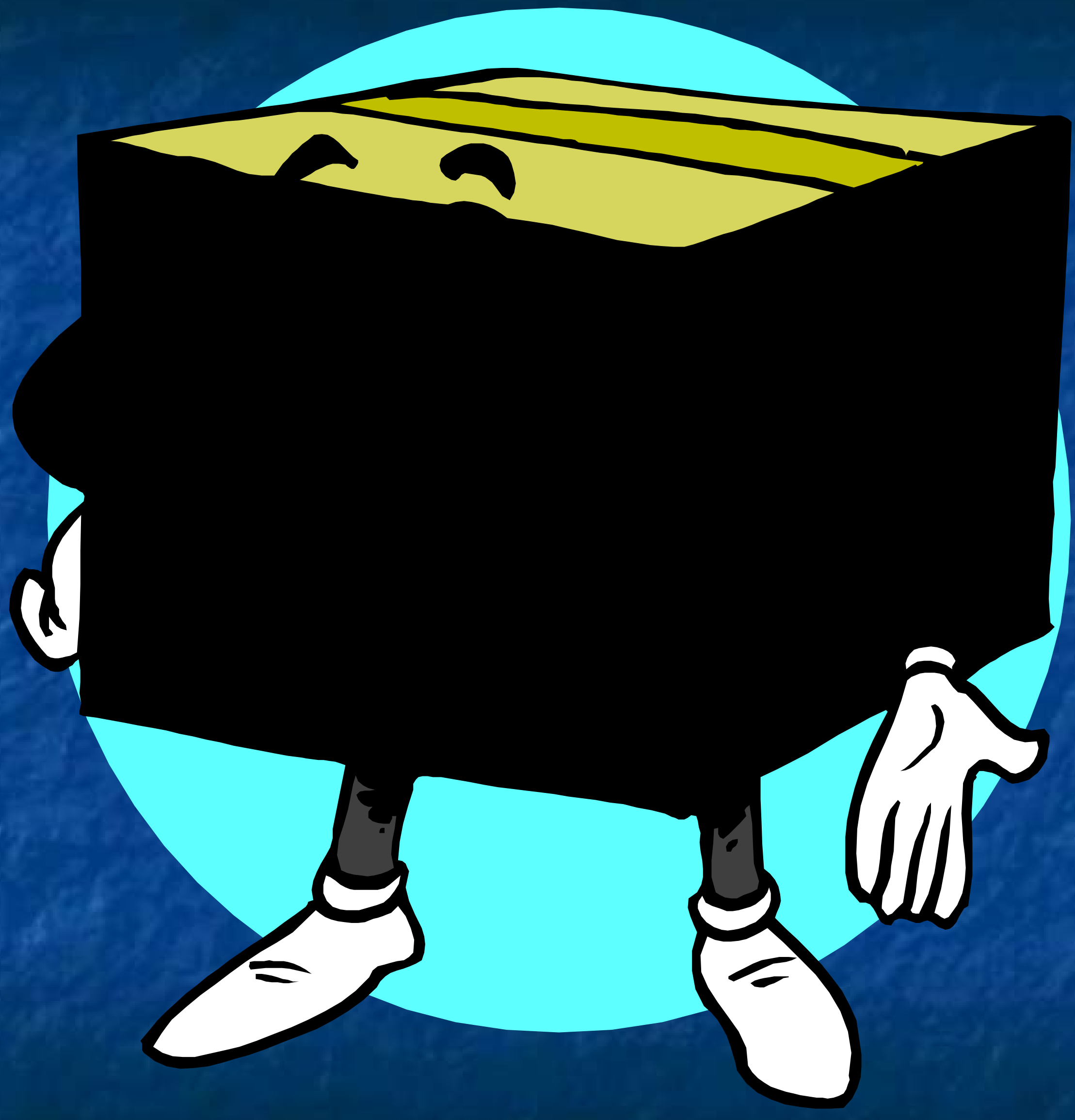
Smart Distribution
Status Briefing

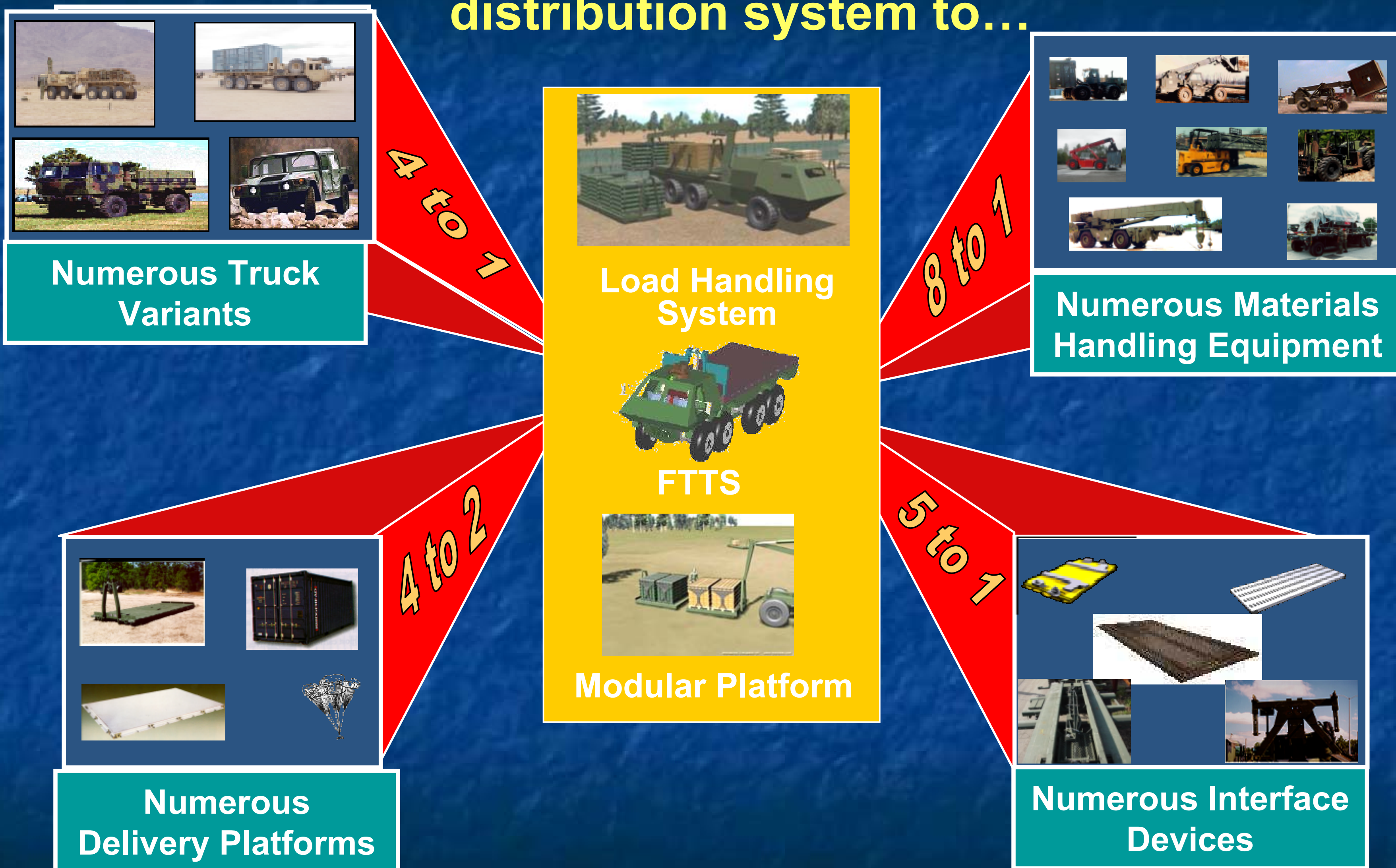
Enabling Technology
For The
Objective Force

Gregory Ferdinand
ferdinan@pica.army.mil
(973) 724-7318

US Army ARDEC
AMSTA-AR-ASL
Picatinny Arsenal, NJ
12 June 2003



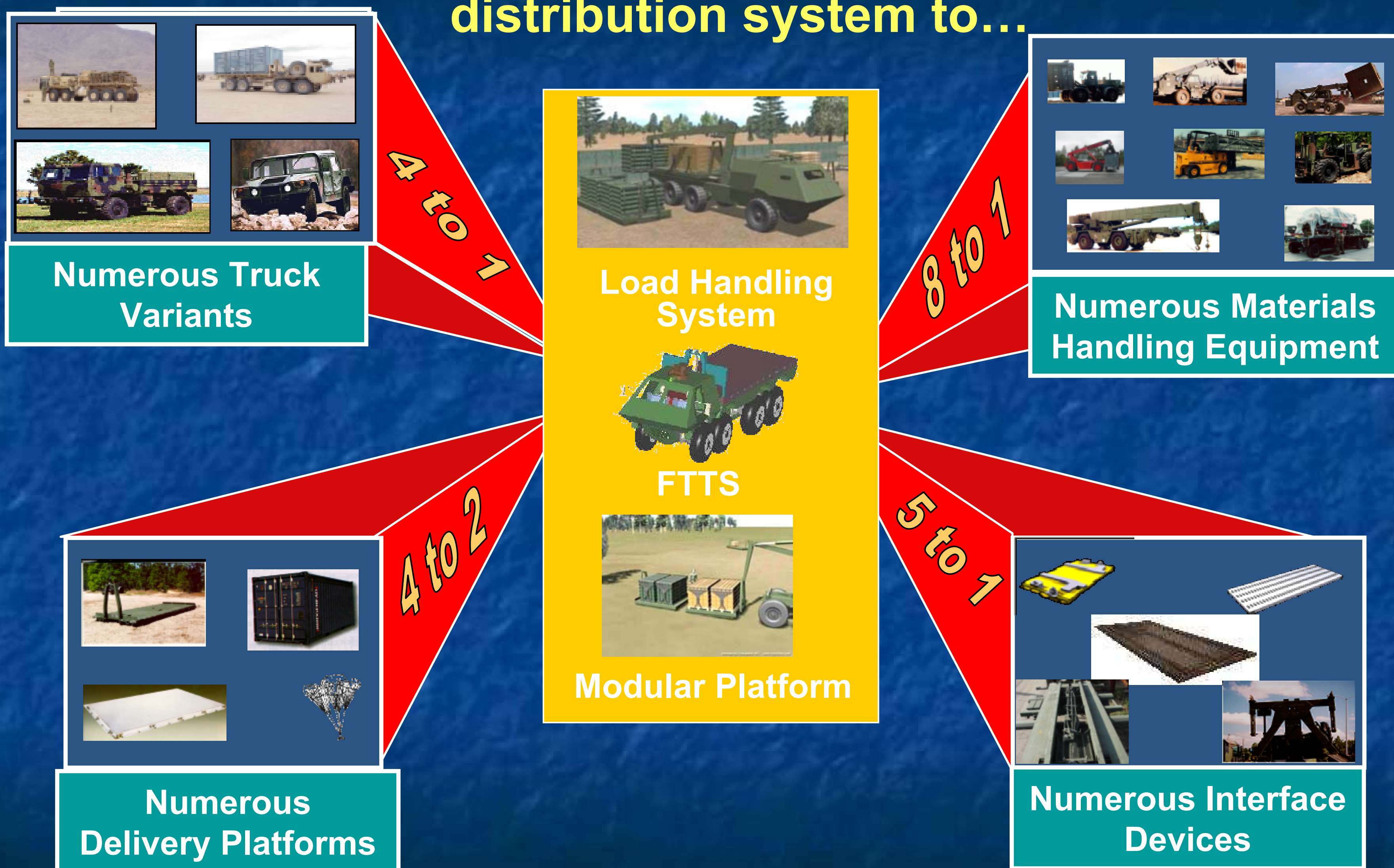
Technology to transform the current cumbersome, seamed, and inefficient distribution system to…



… a seamless intermodal Smart Distribution System

Platform Concept Design

Technology to transform the current cumbersome, seamed, and inefficient distribution system to…



… a seamless intermodal Smart Distribution System

EDCs

- **A-5.7** The *Intelligent Load Handling System* (ILHS) must operate as a dual function of the modular platform self load arm. ILHS shall have the agility and range of motion to pick up and transport pallets that are stacked unevenly on unimproved terrain or positioned in or on itself and various modes of transport. The ILHS will load modular containers and platforms on the FTTS as well as configure modular packaged loads on platforms.

EDCs

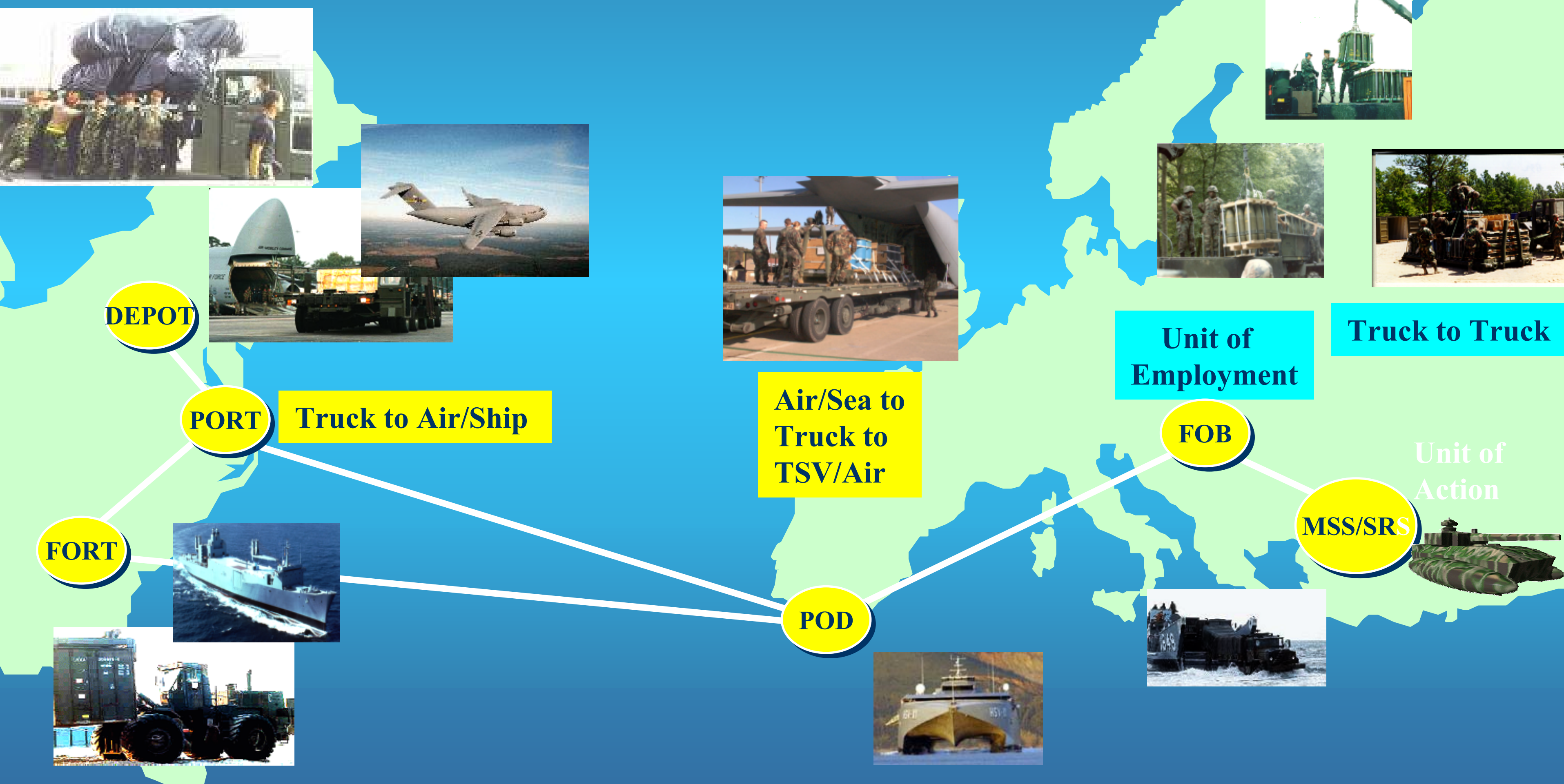
- **A-5.4** FTTS-MSV shall have the capability to employ *Automated Identification Technology* (AIT) to provide strategic, operational, and tactical logistics systems with the vehicle data needed to enhance the Army's ability to request, receive, redirect, track, distribute, control and retrograde within the integrated distribution system.

EDCs

- **A-7 Modular Platform System.** The *modular platform* shall be the primary distribution platform. It shall split into sections that can be loaded and distributed individually. System will facilitate connection of the sections without the use of additional MHE to form a single "CROP-like" platform. As such it will retain the capabilities and characteristics of that intermodal platform. In addition the Modular Platform shall load directly onto any aircraft, be sufficiently secured with restraint rails on 463L equipped aircraft for air transport, and be capable of incorporating Automated Identification Technology devices to track the platform and its contents. In both the split mode and as an entire platform, the Modular Platform shall be capable of being sling loaded or airdropped without damage to the platform or its payload

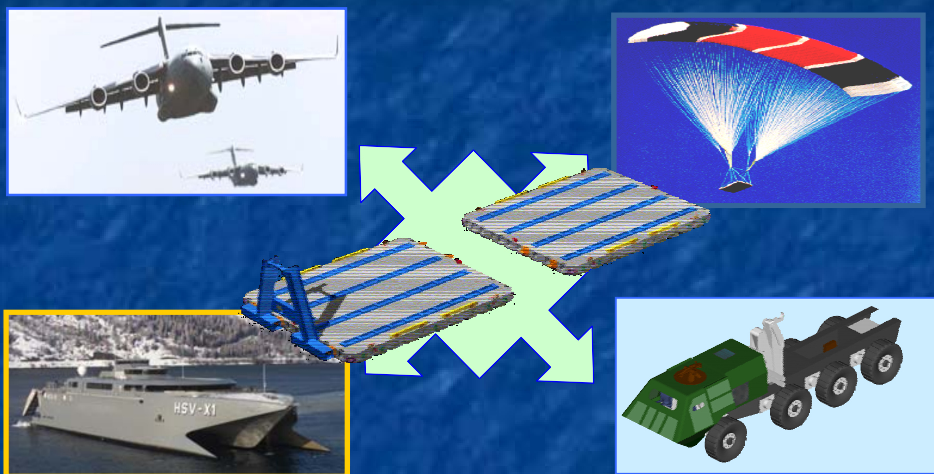
Problem Statement

Objective Force operations require a logistics system with timely, rapid and pulsed delivery of supplies. Incompatibilities between transportation modes, Materials Handling Equipment (MHE) & cargo platforms in the current system will force the inefficient re-handling of supplies by soldiers and a variety of equipment at each logistics node.



The pipeline is too slow and the Army's logistics footprint is too large!

STO ARD-03 Smart Distribution-Modular Intermodal Platform



Schedule & Cost

Tasks	FY04	FY05	FY06	
• Modeling of interface & performance characteristics				
•Design prototypes				
• Prototype hardware & interface evaluations		4		
• Modify hardware & conduct technical evaluations			5	
• Conduct intermodal operational evaluation			6	

X = TRL

Purpose:

- *Demonstrate a lightweight Modular Intermodal Platform (MIP) system compatible with the Theater Support Vessel (TSV), the C-17/C-130, current & future (FTTS) trucks, and aerial delivery (airdrop and sling lift) systems.*

Product:

- *Prototype lightweight modular intermodal platform system delivered to:*
  - *-Natick Soldier Center for PEGASYS Medium STO for FY07 Demo*
  - *-FTTS ACTD in FY06*
- *High fidelity operational model compliant with Joint Virtual Battlespace*

Payoff:

- *Greater agility and survivability through rapid movement and reduced handling of supplies between modes of transportation*
- *Reduced Aircraft Load/Unload Time*
- *One platform for all missions*

Configured Load Building Tool
(A Joint CASCOM, LTA and ARDEC Initiative)

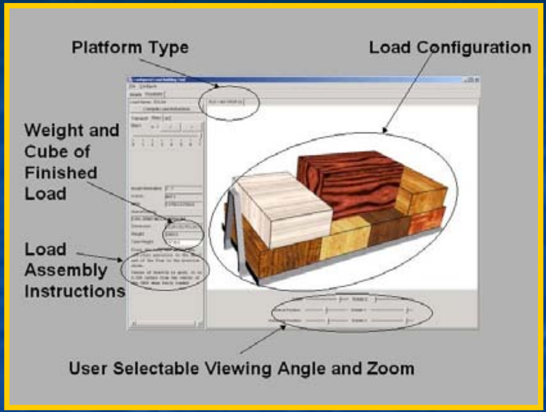
GOALS

To build multi-class loads configured for any consumer on the battlefield, from any stocks in inventory in any configuration.

Interoperable with all current and future STAMIS applications. (DSS, SAARS, SAAS)

Compatible with all current and future material handling equipment, platforms (CROP, flatracks, 463L, multi-modal, etc.) and tactical conveyances (FMTV, HEMTT, PLS, FTTS, etc.)

Accelerated for integration into SBCT



REQUIREMENTS

Graphically depict a 3 dimensional design in the form of pallets, boxes, commodity or capability modules that must fit onto or into current and future platforms \ containers\ conveyances

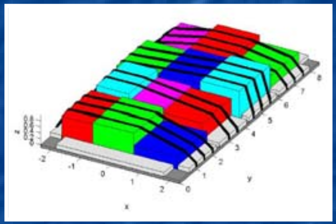
Calculate a center of gravity (CoG) that must be no more than 12 inches from the center of the CROP (class V only)

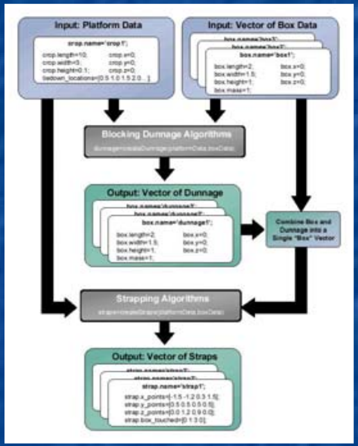
Develop load building rules that accommodate weight and geometry of pallets
Provide simple load building instructions to the user

CLBT Features

CLBT will have a local data store the operator can use to update NSN information when network information is not available.

- •DODIC/NSN designation
- •Nomenclature
- •Packaging parameters
- •Weight\Cube of load





Algorithms and heuristics for strap placement

CLBT will write to or read from inventory tracking scheme to maintain asset visibility as well as creating RF Tag or 2D barcode information

- •Write data to RF Tag
- •Print 2D barcode
- •Create and\or populate required forms

TAG EXTENDED MEMORY - JDTAV RF-Tag File Format

Address	Section
0000	*Reserved*
0001–0254	License Plate Data
0255	*Reserved*
0256–0467	Database Table Pre-Header
0468–0511	*Reserved*
0512–0527	Database Table Header
0528–120127	Commodity Item Records and Single Data Item Records
120128	*Unused*
120129–124730	*4602 Reserved Bytes for Database Query Results*
124731–131050	TCMD Records
131051–131071	*Unused*

AIT interface for inventory management, Consumption Monitoring and battlefield resupply

Vehicle Alignment System (VAS)

NEED: Current procedures for backing tactical trucks (PLS & HEMTT-LHS) to load/unload are inefficient, time consuming, and potentially hazardous

OBJECTIVE: To develop an “add on kit” to assist the vehicle operator during backing maneuvers to quickly and safely align the truck to the intended docking position. VAS will be readily adaptable for various vehicle and MHE platforms.

Vehicle Alignment System

Description:

The VAS, via truck mounted sensor(s) and "in cab" display, will provide visual queues to precisely guide the driver to streamline the load/unload operation. It will enable the vehicle operator to interface PLS flatracks with MILVAN containers and USAF aircraft logistical cargo rail systems.
It will also provide a audible *SAFETY* alert to driver when an object is between the truck and the docking position.

Status:

Concept design contracts (were awarded in Nov 02 to DCS Corp. - Alexandria, VA & SPEC – Austin, TX

Design Approaches:

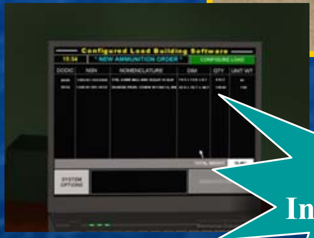
- DCS - camera vision based
- SPEC - LADAR sensing technology

Both contractors have developed promising design concepts.
Phase II proposals under evaluation

Smart MHE Technology

Objective: Develop and demonstrate an advanced MHE automation architecture/capability that:

- Is adaptable (to different platform configurations/ mission reqmnts)
- Is scalable (to multiple platforms)
- Extensible to incorporate log decision aids and log C2 linkages
- Is based on open system standards
- Exploits leading edge robotics, AI, sensor and intelligent control technologies
- Meets FCS requirements
  - Speed
  - Accuracy
  - Dexterity
  - Reliability
  - Safety
  - Significantly reduced operator work load
  - Significantly reduces manpower requirements



Affordable

LOG C2 Interoperability

Common Architecture

JTA Compliance

Phase I Accomplishments

- **Upgraded SCATS hydraulics to enhance speed, accuracy, performance**
  - **Variable displacement pump**
  - **HPU**
  - **Precision joint servo valves**
  - **Accumulator**
  - **Differential pressure transducers at each joint**
  - **Minimize flexible rubber tubing**

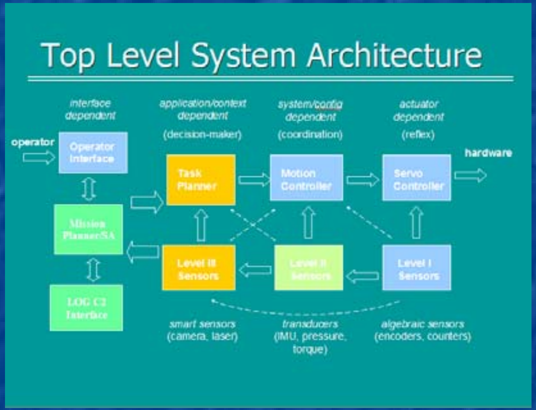
- **Developed/Integrated universal J-Hook End-Effector**
  - **Handle full range of munition related payloads (MLRS, 155, 105, etc)**
- **Advanced driver/operator interface**
  - **PC based**
  - **Task visualization/ animation**
  - **shared control**

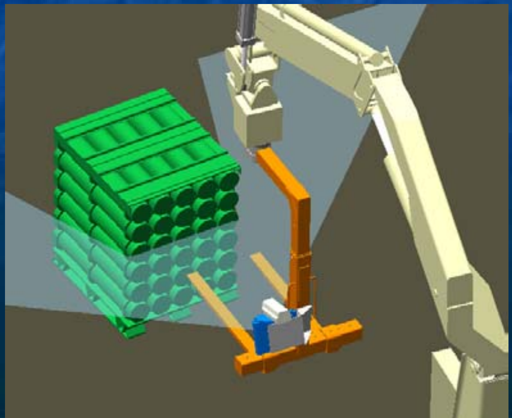
- **Advanced pc/software based control**
  - **High bandwidth joint servo control**
  - **Force control/ dextrous payload manipulation**
  - **Cartesian motion control/ redundancy management**
- Sensor suite integration (vision, laser scanner)
- Successful field demonstration (BGAD)

Phase II Accomplishments

- Completed automation of outriggers
- Implemented wireless pendant
- Automated transport path
- Developed extended open architecture design spec
- Developed enhanced inertial compensation & joint servo loop design.
- Developed integrated LMU/vision processing module
- Enhanced operator interface/ driver queing
- Auto stow/deploy
- Sensor driven pallet acquisition
- IMU/GPS, force sensor integration
- Picatinny on-site demo/

shake-out tests (07-02 thru 10-02)

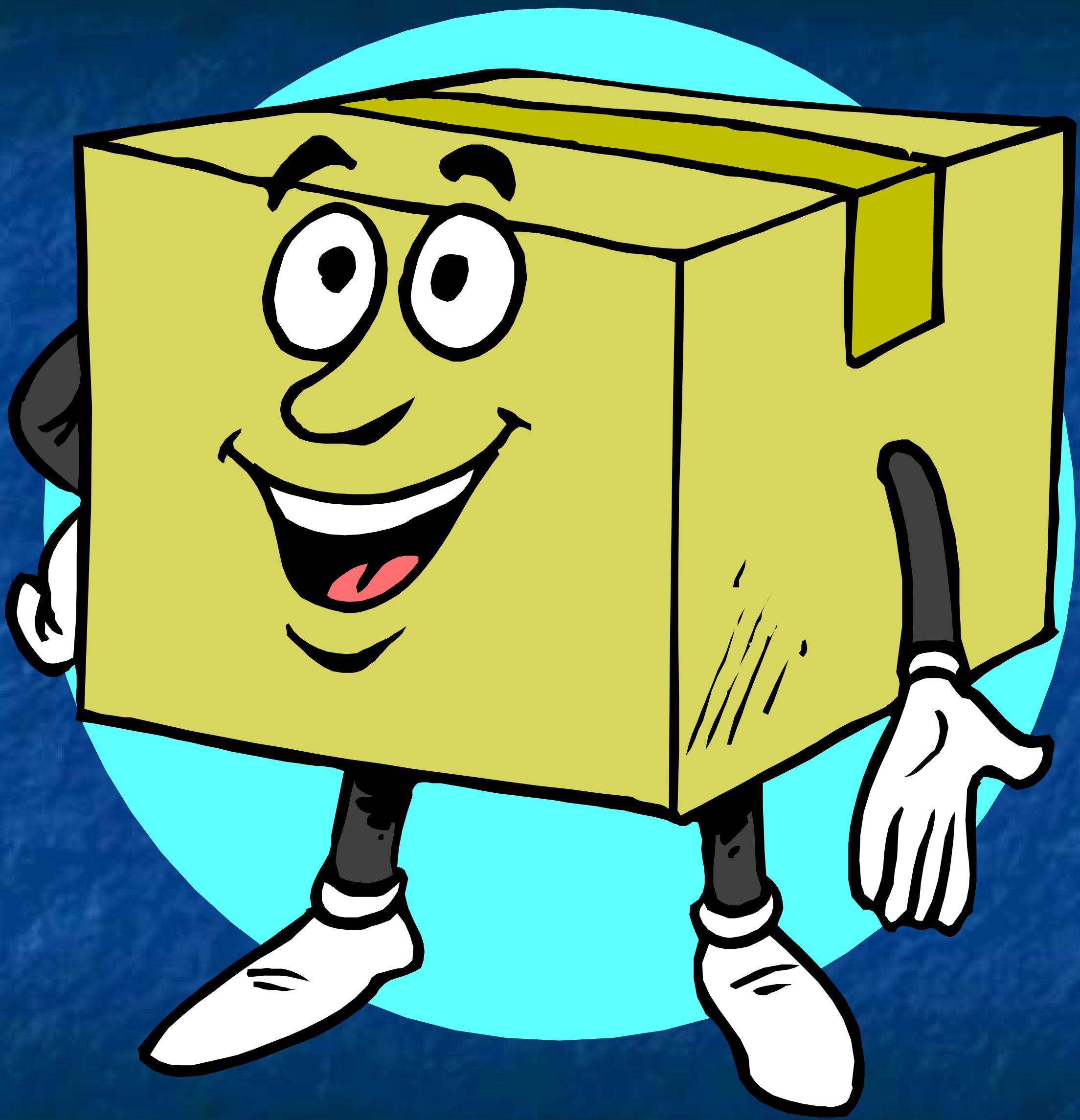




Phase III Plan

- Initiate design study for integrated PLS/load handling system
- Integrate IMU/GPS SW to mission planning, load leveling and safety enhancements.
- In-cab operational capability
- Graphical driving aids
- Fully automate pallet acquisition, deployment and release
- Integrate digital mapping, mission planning and log C2 interface via wireless LAN.
- Initiate integration of prototype load building decision aid.


Smart Distribution
…. For Defense At Home & Abroad
Configured Loads
STRATEGIC DISTRIBUTION PLATFORM
Intermodal Systems
Improve Throughput
Efficiencies
INTERMEDIATE
STAGING BASE
AREA OF
OPERATIONS
Sustainment Modules
Delivered to End User
HSV-X1
Sustainment
Modules Configured
For End User
Liquid Logistics
Intermodal Modular
Platform
Load Building
Tools to Meet
Changing Missions
Platform Type
Load Configuration
Weight and Cube of Finished Load
Load Assembly Instructions
User Selectable Viewing Angle and Zoom
Automation
Reduces Manpower
Requirements
Responsive support over extended distances
▪ Rapid transitions between transportation modes
▪ Efficient reconfiguration
▪ Tailored loads for ease of reception



Thank You!