Space Exploration Logistics Workshop

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Group E

Technology Impacts on Logistics Requirements

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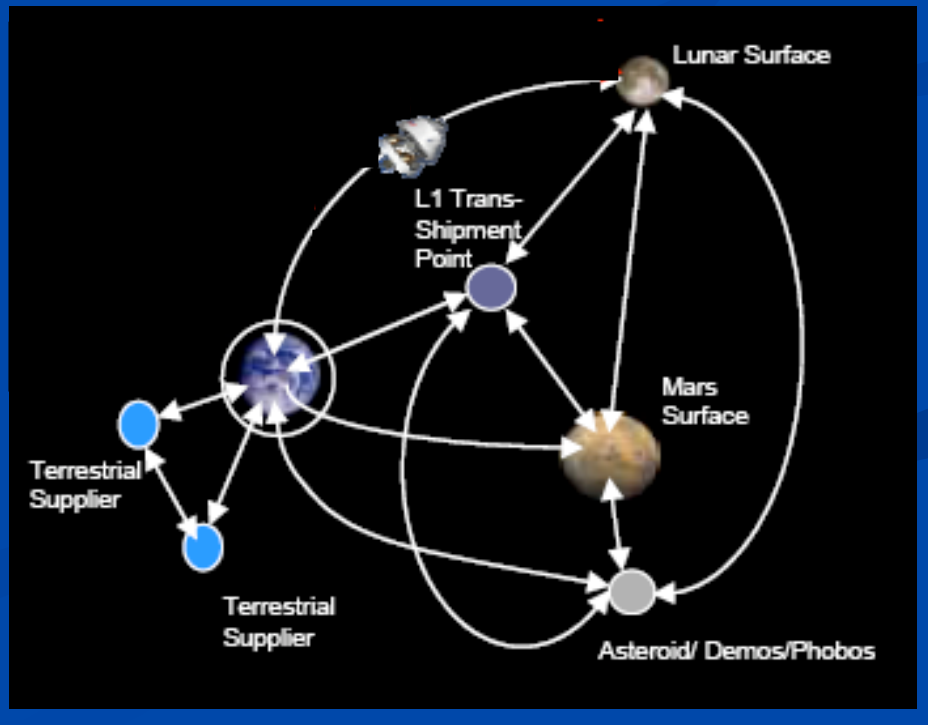


Session Overview

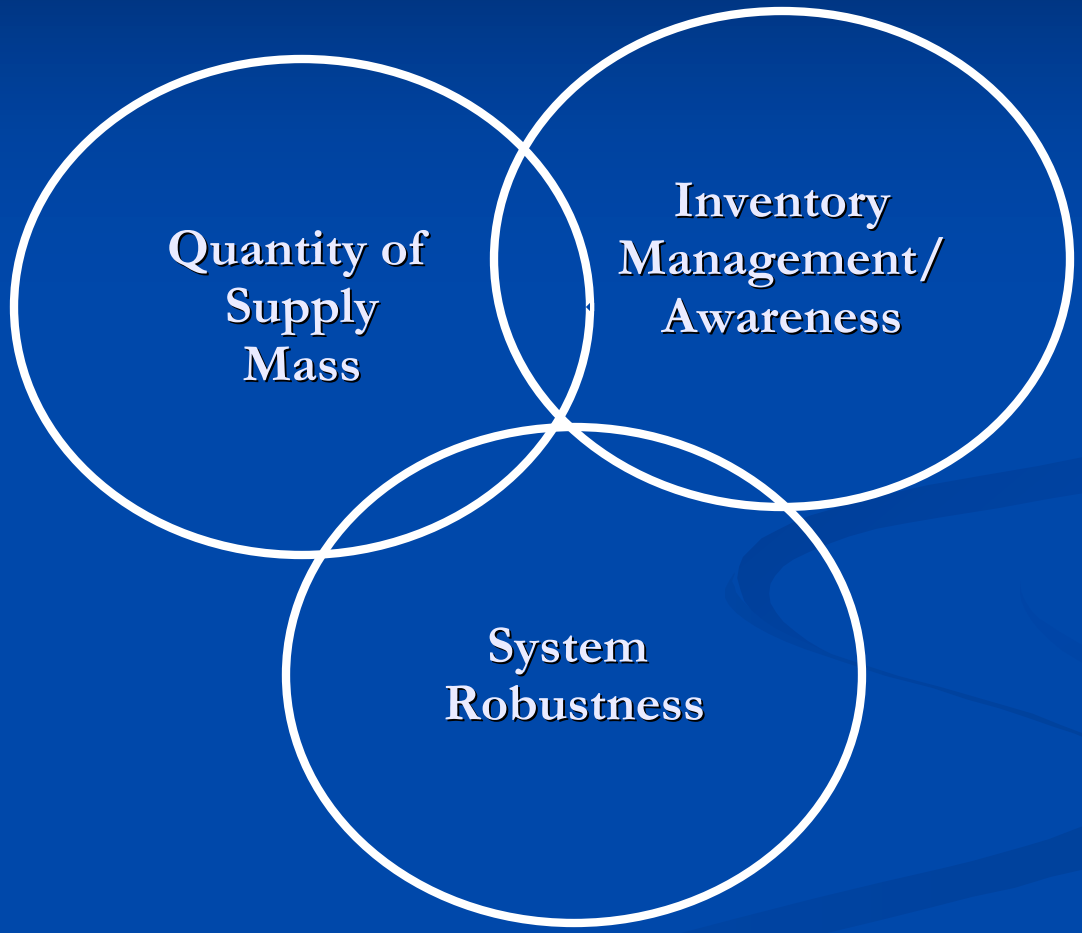
- Technology Impacts on Logistics Requirements
  - Breakout Session Goals
    - Identify and define the impacts of technology on the three different types of exploration missions
  - Breakout Session Organization
    - Brainstorm important issues/topics
    - Pick the "top 3" issues/topics and discuss the Predicted Impact, Potential Mitigation, Testing Methods, Impact on Other Systems, and Recommendation(s) relevant to each mission type

Discussion Points

- RFID
- UID Symbology
- Advanced Propulsion
- ISRU
- Low to Zero Boil-off Storage
- In Space Fuel Depots
- Space Tug

What impact might these technologies have on space logistics?

Technology Impacts on Logistics



Issues –
Common to all Missions

1. *Issue: Quantity of re-supply mass and volume*
   Predicted Impact (if resolved): Optimized launch cargo mix, increased allocation of science equip., increased operational effectiveness
   Potential Mitigation: Development of ISRU, Commonality, Repair in-space, Lower level repair
   Testing Methods: Analysis, Modeling, Simulation, Technology Demos
   Impact on Other Systems: Crew processes/time, hardware design/re-design, software complexity, quality control

Details for #1

- Space maintenance – commonality, repair in space
  - Obsolete parts – lifecycle issues
  - Intermediate level maintenance/ assoc. test equipment
  - Automation to reduce dependence on ground
  - Repair at the component level
  - Reusable/repairable vs. Disposable – level of repair analysis
- Reducing launch re-supply
  - Closed Loop Systems/Regenerative ECLSS – impact on the logistics footprint
  - ISRU – In-Situ Resource Utilization - Fuel, Oxidizer, Crew Consumable (H2O, O2, He, H2, N2), Power
  - Advanced Propulsion – Mars Specific
    - Chemical vs. Electric vs. Solar vs. Others?
    - Capability to send cargo separate from crew in a more efficient manner
  - Near zero boil off

Issues –
Common to all Missions Cont.

2. *Issue:* *Inventory Management and Logistics Situational Awareness*

   Predicted Impact (if resolved): *Optimized inventory effectiveness, increased knowledge of operational status*

   Potential Mitigation: *Automation - RFID/UID, Information Architecture, Integrated Databases*

   Testing Methods: *RFID DTO*

   Impact on Other Systems: *Stowage, Crew Time, Ground/MCC Resources, Supply Items*

Details for #2

- Automated Inventory Control
  - RFID, UID
  - Reducing crew overhead (time) for inventory
  - Accuracy and reliability in inventory control
- Logistics Situational Awareness/ Integrated Log Management
  - Reconfigurability and Commonality between elements
  - Open Architecture Approach
  - Cognition
- Human systems interface
  - Situational Awareness – Info. Kiosk, Hand-held readers, GPS
  - Maintenance – ground support and in-space

Issues –
Common to all Missions Cont.

3. Issue: Systems Robustness and Operability (trade off of robustness vs. optimization)

Predicted Impact (if resolved): Improved system performance to reduce logistics impact

Potential Mitigation: Wireless networks, reduction of thermal constraints, FMEA/FRCAS, design for shipping, certification for multiple configurations, standard rack/bag sizes

Testing Methods: Analysis, Simulation, ISS DTO, Testing of in-orbit cryo transfer

Impact on Other Systems: Hardware and software design and testing, materials, launch vehicles

Details for #3

- Wireless Networks - easier to reconfigure
- Reduction of thermal constraints – mechanical devices with a wider range of temps.
- In-Space Fuel Depots/Refueling
  - Low reliability launcher for consumables (fuel, H2O) – risk issues
  - Design to not preclude the ability to refuel in space
- Ability to return failed parts – Failure modes and effects analysis (FMEA) and Failure Reporting Corrective Actions System (FRCAS)