International Space Station
For the Benefit of Humanity

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ISS Program Manager
The International Space Station
A unique world class facility in space

A Unique Platform for Science
- Crew inhabited 24x7x365
  - Suitable for long-term studies
  - Monitored science efforts

With the Unique Environmental conditions of
- Microgravity
- Exposure to the thermosphere
- 400 km altitude
- Ground track covering 95% of Earth’s population
ISS Program Services Available

- Standard and well defined interfaces for payload developers
- Non standard interfaces for unique or already developed facilities or payloads
- Shortened templates for users of standard services, existing facilities or reflight
- Conditioned and passive up-mass for payload delivery and down-mass for sample return
  - On-board sample stowage at ambient, refrigerated, and frozen temperatures
- Trained crew for tended science and resupply
- Team with unparalleled experience driven to get customers to orbit quickly and maximize their return
- NASA and National Lab research opportunities
ISS RESEARCH ACCOMMODATIONS
(34 PRESSURIZED RACK LOCATIONS AND
22 UNPRESSURIZED EXTERNAL SITES)

NASA Payloads to Lab
(13 Facility Rack Bays)

Research
Facility
Rack

Japanese Experiment Module

NASA Payloads to JEM
(6 Facility Rack Bays,
5 External)

NASA Payloads to COF
(5 Facility Rack Bays 2
External)

NASA Payloads to Express Logistics
Carriers (8 External)

Truss-Attached
Express Logistics
Carriers

ESA Columbus Module

Payload Sites

U.S. Laboratory
NASA Research Infrastructure

2 Human Research Facility Racks

8 ExPRESS Racks

3 Minus Eighty-Degree Laboratory Freezers for ISS (MELFI)

Microgravity Science Glovebox (MSG)

Fluids Integrated Rack (FIR)

Combustion Integrated Rack (CIR)

Materials Science Research Rack

Window Observational Research Facility (WORF)

Source: ISS Program Scientist
ESA and JAXA Research Infrastructure

- **Biolab**
- **European Drawer Rack (EDR)**
- **European Physiology Module (EPM)**
- **European Transport Carrier (ETC)**
- **Fluid Science Lab**
- **Muscle Atrophy Research Exercise System (MARES)**
- **Ryutai (Fluids)**
- **Saibo (Cell Biology)**
- **Kobairo (Gradient Heating Furnace)**
- **Multi-Purpose Small Payload Rack (MSPR)**

Source: ISS Program Scientist
Continually Improving Research Capability

• On orbit analysis capabilities
  – High definition video
  – Analytical Instrumentation
    • Plate reader, microscopes, tissue lysing, PCR, sample transfer and preparation hardware
• Improved data downlink and uplink/commanding capabilities
  – Downlink bandwidth increased to 300 mbps
  – Commanding available through S and K band
  – External wifi for payload data
  – Two additional comm channels to increase payload specific crew communications
• Improved transport capabilities
  – Increase to 6 powered locker locations up and down on each Spx flight starting at Spx3
  – New freezer (-85 C) with twice the capacity of previous single middeck locker
• New research capabilities
  – Rodent research and increased flight capacity (growing to 40 mice per flight)
  – SOA protein crystal growth facility
• 110 A/C outlets
• Simplified processes for getting research to orbit (as little as 6 months, less for exact reflight)
EARLY RESULTS SHOWING BENEFITS OF THE ISS RESEARCH CAPABILITIES
ISS Research Accomplishments

- Expeditions 0 – 32
  - 1441 Investigations
  - 536 NASA-led investigations
  - 905 International-led investigations
  - >1500 scientists served
  - >504 scientific publications
  - 63 participating countries
Early Detection of Immune Changes Prevents Painful Shingles

- From NASA developed technology that detects immune changes early
- We get an early treatment regimen before shingles (varicella zoster virus or VZV) lesions appear
  - Represents the prevention of a painful and debilitating condition in up to one million people each year in the U.S. alone

VZV infected MeWo cells showing typical herpes-virus-induced multinucleated giant cells. Cultures are stained with acrydine orange to identify RNA (red) in the cytoplasm. (NASA)
Telemedicine Advancements

• From ultrasound training methods utilized on the ISS that have been used by the American College of Surgeons to teach ultrasound techniques to surgeons.

• We have the ability to diagnose injuries and illnesses in remote sites
  - Rural areas
  - Mountain bases
  - Disaster areas
  - Battlefield
  - Sports arenas

Image courtesy of Scott A. Dulchavsky, Henry Ford Health System, Detroit, MI.
• From the resin used in the ISS water processor assembly
• A commercial water filtration solution has been developed for use in remote or impacted areas around the globe.
With Hyperspectral Imager for the Coastal Ocean (HREP-HICO)
And the ISS Vantage Point
We Get Unparalleled Views of Earth’s Coast

Manage Fisheries
Organic and Inorganic Particles
Plankton Blooms
Oil Spills
Flood Depth
Water Clarity
Bathymetry
River Plumes
Bottom Characteristics
Rapid and Safe Execution of Humanitarian Relief
Planning and Executing Naval Operations
Local and Global Economic Development

Specialized visible and near-infrared camera to detect, identify and quantify coastal environmental features from the ISS
Education Accomplishments 2000 - 2011

- 5 ISS Partners
- 44 Countries
- 25,000 Schools
- 2,800,000 Teachers
- 43,100,000 Students

“Education is not the filling of a bucket, But the lighting of a fire.” ~W.B. Yeats
ISS Assembly Is Complete,
It’s Available,
Let’s Use It.