National Aeronautics and Space Administration

An Overview of the Microgravity Science Glovebox (MSG) Facility

Reggie Spivey
Teledyne Brown Engineering,
Huntsville, Alabama

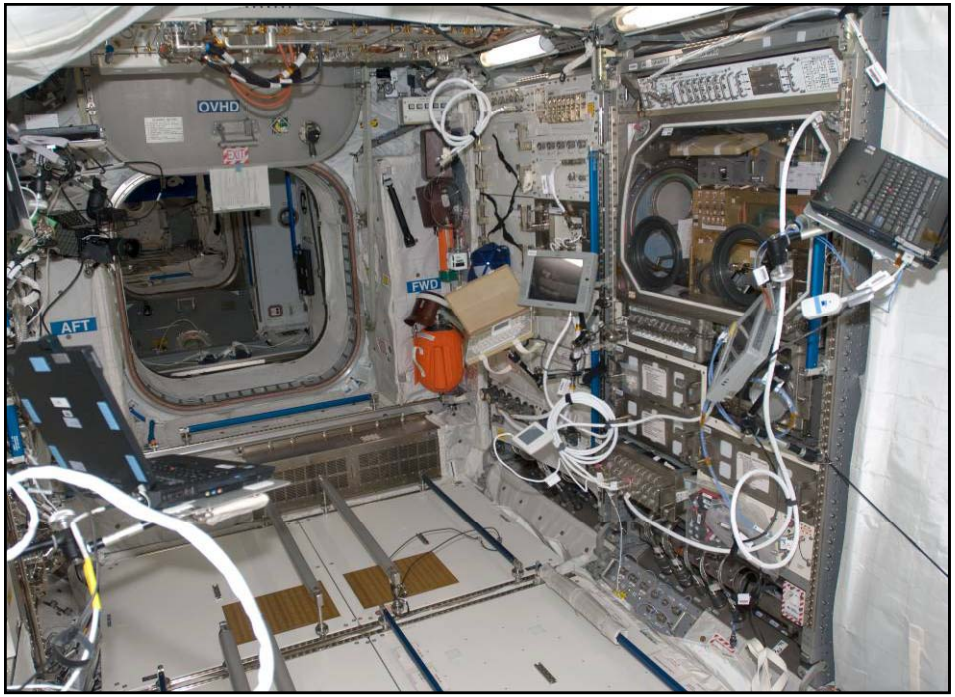
Ginger Flores
NASA Marshall Space Flight Center,
Huntsville, Alabama

NASA / NIH BioMed – ISS Pre-Application Meeting

June 16, 2009

MSG Facility Overview

- The Microgravity Science Glovebox (MSG) is a double rack facility designed for microgravity investigation handling aboard the International Space Station (ISS) in the Columbus Module.
- The unique design of the facility allows it to accommodate science and technology investigations in a “workbench” type environment.

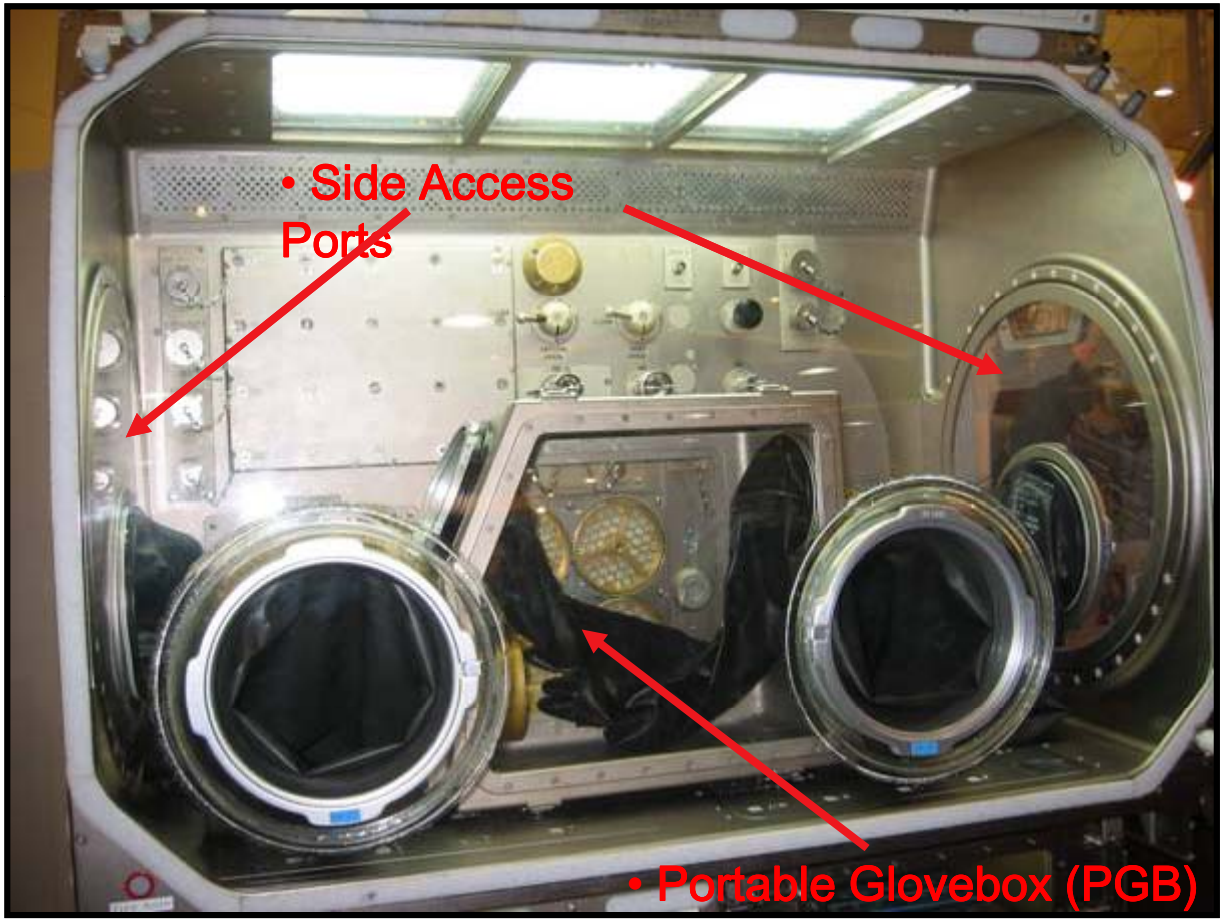


- MSG facility provides an enclosed working area for “hands on” investigation manipulation and observation by the ISS crew. Provides two levels of containment to isolate experiment from the crew and cabin. Experiment resources are provided via connections on back wall.
- The MSG team and facilities provide quick access to space for exploratory and National Lab type investigations to gain an understanding of the role of gravity in the physics associated with new research areas.

MSG-Provided Payload Interfaces / Resources

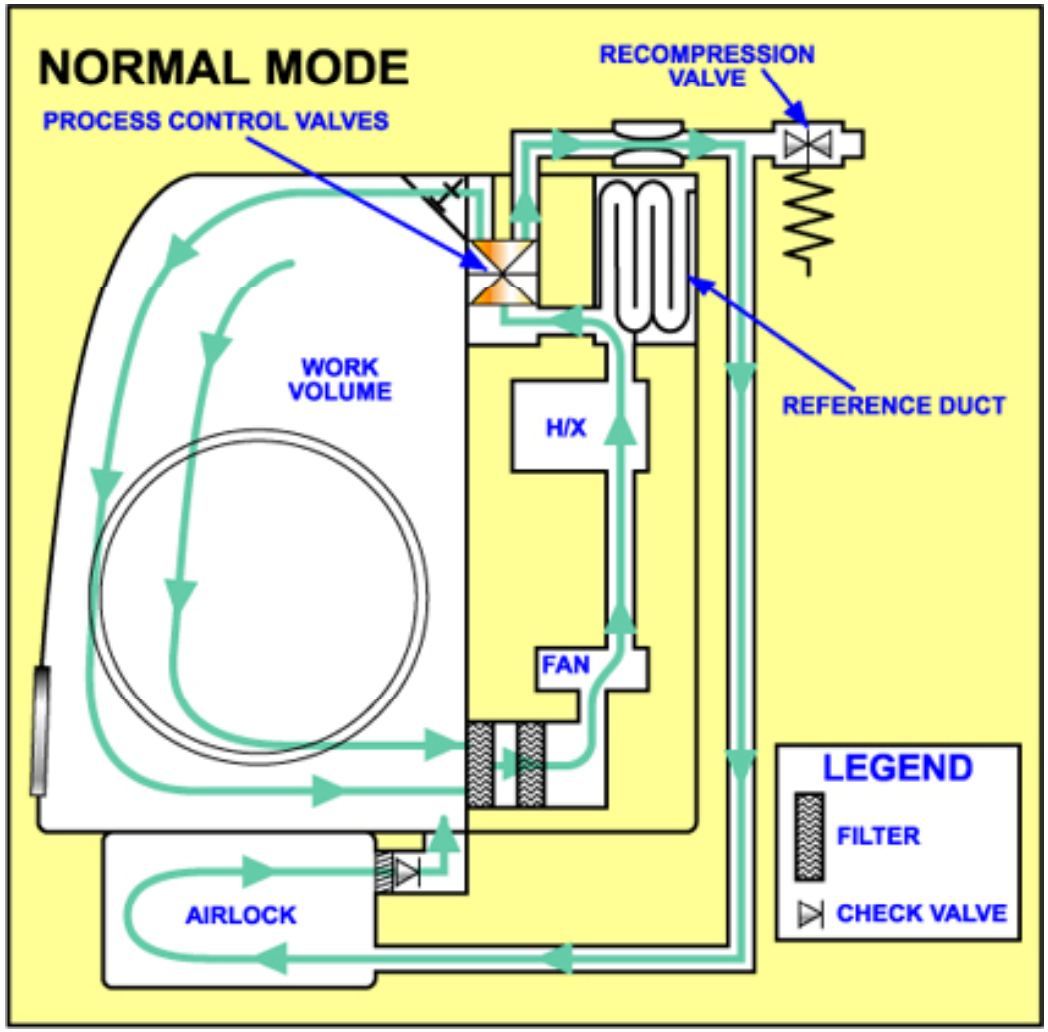
- **Work Volume (WV) - Volume**
  - 0.255 m^3 = 255 liters
- **Work Volume - Dimensions**
  - 906mm wide x 637mm high
  - 500mm deep (at the floor)
  - 385mm deep (at the top)
- **Maximum size of single piece of equipment in WV (via side access ports)**
  - 406mm diameter
- **Maximum size of single piece of equipment in WV (via the airlock)**
  - 254 x 343 x 299 mm
- **Payload Attachment**
  - M6 threaded fasteners in floor, ceiling, & sides
- **Power available to investigation**
  - +28V DC at useable 7 amps
  - +12V DC at useable 2 amps
  - -12V DC at useable 2 amps
  - +5V DC at useable 4 amps
  - +120V DC at useable 8.3 amps
- **Maximum heat dissipation**
  - 1000W Total
    - 800W from coldplate
    - 200W from air flow
- **General illumination**
  - 1000 lux @ 200mm above WV floor
- **Video**
  - 4 color Hitachi HV-C20 cameras
  - 2 Sony DSRV10 Digital Recorders
  - 2 Sony GV-A500 Analog 8mm Recorders
- **Data handling connections**
  - A31P Laptop Computer
  - Two RS422-to-MSG for investigations
  - One MIL-BUS-1553B-to-MSG for communication via MLC
  - Ethernet LAN 2
- **Filtration**
  - 12 HEPA/charcoal/catalyst WV filters (Replaceable on orbit)
- **1 HEPA/charcoal/catalyst Airlock filter**
  - Replaceable on orbit
- **Up to Two Levels of Containment**
  - Physical barrier of MSG structures, gloves, etc.
  - Negative pressure generated by MSG fans.
- **Other resources available**
  - Gaseous Nitrogen
  - Vacuum (VRS & VES)

Payload Interfaces and Resources Provided by MSG



•02Oct08

Containment Method



- Normal Mode means that all Work Volume ports are closed and the Air Handling system is circulating air internally
- Air Circulation proves heat rejection and containment
- One Level of containment provided by air filtration and negative pressure in Work Volume.
- Second level of containment provided by physical barrier of Work Volume.

Available Facilities

- Flight Unit in ISS Columbus Module
- Engineering Unit at MSFC
  - Flight-equivalent unit used as verification tool for investigation hardware
- Ground Unit at MSFC
  - Flight-like unit used for development and limited verifications
- Training Unit at JSC
  - Used to train crew on how to operate investigation hardware
- Ancillary Hardware
  - MSG Laptop Computer
  - Video Equipment
  - Cables, Feedthrus, and Mounting Systems
  - Cleanup Equipment
  - Acceleration Measurement System

Payload Process

	Manifesting	HW Development	Operations	Safety
Driving Document	ISS Increment Definition and Requirements Document - Annex 1 - Annex 5	ISS Payload Interface Requirements Document MSG Investigation Interface Requirements Document	POIC Payload Operations Handbook Volume 1 Volume 2	Safety Policy And Requirements for Payloads Using the Space Transportation System
Payload Developer	– IR Sheets – Crew Overview – Science Description	– Hardware – Software – Standalone test data – Verification	– Procedure inputs – Trainer hardware – Training Course – Resource Needs	– Standalone Safety Data Package – PSRP Review(s)
MSG Team	– PTP Inputs – CEF Inputs – PDL – Documentation Delivery Schedule	– Integrated Testing – Human Factors Testing – Integrated Verification – CoFR – Interface Control Document	– Crew Procedures – Training – Operations Nomenclature – URC Inputs – Schedule Operations – Console Ops	– Integrated Safety Data Package – PSRP Review

Teledyne Brown Engineering (TBE) Mission Support

- Teledyne Brown Engineering (TBE) is the primary contractor supporting NASA's science and mission systems research and development, which includes the integration, testing, and operation of the Microgravity Science Glovebox.

- TBE presently has a vital role in operating the International Space Station and provides space-qualified hardware for on-board research and support of cargo integration.

- Teledyne Brown Engineering, Inc., is a key business segment of Teledyne Technologies, a confederation of commercial and government-supporting companies.

- Headquartered in Huntsville, Alabama, with operations and offices throughout the United States and representation in several other countries. Teledyne Brown is a recognized leader in providing solutions in Space, Defense, Environmental, and Homeland Security programs.

National Aeronautics and
Space Administration
Marshall Space Flight Center

Teledyne Brown Engineering (TBE) Mission Support

Microgravity Science Glovebox

- TBE has supported and integrated numerous Shuttle, SpaceLab and Space Station missions as depicted at the left.

- A partial list of other missions supported, but not illustrated, includes:

- STS-106
- STS-108/ISS UF-1
- STS-110
- STS-111/ISS UF-2
- STS-112/ISS 9A
- STS-113/ISS 11A
- STS-114/ISS ULF-1
- STS-116/ISS 12A.1
- STS-117/ISS 13A
- STS-118/ISS 13A.1
- STS-119/ISS 15A
- STS-120/ISS 10A
- STS-121/ISS ULF1
- STS-121/ISS ULF1.1
- STS-123/ISS 1JA
- STS-126/ISS ULF 2
- STS-128/ISS 17A
- STS-128/ISS 20A

- Soyuz 6, 7, 8, 9, & 10
- Progress 10,11,12,13,14,15, & 17

TBE's Payload Integration Support To NASA

- Skylab
  - Payloads: 1
  - Hardware: 1
- Spacelab
  - Missions: 24
  - Payloads: 140+
  - Hardware: 14
- International Space Station
  - Increments: 8
  - Facilities: 6
  - Payloads: 22 EXPRESS/17 MSG
  - Hardware: 4
- CMC (ISS)
  - Flights: 27 (7 US, 20 Russian)
  - Hardware: 6 delivered to date
    53 scheduled thru 2009

•TBE Has Been Supporting Payload Development, Integration, And Operations For Over 30 Years

Points of Contact

Reggie Spivey

Teledyne Brown Engineering,

Huntsville, Alabama

256-544-0321 (office)

Reggie.A.Spivey@nasa.gov

Ginger Flores

NASA, Marshall Space Flight Center

Huntsville, Alabama

256-544-5068 (office)

Ginger.N.Flores@nasa.gov