



S117E08003

# ISS National Laboratory



**“develop a Research Management Plan for the International Space Station” and to utilize the Space Life Science Lab in an appropriate way to satisfy this plan”**

# Key Issues from the ARC Meeting

- Partners
- Process
- Defining customer needs
- Access to and return from ISS
  - We need a shipping agent (payload Integrator)
  - What happens post Shuttle

# Ground Asset For the ISS National Lab

## Processing the Space Life Sciences Lab

### Biology

#### SLS Lab Building Information

##### BUILDING INFORMATION

<b>Total Net Square Feet:</b>	approximately 73,000
<b>Total Gross Square Feet:</b>	approximately 104,000
<b>Building Population:</b>	140 Resident & 38 Visitors
<b>Laboratory Space:</b>	25 science laboratories 8 hardware laboratories 6 animal holding rooms



#### Lab Capabilities Summary

<b>Controlled Environment Lab</b>	15 Controlled Environment Chambers (CEC)
<b>Applied Genetics Technology Lab</b>	Genetic Identification, Quantification & Qualification
<b>Analytical Chemistry</b>	Organic/Inorganic
<b>Animal Care Facility</b>	Rodent/Aquatic/Avian/Insect
<b>Experiment Processing Support</b>	Shuttle/Station/Unmanned
<b>Flight Experiment Development</b>	Design/Testing/Integration
<b>Astrobiology</b>	UF/FIT Science Programs
<b>Biological Imaging</b>	Atomic Level Visualization
<b>Applied Chemistry*</b>	In-Situ Resource Utilization, Environmental Remediation, Corrosion Detection & Coatings, Polymer & Smart Materials
<b>Applied Physics*</b>	Granular & Surface Systems
<b>Electrostatics*</b>	Dust Characterization & Remediation, Surface Physics

(\*relocating from O&C to SLS Lab in FY07)

#### Unique Agency Capabilities

##### Animal Care Facility (ACF)

- Provides animal husbandry & support for space flight missions
- Skills, equipment and labs unique to pre/post mission support requirements at launch site of life science & biological payloads
- Meets all necessary Agency & Federal cert/license requirements

##### Biological Payloads Processing Support

- Skills, equipment and labs unique to pre/post mission support requirements at launch site of life science & biological payloads
- Additional unique required support provided by analytical & biomolecular chemistry labs

##### Controlled Environment Lab (CEL)

- Skills and infrastructure uniquely developed originally for biological sustainable systems (i.e. bio-regenerative life support systems), now serving multi-discipline investigations
- Orbit Environment Simulators for science 'control' of STS/ISS pressurized environment payloads (temp, humidity, CO2, lighting)



# KSC Flight Payload History



## BioTube

2000: Magnetic Field Apparatus pre-cursor flight  
2002: Magnetic Field Apparatus flight

## KSC GASEOUS NITROGEN FREEZER (KSC GN2)

1997: Develop with outside commercial vendor  
2002: ISS Flight

## KSC FIXATION TUBE (KFT)

1997: Design, fabricate, test and certify to support new CUE requirements  
1998: Modify to improve firing reliability  
2002: ISS Flight

## MICROGRAVITY PLANT NUTRIENT EXPERIMENT (MPNE)

1994 - 1997: Develop first flight hardware demonstration unit  
1998 - 1999: Modify to accommodate science investigators

## PLANT GROWTH FACILITY (PGF)

1994 - 1996: Design & fabrication  
1996 - 1997: In-house testing and certification  
1998: Upgrades to lighting, CO<sub>2</sub>, and temperature control systems

## BIOLOGICAL RESEARCH IN CANISTER (BRIC)

1994: Develop BRIC-100 Canister  
1995: Develop BRIC-100VC Canister  
1997: Modify BRIC-100 for gas exchange  
1997: Add LiOH and Purafix to improve science  
1997: Develop BRIC-LED Assembly  
1998: Modify BRIC-60 for gas sampling  
1999: Developed Passive Cooler for inhibiting sample growth  
2003: Two stage POFU Inhibitor/active delivery  
2003: Rapid manifesting demonstration  
2006: Passive Observations for Experimental Microbial Systems (ISS Inc 13)

*BRIC-100/BRIC-100VC Flights*

*BRIC-60/BRIC-LED Flights*

## PLANT GROWTH UNIT (PGU)

1988: Develop Air Exchange System  
1996: Develop Plant Growth Chamber quick release to allow inflight harvesting  
1988 - present: Sustaining Engineering



1983

STS-29  
First KSC  
Payload

STS-49  
First Flight Orister  
Endeavour

1997

STS-71  
First MIR Docking

1998

STS-88  
First ISS Element  
Launch

2003

STS-107

2006

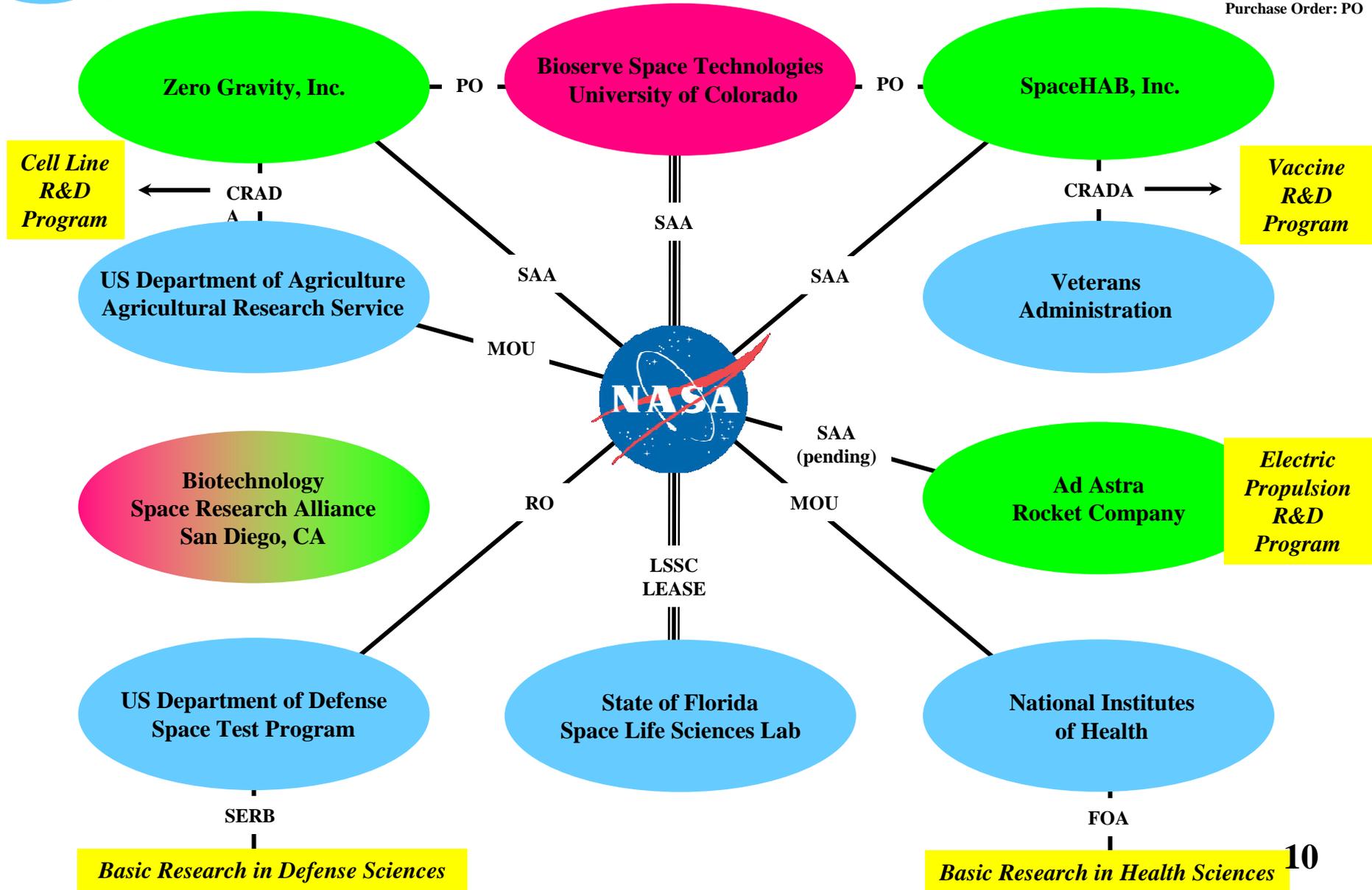
STS-121



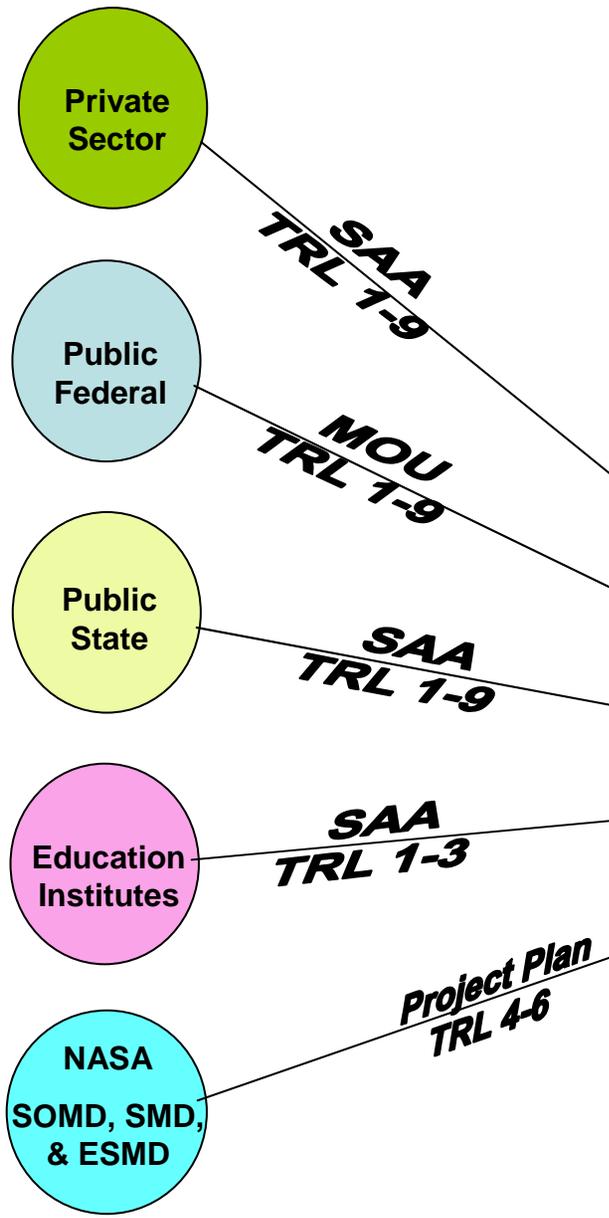
- Academic Sector
- Industrial Sector
- Government Sector

# ISS National Lab Network

Cooperative Research & Development Agreement: CRADA  
 Funding Opportunity Announcement: FOA  
 Memorandum of Understanding: MOU  
 Resident Office, JSC: RO  
 Space Act Agreement: SAA  
 Space Experiments Review Board: SERB  
 Purchase Order: PO

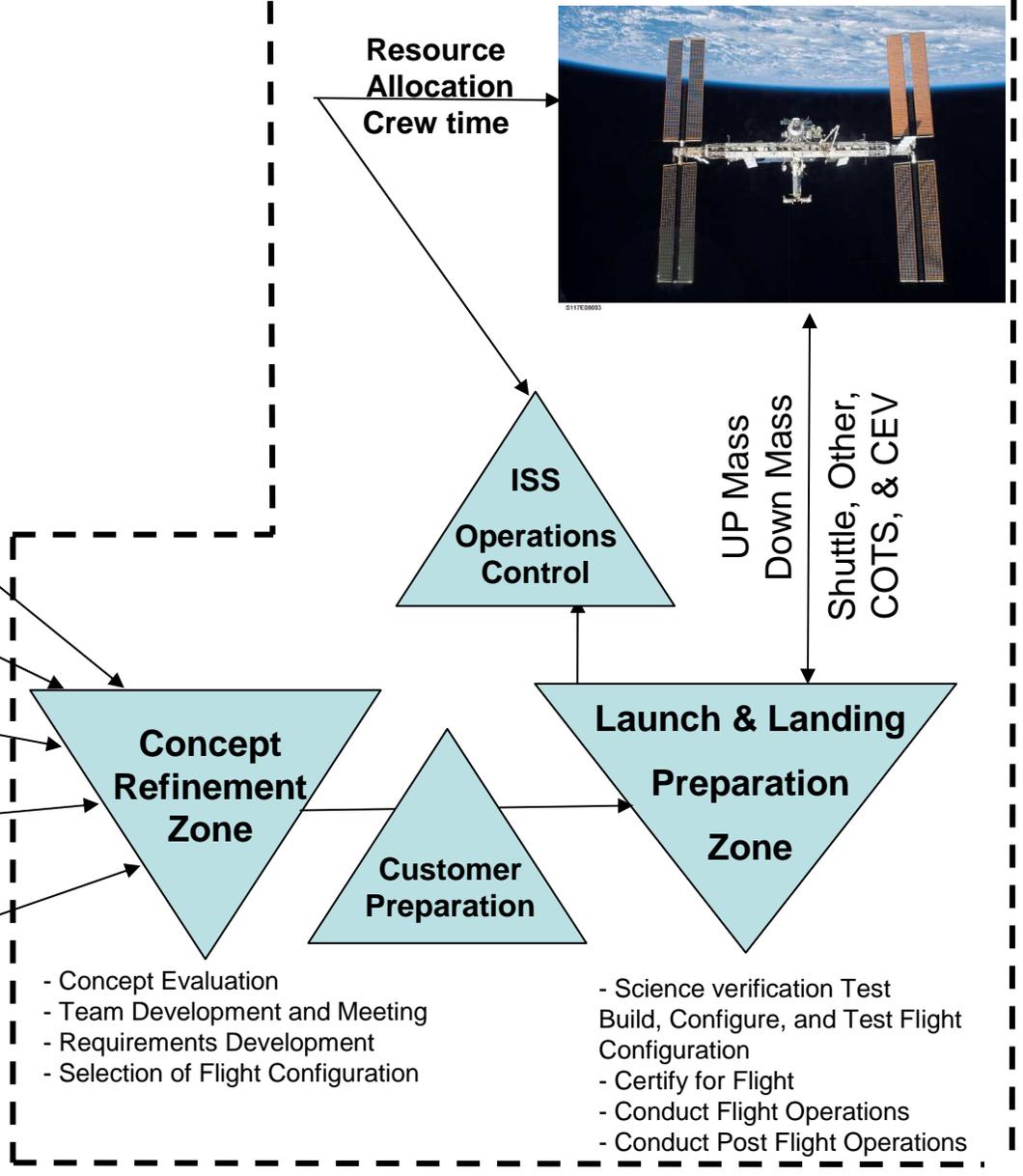


# Customers



Activity Selected for ISS Experimentation Evaluation

# ISS National Laboratory

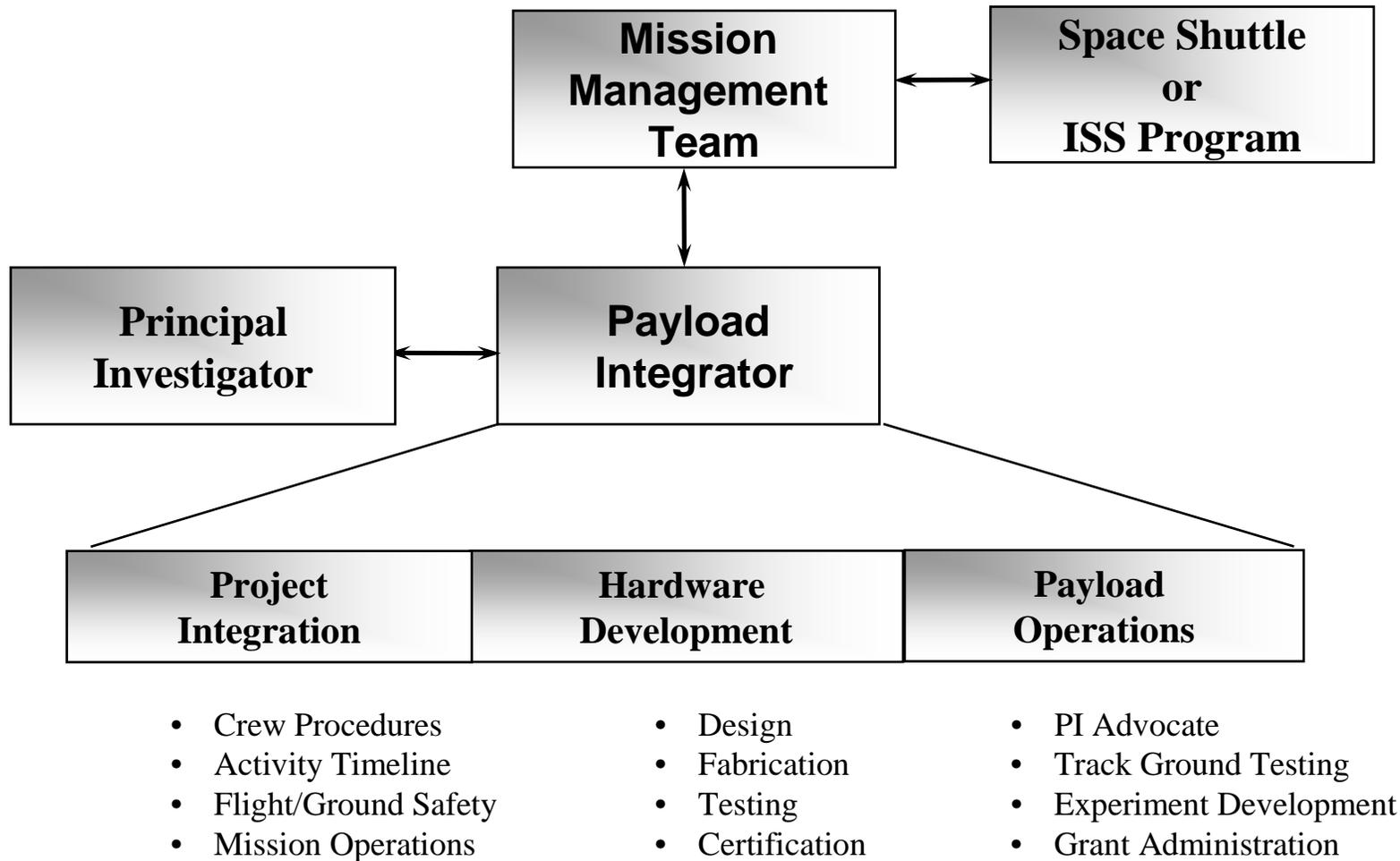


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# ISS National Laboratory Usage

- ISS National Lab User selects, and develops specific investigations
- Payload Definition Phase
- Obtains space allocation from ISS National Lab reserve
- Select specific flight hardware for investigation from available inventory
- Experiment unique equipment is developed at the User's expense ( with the help of the development team if necessary)
  - Available User Support
    - Flight Hardware Inventory
    - Flight Expertise ( Science and Engineering)
    - Training for PI's
    - Experiment Concept Development
    - Flight Requirements Development
    - Rapid proto typing and payload development
      - Hardware Development
      - Software Development
    - Experiment Monitoring and Control
- Manifesting Process Execution (Integration Team)
- Launch and Landing Execution (NASA Provided)
- ISS Operation are managed by NASA based on customer input for specific activities

# Payload Team



# Flight Project Cycle



- A      Develop an understanding of the proposed science requirements through a site visit with the investigator and dialogue. With this understanding, prepare a feasibility analysis with recommendations for implementation approach. Program approval required to proceed.
- B      Validate experiment feasibility and identify remaining risk areas with mitigation recommendations. Based on this data, refine the implementation approach. Develop preliminary integration products. Program approval required to proceed.
- C/D    Request Selection for Flight. Complete experiment unique hardware. Complete integration cycle for specific launch and on-orbit platform. Concurrence for Flight Readiness required from Program before final preflight milestones.
- E      Experiment operations.

# Payload Definition Phase

- One visit to PI's Lab to understand his needs
- PI visit SLS Lab to understand the payload processing flow
- The PI receives a “project Definition Report” with recommendations for implementation
  - Feasibility Assessment
  - Recommended hardware
  - Implementation schedule
  - Cost Estimate
- Total cost approximately \$20K

# Deliverables for Site Visit and Concept Definition Phase

## Site Visit

Conduct PI Familiarization

Available  
Hardware

Preliminary Activity  
Timeline

Mission Operation  
Procedures

Obtain Science Requirements

Feasibility  
Analysis

Implementation  
Approach

## Concept Definition (Phase A) Products

Draft Experiment  
Requirements  
Document

Hardware  
Needs  
Assessment

Experiment  
Requirements  
Review Package

Submit  
Request for  
Flight

# Role 1 – Payload Integration

- Develops products needed by the ISS Integration
- The payload integration team for all ISS National Lab payloads (*Working with the ISS team planning the activity on station*)
  - ISS Resources Scheduling
  - Crew Training
  - Hardware Verifications
  - Manifesting
  - Documentation
    - Safety
    - Procedures

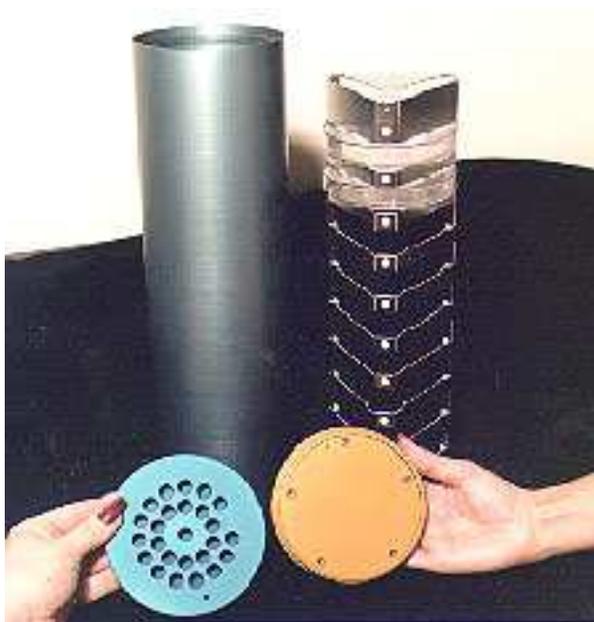
# Role 2 - Inventory Management And Hardware Development

- Develop hardware requirement
- Map against existing inventory
- Perform minor mods or build new hardware
  - Concept, PDR, detail design, CDR, fab & Test
  - SVT and PVT
  - Certify for Flight
- Develop standard experiment unique equipment packages
- Maintain hardware inventory

# Role 3 - Processing and Launch Site Operations

- Provide PI support
- Maintain PI Labs
- Perform Ground Controls in SLS Lab  
Orbital Environmental Simulators
- Receive and manage Flight Hardware
- In-flight operations support using the SLS  
Lab Experiment Monitoring area
- Return flight samples to investigator

# Examples of Existing Simple Hardware



# Acronyms

ARC	NASA Ames Research Center (California)	NRA	NASA Research Announcement
BRIC	Biological Research in Canisters	NSTS	National Space Transportation System (shuttle)
CDR	Critical Design Review	PDR	Preliminary Design Review
COTS	Commercial Off the Shelf Hardware	PIP	Payload Integration Plan
CUE	Collaborative Ukrainian Experiment (Payload)	PWQ	Process Waste Questionnaire
DFRC	NASA Dryden Flight Research Center (California)	SMAC	Spacecraft Maximum Allowable Concentration
ERD	Experiment Requirements Document	SSP	Space Shuttle Program
EUE	Experiment Unique Equipment	STS	Space Transportation System
FBP	Fundamental Biology Program	UB-E	KSC Flight Experiments Project Management Office
GN2	Gaseous Nitrogen (Freezer)	WAD	Work Authorization Document
HW	Hardware		
ISLSWG	International Space Life Sciences Working Group		
ISS	International Space Station		
IVA	Intra-vehicular Activity		
JSC	NASA Johnson Space Center (Houston, Texas)		
KFT	Kennedy Space Center Fixation Tube		
KSC	NASA Kennedy Space Center (Florida)		
LSSF	NASA Life Sciences Support Center (KSC)		
MDK	Space Shuttle Mid-deck		
MLE	Mid-deck Locker Equivalents		
MSFC	NASA Marshall Space Flight Center		
NASA	National Aeronautics and Space Administration		