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# LHA(R) Cargo Handling System Trade Study Models

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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
Caveat

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.
• 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.

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Questions?