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LHA(R) Cargo Handling System Trade Study Models

- presented to the 73rd Military Operations Research Society Symposium -

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Littoral Warfare Analysis

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Agenda

- Motivation for Tasking
- Tasking
- Approach and Assumptions
- Model Functionality
- Demonstration
- Conclusions
- Future Directions

This brief is for one of the ship concepts for LHA(R) and does not reflect the final LHA(R) design.

Motivation for Tasking



- LHA(R) undergoing trade study to answer question:
 - What cargo handling system is best for the LHA(R) well deck?
- Current LHDs use a combination of fork trucks and overhead cargo monorail to move pallets.

Why Change?

- Cargo monorail maintenance.
- If the well deck had a bridge crane (like LPD-17), a variety of additional tasks could be performed over and above pallet loading.
 - LCAC Skirt Maintenance
 - LCAC Engine Maintenance
 - etc.

Why Not Change?

- Requirement handed down from earlier LHA/LHDs:
 - 150 pallets/hour must pass through the well deck and out onto LCACs.
- Questions:
 - Will a bridge crane meet this requirement?
 - Does the current system meet this requirement?

Tasking

- Construct AutoMod simulations to determine the pallet throughput achievable using:
 - Fork Trucks alone.
 - Current cargo monorail system.
 - Proposed bridge crane system.

Approach & Assumptions

- For current operations, consulted with SMEs
 - Former Combat Cargo Officer
 - Former LCAC operator.
- For proposed bridge crane operations, consulted with LHA(R) Mission Systems IPT.
 - Research into currently available bridge crane systems.
 - Notional characteristics of bridge crane system.
- Utilized previously collected data relating to well deck operations.

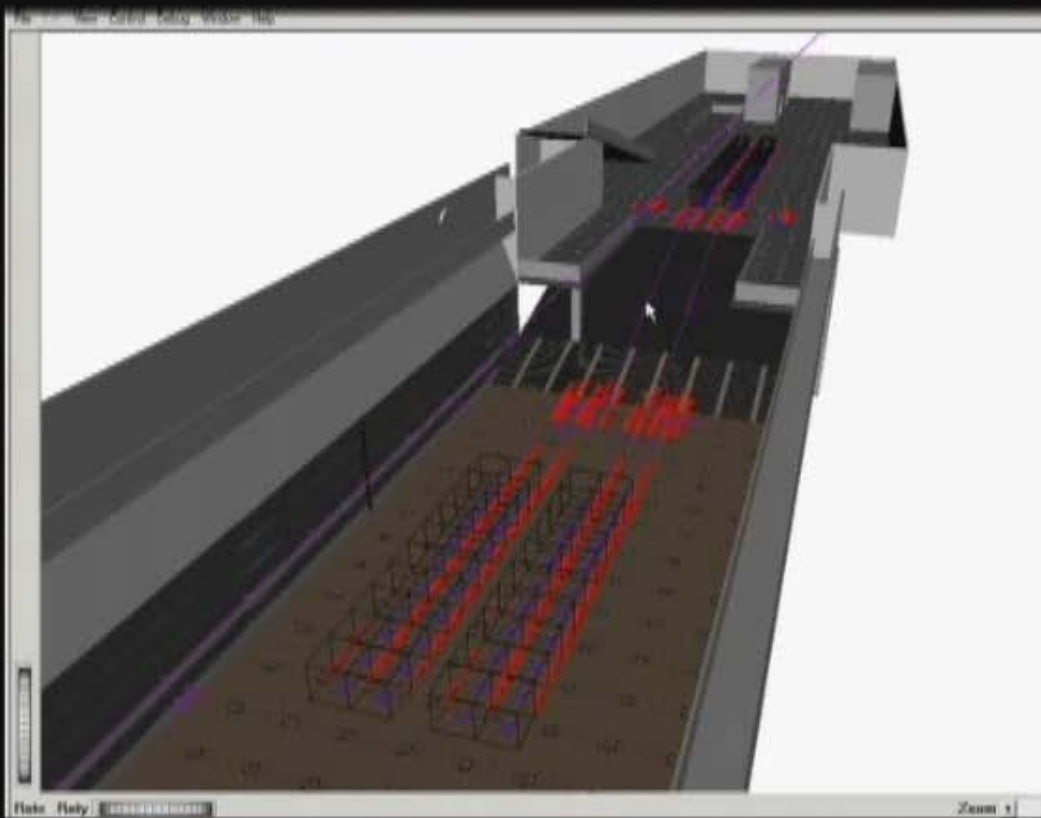
Approach & Assumptions



- Resulting assumptions:
 - 40 pallets pre-staged on the upper vehicle deck
 - 1 LCAC off-cushion in well deck close to ramp.
 - 10K rough terrain fork trucks always back down the ramp.
 - Fork truck speed varies based on level/inclined surface.
 - Only one fork truck at a time allowed onto LCAC.

Model Functionality

- For each cargo handling option, the model
 - Loads the LCAC as fast as possible.
 - Allows the LCAC to leave.
 - Brings the next LCAC in.
- Extra time added for non-concurrent operations:
 - Time required for
 - Starting/stopping engines
 - Raising/lowering bow ramp
 - Fueling
 - etc.



Conclusions

- 1. Neither fork trucks alone nor current monorail system could meet the 150 pallets/hr requirement.
 - Why?
 - Most likely because early LHDs had 9 cargo monorail cars.
 - Latest LHDs only have 3 monorail cars, with one of them held in reserve.
- 2. The bridge crane achieved throughput comparable to the current monorail system.

Future Directions

- Develop similar model to determine realistic, achievable throughput rates of notional skin-to-skin replenishment.
 - On Container Ship
 - Setup
 - Pickup
 - Transfer
 - On Receiving Ship – MPF(F)
 - Set down
 - Break out
 - Transport below deck.

Future Directions

- Develop similar model to determine realistic, achievable throughput rates of notional interfaces between connectors and MPF(F), taking into account
 - Geometry of interface
 - Material Handling Equipment used
 - Manpower required
 - Vehicles versus palletized or containerized cargo
- Use models to identify bottlenecks and compare interface options.

Future Directions

- But how do we deal with uncertainty regarding MPF(F) and Connector designs?
- A) Make baseline assumptions
 - Deck space available.
 - Cargo handling equipment available.
 - Types of cargo being transferred.
 - Provides a baseline throughput rate.

or

- B) Model *several* promising design scenarios and use the models to evaluate throughput of each option.

Questions?