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

- Quantity of Supply Mass
- Inventory Management/Awareness
- System Robustness
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)