Space Exploration Logistics Workshop

17-18 January 2006

Omni Shoreham Hotel, Washington, DC

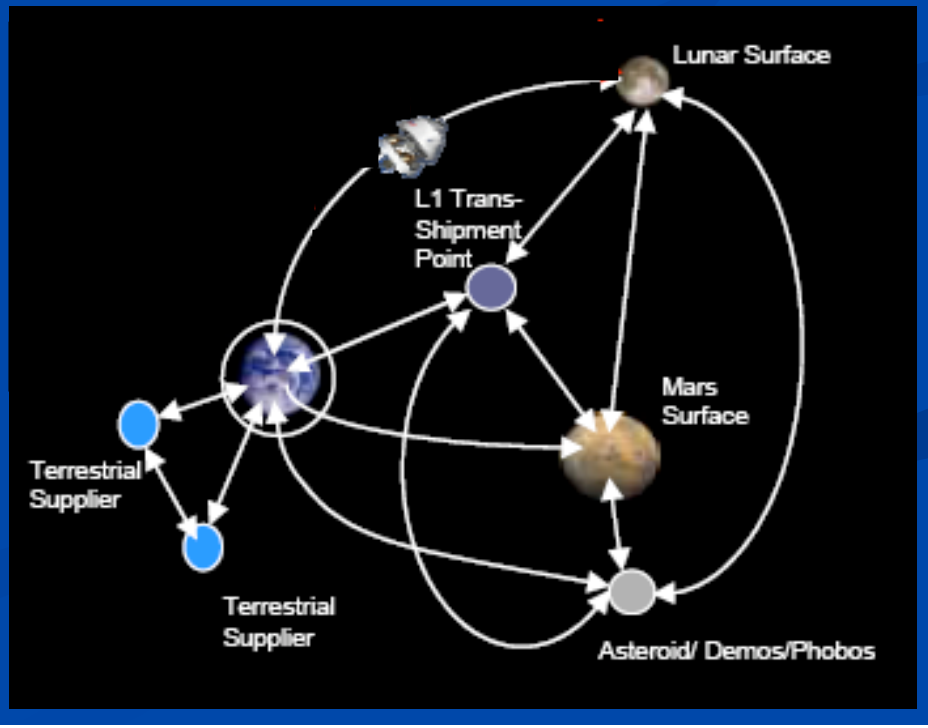
Group A

RFID & Information Architecture for Remote Logistics

Group Leader
Dr. Olivier deWeck, MIT

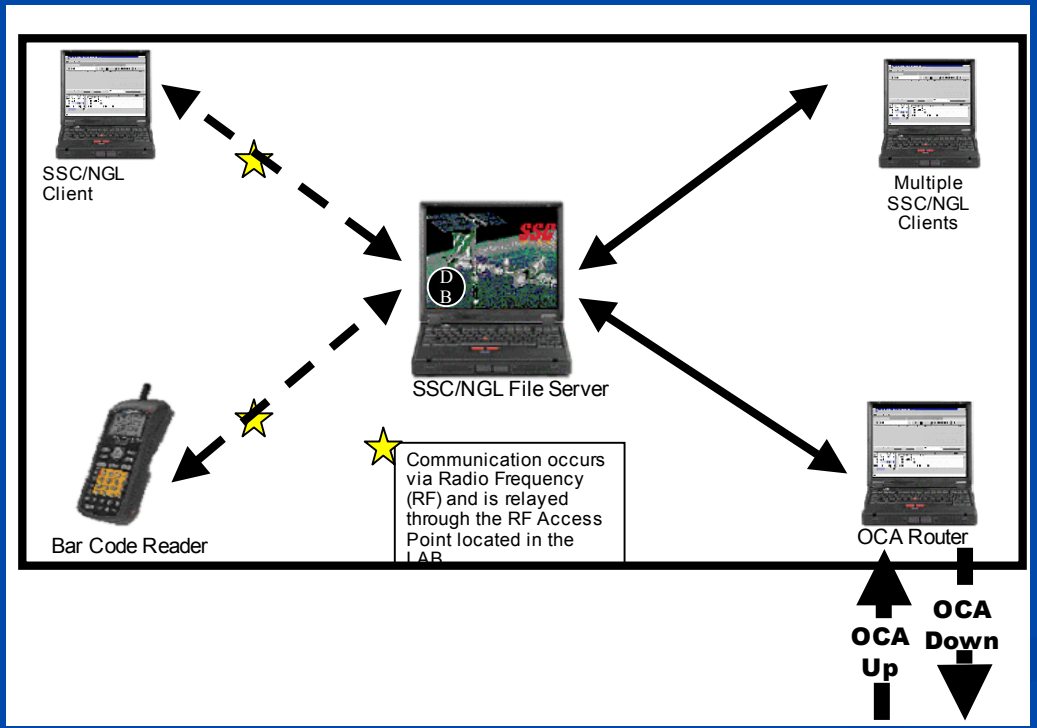
Group Facilitator
William A. (Andy) Evans, USA [SOLE]

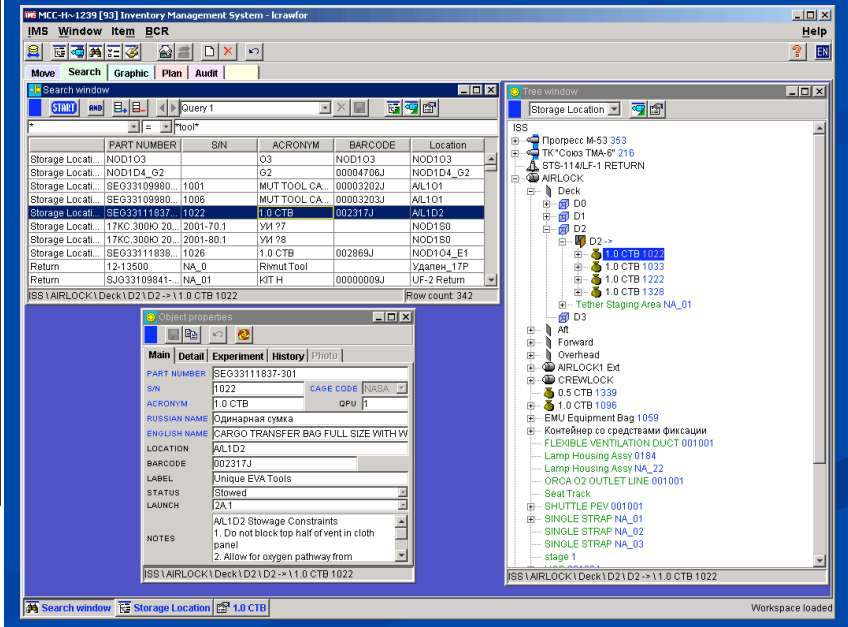
Group Scribe
Mr. Xin (Mike) Li, MIT



ISS Inventory Management

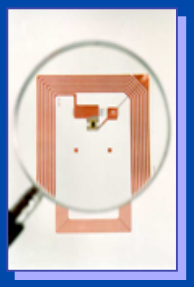
- Barcode-based (manual) system
- Inventory Management System (IMS)



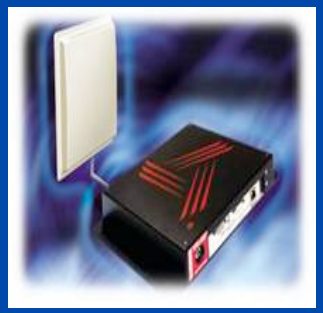


What is RFID?

- Radio Frequency Identification
- System to read active/passive tags
- Automated asset tracking



RFID Tag



Interrogators

Network

Middleware/Analytic Tools

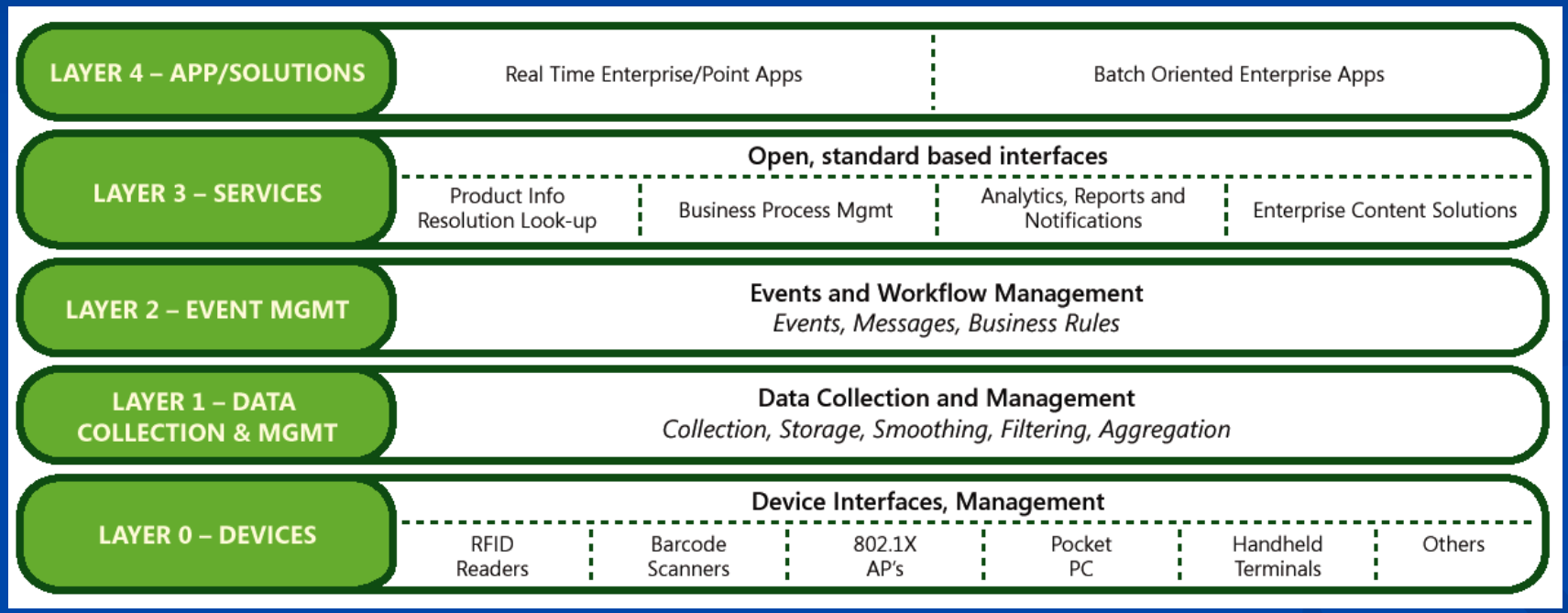
Session Overview

- RFID & Information Architecture for Remote Logistics
  - A discussion of the development of interfaces to an open systems architecture to provide asset visibility, accountability and other utility in remote logistics operations.
- Breakout Session Goals
  - Identify and define the impact of topics related to RFID & Information Architecture on the three different types of exploration missions
- Breakout Session Organization
  - Brainstorm important 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

- Sensor technology
  - RFID
  - UID
  - Combination
- Modular Open Systems Architecture
  - Middleware
  - Logistics Management System
- Utility
  - Asset Visibility
  - Accountability
  - Spatial Orientation
  - Maintenance

EPCglobal Architecture



Issues
Common to all Missions

1. Issue: **Criteria for Tagging/Tracking (what and when)**
   Predicted Impact: Total Asset Visibility, High Costs
   Potential Mitigation: Increased Inventory, more crew time, large logistics footprint
   Testing Methods: Pilot projects, Flight Test, Simulation Models
   Impact on Other Systems: Standardization, Interoperability, Compatibility
   Potential Solution(s): RFID/UID/Smart Tags/Middleware/Integrated Database/Open Architecture

2. Issue: **Design of Middleware**
   Predicted Impact: Balanced Information Flow, Data Filtering
   Potential Mitigation: Decision Support Information, Alerts/Messages
   Testing Methods: Real RFID Data Analysis
   Impact on Other Systems: Interoperability, Standardization
   Potential Solution(s): Solution Vendors

3. Issue: **Durability**
   Predicted Impact: System Robustness, High Costs
   Potential Mitigation: Increased Reliability, Lower Maintenance Cost
   Testing Methods: Tag/Reader Lab Durability Test, Flight Test, Simulation Models
   Impact on Other Systems:
   Potential Solution(s): Designed package

Issues/Recommendations –
Common to all Missions

4. *Issue:* **Package vs Cost vs Reliability**
   Better designed package to increase tag readability
   Predicted Impact: Increased Robustness, Increased Costs
   Potential Mitigation:
   Testing Methods: Make recommendation about RFID friendly package design and work with Space supply vendors
   Impact on Other Systems:
   Potential Solution(s): Package Design Recommendations

5. *Issue:* *Reliabiliy /Robustness*
   Predicted Impact: Increased Costs, System Robustness
   Potential Mitigation: Built-in Redundancy to increase robustness, supporting both Bar code and RFID Tags ,Data Inconsistency
   Testing Methods: Pilot Projects
   Impact on Other Systems:
   Potential Solution(s):

Issues/Recommendations –
Common to all Missions

6. Issue: **Human Systems Integration**
   - Improve business process to reduce human factor errors
   - Look at 10-15 years horizon to incorporate active tags, Robotic solutions
   - Well-organized grouping/Procedure Design

   Predicted Impact: Improved operation efficiency, More/less crew time
   Potential Mitigation: Retraining crew for standard procedures
   Testing Methods: Simulations, Pilot Projects
   Impact on Other Systems: Integrated Database
   Potential Solution(s):

7. Issue: **Smart Tags**
   what data to store/where to store/Limited data bandwith for downlink and uplink

   Predicted Impact: Increased information availability and accurary, Costs
   Potential Mitigation: Balanced of number of smart tags and data storage
   Testing Methods: Pilot projects and Bandwidth analysis
   Impact on Other Systems: High requirement for Integrated Database/Service Oriented Architecture, Smart data integration capability, Data cache management
   Potential Solution(s): Multiview of data

Issues/Recommendations –
Common to all Missions

8. Issue: **Integrated Database/Open Architecture**
   Consolidate inventory databases, User friendly,
   Predicted Impact: Increased operation efficiency, reduced costs
   Potential Mitigation: Data belong to different organization, Standard data dictionary
   Testing Methods: Develop Database and test for different use cases
   Impact on Other Systems: Middleware, Open architecture
   Potential Solution(s):

9. Issue: **Standards**
   Predicted Impact: Information Exchangeable, Reduced implementation costs
   Potential Mitigation: Many parties are involved, hard to come
   Testing Methods:
   Impact on Other Systems:
   Potential Solution(s):

10. Issue: **Criticality Analysis**
    Identify critical space supply for tracking
    Predicted Impact: If we track everything, system may overloaded.
    Potential Mitigation:
    Testing Methods: Pilots and experiment and data analysis, Interviews
    Impact on Other Systems:
    Potential Solution(s):

Issues vs Scenarios

Issues	Short Lunar	Long Lunar	Mars
1. Criteria for Tracking/Tagging	M	M	M
2. Design of Middleware	L	M	M
3. Durability	L	M	H
4. Package vs Costs	M	M	M
5. Reliability and Robustness	M	M	H
6. Human Systems Integration	M	M	M
7. Smart Tags	M	M	M
8. Integrated database/Open Architecture	L	M	H
9. Standards	M	M	M
10. Criticality Analysis	M	M	M

High – Medium -Low