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Please use the same title listed on the 75th MORSS Disclosure Form 712 A/B. If the title of the presentation has changed please list both.)

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An Experiment in Theater ~~Sustainment~~ using the Joint Analysis System

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SPECIAL SESSION 1:		TUTORIAL:	
SPECIAL SESSION 2:		OTHER:	
SPECIAL SESSION 3:			

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An Experiment in Theater Sustainment using the Joint Analysis System (U)

Paul J. Bross
Center for Innovation

Richard Madson
L&MR LMIC - IS&GS

Logistics and Material Readiness (L&MR) Project Overview

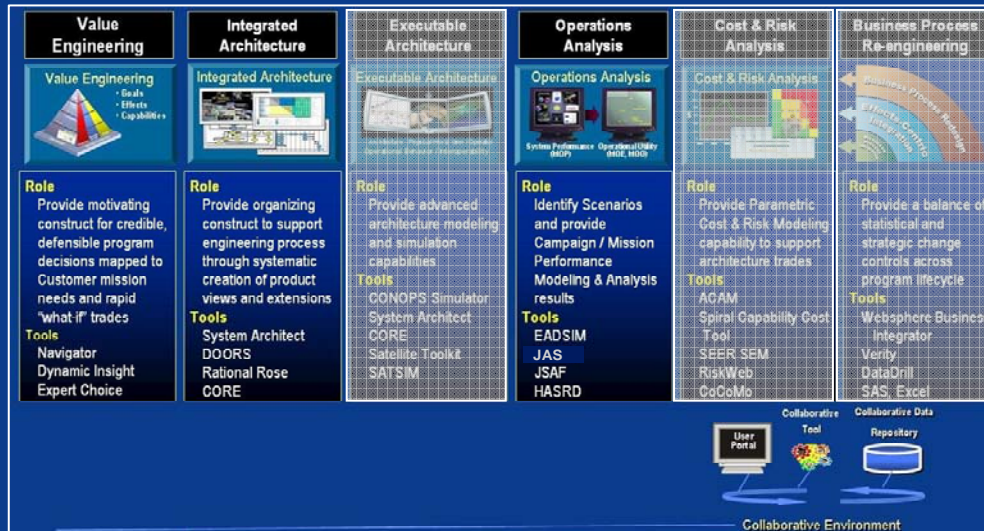


- L&MR LMIC tasked to develop the integrated architecture for DoD logistics
- Mobility workshops were conducted to scope effort
 - Resulting focus: Theater Transportation and Distribution
- Value Engineering sessions conducted to confirm validity of focus
- Operational DoD Architecture Framework views developed
- Operational analysis of the architecture using JAS (was JWARS)
 - Increment 0 - "Proof of Principle"
 - Series of discovery experiments to determine the capability of JAS to address Logistics and Materiel Readiness (LMR) issues.
 - Issues include both operational outcome effects and lower-level metrics focused specifically on logistics functions.
 - Data generated by JAS output not study quality, however may be used to shape subsequent studies.

OMEGA® Engineering Framework Competencies



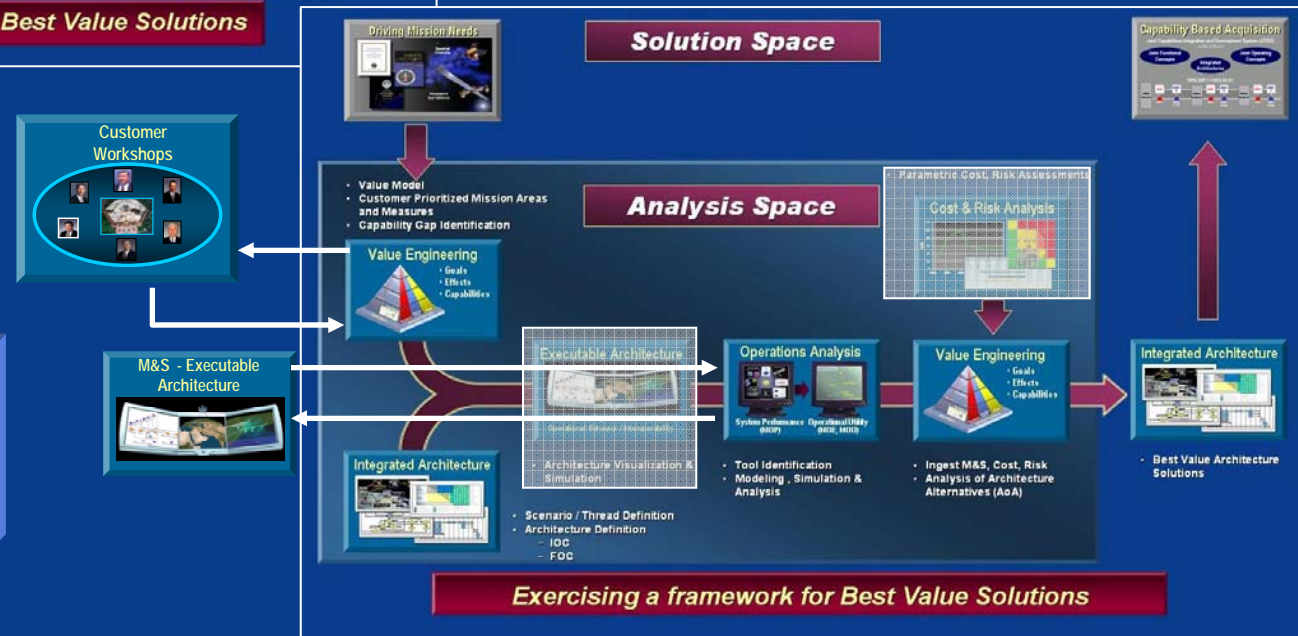
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Framework competencies for Best Value Solutions

OMEGA® Engineering Framework
Tailored for Capability Based Assessment (CBA) of L&MR

Cycle Repeated for each level of Capability Based Assessment

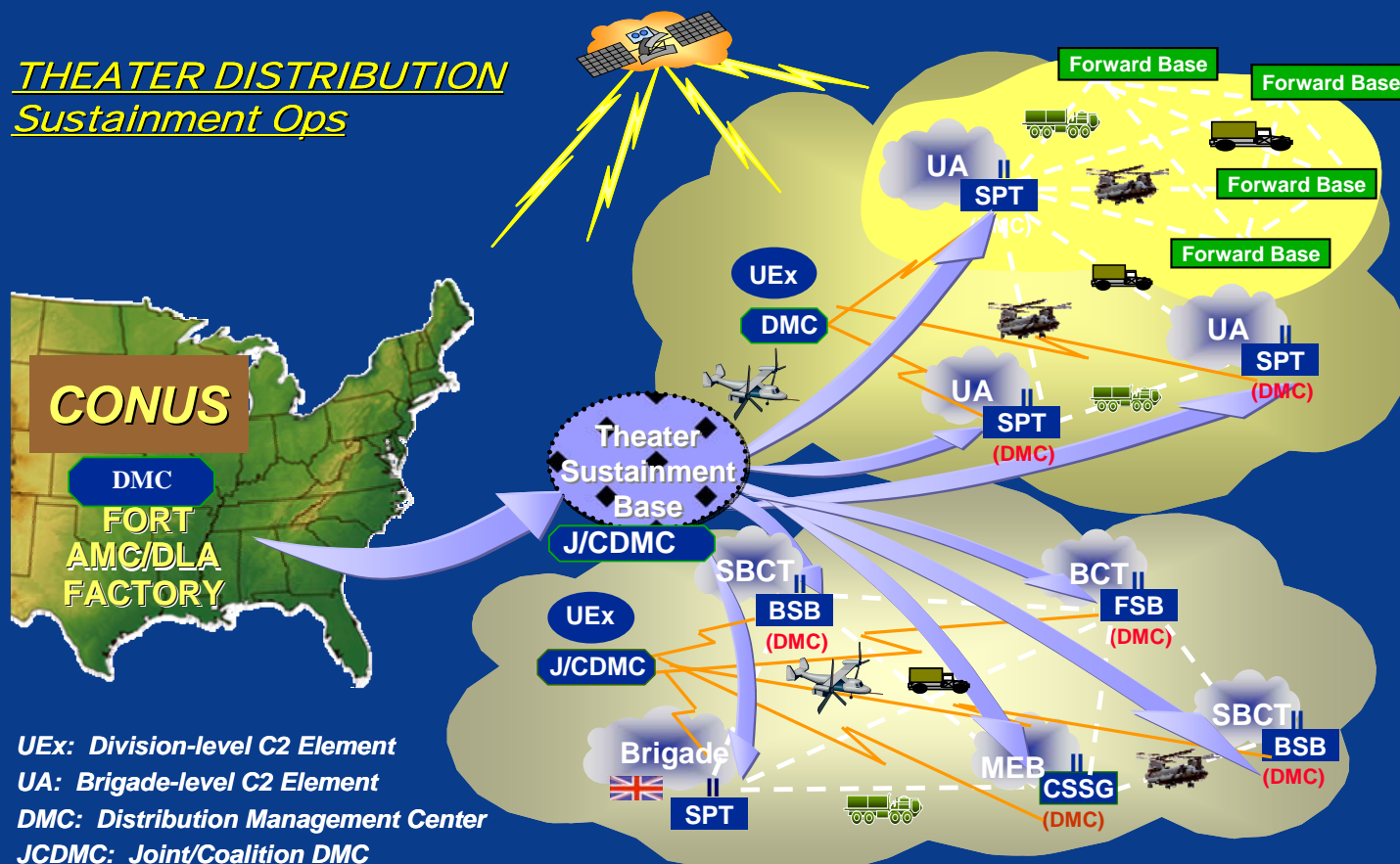


LMR LMIC Project Overview

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Area of Interest: Agile Sustainment with focus on the seams between strategic delivery into theater and transfer of materiel and supplies to the end user

Distribution Operational View OV-1



Joint Data Support (JDS) Assessment



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Joint Data Support

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Expand All - Collapse All

Home (U)

What's New (U)

Analytic Agenda (U)

Scenarios (DPS, MSFD, AB) (U)

Studies (U)

Forces, Units, Equipment (U)

M&S Tool Registry (U)

Reference Data and Links (U)

Archived Products (U)

JDS Web Site Access (U)

JDS Forums (U)

Acronyms and Abbreviations (U)

Suggestions and Feedback (U)

About JDS (U)

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Strategic Analysis M&S Toolkit Tool Classification

Tool	Planning		Traditional Force-on-Force			C4ISR			Mobility and Logistics			WMD		Non - Traditional		
	Adaptive Planning	Effects Based	Air Power	Ground	Maritime	C2	COMM	ISR	Force Allocation	Logistics	Inter-Theater	Intra-Theater	Missile Defense	CBRN	Special Operations	Behavior
Analytical Baseline Tools																
AMP										M	M					
EADSIM			M										M			
ELIST											M					
HPAC														E		
ITEM			C	C	C								C			
JCATS	M			M											M	
JICM			C	C												
MIDAS										M						
THUNDER			C	C	C											
Component Study Tools																
APOD										E	E					
ARCEM											E					
CFAST	M										M	M				
CMARPS											E					
COSMOS						M	M	M					M			
FSST									M							
IGS	C	C	C	C	C										C	C
JAS			C	C	C	C	C	C	C	C	C	C	C	C		
JFAST	M															
JFCT									M							
NETWARS						M										
NSS				C				C					C			
STK						M	M									
SUSGEN									M							
VLS Track													E			

JAS tool provides most breadth:

• Force-on-Force

• C4ISR

• Mobility & Logistics

• WMD

JAS tool provides most breadth:

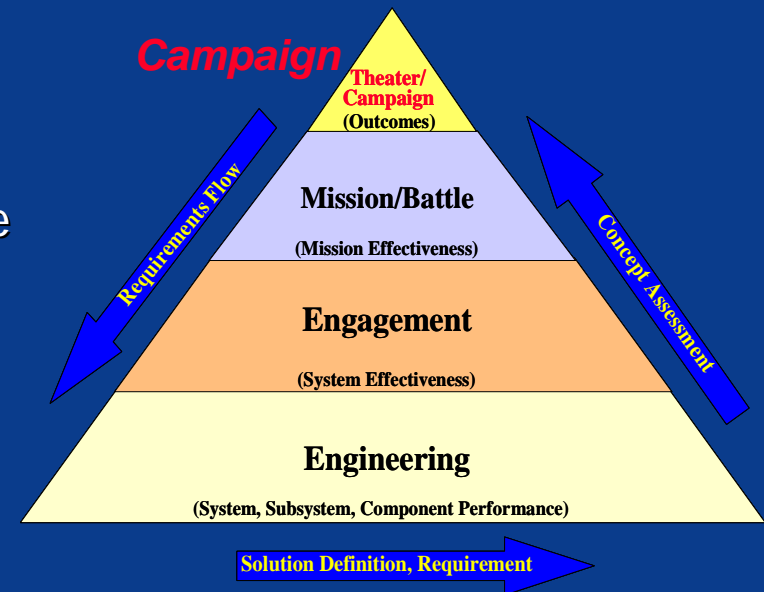
- Force-on-Force
- C4ISR
- Mobility & Logistics
- WMD

Joint Analysis System (JAS)



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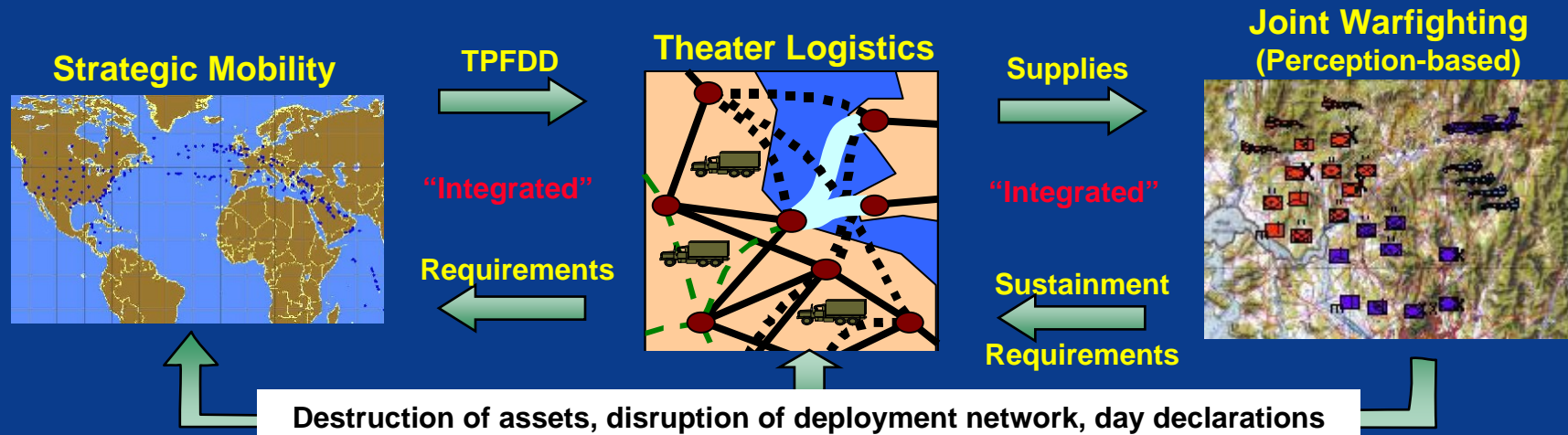
- A high-fidelity Campaign wargame simulation
 - sponsored by the JFCOM - Joint Forces Command (J9)
 - jointly developed by CACI, Inc. and PROSOFT
- Intended to provide high fidelity to all forms of battle
 - Land
 - Air
 - Sea
 - Undersea
 - Space, not at high fidelity
 - Amphibious
 - Airborne
 - Chemical warfare
 - TBM / TBM defense
 - Special Operations
- Strong emphasis on Transportation & Logistics
 - Strategic Mobility and Intra-Theater Logistics
- An agent-based simulation
- Platforms:
 - PC-based application, with either a PC- or Sun-based Oracle server.
 - Can export data to Excel, Access, or XML.
 - Usually runs on a DoD SECRET system, scenario / data classified. Can run Unclassified.
- JAS continues to evolve
 - Current version is "Release 2.0"



JAS – Fully Integrated from Fort to Foxhole



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C4ISR-centric, Joint Campaign-Level Model with Integrated Strategic Mobility, Theater Logistics, and Joint Warfighting

Each Functional Area ...

JAS Warfighting Areas

Land Warfare

Maritime Warfare

Air & Space Warfare

Intratheater Logistics

Strategic Mobility

Special Operations

TBMD & WMD

ISR

C² and Communications

Consists of:

Planning

- User Inputted rules or events
- Decision logic implemented in code

Execution

- Controlled via C2 logic / rules
- Includes Movement / Maneuver / Combat

Adjudication

- Results of interactions, e.g. kills and detections

Note: TPFDD = Time-Phased Force Deployment Data

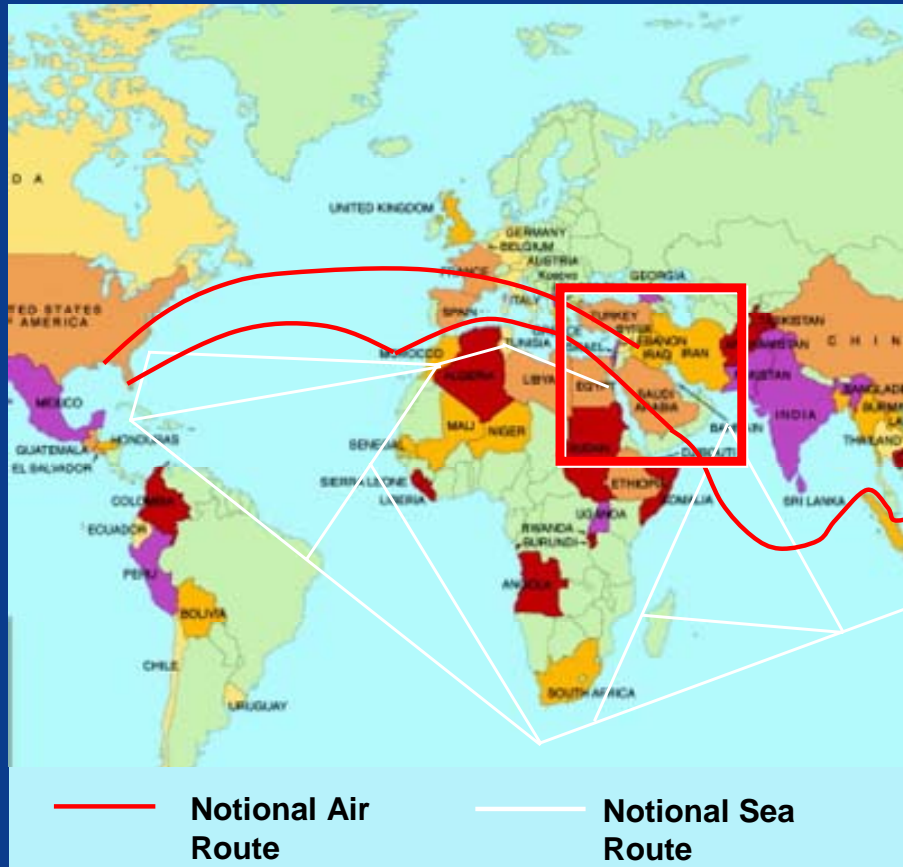
JAS Transportation and Logistics



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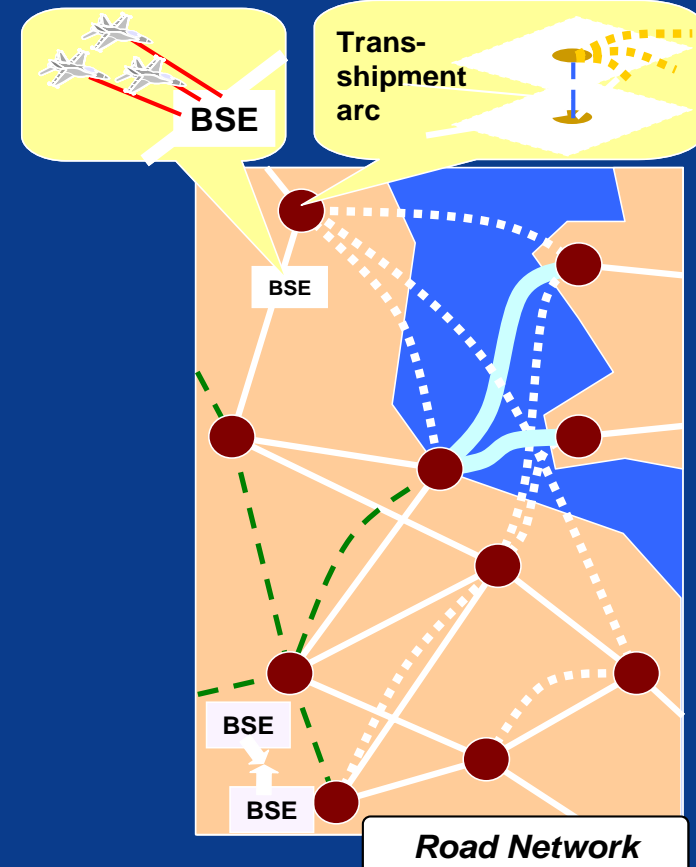
Inter-theater transportation (Strategic Mobility)

- From Continental US to another region Point of Debarkation (APOD, SPOD)
- Input Time-Phased Force Deployment Data (TPFDD) defines transportation requirement



Intra-theater transportation

- Theater Point of Debarkation (POD) to Tactical Assembly Area (TAA) location





- JAS requires a very detailed transportation and logistics plan for the scenario
 - For each unit, scenario must specify when, where, and how it will arrive in the theater
 - JAS models the capabilities of each seaport, aircraft, road, etc.

Inter-theater transportation

- Planning: Strategic Mobility

Order of Battle
Required delivery dates
Sealift ships
CRAF aircraft
Airlift aircraft
No-fly zones
Canal Status
Ports/ Installations

Deployment
Flow
Scheduler

Loading of ships
Loading of aircraft
Routes
Departure Times
Arrival times

-Execution

- Pauses for SLOC Closure
- No-fly zones

-Adjudication

- Mine Fields
- Ship Interdiction
- Arrival at ports
- Unloading
- Chemical attacks on ports

Intra-theater transportation

- Planning: Intra-theater Logistics

•Admin Move Orders
•Commander's Inputs
•Installation requests
•POD to destination shipping requirements
•Sustainment stockpiles
•Network status

Theater
Scheduler

•Generic to specific items conversion
• Shipment orders

-Execution

- Supply requests
- Conversion of generic items
- Distribution systems operated by component commander
- Movement on network

-Adjudication

- Resource attrition due to attacks
- Inventory levels

Design Memo - Increment 0 "Proof of Principle"



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Design Memo for OA Modeling of Joint Deployment and Distribution Enterprise (JDDE) with JAS

Increment 0 – Proof of Principle

- Series of discovery experiments to determine the capability of JAS to address Logistics and Materiel Readiness (LMR) issues.
- Issues include both **operational outcome** effects and **lower-level metrics** focused specifically on logistics functions.
- Data generated by JAS **output not study quality**, however may be used to shape subsequent studies.
- Base Case scenario is derived from a US Joint Forces Command (JFCOM) scenario based on the Unified Quest series.

Increment 0 – Study Variables



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Operational Dependent Variables:

- Time to Achieve Objective
- Time spent inactive due to supply shortage
- Time to gain Air Superiority
- Percent sorties not flown due to logistics
- Time SLOC last opened and not closed again by Red forces
- Percent of time SLOC is open
- Percent of TBMD launches leaking through defenses
- Loss Exchange Ratio (LER)

Control Variables (constant during Inc0):

- Time to load, unload, process
- Command and control structure for logistics planning
- Command and control structure for lift asset management
- All other JAS factors, including weather, terrain, *etc.*

Logistical Dependent Variables:

- Available Days of Supply
- Lift capacity shortfalls
- Total number of supply requests delivered by common user assets
- Percent of lift assets used per day per task force

Independent Variables

- **Days of Supplies:** *Class III – Fuel, Class V – Ammo, and Bulk Cargo – all other classes (food, medical, maintenance, ...)*
 - UD: number of Unit Days of Supply to be held by operating BSEs and Brigade-level headquarters elements
 - SD: number of Days of Supply to be held by SSAs and other logistics echelons rearward of operating Brigades
- **Quantity of Transport Assets**
 - AT: number of Air Transport assets available for intra-theater transportation
 - GT: number of Ground Transport assets available for intra-theater transportation
- **Quality of Transport Assets**
 - JH: mix of intra-theater aircraft representing C130J or C130H lift capacity
 - FT: mix of ground intra-theater trucks representing the future truck system or the existing fleet

Design Memo – Phased Approach



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Phase I: Develop the study base case scenario

- Complete the orders and routing inputs necessary to implement the remainder of the campaign after the Air Superiority phase.
- Establish and document the base case set of control variable settings.

Phase II: Initial Discovery Runs

Begin with all values set at the base case levels. Using the UD variable as an example the process is expected to proceed as follows:

- Assume the base case value for UD is 15 Days of Supply (DOS)
- Run 5 replications of UD = 15
- Generate two variations above base case \Rightarrow UD = 20, 25 and run 5 replications each
- Generate two variations below base case \Rightarrow UD = 5, 10 and run 5 replications each
- For each UD setting for each individual replication (1-5), calculate the Dependent Variables and the mean of each.
- Plot the results
- Based on the timing considerations previously noted it is expected that completing the initial set of calculations for variables UD, SD, AT, and GT will take approximately one month unless we have greater access to the lab facilities and that there are no problems encountered during the JWARS runs.

Phase III: Force Mix Discovery Runs

Based on Phase II results:

- Determine the mixture of settings to use for the comparisons of the C130J vs. C130H and the Future truck system vs. the legacy trucks.
- Determine whether to conduct as two separate pair-wise comparisons (aircraft/trucks only) or a factorial experiment with all combinations represented in a formal full factorial design.

L&MR OA JAS Increment 0 Modeling Process & Schedule

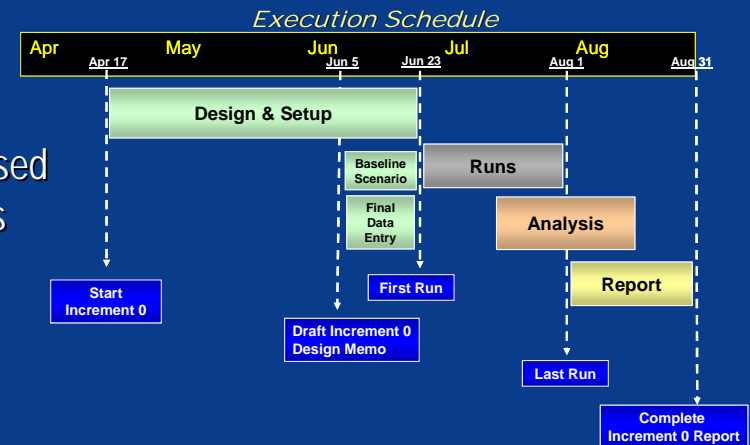
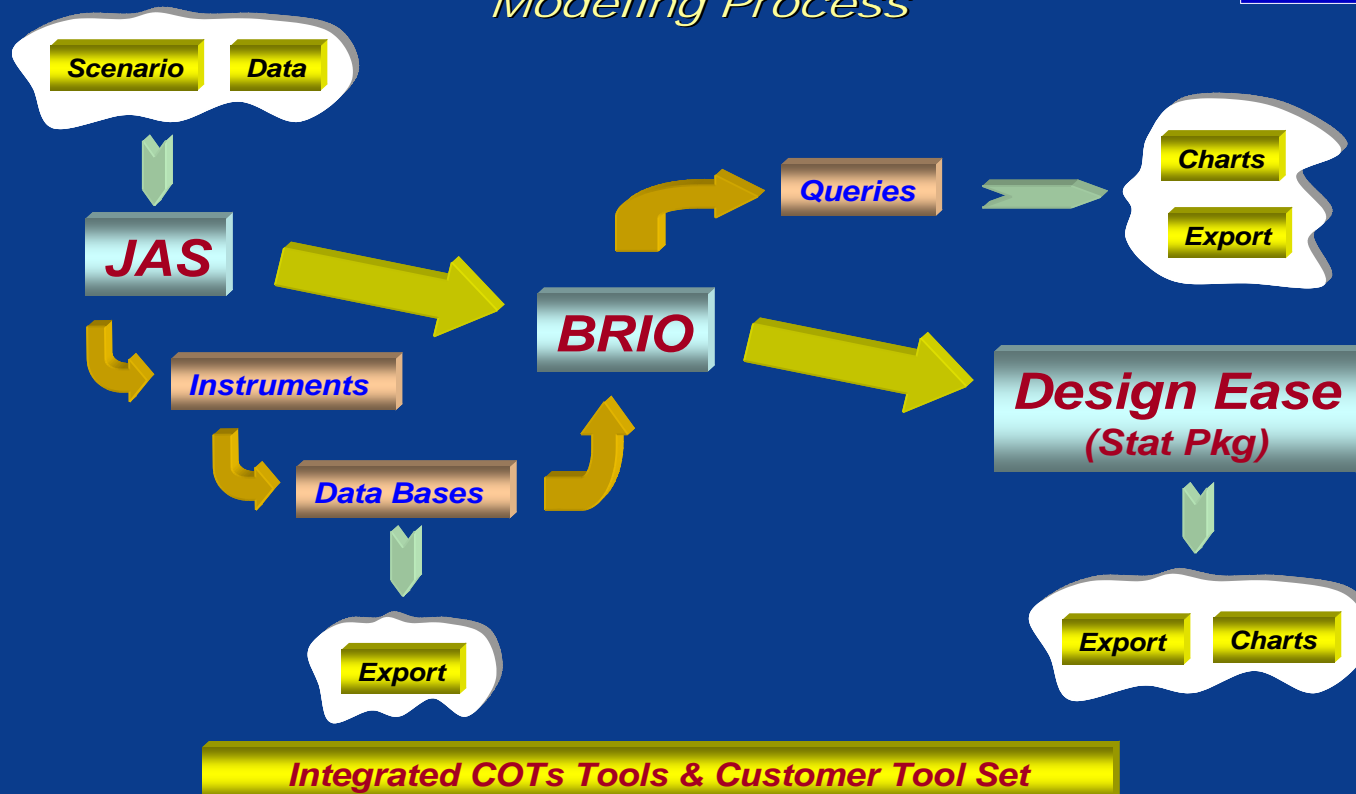


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Tools to Support Analysis:

- JAS - Campaign analysis model
- Hyperion Intelligence tool (BRIO) - Data gathering and analysis tool used during the Design and Setup, Analysis, and Report generation phases
- Design-Ease – Statistical package and experimental design analysis

Modeling Process



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JAS Scenario Browser



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Select a Scenario

Review Task Organization & Associated Battle Space Entities (BSEs)

Review Battle Space Entity (BSE) Assets

	Asset Name	Asset ID	Amount Authorized	Amount On Hand
1	Truck, Fuel, Bulk, PRO	PRO-TRK-POL	200	200
2	Truck, Cargo, PRO	PRO-TRK-CGO	10000	10000
3	Truck, Heavy, Equipment, PRO	PRO-TRK-HET	800	800
4	TROOP, PRO	PRO-TRP	50000	48585
5	GROUND COMPOSITE SENSOR	GROUND COMPOSITE SENSOR	1	1

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JAS Battle Space Entity (BSE) - Assets



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Scenario Explorer: JWARS_R1.6_SR2.16_TRIDENT_WARRIOR_2005_V011805_H

Tools Options Help

View: Campaign Planning View Side: N/A

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Overview

- Annex A: Task Organization
 - Joint Task Organization
 - Maritime Task Organization
 - Force Structures
- Annex B: Intelligence
- Annex C: Operations
- Annex D: Logistics
- Annex K: Communications
- Characteristics and Performance

List View Table View Plugins Table Land Unit Info Table

BLUE_JTFJ2

- C1_FAC
- C2_FAC
- E_CITY
- HLSD_FAC_1
- HLSD_FAC_2
- JFLCC
 - AMBER_HOME_SECRETARY
 - AMBERLAND_PM
 - CORAL_COUNCIL
 - ELBEE_ISLAND_LEADERSHIP
 - GARNET_GOVERNOR
 - JADE_PM
 - cssJFLCC_R

Overview Unit Info BSE Type Force Flow Plugins Resources Owns/Controls

Overview Resources Plugins Related BSES

	Asset Name	Asset ID	Amount Authorized	Amount On Hand	Pl
1	Truck, Fuel, Bulk, PRO	PRO-TRK-POL	200	200	
2	Truck, Cargo, PRO	PRO-TRK-CGO	10000	10000	
3	Truck, Heavy, Equipment, PRO	PRO-TRK-HET	800	800	
4	TROOP, PRO	PRO-TRP	50000	48585	
5	GROUNDCOMPOSITESENSOR	GROUNDCOMPOSITESENSOR	1	1	

BSE Assets

Truck, Fuel, Bulk, PRO (PRO-TRK-POL) More Info

Overview Platform Related BSES and BSE Types

ID: PRO-TRK-POL

Name: Truck, Fuel, Bulk, PRO

Genre: ITEM

Class: General

☐ Is Comm Provider

☐ Is Comm Subscriber

☐ Is GPS Jammer

Asset Overview

Truck, Fuel, Bulk, PRO (PRO-TRK-POL) More Info

Overview Platform Related BSES and BSE Types

Overview

Platform Type: AssetPlatform

Vehicle Category: Wheeled Low Mobility

Length: 10

Max Speed: 100000

Average Speed: 100000

Fuel Type: DF2

Fuel Consumption: 0.002

Crew Size: 2

Utilization Rate: 12.0

Asset Platform Characteristics

Slide 7 of 7

start VisualAge Smalltalk... Microsoft PowerPoint ... 10:25 AM

JAS Consumption Sustainment Guidance



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Scenario Explorer: JWARS_R1.6_SR2.16_TRIDENT_WARRIOR_2005_V011805_H

File Tools Options Help

View: Campaign Planning View Side: US-JTF

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Overview

- Annex A: Task Organization
 - Joint Task Organization
 - Maritime Task Organization
 - Force Structures
- Annex B: Intelligence
- Annex C: Operations
- Annex D: Logistics
 - Strategic Installations
 - Strategic General Data
 - Geographic Location for Transportation
 - Strategic Air Transportation
 - Strategic Sea Transportation
 - Cargo Organization
 - Transport Vehicle Payload Assignments
 - TPFDD
 - Theater Logistics
 - Theater Transport
 - Land Consumption Sustainment**
 - Maritime Combatant Logistics
- Annex K: Communications
- Characteristics and Performance

Command Guidance | General Supply Data | Class 3 - POL | Class 5 - Munitions

Land Supply Planner Look-Ahead Period (days):	7
Supply on Hand at Land Unit Activation (days):	15
Supply Maintained at Brigade Rear (days):	15
Supply Maintained at Division Rear (days):	15
Supply Maintained at Corps Rear (days):	10
Supply Maintained at Army Rear (days):	15

Days of Supply

UD – (Land Units/Brigade Rear)

SD – (Division/Corps/Army Rear)

- UD**: the number of Unit Days of Supply to be held by operating BSEs and Brigade-level headquarters elements
- SD**: the number of Days of Supply to be held by SSAs and other logistics echelons rearward of operating Brigades

start JWARS Launcher Scenario Browser Scenario Explore... JWARS Launcher Scenario Browser Scenario Explore... Microsoft Power... 10:16 AM



Instrument Queries

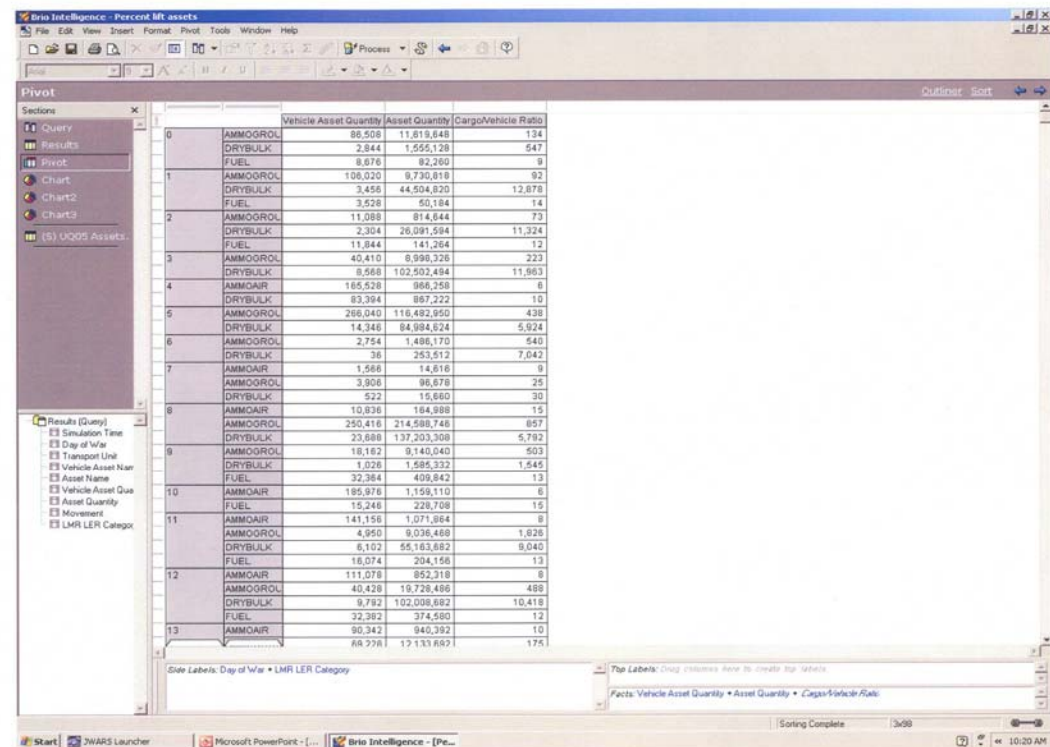
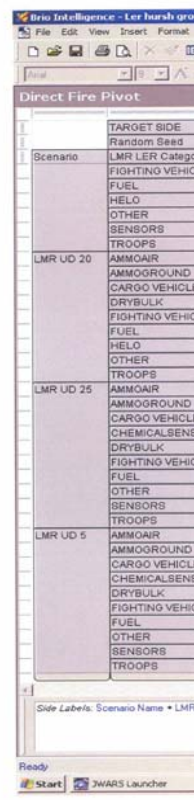
BRIO Query of Instrument Data

Data Results

Pivot Table of BRIO Query Results

Computational Results

Computational Results of BRIO Query



Graphic Presentation of BRIO Query Metric Generation



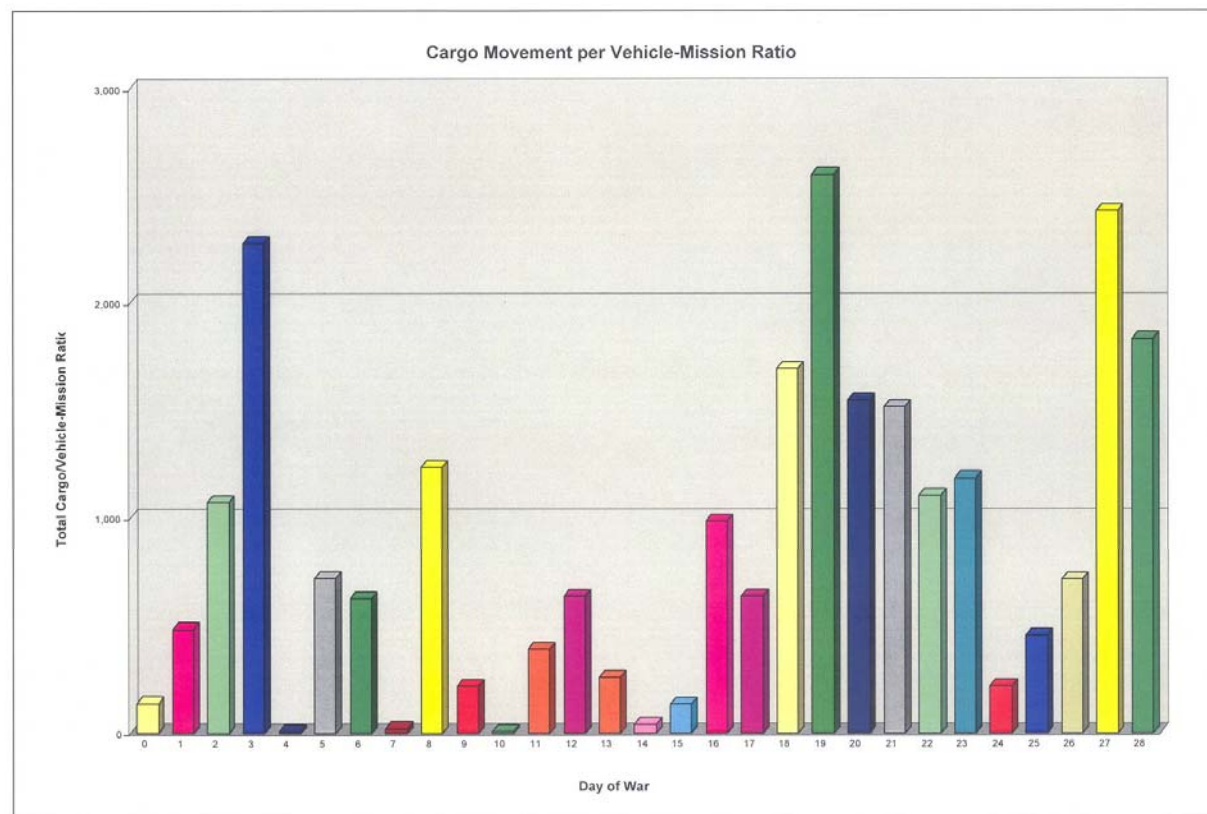
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Vehicle-Missions by Type

Cargo Movement by Type

Cargo/Vehicle-Mission Rate

ation of BRIO Query Results



B:UD05-S04 Data

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Design of Experiments (DoE) Statistical Package (Design Ease Ver-6)



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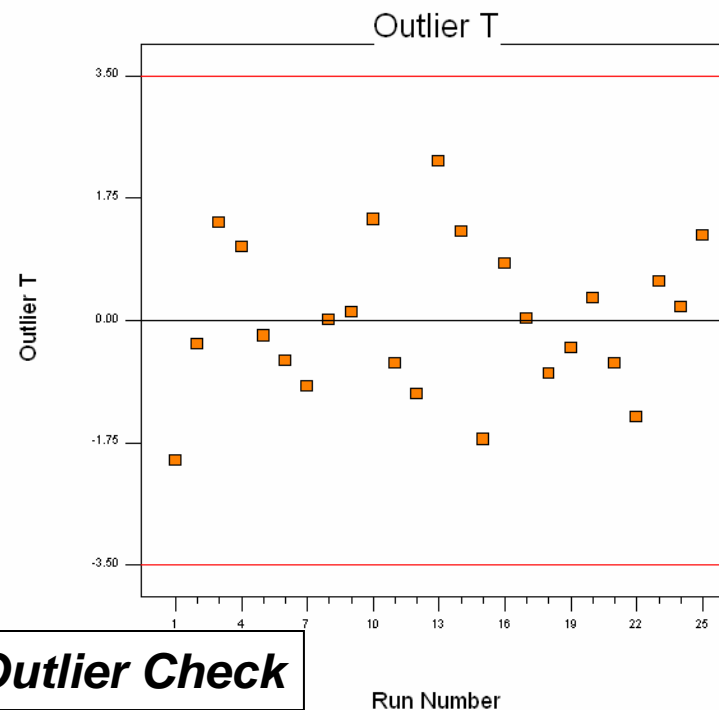
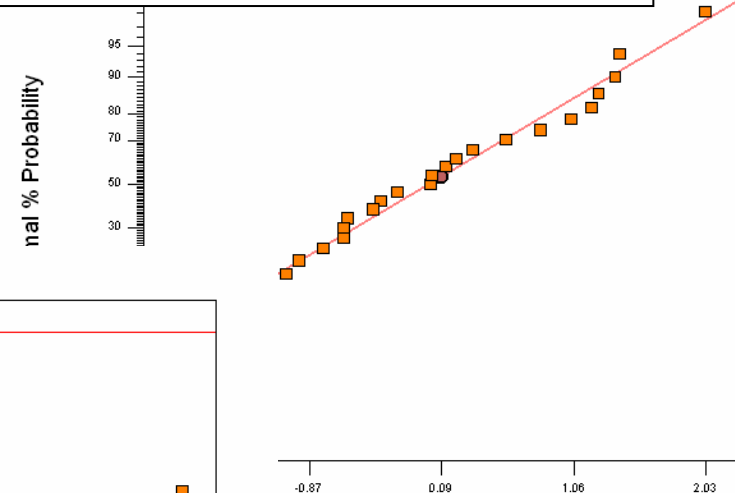
DOE Layout Design Ease 6.0.7

File Edit View Display Options Design Tools

Notes for LMR UD de6

	Std	Run	Block	Factor 1 A:UD	Response 1 Troops	Response 2 Cargo Vehicles	Response 3 Fighting Vehicles
	1	5	Block 1	LMR UD 05	11.6354	2.86233	3.36311
	6	2	Block 1	LMR UD 10	13.8502	3.67469	4.09027
	11	1	Block 1	LMR UD 15 (BL)	12.8503	3.25162	3.603
	16	4	Block 1	LMR UD 20	15.4076	4.1976	4.19684
	21	3	Block 1	LMR UD 25	15.4767	4.13679	3.71839
	2	10	Block 2	LMR UD 05	13.547	3.25267	5.06481
	7	9	Block 2	LMR UD 10	14.4214	5.47992	4.06038
	12	8	Block 2	LMR UD 15 (BL)	15.0241	4.15391	4.63962
	17	6	Block 2	LMR UD 20	13.5085	3.61883	4.61858
	22	7	Block 2	LMR UD 25			
	3	15	Block 3	LMR UD 05			
	8	14	Block 3	LMR UD 10			
	13	13	Block 3	LMR UD 15 (BL)			
	18	12	Block 3	LMR UD 20			
	23	11	Block 3	LMR UD 25			
	4	18	Block 4	LMR UD 05			
	9	20	Block 4	LMR UD 10			
	14	19	Block 4	LMR UD 15 (BL)			
	19	17	Block 4	LMR UD 20			
	24	16	Block 4	LMR UD 25			
	5	25	Block 5	LMR UD 05			
	10	22	Block 5	LMR UD 10			
	15	24	Block 5	LMR UD 15 (BL)			
	20	23	Block 5	LMR UD 20			
	25	21	Block 5	LMR UD 25			

DOE Normality Assumption Check



DOE Outlier Check

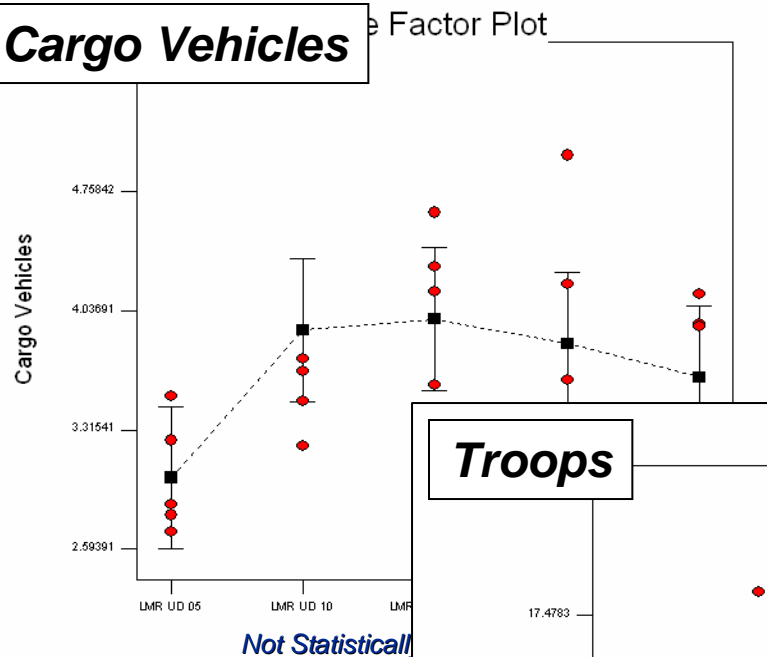
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Loss Exchange Ratio (LER) of Troop Losses By Unit Distribution (UD)

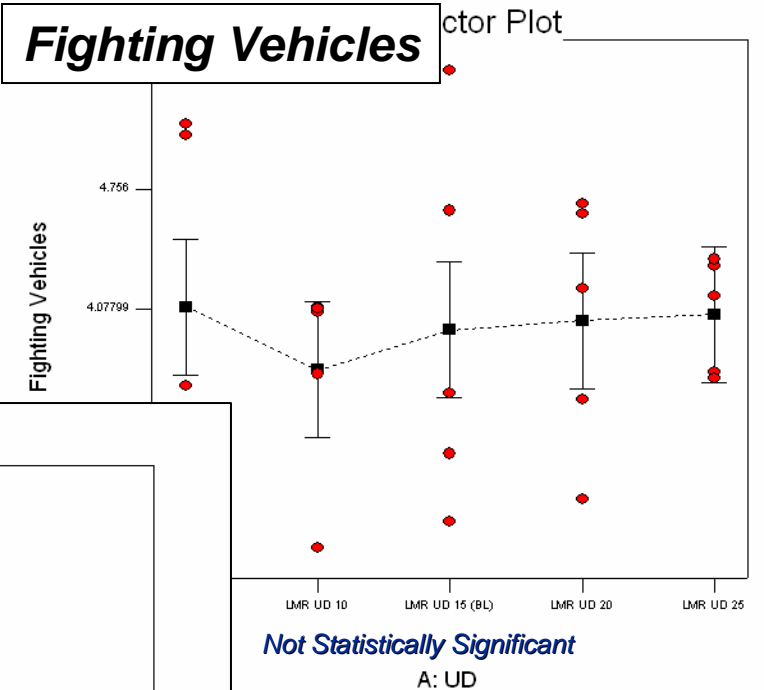


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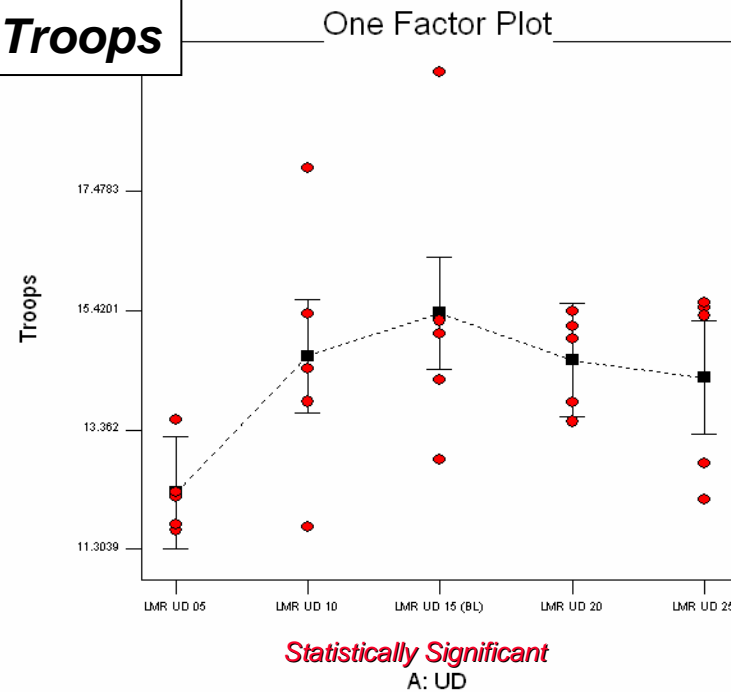
Cargo Vehicles



Fighting Vehicles



Troops



$$\text{LER} = \frac{\text{Red Loss}}{\text{Blue Loss}}$$

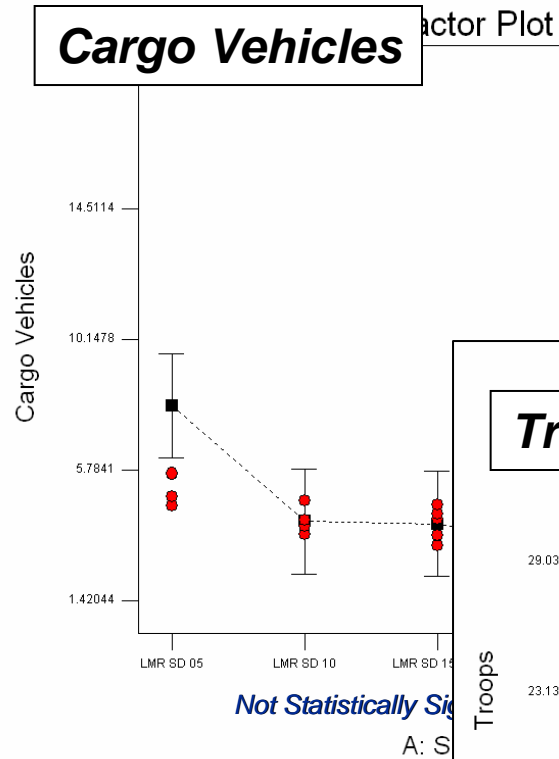
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Loss Exchange Ratio (LER) of Troop Losses By SSA Distribution (SD)

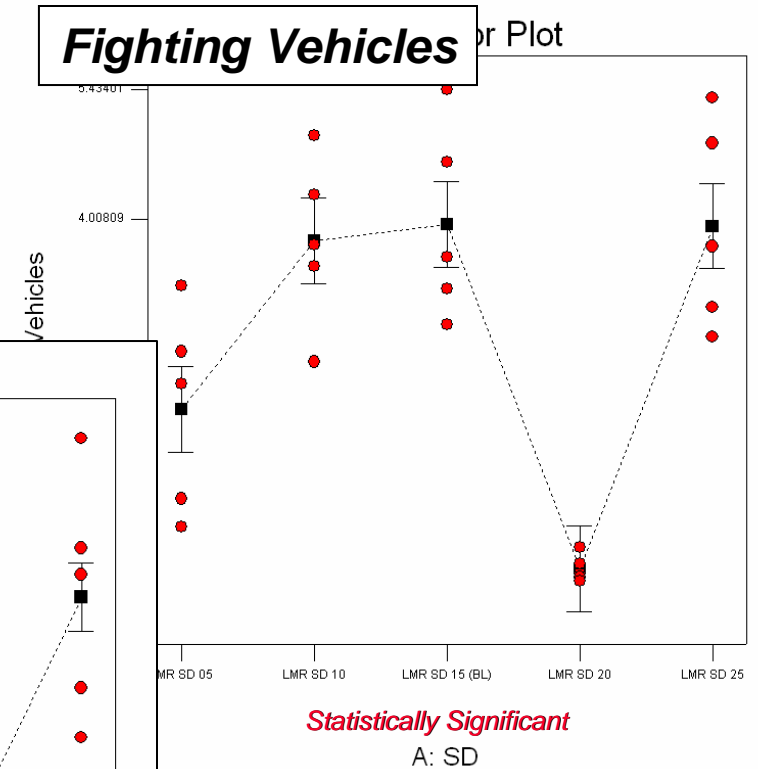


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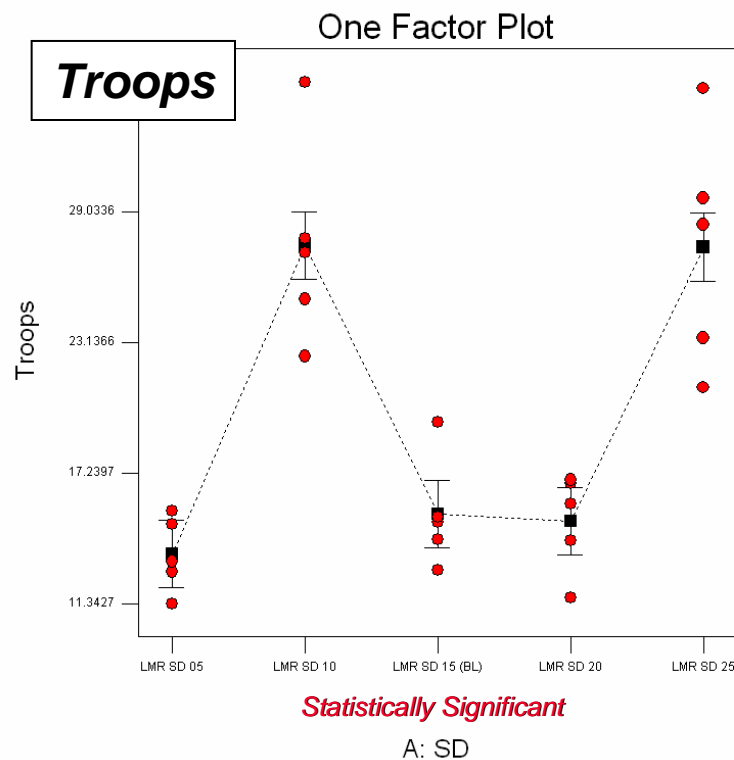
Cargo Vehicles



Fighting Vehicles



Troops

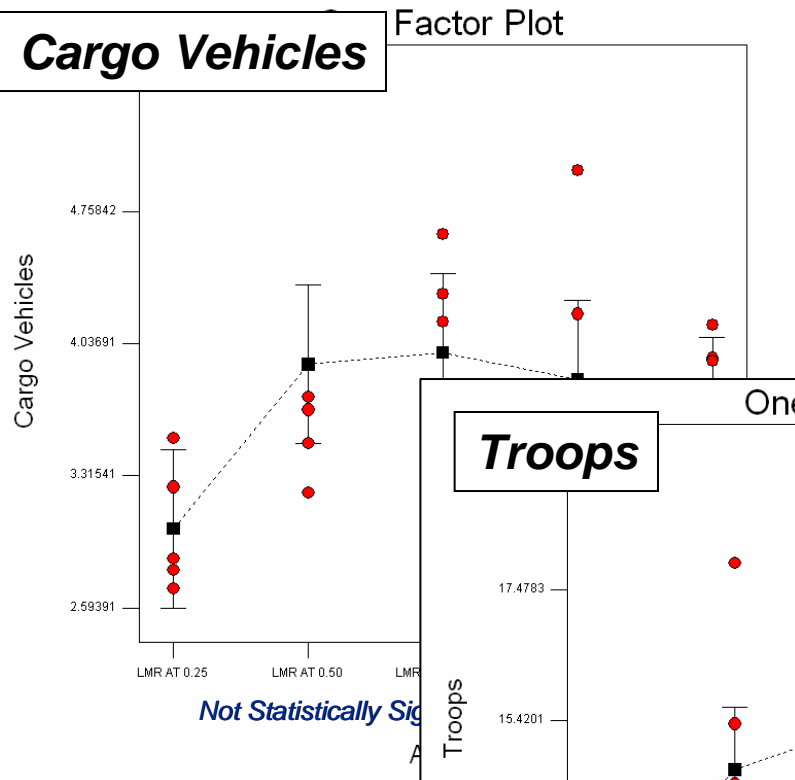


$$\text{LER} = \frac{\text{Red Loss}}{\text{Blue Loss}}$$

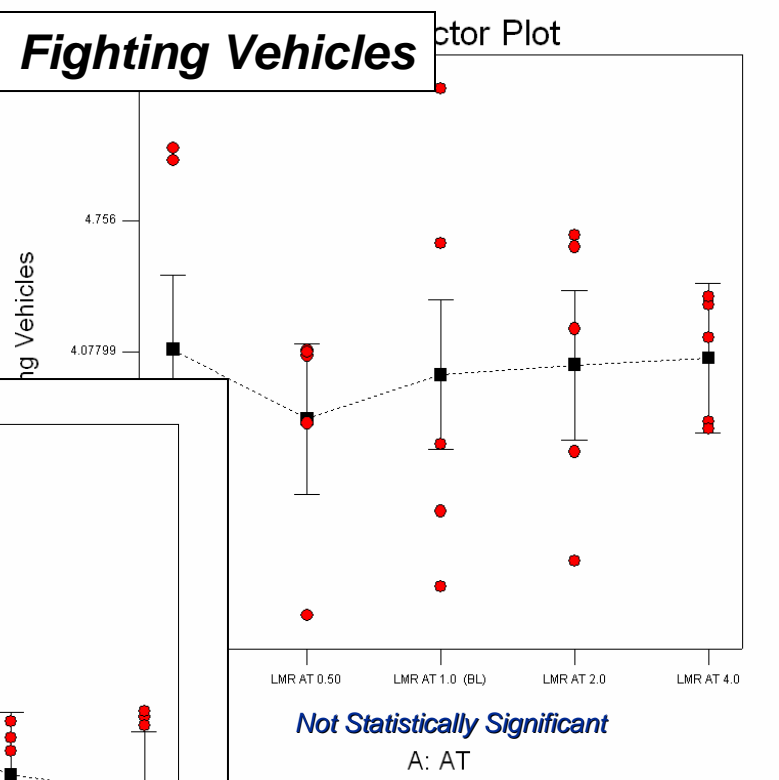
Loss Exchange Ratio (LER) of Troop Losses By Air Transport Variations (AT)

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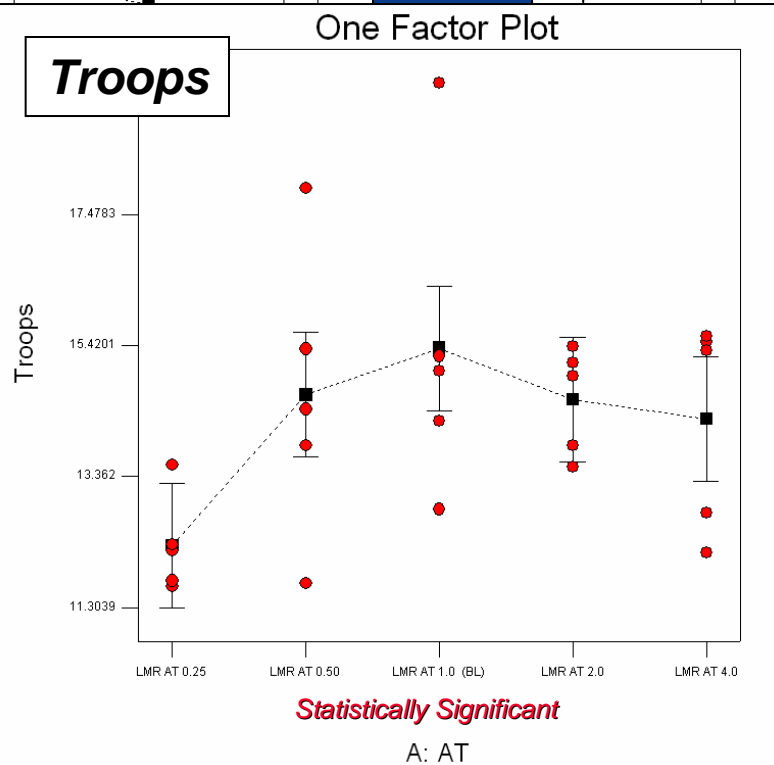
Cargo Vehicles



Fighting Vehicles



Troops



$$\text{LER} = \frac{\text{Red Loss}}{\text{Blue Loss}}$$

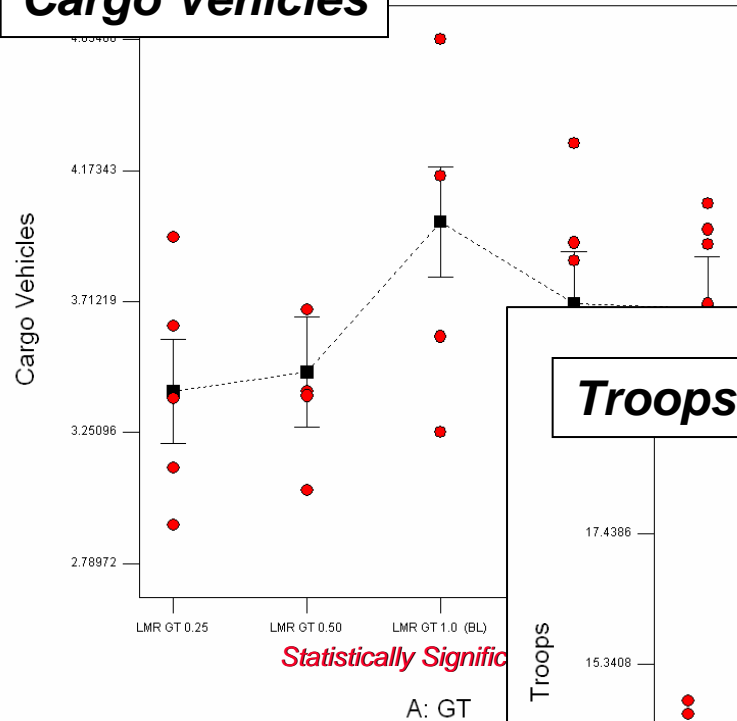
Loss Exchange Ratio (LER) of Troop Losses By Ground Transport Variations (GT)



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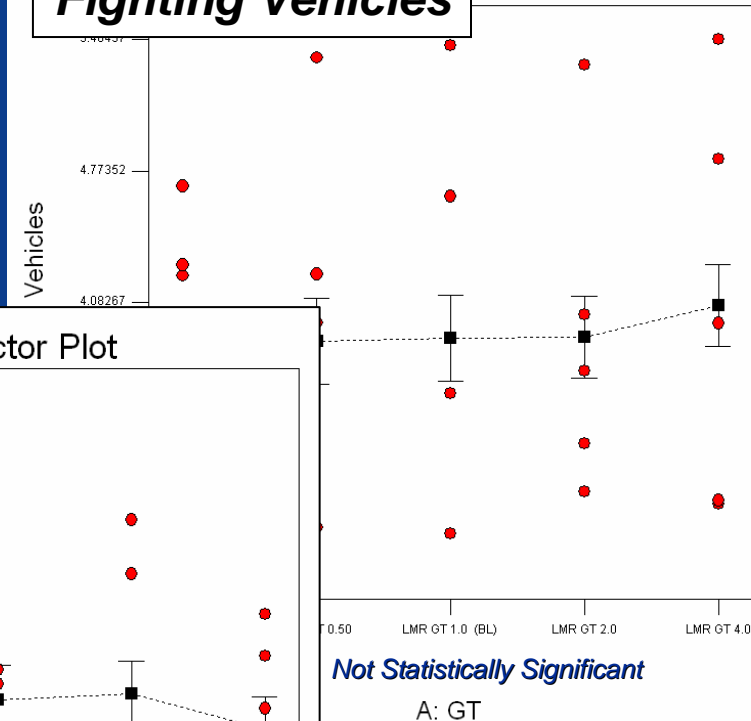
Cargo Vehicles

Factor Plot



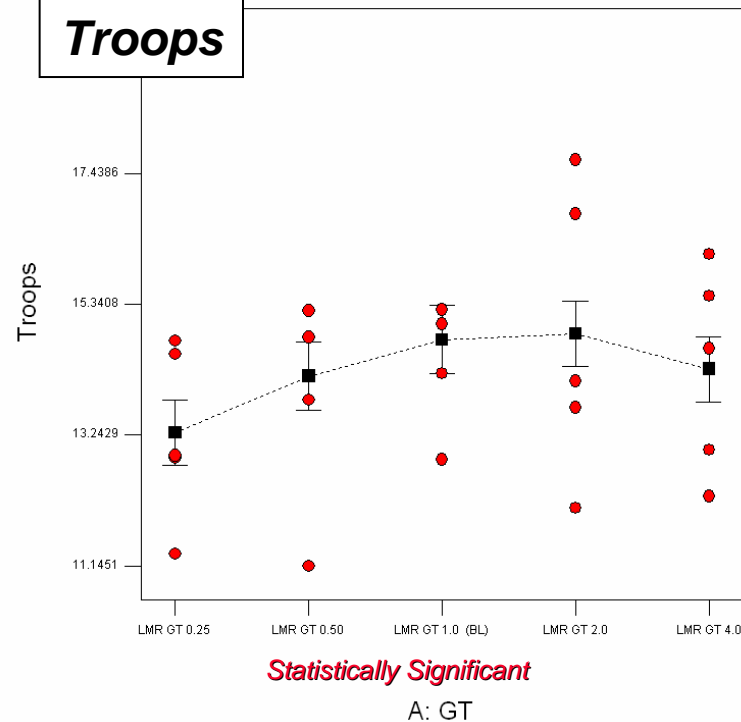
Fighting Vehicles

Factor Plot



Troops

One Factor Plot



$$\text{LER} = \frac{\text{Red Loss}}{\text{Blue Loss}}$$

Summary of Metrics



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Metric Name	Description	Status C-Complete P-Partial N-Not Able	Comments	Associated JWARS Instrument(s)
Total Lift Assets Available by Type	By Type	C	Common User and C-130J	Air Unit Status Report
	By Mode	C	Air and Ground (separate queries for air and ground)	TLT CU Unit Vehicle Inv
Total Lift Capacity Available	By Type	C	Common User and C-130J	Air Unit Status Report
	By User	C	Air and Ground (separate queries for air and ground)	TLT CU Unit Vehicle Inv
Total Number of Requests	By Type	C		TLT Req Sust Sngl Ship
Percent of lift assets utilized	Per day	P	Cargo to Vehicle Ratio and number of trucks per mission	TLT Road Trans Creation
	Per campaign	P	could not connect inventory with usage to get percentage	TLT Road Trans Content
				TLT Road Trans Departure
Starting Days of Supply (DOS) at:	Combat Units	C	This is an Excel file showing DOS for all scenarios	JWARS: Land Consumption Sustainment
	SPOD/APOD	C		Command Guidance
	Installations	C		
	SSA	C		
Days of Supply (DOS) at:	Combat Units	C	This is an Excel file showing DOS for all scenarios	JWARS: Land Consumption Sustainment
	SPOD/APOD	C		Command Guidance
	Installations	C		
	SSA	C		
Lift Capacity Shortfalls	Planes	C	Returns cargo not delivered by air and ground	TLT Cu Cargo Dlvry Shrtfl
	Trucks	C		TLTA Trans Cgo Not Loaded
LER Ground	Direct Fire	C	Direct Fire adjudication	ADJ Direct Fire KVS
	Indirect Fire	C	Indirect Fire adjudication	ADJ indirect Fire KVS
	Air to Ground	C	Air to Ground Fire adjudication	ADJ A2G Fire KVS
LER Air	Air to Air	C	Air to Air (only for UD scenarios)	Air ATO Gen, Air ATO Exec Order Sch
	Surface to Air	C	Surface to Air (only for UD Scenarios)	ADJ S2A KVS, Adj A2A KVS
TBM Percent Leakage	TBM Launched	C	Brio query has data for TBM Launch and Leak	TBM MSL launch
	TBM Leaked	C	Excel File has percentage (only C-130 and Baseline scenarios)	Tbm Leaker
Time to Objective	Ground Units	C	Time it took TF Longstreet to reach each of its three objectives	JWARS video playback

Analysis of Increment 0 Metrics



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Metrics	Phase II		Phase III			
	Days of Supply		Baseline	Quantity		Quality
	UD	SD		GT	AT	C-130
Total Ground Lift Assets Available by Type	X	X	X	X	X	X
Total Air Lift Capacity Available	X	X	X	X	X	X
Total Number of Requests	X	X	X	X	X	X
Cargo to Vehicle Ratio	X	X	X	X	X	
Days of Supply (DOS) at:	X	X	X	X	X	X
Lift Capacity Shortfalls	X	X	X	X	X	X
LER Ground	X	X	X	X	X	X
LER Air	X		X			
Time to Objective	X		X			
TBM Percent Leakage			X			X

Depth and Breadth in Analysis

Operational Analysis Lessons Learned



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- Proof of Principle
 - Not study quality data
 - Demonstrated relative comparisons vice absolute results
- Pre-determined successful baseline “seeds” not always successful with variations/changes
- Used JAS Release 1.6-SR2.15-RCS, did not transition to JAS Release 2.0
- Focused scenario to generate potential logistic opportunities
- Setup to ensure logistics plays reasonably
- Limited air routes did not provide significant pulsing of Quality of Intra-Theater Air Transports activity
- DOE requires scheduling of computing assets for production runs
 - 5 reps w/ 5 conditions for 5 combination »»» 125 runs
 - BRIO export required scheduling considerations
 - Multi-processing capability was essential

JAS Enhancement Items



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Desired JAS Logistics Enhancements / Refinements

1. Capability to use different load/unload times for cargo carrying assets such as trucks at different echelons. For example, Army 5-ton trucks carrying materials from Division to Brigade to have different loading parameters than the same asset moving cargo from Brigade to Battalion. This might also be satisfied with a "transfer" variable at the echelon without affecting the asset data.
2. Capability for inter-theater response to sustainment requests without having to go through a pre-planned TPFDD.
3. Capability to integrate inter- and intra-theater transportation and logistics planning. For example, a sensitive munition being brought straight from CONUS to the requestor where the APOD/SPOD is chosen with a view to available assets in theater for the onward movement of the shipment or shipped direct to the requesting BSE.
4. Expand the Land Sustainment visibility to all classes of supply instead of just Class III and Class V.
5. Permit replacement of Class VII pacing items.
6. Add an abstract maintenance capability by a mean-time-to-repair function to permit rough repair of damage.
7. Break casualty data into Item level bins such as damaged/killed and people into wounded/killed.
8. Permit the creation and repair of infrastructure (such as bridges, port berths, *etc.*) during the play of the game. In the case of "new" installations, have them properly recognized for arc/node and other calculations. [This may mean having to "reinitialize" some environmental parameters during a run.]
9. Capability to have cargo re-directed while in transit based on user priorities.
10. Capability to reconstitute units. [May be a blend of repair/replace]

Conclusions and Recommendations



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- Demonstrated the OMEGA[®] framework and DoD provided tools (JAS) can be used collaboratively to evaluate logistics enterprise architecture alternatives
 - Modifications to the DoDAF schema & JAS descriptions were required to model and perform operational driven assessment of the JDDE architecture (JIC)
- Although JAS fell short in several areas, the team recommends using OMEGA[®] & JAS for modeling and simulation of the proposed JDDE Architectures
 - Identified shortfalls and recommend JAS modifications
 - Explore federating JAS with other models for work-arounds
 - Input M&S determined MOO & MOE into OMEGA[®]'s Value Model to "grade" JDDE alternatives
- Working with JFP LMIC and JAS Program Office to develop logistic enhancements in support of Experimentation
- Recommend follow-on analysis activities