the new location. The mission flew to its original orbit point and ignored the orbit point change. Also, missions transferred to JCATS still appeared in various pull-down lists. Authority should be removed from the controlling JTLS station once transferred and the IC should receive the same response as he does when he tries to give an order to a unit or mission he does not have authority over. When transferred back to JTLS, the sending JTLS station should be the one who gains authority over it.

#### 4.2.105 JTLS-2005-1478 Order Lines Change Position on Map

When a route is built, the order lines will change position after the Player has added a new point. When a new point is added, the route erases itself and redraws all the points to where they should be, and then moves all the points again. This occurred on a Windows box, and has not been reproduced

under Netbeans.

#### 4.2.106 JTLS-2005-1598 Strip Alert Missions Unusable In Quick Manual Pair

Request GIAC display of air tracks on the ground. This would allow the quick Manual Pair order to be used for strip alert missions, and include all launchable alert aircraft. Currently, a mission has a flag called the Active flag. This flag is set by the combat model and indicates to the GIAC whether the mission should be displayed on graphics or not. This flag is also used to inform the COP interface programs whether the mission is flying and should be displayed on the COP or not. Alert missions should not be displayed on the COP. This means that the single Active flag cannot be used. The Active flag should tell the COP whether the mission is flying or not. In addition, the user interface should be allowed to indicate whether Active missions and/or Alert missions should be displayed. This should be independent of the COP feed.



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## APPENDIX A. ABBREVIATIONS AND ACRONYMS

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
Apache	Open-source Web server used by Web Enabled JTLS.
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	Antitank Guided Missile
ATK	Attack
ATO	Air Tasking Order
ATOG	Air Tasking Order Generator

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ATORET	Air Tasking Order Retrieve Program
ATOT	Air Tasking Order Translator
Attribute	Data item belonging to an entity, such as name, size, or number of subentities.
AWACS	Airborne Warning and Control System
AZ	Altitude Zone
BADGE	Bilateral Air Defense Ground Environment (Used by JDA)
BAI	Battlefield Air Interdiction
BDA	Battle Damage Assessment
BDE	Brigade
BN	Battalion
C3	Command, Control, & Communications
C3I	Command, Control, Communications, & Intelligence
C4I	Command, Control, Communications, Computers, & 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. The combat model in JTLS that simulates execution of ground, naval, air, logistics, and intelligence activities.
Checkpoint	A temporary halt in the game initiated either manually by the Controller or automatically by the CEP.
CMDR	Commander
COP	Common Operational Picture
CP	Combat Power
CS	Combat System
CSP	Combat System Prototype
CTAPS	Contingency Tactical Air Planning System



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CTG	Commander Task Group
CTRL	Control. A keystroke as in “CTRL-C”.
DCA	Defense Counter Air
DCL	Digital Command Language. The standard operating system user interface for DEC computer systems.
DDS	Database Development System
DEC	Digital Equipment Corporation. The manufacturer of VAX/VMS computers.
DEMSDB	Demonstration Standard Database. A 5-sided database delivered with the current JTLS release.
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 Measures
ECP	Engineering Change Proposal
ELINT	Electronic Intelligence
ELS	Entity Level Server
EODA	Entity Level JTLS Object Data Authority server. Distributes data to ELS clients.
ETA	Estimated Time of Arrival
FARP	Forward Arming and Refueling Point
FLP	Fire Lethality Prototype
FOL	Forward Operating Location
FWL	Initials of Frederick W. Lanchester, generally credited with origination of the differential equation model of attrition, hence Lanchestrian attrition.
GAL	Gallon

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GCCS	Global Command and Control System
GDP	Graphical Database Program
GRTE	Ground Route
GS	General Support
GSR	General Support Reinforcing
GUI	Graphical User Interface
HARM	High-speed Anti-Radiation Missile
HE	High Explosive
Hectare	10,000 square meters
HELO	Helicopter
Hex	Hexagon
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQ	Headquarters
HRU	High Resolution Unit
HTML	Hypertext Markup Language
HTT	HUP Target Type
HUP	High Resolution Unit Prototype
ICM	Improved Conventional Munitions
ICP	Interface Configuration Program. An interactive program that allows the user to define the specifications for each game process that can be started for a particular scenario.
ICPLogin	Interface Login Program
ID	Identifier
IFF	Identification Friend or Foe
IIP	Intel/Information Prototype
IMT	Information Management Tool. The JTLS program that provides real-time tabular scenario information.
INFO	Information
Initialization	Phase of game during which data sets are read and the game is configured for Players.
INTEL	Intelligence
JDA	Japan Defense Agency
JEDI	JODA Entity Data Identifier

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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 server. Distributes data to JTLS Data System clients.
JOI	JTLS Operational Interface. Provides JTLS communication capability with C4I systems.
JPL	Jet Propulsion Laboratory
JSDF	Japanese Self-Defense Force
JTLS	Joint Theater Level Simulation
JWFC	Joint Warfighting Center
JXSR	JTLS XML Serial Repository. A Web service which obtains data from a JODA and provides it as XML to the Web Hosted Interface Program through the Apache Web Server.
KIA	Killed in Action (aka “Remains”)
KM	Kilometer
KNOTS	Nautical miles per hour
LA	Lethal Area
LAN	Local Area Network
LAT	Latitude
LB	Login Build. A JTLS order type.
LDT	Lanchester Coefficient Development Tool. This program assists in the development of Lanchester coefficients, which are used to assess the results of force-on-force land combat in JTLS.
LOG	Logistics
LOGIN	Logistics Input. Arrival of supplies in the theater.
LOGREP	Logistics Report
LONG	Longitude
LOTS	Logistics Over The Shore

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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. A form submitted by users and developers to report problems or desired enhancements to the JTLS model.
MG	Machine Gun
MHE	Materiel Handling Equipment
MIP	Model Interface Program. A generic term for MPP, IMT, etc.
MOGAS	Motor gasoline
MOPP	Mission-Oriented Protective Posture
MOSAIC	NCSA user interface software
MOTIF	An X-Window System graphical interface
MP	Maneuver Prototype
MPP	Message Processor Program. This message processing and display utility has been replaced by the XML Message Service and the WHIP Message Browser.
MSC	Major Subordinate Command
MSG	Message
MTF	Message Text Formats
MUREP	Munitions Report
NCSA	National Center for Supercomputing Applications (University of Illinois)
NEO	Noncombatant Evacuation Operations
NFS	Network File Server
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

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OMA	Order Management Authority. Provides an order verification and forwarding service to the WHIP.
ONC	Operational Navigation Chart
OPM	Online Players Manual
OPP	Order Preprocessing Program
Oracle	A relational database management system and name of the company.
OTH	Over the Horizon
OTH Gold	OTH 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.
PP	Postprocessor Program (a JTLS component)
PSYOPS	Psychological Operations
QRA	Quick Reaction Alert
QRA.DCA	Quick Reaction Alert, Defensive Counter Air
QRA.OAS	Quick Reaction Alert, Offensive Air Support
RAM	Random Access Memory
RDMS	Relational Database Management System
RECCE	Reconnaissance. Usually refers to Air Missions.
RECON	Reconnaissance. Usually refers to Ground Missions.
REGT	Regiment
RNS	Random Number Seed
ROE	Rules of Engagement
RPT	Report
RSP	Reformat Spreadsheet Program

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SAL	Surface-to-Air Lethality
SAM	Surface-to-Air Missile
SAM/AAA	Surface-to-Air Missile/Anti-Air Artillery
SC	Supply Category
SCP	Simulation Control Plan
SDB	Standard Database
SEAD	Suppression of Enemy Air Defense
SIMSCRIPT	Computer programming language (product of CACI, Inc.). A multiple-pass compiler.
SIP	Scenario Initialization Program
SITREP	Situation Report
SLP	Sustainment Log Prototype
SOF	Special Operations Forces
Solaris	Sun Microsystems' proprietary operating system.
SP	Survivability Prototype
SQL	Structured Query Language
SR	Short Range
SRP	Start/Restart Program (a JTLS component)
SRTE	Sea Route
SSM	Surface-to-Surface Missile
STR	Software Trouble Report
SUN	Sun Microsystems, Inc.
SUP	Ship Unit Prototype
SVP	Scenario Verification Program. Verifies consistency of data entered for a given scenario.
SYNAPSE	Synchronized Authentication and Preferences Service. Provides a user data sharing service in a central location and allows a WHIP configuration to be independent of the local machine.
TADIL	Tactical Digital Interface Link
TCP/IP	Transmission Control Protocol/Internet Protocol. A set of computer networking standards that specify the protocol for two or more computers to communicate with each other. TCP/IP was developed by the Department of Defense to support its Defense Data Network.

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TEL	Transporter Erector Launcher
TG	Prefix for Target entity attributes.
TGT	Target
TMU	Terrain Modification Utility. A utility program used to modify JTLS hex-based terrain files.
TOE	Table of Organization and Equipment
TOT	Time on Target
TOW	Tube-launched Optically-tracked Wire-guided missile
TPFDD	Time-Phased Force Deployment Data
TGS	Terrain Generation Service (formerly TPS:Terrain Preparation System)
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	A computer operating system.
UNK	Unknown
UOM	Unit of Measure
USA	United States Army
USAF	United States Air Force
USCG	United States Coast Guard
USMC	United States Marine Corps
USMTF	U.S. Message Text Format
USN	United States Navy
UT	Prefix for Unit Attributes
UTM	Universal Transverse Mercator
VAX	A family of minicomputers developed by Digital Equipment Corporation.
VIFRED	Visual Forms Editor
VMS	Virtual Memory System

VTOL	Vertical Takeoff and Landing aircraft
WAN	Wide Area Network
WDRAW	Withdraw
WEJ	Web Enabled JTLS. Composed of several Web services which interface with the WHIP through an HTTP Web server.
WHIP	Web Hosted Interface Program. An integrated Web interface to JTLS.
WIA	Wounded in Action
WPC	Warrior Preparation Center
WPN	Weapon
WT	Weight
WW	Wild Weasel
XMS	XML Message Service. Provides a JTLS message indexing service.



## **APPENDIX B. COMBAT SYSTEM CATEGORY DEFINITIONS**

This Appendix provides definitions of the 99 Combat System categories used in the Standard Database. Note that the C3I combat system has been removed due to the changes in Version 3.2.

### **INFANTRY**

#### **(INFANTRY)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with pistols, rifles, submachine guns, 5.56mm squad automatic weapons, rifle grenade launchers, single round grenade launchers, LAWs, hand grenades, bayonets, hasty mines. Effective ranges 400m to 800m. These are soldiers primarily trained to fight dismounted or with a significant secondary mission of fighting as infantry. Includes dismount teams in mechanized infantry units. A significant portion (70%) of combat engineer units and a smaller portion (50%) of military police units should probably be counted as infantry. Artillery units might have a lesser portion (25%) counted as infantry. This is a personnel combat system.

### **ELITE INFANTRY**

#### **(ELITE-INF)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with pistols, rifles, submachine guns, 5.56mm squad automatic weapons, rifle grenade launchers, LAWs, single round grenade launchers, hand grenades, bayonets, and hasty mines. Have more automatic weapons, grenade launchers and LAWs than INFANTRY. Effective ranges out to 400m to 800m. ELITE-INFANTRY are about 150 to 200% as effective in Lanchester combat as INFANTRY. These are well trained, highly motivated soldiers primarily trained to fight dismounted. These soldiers are primarily found in specialized units: SF, Ranger, Airborne, Commando, etc. This is a personnel combat system.

### **INFANTRY/ENGINEER SPECIAL WEAPONS**

#### **(INFENG-SPWPN)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with a personal weapon such as pistols, rifles, submachine guns, hand grenades, and bayonets; but their primary lethality comes from the special weapon they operate. These weapons are primarily anti-fortification weapons although they may be used in the anti-armor role. These include SMAW, Wasp, Bunkerfaust, T67 and other flamethrowers, various short range recoilless rifles, 90mm M67 or TYPE 51; 82mm B10, M60A or M79; 89mm M69; 120mm M43; 107mm B11; 128mm M71, and satchel charges. Effective ranges out to 500m. These are soldiers primarily trained to fight using a special weapon. A portion (20%) of combat engineer units should probably be

counted as INFENG-SPWPN. HUPs which had explosives combat systems should replace an explosives combat system and a personnel combat system for one INFENG-SPWPN combat system. This is a personnel combat system.

## OTHER TROOPS

### (OTHER-TROOPS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with weapons similar to infantry, but not armed as extensively. OTHER-TROOPS are about 25 to 33% as effective in Lanchester combat as INFANTRY. These are soldiers whose primary role is other than fighting dismounted. Includes headquarters and support troops in infantry units. Generally all troops in units other than infantry, engineer or military police; however you may give any unit some percent of its troops as INFANTRY, based on your evaluation of the unit's ability (training) to engage in ground combat. This is a personnel combat system.

## SNIPER

### (SNIPER)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with sniper rifles of various caliber, up to 12.7mm. Effective ranges out to 1500m. More effective in Lanchester combat than INFANTRY against most soft and lightly armored combat systems. More survivable than INFANTRY. These are soldiers specifically trained and armed as snipers. This is a personnel combat system.

## CREW

### (CREW)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms when not manning another combat system. Armed with weapons similar to infantry, but not armed as extensively. These are soldiers whose primary role is operating another combat system: vehicle drivers, gunners, loaders and commanders; gun crews and operators of any other crewed combat system. It is the specified Crew combat system. This means you must have enough combat system CREW to man all the combat systems that require crews. The Combat System Prototype (CSP) data identifies which combat systems require crews and how many of the Crew combat system are required.

## CREW-SERVED WEAPONS

### (CREW-WEAPON)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Machineguns of caliber 7.62mm or larger and automatic grenade launchers. Effective ranges 600m to 1500m. Examples: 7.62mm M60/E3/E4, M240B/G, FN MAG, RPD, PK/PKS/PKM,

RPK, RP46, Pecheneg, SG43/SGM/Type 57, Type 67/672C/74/80/81, WQ112, AAT F1, HK21/11, MG42/59, MG1/2/3, MG4, MGM1, M52, Model 62, Model 68, L4A4/L7A2, SS77, T74 and M53/M72/M77/M84; 12.7mm DShK-38/Type 54/59, NSV/NSW, Type 77/85, QJZ89, M2HB, 50MG, GAU19A; 14.5mm Type 75-1, KPV, Pirat; 30mm AGS17, AGS30; 35mm W87, QLZ87; 40mm MK19, GMG, and Striker. This is not a crewed combat system. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. coaxial or turret mounted machineguns).

#### MEDIUM ANTI-TANK WEAPON - LONG RANGE

(AT-MAW-LR)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank rocket/missile launcher with max effective anti-tank ranges greater than 800m but less than 1500m. Armor penetration generally greater than 400mm but less than 800mm. These systems are used primarily in the anti-tank role. Examples: Dragon, Dragon 2, AT-7 (Saxhorn), AT-13, Shipon 2, Folgore 80mm, and Type 87 Chu-MAT. This is a crewed combat system. May be fired from vehicles, but usually employed from a ground mount.

#### MEDIUM ANTI-TANK WEAPON - SHORT RANGE - MEDIUM LETHALITY

(AT-MAW-SR-ML)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank rocket/missile launcher with max effective anti-tank ranges greater than 500m but less than 800m. Armor penetration greater than 400mm but less than 800mm. These systems are used primarily in the anti-tank role. Examples: Dragon 2T, LAW 80, M2/M3 Carl Gustav, and RPG29. This is not a crewed combat system. May be fired from vehicles, but usually employed from a ground mount or shoulder launched.

#### MEDIUM ANTI-TANK WEAPON - SHORT RANGE - HIGH LETHALITY

(AT-MAW-SR-HL)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank rocket/missile launcher with max effective anti-tank ranges greater than 500m but less than 800m. Armor penetration greater than or equal to 800mm. These systems are used primarily in the anti-tank role. Examples: Eryx, Alcotan 100, Bumble Bee and Shipon 1. This is not a crewed combat system. May be fired from vehicles, but usually employed from a ground mount or shoulder launched.

#### MEDIUM ANTI-TANK WEAPON - SHORT RANGE - TOP ATTACK

(AT-MAW-SR-TA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank rocket/missile launcher with max effective anti-tank ranges greater than 500m but less than 800m. Top attack capability allows it to defeat most armor. These systems are used primarily in the anti-tank role. Examples: Predator (SRAW) and MBT LAW. This is not a crewed combat system. May be fired from vehicles, but usually employed from a ground mount or shoulder launched.

#### HEAVY ANTI-TANK WEAPON - SHORT RANGE - MEDIUM LETHALITY

(AT-HAW-SR-ML)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank gun or rocket/missile launcher with max effective anti-tank range of 2000m to 3000m. Armor penetration greater than 400mm but less than 700mm. Examples: Milan, SuperDragon, RAAD, AT-3(Sagger) (Malyutka) (Malyutka-M), AT-4(Spigot) (Fagot) and MAF. This is a crewed combat system. Crew should be modeled as combat system CREW. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. M2 Bradley, BRDM-2 Sagger). Do include non-armored vehicle mounted weapons (i.e. unarmored HMMWV/jeep mounted tow). The vehicle of the non-armored vehicle mounted weapons should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### HEAVY ANTI-TANK WEAPON - SHORT RANGE - HIGH LETHALITY

(AT-HAW-SR-HL)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank gun or rocket/missile launcher with max effective anti-tank range of 2000m to 3000m. Armor penetration greater than or equal to 700mm. Examples: Milan 2, Milan 2T/3, Flame, AT-3(Sagger) (Malyutka2) (Malyutka2M), Red Arrow 8A/C, Baktar Shikan and Gill. This is a crewed combat system. Crew should be modeled as combat system CREW. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. M2 Bradley, BRDM-2 Sagger). Do include non-armored vehicle mounted weapons (i.e. unarmored HMMWV/jeep mounted tow). The vehicle of the non-armored vehicle mounted weapons should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### HEAVY ANTI-TANK WEAPON - SHORT RANGE - TOP ATTACK

(AT-HAW-SR-TA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank gun or rocket/missile launcher with max effective anti-tank range of 2000m to 3000m. Top attack capability allows it to defeat most armor. Examples: Javelin, TRIGAN, RBS 56 BILL 1/BILL 2 and MACAM. This is a crewed combat system. Crew should be modeled as combat system CREW. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. M2 Bradley, BRDM-2 Sagger). Do include non-armored vehicle mounted

weapons (i.e. unarmored HMMWV/jeep mounted tow). The vehicle of the non-armored vehicle mounted weapons should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### HEAVY ANTI-TANK WEAPON - LONG RANGE - HIGH LETHALITY (AT-HAW-LR-HL)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank gun or rocket/missile launcher with max effective anti-tank range of 3500m or greater. Armor penetration greater than or equal to 600mm. Examples: TOW, ITOW, TOW2A, AT-5(Spandrel) (Konkurs) (Konkurs-M), Red Arrow 8E, Toophan 1 and 2, Spike-MR, MAPATS and Type 79 Jyu-MAT (KAM-9). This is a crewed combat system. Crew should be modeled as combat system CREW. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. M2 Bradley, BRDM-2 Sagger). Do include non-armored vehicle mounted weapons (i.e. unarmored HMMWV/jeep mounted tow). The vehicle of the non-armored vehicle mounted weapons should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### HEAVY ANTI-TANK WEAPON - LONG RANGE - TOP ATTACK (AT-HAW-LR-TA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Antitank gun or rocket/missile launcher with max effective anti-tank range of 3500m or greater. Top attack capability allows it to defeat most armor. Although not a top attack weapon, the AT-14 is best modeled as this combat system because of its extremely high penetration ability. Examples: TOW2B and AT-14. This is a crewed combat system. Crew should be modeled as combat system CREW. Do not include weapons that are mounted on combat vehicles modeled separately as combat systems (i.e. M2 Bradley, BRDM-2 Sagger). Do include non-armored vehicle mounted weapons (i.e. unarmored HMMWV/jeep mounted tow). The vehicle of the non-armored vehicle mounted weapons should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### ANTI-TANK GUN 73 TO 106MM - NOT MISSILE CAPABLE (ATG73-106NMC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Multi-purpose weapon used primarily in anti-tank role, but also in anti-bunker or anti-personnel role. Max effective anti-tank range greater than or equal to 700m. Examples: 73mm SPG-9, 100mm T12/MT12/Type 73 (CHI)/M87 (YUG), 90mm PV-1110 and 106mm M40/T126/T173. This is a crewed combat system. Crew should be modeled as combat system CREW. May be ground or

non-armored vehicle mounted. Armored vehicle mounted recoilless rifles are better modeled as an armored gun system or a tank. If non-armored vehicle mounted, the vehicle should be modeled separately as a combat system: UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### ANTI-TANK GUN 100 TO 125MM - MISSILE CAPABLE

(ATG100-125MC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Used primarily in the anti-tank role. Capable of firing an anti-tank guided missile from the gun tube. Max effective anti-tank range greater than or equal to 4000m. Examples: 100mm T12/MT12 and 125mm 2A45M (Sprut-B). This is a crewed combat system. Crew should be modeled as combat system CREW. This is a ground mounted weapon; vehicle mounted variants are modeled as either tanks or armored gun systems.

#### MORTAR DISMOUNTED 50MM TO 60MM

(MTRDISM50-60)

Cause attrition via indirect fire Lanchester equations and point lethality high resolution combat algorithms. The standard database discourages explicit fire of light mortars, although the data is there to support the area lethality explicit fire algorithms. Includes 60mm and smaller mortars. Examples: 50mm M-8; 51mm L10A1, TN8111, E1; 52mm IMI 52 Cdo; 60mm commando: C6, M60D, Antos, Elis, Vammas, MO60C, FMK-1/2, HM12/13, C03, Model 87, M4/M4MK1, LM60K, M4L3, XT81, M70; 60mm standard: M2 (USA), M19, M1 (SAF), M6 (SAF), KM181, LM-60D, Soltam C576/C08/C06, M-57, M-90, M-94, HM14, Al-Jaleel, FMK-3, M6-111/M6-211 (AUS), Model L/LL-M86, Model 87, M224, M84, M/965, Vammas, TDA Proximity, NR 493, M60, MO 60L/LP, T75, Type M-83A, Type 63-1, Type WX90 and Type WW90L/M. This is not a crewed combat system. This is a ground mounted weapon. Ground mount systems may be transported in vehicles. If transported by vehicle the vehicle should be modeled as a separate combat system as appropriate: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP.

#### MORTAR DISMOUNTED 81MM TO 82MM

(MTRDISM81-82)

Cause attrition via indirect fire Lanchester equations and point lethality high resolution combat algorithms. The standard database discourages explicit fire of light mortars, although the data is there to support the area lethality explicit fire algorithms. Includes 81mm mortars and 82mm mortars. Examples: 81mm M29A1, M252, M29 (SWE), NR475A1, M8-111/211/522, 1MT81, E1/E1Imp, KM187, M81, Model 1972, Vammas STD/LR, FMK-2, AWPC, Type W87, Type W91, HP SB/LB Model LN/LL, Model LN-M86/LL-M86, M-68, M3 (SAF), MO81LC/LL/LP/LLR, E44, HM15, L16A2, MO81-61L, Soltam B433/B449/B455/B502, Otobreda 81, M1, T75, UT-1/NT-1, ZTS; 82mm M-36, M-37, M-41, 2B9, 2B14, M-69A/B (YUG), 1MT82, Model M69 (EGY), Model 77, Model 94, Al-Jaleel, M93, M96 LM/LRLM (CRO), Type 67, Type W84 and Type W99. This is a crewed combat

system. Crew should be modeled as combat system CREW. This is a ground mounted weapon. If transported by vehicle the vehicle should be modeled as a separate combat system as appropriate: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP.

#### MORTAR SELF PROPELLED LIGHT - LIGHT ARMOR - OPEN WEAPON

(MTRSPLT-LAO)

Cause attrition via indirect fire Lanchester equations and point lethality high resolution combat algorithms. The standard database discourages explicit fire of light mortars, although the data is there to support the area lethality explicit fire algorithms. Includes 81mm and 82mm mortars, generally mounted in lightly armored vehicles. Protected from small arms fire and shell splinters. May be dismounted, but generally fired from the vehicle mounting. The weapon is usually protected during movement but exposed while firing. Many vehicle types have been used to mount various mortars. Examples: 81mm M125 and LAV-M. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the MTRSPLT-LAO.

#### MORTAR DISMOUNTED HEAVY

(MTRDISMHVY)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Includes mortars larger than 82mm. Examples: 98mm M98, Model 1997; 100mm Type 71; 107mm M30, M38, M107; 120mm M-43, 2B11, Nona SVK-M, Type W86, XT86, Model L, Model M86SB/LB, M12-1111/2222/3222, M41D, Model 82, Model 87, M120, MO120AM50, UBM52, M74, M75, FMK-2, Al-Jaleel, Vammass STD/LR, Soltam K5/K6/A7A2/M-65/M66, Model UK2, HM16, E56, AWPC M132, MO 120 LT/RT, E1/E1Imp, HY12, Type 55; 160mm M1943, M160, M58, M66; and 240mm M240. This is a crewed combat system. Crew should be modeled as combat system CREW. This is a ground mounted weapon. Almost always transported or towed by vehicle. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### MORTAR SELF PROPELLED HEAVY - LIGHT ARMOR - OPEN WEAPON

(MTRSPHVY-LAO)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Includes mortars larger than 82mm, generally mounted in lightly armored vehicles. Protected from small arms fire and shell splinters. May be dismounted, but generally fired from the vehicle mounting. The weapon is usually protected during movement but exposed while firing. Many vehicle types have been used to mount various mortars. Turreted 120mm mortars are modeled as combat system MTRSP120-LAT. Examples: 107mm M106;

120mm M12-2330, M121 (USA); and 240mm 2S4. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the MTRSPHVVY-LAO.

**MORTAR SELF PROPELLED 120MM - LIGHT ARMOR - TURRETED WEAPON**  
(MTRSP120-LAT)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Includes turreted 120mm mortars, generally mounted in lightly armored vehicles. Protected from small arms fire and shell splinters. Examples: 120mm 2S9, 2S23, 2S31, AMS, AMOS, WIESEL2, PRAM-S and WZ551. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the MTRSP120-LAT.

**ARTILLERY TOWED - VERY LIGHT**  
(ARTYTOW-VLT)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Towed howitzers/guns of caliber up to and including 95mm. These guns are primarily used in the anti-tank role. Max effective anti-tank range greater than or equal to 1000m. Examples: 75mm M116; 76mm M1966 (RUS), M48 (YUG), M1943/ZIS-3/Type 54; 76.2mm Model 1984 (ROM); 85mm D44/M52 (CZ)/Type 56 (CHI) and D48. This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

**ARTILLERY TOWED - LIGHT**  
(ARTYTOW-LT)

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Towed howitzers/guns of caliber greater than 95mm but less than 125mm. Examples: 98mm Model 93; 100mm M1944, M53 (CZ), M1977 (ROM); 105mm Light Gun, LFG, KH178, M56, M101, M102, M119, M425; 120mm 2B16 (RUS); 122mm D-30, D-74, M1938/M-30 and Type 54-1 (CHI). This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

**ARTILLERY SELF-PROPELLED - LIGHT - TURRETED WEAPON**  
(ARTYSP-LT-T)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms and area lethality explicit fire algorithms. Self propelled howitzers/guns of caliber less than or equal to 125mm with the gun in an enclosed turret. 120mm combined howitzer/mortars are



modeled as combat system MTRSP120-LAT. Protected from small arms fire and shell splinters. Examples: 105mm M7, M52, M108, FV433, AMX MK51, Type 74; 122mm 2S1, Model 89, SP122, Thunder-1, Type 89 and 122-T55. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the ARTYSP-LT-T

#### ARTILLERY SELF-PROPELLED - LIGHT - OPEN WEAPON

##### (ARTYSP-LT-O)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms and area lethality explicit fire algorithms. Self propelled howitzers/guns of caliber less than or equal to 125mm with the gun in an open turret or un-turreted. Protected from small arms fire and shell splinters when not in action. Examples: 75mm DN5 Bufalo (MEX); 100mm M1944-T34; 122mm D30-T34, D30-T55, Type 54-1, Type 70-1, Type 85, M1981, M1985, M1991 and M1997. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the ARTYSP-LT-O.

#### ARTILLERY TOWED - MEDIUM LIGHT

##### (ARTYTOW-MLT)

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Towed howitzers/guns of caliber greater than 125mm but less than 145mm. Examples: 130mm M46, M59-1M (EGY), M1982 (ROM) and Type 59-1 (CHI). This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### ARTILLERY SELF-PROPELLED - MEDIUM LIGHT

##### (ARTYSP-MLT)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. All self propelled howitzers/guns of caliber greater than 125mm but less than 145mm regardless of turret. Protected from small arms fire and shell splinters. Examples: 130mm Catapult, Type 83 (CHI), M1975, M1991 and M1992. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the ARTYSP-MLT.

#### ARTILLERY TOWED- MEDIUM HEAVY

##### (ARTYTOW-MHV)

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Towed howitzers/guns of caliber greater than 145mm but less than 170mm. Examples: 152mm D1/Type 54, D20/Type 66, 2A65(M1987), 2A36(M1976), 2A61, M1937/M1938, Model 1985 (ROM), M1981 (ROM), Type 83/Type 86 (CHI), M84; 155mm M114/T65, Model 50, M59, M65, M198, FH-70, FH-77A/B, FH-88, FH-2000, GM45, GC45, GHN45, EH52, HM41, KH179, WAC21(WA021), G5, M777, M83, TIG 2000, M68/M71, M46S, M46/84 (YUG), TR-F1, Model 845 and M139. This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

#### ARTILLERY SELF-PROPELLED - MEDIUM HEAVY- TURRETED WEAPON

(ARTYSP-MHV-T)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Self propelled howitzers/guns of caliber greater than 145mm but less than 170mm with the gun in an enclosed turret. Protected from small arms fire and shell splinters. Examples: 152mm 2S3, 2S19, Dana, Type 83; 155mm M109, M52T, GCT, AS90, FH-77, G6, PzH 2000, K9 Thunder, Palmaria, Bandkanon 1A, L33, Doher, Zuzana, Thunder-2, PLZ45, Type 75, Type 99 and VCA 155. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the ARTYSP-MHV-T.

#### ARTILLERY SELF-PROPELLED - MEDIUM HEAVY - OPEN WEAPON

(ARTYSP-MHV-O)

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Self propelled howitzers/guns of caliber greater than 145mm but less than 170mm with the gun in an open turret or un-turreted. Protected from small arms fire and shell splinters when not in action. Examples: 152mm 2S5, M1974, M1977, M1991; 155mm MK F3, CAESAR, 155/52 APU SBT, M44T, 155 GH 52 APU, XT69 and XT69A1. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the ARTYSP-MHV-O.

#### ARTILLERY TOWED - HEAVY

(ARTYTOW-HVY)

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Towed howitzers/guns of caliber 170mm and greater. Examples: 180mm S23 and 203mm M115. This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

**ARTILLERY SELF-PROPELLED - HEAVY - OPEN WEAPON****(ARTYSP-HV-O)**

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Self propelled howitzers/guns of caliber 170mm and greater with the gun in an open turret or un-turreted. Protected from small arms fire and shell splinters when not in action. Examples: 170mm M1978 Koksan; 175mm M107, Romach; 203mm M110, 2S7 and NORINCO 203 SP. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should be modeled separately; they are not included in the lethality values of the ARTYSP-HV-O.

**MULTIPLE ROCKET LAUNCHER - SHORT RANGE - TOWED****(MRL-SR-TOWED)**

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Max range of 15 km or less. Examples: 60mm M91; 70mm M93A3, NDL40, RA7040; 107mm Type 63, FADGR1, RO107; 126mm Kung Feng 3; 128mm M63 and M91A3. This is a crewed combat system. Crew should be modeled as combat system CREW. Prime movers should be modeled separately as a combat system: UTIL-VEH-LA, UTIL-VEH-NA or EQUIP-OTH-SP as appropriate.

**MULTIPLE ROCKET LAUNCHER - SHORT RANGE - VEHICLE****(MRL-SR-VEH)**

Cause attrition via indirect fire Lanchester equations and area lethality explicit fire algorithms. Do not cause attrition via high resolution combat. Max ranges of 15 km or less. Contains a mix of lightly armored and unarmored vehicles. Examples: 60mm LOV M93A1; 70mm LAU97; 107mm M1992, M1992/2, Type 81, FADGR1; 117mm Kung Feng 6; 126mm Kung Feng 4; 128mm LOV RAK24, M85; 130mm Type 75 (JPN), Type82/Type 85(CHI); and 220mm TOS-1. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should not be modeled separately; they are included in the lethality values of the MRL-SR-VEH.

**MULTIPLE ROCKET LAUNCHER - MEDIUM RANGE - VEHICLE****(MRL-MR-VEH)**

Cause attrition via indirect fire Lanchester equations, point lethality high resolution combat algorithms, and area lethality explicit fire algorithms. Minimum range less than 15 km and maximum range greater than 15km. Only a part of the full lethality of these systems is applied to Lanchester combat. Contains a mix of lightly armored and unarmored vehicles. Examples: 110mm LARS; 117mm RT2000 Thunder; 122mm BM11, Dr Khan, RM70, BM21 GRAD/GRAD1/GRAD-V, BM22(9P140), Type 81/83/89/90 (CHI), RL21, SR114, M96 Typhoon, HM20, ZIL Sakr, M1977/M1985 (NKO), Firos30, T122, Valkiri MK2, APR40; 127mm SS30 Astros2, Valkiri MK1; 128mm

Teruel, M77 Oganj; 130mm Kooryong; and 180mm Type 71. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should be modeled separately; they are not included in the lethality values of the MRL-MR-VEH.

#### MULTIPLE ROCKET LAUNCHER - LONG RANGE - VEHICLE

(MRL-LR-VEH)

Non-attritor, do not cause attrition via indirect fire Lanchester equations, since the minimum range of these systems is greater than the minimum range for Lanchester combat. Cause attrition via area lethality explicit fire algorithms. Minimum range greater than 15 km. Contains a mix of lightly armored and unarmored vehicles. Examples: 160mm LAROM; 214mm Pinacha, 227mm M270 MLRS; 230mm Oghab; 240mm FADJR3, M1985/M1989, M1991; 262mm M87 Orkan; 273mm WM80, Type 83; 300mm 9A52/A100 Smerch; 320mm WS1; and 333mm FADJR5. This is a crewed combat system. Crew should be modeled as combat system CREW. Vehicle mounted machineguns should be modeled separately; they are not included in the lethality values of the MRL-LR-VEH.

#### TANK 120MM - ADVANCED FIRE CONTROL - HIGH SURVIVABILITY

(TANK120-AFHS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 120mm or 125mm, advanced fire control systems, and the highest level of survivability. Examples: M1A1/A2, T-90 (RUS), Challenger II, Type 90 (JPN), Leclerc, and Leopard2A5/2A6. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK120-AFHS.

#### TANK 120MM - ADVANCED FIRE CONTROL - ENHANCED SURVIVABILITY

(TANK120-AFES)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 120mm or 125mm, advanced fire control systems, and an enhanced level of survivability. Examples: T-80U, T-64U, Challenger I, Leopard II, Merkava Mk3, Ariete, T-84/T84U (UKR), and K1A1. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK120-AFES.

#### TANK 120MM - LIMITED FIRE CONTROL - ENHANCED SURVIVABILITY

(TANK120-LFES)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 120mm or 125mm, limited fire control systems, and an enhanced level of survivability. Examples: 125mm T72B/T72S, T72BM, T72M1V, T64BV, T80BV,

Type 90-2/Khalid (CHI) and Type 98 (CHI). Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK120-LFES.

#### TANK 120MM - LIMITED FIRE CONTROL - MEDIUM SURVIVABILITY

(TANK120-LFMS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 120mm or 125mm, limited fire control systems, and a medium level of survivability. Examples: 120mm Chieftain MK5, Type 89 SPATG (CHI); 125mm Type 85-2M (CHI), T72A, T72M1, M84, T64B, T80B, Al Zarrar (PAK), Zulfiqar (IRN) and 2S25 SPATG. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK120-LFMS.

#### TANK 105MM - ADVANCED FIRE CONTROL - ENHANCED SURVIVABILITY

(TANK105-AFES)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, advanced fire control systems, and an enhanced level of survivability. Examples: 105mm Merkava MK1/MK2 and Magach7. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-AFES.

#### TANK 105MM - ADVANCED FIRE CONTROL - MEDIUM SURVIVABILITY

(TANK105-AFMS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, advanced fire control systems, and a medium level of survivability. Examples: 105mm M60A3TTS and Leopard 1A5. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-AFMS.

#### TANK 105MM - ADVANCED FIRE CONTROL - LOW SURVIVABILITY

(TANK105-AFLS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, advanced fire control systems, and a low level of survivability. Examples: 105mm AMX30B2, SK105[AFC] and Stingray2. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-AFLS.

**TANK 105MM - LIMITED FIRE CONTROL - ENHANCED SURVIVABILITY****(TANK105-LFES)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms Tanks with main guns of caliber 105mm or 115mm, limited fire control systems, and an enhanced level of survivability. Examples: 105mm M55S1 (YUG); and 115mm T-62MV (RUS). Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-LFES.

**TANK 105MM - LIMITED FIRE CONTROL - MEDIUM SURVIVABILITY****(TANK105-LFMS)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, limited fire control systems, and a medium level of survivability. Examples: M60A3, M48H (TAI), T-55AMV (RUS), AMX30EM2, Leopard 1A3/1A4, K1, Safir74 (IRN); and 115mm T-62M (RUS). Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-LFMS.

**TANK 105MM - LIMITED FIRE CONTROL - LOW SURVIVABILITY****(TANK105-LFLS)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, limited fire control systems, and a low level of survivability. Examples: 105mm M48A5[LFC], T-72Z (IRN), Type 74 (JPN), OF-40 MK2, Type 59-2[LFC] (CHI), Type 79 (CHI), Type 80 (CHI), Type 85 (CHI), Type 63A/Type 99 (CHI), and Stingray. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-LFLS.

**TANK 105MM - NO FIRE CONTROL - MEDIUM SURVIVABILITY****(TANK105-NFMS)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, no fire control systems, and a medium level of survivability. Examples: 105mm M60A1 and Leopard 1A1A1. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-NFMS.

**TANK 105MM - NO FIRE CONTROL - LOW SURVIVABILITY****(TANK105-NFLS)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 105mm or 115mm, no fire control systems, and a low level of survivability. Examples: 105mm, AMX13, AMX30/AMX30S/AMX30ER, M48A5[NFC], SK105[NFC], Type 59-2[NFC] (CHI), Oliphant, Tariq, Vickers MK1; and 115mm T62. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK105-NFLS.

#### TANK 85MM TO 100MM - LIMITED FIRE CONTROL - LOW SURVIVABILITY

(TANK100-LFLS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 85mm to 100mm, limited fire control systems, and a low level of survivability. Example: 90mm M48A3; 100mm T-55AM (RUS) and Type 69-2 (CHI). Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK100-LFLS.

#### TANK 85MM TO 100MM - NO FIRE CONTROL - LOW SURVIVABILITY

(TANK100-NFLS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tanks with main guns of caliber 85mm to 100mm, no fire control systems, and a low level of survivability. Example: 85mm T34-85, Type 63 (CHI), Type 62 (CHI), and M1985(PT85) (NK), 90mm AMX13, M47, M48A1/A2, M24, M36, Scorpion90 and Tosan; 100mm TR-85, TR580, T54, T55, Type 59, and Type 69. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK100-NFLS.

#### TANK 76MM - NO FIRE CONTROL - LOW SURVIVABILITY

(TANK76-NFLS)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. All vehicles with main guns of caliber 75 or 76mm, whether wheeled or tracked. Most have no fire control system and low survivability. Example: 75mm AMX13; 76mm Rooikat, Scorpion, Saladin, Cougar, M41, Type 74, PT76, and M18TD. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the TANK76-NFLS.

#### ARMORED GUN SYSTEM 105MM - LIGHT ARMOR

(AGS105-LF-HA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally wheeled armored vehicles mounting 105mm tank guns, most with limited fire control systems. Protected across their frontal arc from heavy machineguns. Examples: NORINCO 105mm and 120mm TD, AMX10RC, Centauro B1, R400, Rooikat 105mm, VEXTRA, Piranha TML105, 105mm LPT AG and LAV-III MGS. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the AGS105-LF-HA.

#### ARMORED GUN SYSTEM 90MM - LIGHT ARMOR

(AGS90-LA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally wheeled armored vehicles mounting 90mm tank guns, most with no fire control systems. Protected from small arms fire and shell splinters. Examples: AML90, ERC90, VBC90, EE9, Eland90, BMR-VEC 90, Simba CM90, Ratel FSV90, Piranha 90mm, LAV-150 90mm, Pandur 90mm, Dragoon LFV-90, Scorpion 90, LAV-AG and Pizarro 90. Vehicle crew should be modeled as combat system CREW. Coaxial, bow and turret mounted machineguns should not be modeled separately; they are included in the lethality values of the AGS90-LA.

#### ANTI-TANK GUIDED MISSILE SYSTEM SELF-PROPELLED - LONG RANGE - TOP ATTACK - LIGHT ARMOR - TURRETED WEAPON

(ATGMSP-LT-LT)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tracked or wheeled armored vehicle mounting an ATGM but no gun and dedicated to the anti-tank role. Max effective anti-tank range of 3500m or greater. Some vehicles may have machineguns. Vehicles are generally lightly armored although some are more heavily armored. Top attack capability allows it to defeat most armor. Gunner protected while firing. Although not a top attack weapon, the AT-14 is best modeled as this combat system because of its extremely high penetration ability. Examples: VAB HOT[Mephisto], LAV-III TOW and BMP3-TD AT14. Vehicle crew should be modeled as combat system CREW. ATGM and machinegun should not be modeled separately; they are included in the lethality values of the ATGMSP-LT-LT.

#### ANTI-TANK GUIDED MISSILE SYSTEM SELF-PROPELLED - LONG RANGE - HIGH LETHALITY - LIGHT ARMOR - TURRETED WEAPON

(ATGMSP-LH-LT)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tracked or wheeled armored vehicle mounting an ATGM but no gun and dedicated to the anti-tank role. Max effective anti-tank range of 3500m or greater. Some vehicles may have machineguns. Vehicles are generally lightly armored although some are more heavily armored. Armor penetration greater than or equal to 800mm. Gunner protected while firing. Examples: M901



TOW, M113 TOW[KE], AIFV TOW, BRDM-2 AT5B, AMX-10 HOT, VAB HOT[UTM800], Striker Swingfire, Jaguar1 HOT, Wiesel TOW/HOT, VCC TOW, Pandur TOW/HOT, VCAC HOT, VCR/TH HOT[UTM800], Piranha TOW[KE], V-150 TOW, BMP3-TD AT15, and WZ551 Red Arrow 8. Vehicle crew should be modeled as combat system CREW. ATGM and machinegun should not be modeled separately; they are included in the lethality values of the ATGMSP-LH-LT.

**ANTI-TANK GUIDED MISSILE SYSTEM SELF-PROPELLED - LONG RANGE - HIGH LETHALITY - LIGHT ARMOR - OPEN WEAPON**

(ATGMSP-LH-LO)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tracked or wheeled armored vehicle mounting an ATGM but no gun and dedicated to the anti-tank role. Max effective anti-tank range of 3500m or greater. Some vehicles may have machineguns. Vehicles are generally lightly armored although some are more heavily armored. Armor penetration greater than or equal to 800mm. Gunner not protected while firing. Examples: M113 TOW, Jaguar2 TOW, VBL TOW/HOT, Bravia V-700 TOW/HOT, Pvrbv 551 TOW, BMR600 TOW and MTLB-TD AT9. Vehicle crew should be modeled as combat system CREW. ATGM and machinegun should not be modeled separately; they are included in the lethality values of the ATGMSP-LH-LO.

**ANTI-TANK GUIDED MISSILE SYSTEM SELF-PROPELLED - LONG RANGE - MEDIUM LETHALITY - LIGHT ARMOR - TURRETED WEAPON**

(ATGMSP-LM-LT)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tracked or wheeled armored vehicle mounting an ATGM but no gun and dedicated to the anti-tank role. Max effective anti-tank range of 3500m or greater. Some vehicles may have machineguns. Vehicles are generally lightly armored although some are more heavily armored. Armor penetration less than 800mm. Gunner protected while firing. Examples: BRDM-2 AT4/AT5 mix, Ratel ZT-3 Swift, Type 92B Red Arrow 9 and MTLB-TD AT6. Vehicle crew should be modeled as combat system CREW. ATGM and machinegun should not be modeled separately; they are included in the lethality values of the ATGMSP-LM-LT.

**ANTI-TANK GUIDED MISSILE SYSTEM SELF-PROPELLED - SHORT RANGE - HIGH LETHALITY - LIGHT ARMOR - TURRETED WEAPON**

(ATGMSP-SH-LT)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Tracked or wheeled armored vehicle mounting an ATGM but no gun and dedicated to the anti-tank role. Max effective anti-tank range 2000m to 3000m. Some vehicles may have machineguns. Vehicles are generally lightly armored although some are more heavily armored. Armor penetration greater than or equal to 800mm. Gunner protected while firing. Examples:

BRDM-2 AT4, BRDM-2 AT3(Malyutka2), BOV AT3(Malyutka2), VAB Milan2, VBL Milan2, Spartan Milan2 and BMR-600 Milan2. Vehicle crew should be modeled as combat system CREW. ATGM and machinegun should not be modeled separately; they are included in the lethality values of the ATGMSP-SH-LT.

INFANTRY FIGHTING VEHICLE WITH ATGM - LONG RANGE - HIGH LETHALITY -  
EXTRA HEAVY ARMOR - TURRETED CANNON AND GUN

(IFV-ATLHXACG)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 100mm gun, a 30mm cannon, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection up to 20 to 23mm. Max effective anti-tank range greater than 3500m. Armor penetration greater than 700mm. Example: BMP-3. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Gun, cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATLHXACG.

INFANTRY FIGHTING VEHICLE WITH ATGM - LONG RANGE - HIGH LETHALITY -  
EXTRA HEAVY ARMOR - TURRETED CANNON

(IFV-ATLHXATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection up to 20 to 23mm. Max anti-tank range greater than 3500m. Armor penetration greater than 700mm. Examples: M2/M3 and Centauro VBC. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATLHXATC.

INFANTRY FIGHTING VEHICLE WITH ATGM - LONG RANGE - HIGH LETHALITY -  
HEAVY ARMOR - TURRETED CANNON

(IFV-ATLHHATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection from heavy machineguns. Max anti-tank range greater than 3500m. Armor penetration greater than 700mm. Examples: BMP1M, BMP1 AT5, BTR90, Desert Warrior, AF40-8-1[25mm] and VCC80. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATLHHATC.

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INFANTRY FIGHTING VEHICLE WITH ATGM - LONG RANGE - HIGH LETHALITY - LIGHT  
ARMOR - TURRETED CANNON

(IFV-ATLHLATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection from small arms and shell splinters. Max anti-tank range greater than 3500m. Armor penetration greater than 700mm. Examples: BMP2 AT5, BMD2 AT5, BMD3 AT5, BMP30, Fahd30, Sarath and Type 89 (JPN). Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATLHLATC.

INFANTRY FIGHTING VEHICLE WITH ATGM - SHORT RANGE - HIGH LETHALITY -  
EXTRA HEAVY ARMOR - TURRETED CANNON

(IFV-ATSHXATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection up to 20 to 23mm. Max anti-tank range 2000m to 3000m. Armor penetration greater than 700mm. Examples: M80/M80A, and Marder Milan2. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATSHXATC.

INFANTRY FIGHTING VEHICLE WITH ATGM - SHORT RANGE - HIGH LETHALITY -  
HEAVY ARMOR - TURRETED CANNON

(IFV-ATSHHATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection from heavy machineguns. Max anti-tank range 2000m to 3000m. Armor penetration greater than 700mm. Examples: BMP1 AT3(Malyutka2), WZ501 AT3(Malyutka2), MLI-84 AT3(Malyutka2), MLVM[IFV] AT3(Malyutka2), Warrior Milan2, and BMP23. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATSHHATC.

INFANTRY FIGHTING VEHICLE WITH ATGM - SHORT RANGE - MEDIUM LETHALITY -  
HEAVY ARMOR - TURRETED CANNON

(IFV-ATSMHATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection from heavy machineguns. Max anti-tank range 2000m to 3000m. Armor penetration less than 700mm. Examples: BMP1 AT3(Malyutka) and BMP1 AT4. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATSMHATC.

#### INFANTRY FIGHTING VEHICLE WITH ATGM - SHORT RANGE - MEDIUM LETHALITY - LIGHT ARMOR - TURRETED CANNON

(IFV-ATSMLATC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20mm to 40mm cannon or 73mm gun, heavy anti-tank missile system and coaxial/turret machineguns. Frontal protection from small arms and shell splinters. Max anti-tank range 2000m to 3000m. Armor penetration less than 700mm. Examples: WZ501 AT3(Malyutka), BMP2 AT4, WZ551[IFV] AT3(Malyutka), Type85[IFV] AT3(Malyutka), BMD1 AT3(Malyutka) BMD1P AT4, BMD2 AT4 and BMD3 AT4. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon, ATGM, and machineguns should not be modeled separately; they are included in the lethality values of the IFV-ATSMLATC.

#### INFANTRY FIGHTING VEHICLE - EXTRA HEAVY ARMOR

(IFV-XHA-TC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20 to 40mm cannon or 73mm gun, and machineguns; but generally not mounting an integrated anti-tank missile system. Max effective anti-armor range 1500m to 2000m. Frontal protection up to 20mm to 23mm. Examples: Marder, Luchs, Kentaurus, Pizarro[EA], VCTP, BRM-3K, AB14 Temsah (JOR), CV9030 and CV9040. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon and machineguns should not be modeled separately; they are included in the lethality values of the IFV-XHA.

#### INFANTRY FIGHTING VEHICLE - HEAVY ARMOR

(IFV-HA-TC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20 to 40mm cannon or 73mm gun, and machineguns; but generally not mounting an integrated anti-tank missile system. Max effective anti-armor range 1500m to 2000m. Frontal protection from heavy machineguns. Examples: Warrior, AMX10P, Pizarro/ASCOD, Pandur[25mm], Ratel20 IFV, Simba[25mm], Bionix, VBCI, VEC-2[25mm], BTR80A,

BTR94, Pbv501 and Pbv302[20mm]. Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon and machineguns should not be modeled separately; they are included in the lethality values of the IFV-HA.

#### INFANTRY FIGHTING VEHICLE - LIGHT ARMOR

(IFV-LA-TC)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armored vehicle mounting a 20 to 40mm cannon or 73mm gun, and machineguns; but generally not mounting an integrated anti-tank missile system. Max effective anti-armor range 1500m to 2000m. Frontal protection from small arms and shell splinters. Examples: Sabre, Scimitar, Fox, Wiesel 20, AIFV[25mm], Fiat 6616, ASCOD, Cougar, AMX VCI[20], VAB-VCI, VEC[20/25mm], XA-185 LAV, XA203S, LAV-150[25mm], LAV-25, AV81[25mm], Cobra23-2, Dragoon[30mm], DN5 Toro, Type 87 (JPN), RN94[25mm], Nurol AIFV[20/30mm], Type 90[20/25/30mm] (CHI), Type 89-2[25mm] (CHI), WZ 551 (CHI). Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as combat system INFANTRY. Cannon and machineguns should not be modeled separately; they are included in the lethality values of the IFV-LA.

#### ARMORED PERSONNEL CARRIER - EXTRA HEAVY ARMOR - OPEN WEAPON

(APC-XHA-OW)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with a machinegun on a pintle mount. Armor protection up to 20mm to 23mm. May be used either as infantry transport or reconnaissance vehicle. If used as command vehicle, ammo resupply vehicle, or prime mover, then model as combat system UTIL-VEH-LA. Examples: BMR-2, Leonidas, TABC79, Achzarit, and heavy armor class APCs that have enhanced armor protection added. Vehicle crew should be modeled as combat system CREW. If an infantry dismount team is carried, then the team should be modeled as combat system INFANTRY. Machineguns that stay with the vehicle when the infantry team dismounts should not be modeled separately; they are included in the lethality values of the APC-XHA-OW.

#### ARMORED PERSONNEL CARRIER - HEAVY ARMOR - OPEN WEAPON

(APC-HA-OW)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with a machinegun on a pintle mount. Armor protection against heavy machineguns. May be used either as infantry transport or reconnaissance vehicle. If used as command vehicle, ammo resupply vehicle, or prime mover, then model as combat system UTIL-VEH-LA. Examples: Fuchs, Transportpanzer 1[EA], KIFV, Boragh, VCC1[EA], VCC2, AF40-8-1, Classical (ISR) and light armor class APCs that have enhanced armor protection added. Vehicle crew should be modeled as combat system CREW. If an infantry dismount team, is carried then the team should be

modeled as combat system INFANTRY. Machineguns that stay with the vehicle when the infantry team dismounts should not be modeled separately; they are included in the lethality values of the APC-HA-OW.

**ARMORED PERSONNEL CARRIER - HEAVY ARMOR - TURRETED WEAPON**  
(APC-HA-TW)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with a machinegun in a turret or on a stable mount. Armor protection against small arms and shell splinters. May be used either as infantry transport or reconnaissance vehicle. If used as command vehicle, ammo resupply vehicle, or prime mover, then model as combat system UTIL-VEH-LA. Examples: BMR-600, BTR80, B33 (ROM), AF40-8-1, MRAV/GTK, XA186 and light armor class APCs that have enhanced armor protection added. Vehicle crew should be modeled as combat system CREW. If an infantry dismount team is carried, then the team should be modeled as combat system INFANTRY. Machineguns that stay with the vehicle when the infantry team dismounts should not be modeled separately; they are included in the lethality values of the APC-HA-TW.

**ARMORED PERSONNEL CARRIER - LIGHT ARMOR - OPEN WEAPON - ONE**  
(APC-LA-OW1)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Most are armed with a machinegun on a pintle mount, but some are unarmed. Armor protection against small arms and shell splinters. May be used either as infantry transport or reconnaissance vehicle. If used as command vehicle, ammo resupply vehicle, or prime mover, then model as combat system UTIL-VEH-LA. Examples: M113, M8, M20, MT-LB, BRDM1, BTR152, BTR40, BTR50, BTR60P/PA, OT62A, OT64A/B, OT65(FUG), LAV, BLR (SPN), Panhard M3, Panhard P4, Ferret MK1, Shorland S-55, FV432, Saxon, Sultan, BvS10, BV206S, AIFV/CM21, Transportpanzer1, Type 73 (JPN), Type SU 60 (JPN), Type 82 (JPN), Dragoon, UR416, Type 90 (CHI), Type 89/Type YW534 (CHI), Type 77/WZ211 (CHI), Type 63/YW531 (CHI), Type 85/YW531H (CHI), WZ551 (CHI), WZ523 (CHI), WZ503 (CHI), VTT323/M1973 (NKO), Walid, VCC1, EE3, EE11, Pbv401, Bushmaster, S600, Bison, Panhard Buffalo, Pandur, Cashuat, XA180/XA185, XA-230, TPK420 BL, TM-170, Armadillo, Gypsy, LOV OP, AMX VCI [w/o turret], VCC/TT, VAB VTT, VBL, VXB-170, Fahd [w/o turret], BDX, Piranha w/o turret, Condor, Dingo, Fiat 6614 (ITA), Puma4x4, Puma6x6, MAV-5, M35 (JOR), Terrier LAU, BOV-M, BOV-VP, Casspir MK3, Kobra, Mamba MK2, RG31 Charger, RG32 Scout, Roland, Otokar, Cobra, Akrep, Alvis 4, Tactica, Hussar, LAV 150/150S, Ranger, Ram, RBY MK1, DN3 Sedena, DN4 Caballo, ABI, Aligator, Scarab, M60P and M1114/M1116 armored HMMWVs. Vehicle crew should be modeled as combat system CREW. If an infantry dismount team, is carried, then the team should be modeled as combat system INFANTRY. Machineguns that stay with the vehicle when the infantry team dismounts should not be modeled separately; they are included in the lethality values of the APC-LA-OW1.

**ARMORED PERSONNEL CARRIER - LIGHT ARMOR - OPEN WEAPON - TWO****(APC-LA-OW2)**

This combat system is basically the same as APC-LA-OW1. Since there are so many actual APC systems that fall in this combat system class, three combat systems are assigned to this class. This allows you to differentiate between real world systems based on combat system prototype - combat system (CSP-CS) characteristics: weight, range, mobility, armament; whatever is important for your scenario.

**ARMORED PERSONNEL CARRIER - LIGHT ARMOR - OPEN WEAPON - THREE****(APC-LA-OW3)**

This combat system is basically the same as APC-LA-OW1. Since there are so many actual APC systems that fall in this combat system class, three combat systems are assigned to this class. This allows you to differentiate between real world systems based on combat system prototype - combat system (CSP-CS) characteristics: weight, range, mobility, armament; whatever is important for your scenario.

**ARMORED PERSONNEL CARRIER - LIGHT ARMOR - TURRETED WEAPON - ONE****(APC-LA-TW1)**

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Armed with a machinegun in a turret or on a stable mount, which gives it better lethality than an open weapon APC. Armor protection against small arms and shell splinters. May be used either as infantry transport or reconnaissance vehicle. If used as command vehicle, ammo resupply vehicle, or prime mover, then model as combat system UTIL-VEH-LA. Examples: BRDM2, BTR60PB, BTR70, PRP-4, OT62B/C, OT64C, OT65A, AMX VCI, VXB170 [w/MG turret], AML60, Fennek, Fahd [w/MG turret], Iranian 4x4 APC, Mohafiz (PAK), WZ 551B [w/MG turret] (CHI), WZ531/WZ523 [w/MG turret] (CHI), PSZH IV, MLVM, Grizzly (CAN), Ferret MK2, FV103 Spartan, FV432 [w/PEAK turret], Saracen, Shorland S52, Hornet, Cadillac Gage Scout, Bravia MK1, Bravia Commando MKIII, AAPC (TUR), TAB-71, TAB-77, Type 96 (JPN), HWK11, Simba, AV81, Dragoon LFFV-40mm, DN4 Caballo [w/MG turret], Condor [w/MG turret], LAV150S [w/MG turret], Cobra [w/MG turret], LAV-III [w/MG turret], Pirahna [w/MG turret], Pandur [w/MG turret], Roland [w/MG turret], RN94 [w/MG turret], Tactica [w/MG turret], Hussar [w/MG turret], ASV-150, Eland60, Eagle, SPY, and Snezka. Vehicle crew should be modeled as combat system CREW. If an infantry dismount team is carried, then the team should be modeled as combat system INFANTRY. Machineguns that stay with the vehicle when the infantry team dismounts should not be modeled separately; they are included in the lethality values of the APC-LA-TW1.

**ARMORED PERSONNEL CARRIER - LIGHT ARMOR - TURRETED WEAPON - TWO****(APC-LA-TW2)**

This combat system is basically the same as APC-LA-TW1. Since there are so many actual APC systems that fall in this combat system class, two combat systems are assigned to this class. This allows you to differentiate between real world systems based on combat system prototype - combat system (CSP-CS) characteristics: weight, range, mobility, armament; whatever is important for your scenario.

#### AMPHIBIOUS VEHICLE - LIGHT ARMOR - TURRETED WEAPON (AMPHIB-LA-TW)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Very similar to APC, but if listed here the carry capacity of operational items of this combat system will be added to the carry capacity of the first wave in an amphibious assault conducted by a unit having these combat system. Frequently mounting a turreted machinegun or automatic grenade launcher, which gives it better lethality than an open weapon APC. Armor protection against small arms and shell splinters. Examples: AAV7A1, LVTP5, LVTP7 and Arisgator, Vehicle crew should be modeled as combat system CREW. Dismount team should be modeled as INFANTRY. Machineguns should not be modeled separately; they are included in the lethality values of the AMPHIB-LA-TW.

#### TRUCK CARGO

##### (TRUCK-CARGO)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally mounting only a machinegun on a pintle. The lethality values are based on 60% of cargo trucks having a machinegun. Generally based on a five ton cargo truck, but which Transportation Class asset is mapped to TRUCK-CARGO is determined by data in the SLP. Thus a ten ton truck might be modeled as two of combat system TRUCK-CARGO. This is not a crewed combat system. JTLS DEPOT type units use this combat system to send dry supplies via explicit convoys. DEPOT type units may also use this combat system to assist other non-NAVAL type units in conducting a unit move by truck. JTLS GROUND, FARP, SQUADRON, and AIRBASE type units do not create explicit convoys, but may use cargo trucks to assist themselves in a unit move by truck. NAVAL type units (ships) will never use combat system TRUCK-CARGO. Trucks with dedicated full time loads, such as maintenance vans or kitchen vans, should be modeled as EQUIP-OTH-SP rather than TRUCK-CARGO.

#### TRUCK TANKER

##### (TRUCK-TANKER)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally mounting only a machinegun on a pintle. The lethality values are based on 40% of tanker trucks having a machinegun. Generally based on a 5000 gallon tanker, but which Transportation Class asset is mapped to TRUCK-TANKER is determined by data in the SLP. Thus a 10,000 gallon tanker might be modeled as two of combat system TRUCK-TANKER. This is not a crewed combat system. JTLS DEPOT type units use this combat system to send wet supplies via



explicit convoys. JTLS GROUND, FARP, SQUADRON, and AIRBASE type units do not create explicit convoys, but may use tanker trucks to assist themselves in a unit move by truck. NAVAL type units (ships) will never use combat system TRUCK-TANKER.

#### TRUCK LIGHT CARGO

(TRUCK-LT-CGO)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally mounting a machinegun or an automatic grenade launcher. The lethality values are based on 40% of light cargo trucks having a crew served weapon. Generally based on a 2.5 ton truck, but which Transportation Class asset is mapped to TRUCK-LT-CGO is determined by data in the SLP. This is not a crewed combat system. JTLS DEPOT type units use this combat system to send dry supplies via explicit convoys. DEPOT type units may also use this combat system to assist other non-NAVAL type units in conducting a unit move by truck. JTLS GROUND, FARP, SQUADRON, and AIRBASE type units do not create explicit convoys, but may use TRUCK-LT-CGO to assist themselves in a unit move by truck. NAVAL type units (ships) will never use combat system TRUCK-LT-CGO. All SLPs currently use the transportation class data that specify TRUCK-LT-CGO as a general cargo carrier. A specific ambulance transportation variant that can only carry personnel and casualties has been added to SDB and the SLP utility transportation class variant can be changed to this.

#### TRUCK - HEAVY EQUIPMENT TRANSPORTER

(TRUCK-HET)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Survivability values of this combat system are based on a large truck type vehicle. This is not a crewed combat system. This combat system will not be used for explicit resupply convoys. JTLS DEPOT type units use this combat system to assist other non-NAVAL type units in conducting a unit move by truck. JTLS GROUND, FARP, SQUADRON, and AIRBASE type units may use heavy equipment transporters to assist themselves in a unit move by truck. NAVAL type units (ships) will never use combat system TRUCK-HET. The absence or presence of heavy equipment transporters has no impact in the game on the loss (breakdown) rates of systems being transported.

#### UTILITY VEHICLE - LIGHT ARMOR

(UTIL-VEH-LA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally mounting a machinegun or an automatic grenade launcher. The lethality values are based on 50% of light armor utility vehicles having a crew served weapon. This is a crewed combat system. These are vehicles that would be classified as APCs if their primary role was infantry transport or reconnaissance. This combat system consists of APCs primarily performing other roles:

command vehicles, fire direction center, maintenance, ammo resupply, ambulances, prime movers, etc. The utility vehicle combat system is no longer used for explicit convoys; either for moving supplies or for moving a unit. Example: M577

#### UTILITY VEHICLE - NO ARMOR

(UTIL-VEH-NA)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Generally mounting a machinegun or an automatic grenade launcher. The lethality values are based on 25% of non-armored utility vehicles having a crew served weapon. This is a crewed combat system. The utility vehicle combat system is no longer used for explicit convoys; either for moving supplies or for moving a unit. Example: Jeep, HMMWV, Land Rover, GAZ-69, unarmored ambulances.

#### AIRCRAFT

(AIRCRAFT)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Used to represent the number of fixed wing aircraft in fixed wing squadrons, the number of rotary wing aircraft in rotary wing squadrons, or the number of UAV's in UAV squadrons. This is not a crewed combat system. Has no impact in any unit other than a JTLS SQUADRON type unit. Causes air to air and/or air to ground attrition through the air algorithms within the model.

#### EQUIPMENT - CHEMICAL

(EQUIP-CHEM)

Cause attrition via direct fire Lanchester equations. Do not cause attrition via high resolution combat. Some systems mount a machinegun on a pintle mount. The lethality values are based on 15% of chemical related equipment having a machinegun. Survivability values of this combat system are based on 80% truck type vehicles and 20% trailers. The absence or presence of chemical related equipment combat systems has no impact on the limited chemical play within the game. Examples: various decontamination vehicles. Crew should be modeled as combat system CREW. This combat system is primarily intended to enhance intelligence play.

#### EQUIPMENT - OTHER - SELF-PROPELLED

(EQUIP-OTH-SP)

Causes attrition via direct fire Lanchester equations and via point lethality high resolution combat algorithms. Generally mounting a machinegun on a pintle mount. The lethality values are based on 25% of other equipment having a machinegun. Survivability values of this combat system are based on 50% truck type vehicles and 50% lightly armored vehicles. This is a crewed combat system. Crew should be modeled as combat system CREW. Used to represent any piece of equipment that you may

want to track that doesn't match another combat system. Any truck that is not a general cargo carrier could be modeled as EQUIP-OTH-SP. Examples: kitchen trucks, recovery vehicles. This combat system is no longer used to represent explosives in the SOF\_CSP or OTHER\_SF\_CSP. The combat system INFENG-SPWPN is now used to represent someone using hand placed explosive charges, C4, satchel charges, demolition devices, etc.

#### EQUIPMENT - OTHER - TOWED

##### (EQUIP-OTH-TO)

Non-attritor, causes no losses in Lanchester combat or high resolution combat. Survivability values of this combat system are based on unarmored trailers or vans. This is a not a crewed combat system. Used to represent any piece of towed or carried equipment that you may want to track that doesn't match another combat system. Any trailer, with or without equipment mounted in it. This combat system will not be used for explicit convoys. If you want to use the carry capacity of cargo trailers in the model they will have to be modeled as TRUCK-CARGO, TRUCK-LT-CGO, or TRUCK-TANKER. Examples: kitchen trailers, trailers with maintenance or parts vans, water or fuel trailers, trailers with signal or FDC vans, generators, radar equipment (if not modeled as a sensor target), etc. This combat system is no longer used to represent explosives in the SOF\_CSP or OTHER\_SF\_CSP. The combat system INFENG-SPWPN is now used to represent someone using hand placed explosive charges, C4, satchel charges, demolition devices, etc.

#### EQUIPMENT - ENGINEER1

##### (EQUIP-ENG1)

Cause attrition via direct fire Lanchester equations and point lethality high resolution combat algorithms. Some systems mount a machinegun on a pintle mount. The lethality values are based on 30% of engineer equipment having a machinegun. Survivability values of this combat system are based on 55% truck type vehicles and 45% armored vehicles. Engineer squad vehicles should be counted as APC's unless they are significantly different. Dump trucks may be counted as cargo trucks, utility vehicles or as engineer equipment. Vehicle crew should be modeled as combat system CREW. The absence or presence of engineer equipment combat systems currently has no impact in the game on a unit's ability to conduct the limited engineering functions within the game. This will change in future versions of the model. Examples: bulldozers, plows, tractors, digging machines, mine laying equipment, mine clearing equipment, cranes, and combat engineer vehicles. Some mine laying and mine clearing equipment may be better represented by the SSM target types MCLC.TRAILER (Mine Clearing Line Charge), VOLCANO(APC), and VOLCANO(TRUCK).

#### EQUIPMENT - ENGINEER2

##### (EQUIP-ENG2)

This combat system is basically the same as EQUIP-ENG1. Since there are many different types of engineer systems, three combat systems are assigned to this class. This allows you to differentiate between real world systems based on combat system prototype - combat system (CSP-CS) characteristics: weight, range, mobility, armament and digging rate(future); whatever is important for your scenario.

#### EQUIPMENT - ENGINEER3

(EQUIP-ENG3)

This combat system is basically the same as EQUIP-ENG1. Since there are many different types of engineer systems, three combat systems are assigned to this class. This allows you to differentiate between real world systems based on combat system prototype - combat system (CSP-CS) characteristics: weight, range, mobility, armament and digging rate(future); whatever is important for your scenario. In future versions when digging rate becomes a CSP-CS characteristic, this combat system could be used to represent dozer blades mounted on other combat systems. In this case the CSP data should show that this combat system is a non-attritor and is not a crewed combat system.

#### ELDERLY CIVILIANS

(ELDERLY-CIVILNS)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Also suffer no losses in Lanchester combat. Are subject to area lethality and point lethality algorithms. This represents non-combatant men and women 65 years old or older. This is a personnel combat system.

#### CIVILIAN MEN - 15 YEARS AND UP

(MEN.15.UP)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Also suffer no losses in Lanchester combat. Are subject to area lethality and point lethality algorithms. This represents non-combatant men between 15 and 64 years old. This is a personnel combat system.

#### CIVILIAN WOMEN - 15 YEARS AND UP

(WOMEN.15.UP)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Also suffer no losses in Lanchester combat. Are subject to area lethality and point lethality algorithms. This represents non-combatant women between 15 and 64 years old. This is a personnel combat system.

#### CIVILIAN YOUTH - 6 TO 14 YEARS OLD

(YOUTH\_6-14YO)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Also suffer no losses in Lanchester combat. Are subject to area lethality and point lethality algorithms. This represents non-combatant boys and girls between 6 and 14 years old. This is a personnel combat system.

#### CIVILIAN INFANTS 0 TO 5 YEARS OLD

(INFANTS\_0-5YO)

Non-attritor, cause no losses in Lanchester combat or high resolution combat. Also suffer no losses in Lanchester combat. Are subject to area lethality and point lethality algorithms. This represents non-combatant boys and girls between birth and 5 years old. This is a personnel combat system.



## APPENDIX C. VERSION 3.2 STANDARD DATABASE CHANGES

The JTLS 3.2.0.0 Standard Database (SDB) includes extensive data item modifications implemented since the Version 3.1 release. Items that have been changed, added, deleted, or renamed are described in this Appendix.

### C.1 GENERAL MODIFICATIONS

An inclusive listing of changes is not possible, due to the extensive revision of the database. Significant modifications include the following:

1. Most of the TUPs are new based on TO&E data researched for the specific units in the scenario.
2. Combat System Prototypes were built specifically for the forces in the scenario.
3. Air Control Prototypes were built specifically for the forces in the scenario.
4. A new Pumping Station subcategory, named PIPELINE\_INT\_PT, was added.
5. A new Sensor Site subcategory, named AN-MPQ64, was added.
6. Several new Aircraft Classes were added:
  - AERO.COMMNR690
  - AEW.SEA.KING
  - AH1.GAZELLE
  - C140.JETSTAR
  - F33C.BONANZA
  - MFI-17.MUSHSHAK
  - MH6.LITTLE.BIRD
  - MQ1A.PREDATOR
  - PHOENIX.UAV
  - PR9.CANBERRA
  - RQ7A.SHADOW
  - TB200.TOBAGO
  - TB21.TRINIDAD
7. The High Explosive Targetable Weapons fired by naval guns were changed from a single round to a burst, due to the implementation of volley fire. New Area Kill Lethality sets were added for these weapons. Calibers were adjusted for the new weapons.

## C.2 NEW sdboif SCENARIO

The release version of SDB includes a new scenario, sdboif, which stands for Standard DataBase Operation Iraqi Freedom. This is a scenario based on the Coalition invasion of Iraq in March 2003. While this scenario contains most of the combat units available at the start of the war, it is not complete. This scenario will continue to have units and targets added to it over time. The target set only includes some of the targets in Iraq. A pipeline network and a rail network were built, but only within Iraq. Our goal was not 100% accuracy with this scenario, as only unclassified sources were used. Our goal was to present a workable scenario that was recognizable to people when used as a demonstration of the model's capabilities or when conducting training on the simulation.

This database is completely different than the ATLANTIS SDB.

## C.3 COMBAT SYSTEM UPGRADES

This section provides instructions for upgrading from 43 to 99 Combat Systems if you haven't already done so.

1. Delete unused TUPs, unless:

- you plan to use them eventually.
- they will be used with Detach Unit By TUP.

2. SQL Airbase, Squadron, and Naval TUPs to remove Combat Systems with zero TOE.

- Do not do this for Ground, Depot, or FARP units. Other units may be attached that own additional Combat Systems. These are required to support the CS Score value.

3. Take care of Combat Systems that are no longer specifically included in the 99 CS.

- Any TUP that has BRIDGING-EQP Combat Systems should have them moved to the OTHER-EQUIP Combat System.
- Any TUP that has SPE1-SPT-EQP Combat Systems should have them moved to the OTHER-EQUIP Combat System.
- Delete these Combat Systems:  
BRIDGING-EQP, LAW, SPE1-SPT-EQP, C3I



4. Rename the 43 Combat Systems to their new 99 CS names.

**Table C.1 Renamed SDB 31 Combat Systems**

<b>43 CS NAME</b>	<b>99 CS NAME</b>
AIRCRAFT	AIRCRAFT
AMPHIB-VEH	AMPHIB-LA-TW
APC	APC-LA-OW1
ARMR-GUN-SYS	AGS90-LA
ATGM-AFV	ATGMSP-LT-LT
C3I	Delete - No longer used
CHEM-REL-EQP	EQUIP-CHEM
COMD-SIG-VEH	UTIL-VEH-LA
CREW-WEAPONS	CREW-WEAPON
ELDERLY-CIVILNS	ELDERLY
ENGINEER-EQP	EQUIP-ENG2
HAW-ATGM	AT-HAW-LR-HL
HV-HOWTZ-GUN	ARTYTOW-MHV
HV-SP-HOWTZ	ARTYSP-MHV-T
HVY-EQP-TRAN	TRUCK-HET
IFV	IFV-HA-TC
IFV-W-ATGM	IFV-ATLHXATC
INFANTRY	INFANTRY
INFANTS_0-5YO	INFANTS
LAV	IFV-LA-TC
LR-MLRS	MRL-LR-VEH
LT-HOWTZ-GUN	ARTYTOW-LT
LT-SP-HOWTZ	ARTYSP-LT-T
MAW	AT-MAW-LR
MD-HOWTZ-GUN	ARTYTOW-MLT
MEN.15.UP	MEN
LT-MORTARS	MTRDISM81-82
HV-MORTARS	MTRDISMHVY

**Table C.1 Renamed SDB 31 Combat Systems (Continued)**

43 CS NAME	99 CS NAME
OTHER-EQUIP	EQUIP-OTH-SP
OTHER-TROOPS	OTHER-TROOPS
RCL-RIFLE	ATG73-106NMC
SR-MRL	MRL-SR-VEH
TANKS-3	TANK100-LFLS
TANKS-1	TANK120-AFHS
TANKS-2	TANK105-AFMS
TRUCK-CARGO	TRUCK-CARGO
TRUCK-TANKER	TRUCK-TANKER
TRUCK-UTILTY	UTIL-VEH-NA
WOMEN.15.UP	WOMEN
YOUTH_6-14YO	YOUTH

5. Create the remaining 56 Combat Systems by cascade duplicating from the existing 42 Combat Systems. *Be sure to SAVE after each cascade duplicate.*

**Table C.2 SDB 3.1 Cascade Duplicate CS Names**

43 CS RENAMED	CASCADE DUPLICATE NAME
AGS90-LA	AGS105-LF-HA
APC-LA-OW1	APC-HA-OW
APC-LA-OW1	APC-HA-TW
APC-LA-OW1	APC-LA-OW2
APC-LA-OW1	APC-LA-OW3
APC-LA-OW1	APC-LA-TW1
APC-LA-OW1	APC-LA-TW2
APC-LA-OW1	APC-XHA-OW
APC-LA-OW1	MTRSPHVY-LAO
APC-LA-OW1	MTRSPLT-LAO
ARTYSP-LT-T	ARTYSP-LT-O

**Table C.2 SDB 3.1 Cascade Duplicate CS Names (Continued)**

<b>43 CS RENAMED</b>	<b>CASCADE DUPLICATE NAME</b>
ARTYSP-LT-T	ARTYSP-MLT
ARTYSP-LT-T	MTRSP120-LAT
ARTYSP-MHV-T	ARTYSP-HV-O
ARTYSP-MHV-T	ARTYSP-MHV-O
ARTYTOW-LT	ARTYTOW-VLT
ARTYTOW-LT	ATG100-125MC
ARTYTOW-MHV	ARTYTOW-HVY
ATGMSP-LT-LT	ATGMSP-LH-LO
ATGMSP-LT-LT	ATGMSP-LH-LT
ATGMSP-LT-LT	ATGMSP-LM-LT
ATGMSP-LT-LT	ATGMSP-SH-LT
AT-HAW-LR-HL	AT-HAW-LR-TA
AT-HAW-LR-HL	AT-HAW-SR-HL
AT-HAW-LR-HL	AT-HAW-SR-ML
AT-HAW-LR-HL	AT-HAW-SR-TA
AT-MAW-LR	AT-MAW-SR-HL
AT-MAW-LR	AT-MAW-SR-ML
AT-MAW-LR	AT-MAW-SR-TA
EQUIP-ENG2	EQUIP-ENG1
EQUIP-ENG2	EQUIP-ENG3
EQUIP-OTH-SP	EQUIP-OTH-TO
IFV-ATLHXATC	IFV-ATLHHATC
IFV-ATLHXATC	IFV-ATLHLATC
IFV-ATLHXATC	IFV-ATLHXACG
IFV-ATLHXATC	IFV-ATSHHATC
IFV-ATLHXATC	IFV-ATSHXATC
IFV-ATLHXATC	IFV-ATSMHATC
IFV-ATLHXATC	IFV-ATSMLATC
IFV-HA-TC	IFV-XHA-TC

**Table C.2 SDB 3.1 Cascade Duplicate CS Names (Continued)**

<b>43 CS RENAMED</b>	<b>CASCADE DUPLICATE NAME</b>
INFANTRY	ELITE-INF
INFANTRY	INFENG-SPWPN
INFANTRY	SNIPER
MRL-LR-VEH	MRL-MR-VEH
MRL-SR-VEH	MRL-SR-TOWED
MTRDISM81-82	MTRDISM50-60
OTHER-TROOPS	CREW
TANK100-LFLS	TANK100-NFLS
TANK100-LFLS	TANK76-NFLS
TANK105-AFMS	TANK105-AFES
TANK105-AFMS	TANK105-AFLS
TANK105-AFMS	TANK105-LFES
TANK105-AFMS	TANK105-LFLS
TANK105-AFMS	TANK105-LFMS
TANK105-AFMS	TANK105-NFLS
TANK105-AFMS	TANK105-NFMS
TANK105-AFMS	TANK120-LFES
TANK105-AFMS	TANK120-LFMS
TANK120-AFHS	TANK120-AFES
TRUCK-CARGO	TRUCK-LT-CGO

6. Complete a download of the Oracle database.
7. Save copies of the following files from your scenario directory to a safe location.

**Table C.3 Scenario File Names**

<b>ORIGINAL NAME</b>	<b>VALID COPY CHECK</b>
'scenarioName'.ccp_cs	Same CCP names as SDB?
'scenarioName'.ccp_cs_tt	Same CCP names as SDB?
'scenarioName'.csp_cs	Same CSP names as SDB?

**Table C.3 Scenario File Names (Continued)**

ORIGINAL NAME	VALID COPY CHECK
'scenarioName'.csp_cs_mft	Same CSP and Land Minefield names as SDB?
'scenarioName'.cs_tt	
'scenarioName'.cs_tw	Same Targetable Weapons as SDB?
'scenarioName'.eph	
'scenarioName'.flp_cs	Same FLP names as SDB?
'scenarioName'.flp_csp_cs	Same FLP and CSP names as SDB?
'scenarioName'.fwl	
'scenarioName'.fwl_cs	
'scenarioName'.sp_cs	Same SP names as SDB?
'scenarioName'.spec_cs	
'scenarioName'.up_up	

8. Copy the files in the list above from SDB to your scenario with your scenario name.
9. If your answer is NO to the question in the Valid Copy Check column, edit the SDB file to match your scenario.
10. Add data for additional CSPs needed for your scenario.
11. Make changes to each TUP's authorized Combat Systems to match the new 99 CS.
12. Make changes to each TUP's Supply Categories based on the Combat System changes.
13. Make adjustments to personnel Combat Systems to reflect crew requirements.
14. Copy the new\_tup\_cs\_score.tbl file from the SDB alterdata directory to your alterdata directory.
15. From the DDS Alter Database menu, select TUP and reset TUP CS Score. Select Load and Modify TUP CS Score.

#### C.4 SUPPORTING EXISTING COMBAT SYSTEMS

This section provides instructions for users who choose to retain their existing set of Combat Systems.

1. Lanchester coefficient data are still reduced. Since they are no longer indexed by FLP and SP, you must use the FLP and SP FWL modifiers to account for those differences. Typically, the Opposing Force FLP and SP resulted in the Opposing Force causing less attrition to other forces while taking more attrition from other forces. Using the same FLP and SP FWL modifier values listed in [Section C.1](#) is recommended.
2. The CSP-CS data now include a Killer FWL Modifier and a Victim FWL Modifier. You may prefer to change these MODIFIERS for less-capable systems in some CSPs. Note that a Victim FWL Modifier greater than 1.0 means that the associated Combat System will suffer more losses.

## C.5 REMAINING ENHANCEMENTS

This section describes data that have not been added or updated for this release.

SUP Combat Systems have not been changed to the new 99 Combat Systems. Minimal changes were made to the NAVY\_CSP that allow existing SUPs to function. SUP changes that include a new NAVY\_CSP will be provided for a future JTLS release.

The ECP *JTLS-2005-1480 Lifeboat Representation* has not been fully implemented or tested for this release. Therefore, no SUP has been assigned a Lifeboat HUP. If you choose to use this functionality, you must assign a Lifeboat HUP to the SUP of interest and change the SUP Lifeboat Mean Time To Deploy, which is currently set to the default time of 1.0 minutes. Lifeboat HUPs have been added; Lifeboat HUP names are identified by the initial characters LB.

SSM target subcategories now have an array of targetable weapons they can fire. New SSM subcategories have been built for use by ships, but the SUPs have not been updated to use the new subcategories. The current SUPs have the old SSM subcategories, which are still functional. Since there is no caliber for SSM targets, new supply categories for ship launched torpedoes and missiles will need to be added to control targetable weapon selection. We hope to do a major update of all SUPs in 2007 but that will depend on the priorities assigned by the government.