Group I

Spaceport and Earth-to-Orbit Logistics

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Spaceport Logistics is Fun!!!
Session Overview

- Spaceport and Earth-to-Orbit Logistics
- Goals
  - Discuss the issues/topics related to Spaceport and Earth-to-Orbit Logistics for the three different exploration mission types
- Organization
  - Identify the important issues (starter list + attendee participation)
  - Pick the “top 3” issues/topics relevant to each exploration mission type
  - Discuss potential impacts, mitigations and opportunities, early tests/demonstrations, and interfaces to other systems
Discussion Points

- Improved hardware reliability
- Level of Repair (LRU vs. SRU)
- Modular Open System Architecture
- Automated Health Monitoring
- Universal (Flexible) Test Equipment - on-orbit
- Commonality Across Systems (or Extensibility)
- Cost per Pound (Kg) to orbit
- Refurbishment of CEV location (launch site vs. manufacturer)
- Verification tasks/equipment for Reusable CEV (location / portability of equipment)
- Spares Quantity vs. Cannibalization
- Automated Item Tracking (e.g., RFID)
The Top 3 Issues

1. Lack of robustness in getting supplies from Earth to orbit
2. Inadequate operations considerations in design
3. Lack of lean design in current processes
Issues –
Common to all Missions

1. Issue: Lack of robustness in getting supplies from Earth to orbit
   Predicted Impact: Loss of mission effectiveness

   Potential Mitigation: Vehicle health monitoring IVHM (integrated vehicle health management),
   Flexibility for the unknown-unknowns,
   Ability to “move” payloads between vehicles (U.S. and others),
   Material commonality,
   Universal (Flexible) Test Equipment,
   Responsive manifesting and lead-time/Just-in-time manifesting

   Testing Methods: Organization KPIs, Analysis, Modeling, Demo flights and early use of CEV to ISS

   Impact on Other Systems: Standard system interfaces, Commonality, Improved business processes and IT
Details for #1

- **Robustness and reliability**
  - Vehicle health monitoring, IVHM (integrated vehicle health management)
  - Flexibility for the unknown-unknowns
  - Ability to “move” payloads between vehicles, U.S. and others
  - Material commonality
  - Universal (Flexible) Test Equipment, on-orbit. Risk of loss with one LRU.
  - Responsive manifesting and lead-time/ Just-in-time manifesting
Issues –
Common to all Missions Cont.

2. Issue: Inadequate operations considerations in design
   Predicted Impact: Risk of lack of sustainability
   Potential Mitigation: Early operations costing/modeling – quantifying and implementing,
   Understanding the impact of design decisions on operations,
   Partnering of Design Personnel with Ops Personnel
   Testing Methods: KPIs, develop operability measures
   Impact on Other Systems: extensive impacts on multiple systems
Details for #2

- Early operations costing/modeling – quantifying and implementing
  - Establishing the hardware flow, GEM FLO
  - Understanding all the manifesting models that exist today

- Launch turn-around logistics (spaceport processing)
  - CEV Refurbishment location (launch site vs. manufacturer)
  - Minimize refurb at remote locations like the landing site
3. Issue: Lack of lean design in current processes
   Predicted Impact: inefficiencies (in cost, time, etc.)
   Potential Mitigation: Implement lean design as a top-down process,
   Education on the importance of global optimization,
   Clearly document and define processes
   Testing Methods: simulations, lessons learned from similar systems, lean team exercises
   Impact on Other Systems: lessons learned and process improvements will be exportable to other systems, may force other systems to support the lean process
Details for #3

- Integration of logistics needs and requirements
- Lean design/supply chain optimization including business processes
- Cost to Orbit (Launch Site to LEO)
Points Not Yet Developed

- Capturing the whereabouts of supplies,
  - use one RFID tag/number for end to end inventory tracking
  - Real-time information
  - Define where logistics warehouses/control points should be
- Carrier integration for exploration
- Spares Quantity vs. Cannibalization