
NASA Advisory Council Space Operations Committee

Johnson Space Center
April 13 & 26, 2010

Space Operations Committee

Meeting at Johnson Space Center, April 13 & 26, 2010

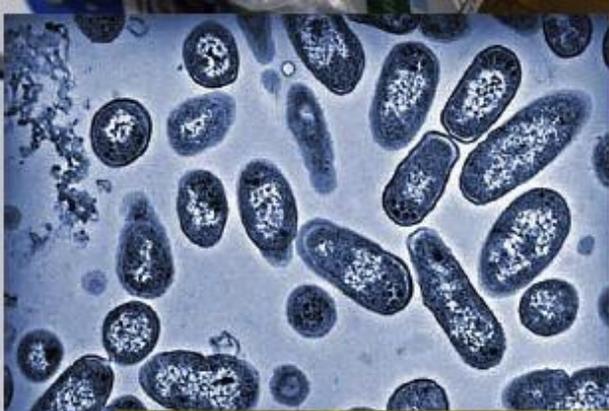
- Col. Eileen Collins (ret.), Chair
 - Former NASA Astronaut
- Dr. Pat Condon, Vice Chair
 - Aerospace Consultant, former Commander of the Ogden Air Logistics Center, the Arnold Engineering Development Center, and the Air Force Armament Laboratory
- Dr. Leroy Chiao
 - Former NASA Astronaut and International Space Station Commander
- *Dr. John Grunsfeld*
 - *Former NASA Astronaut, Deputy Director, Space Telescope Science Institute*
- Mr. Tommy Holloway
 - Former Space Shuttle and International Space Station Program Manager
- Mr. Glynn Lunney
 - Former NASA Flight Director
- Ms. JoAnn Morgan
 - Former Kennedy Space Center Associate Director, KSC Safety & Mission Assurance Director
- Mr. Bob Sieck
 - Former Space Shuttle Launch Director
- Jacob Keaton, Executive Secretary, NASA

Summary of Activities

- **International Space Station Utilization Update**
 - Dr. Julie Robinson, ISS Program Scientist
- **Space Shuttle Program Transition and Retirement Update**
 - Space Shuttle Program Business Office, Human Capital, and Transition and Retirement Lead
- **Space Operations Mission Directorate Update**
 - Bill Gerstenmaier, Associate Administrator, SOMD
 - John Shannon, Space Shuttle Program Manager
- **Facility Fact-Finding**
 - International Space Station Flight Control Room
 - Briefed by Deputy Director, Mission Operations Directorate
 - Space Vehicle Mockup Facility (Building 9)
 - Briefed by a current Flight Director
- **Commercial Space Committee Meeting - April 26th**
 - Peggy Whitson, Chief of Astronaut Office
 - Mike Suffredini, International Space Station Program Manager
- **Observations and Recommendations**
 - Four recommendations
- **Next meeting July 27-28, 2010, at Kennedy Space Center**

International Space Station Utilization





Microbial Vaccine Development – Scientific findings from *International Space Station* research have shown increased virulence in *Salmonella* bacteria flown in space, and identified the controlling gene responsible. AstroGenetix, Inc. has funded their own follow-on studies on ISS and are now pursuing approval of a vaccine as an Investigational New Drug (IND) with the FDA. They are now applying a similar development approach to methicillin-resistant *Staph aureus* (MRSA).

Top image credit: Pacific Northwest National Laboratory

Bottom image credit: Rocky Mountain Laboratories

Source: ISS Program Scientist, NASA

A microscopic image showing several spherical microcapsules of varying sizes against a light brown background. The capsules have a distinct outer shell and some internal structure. One large capsule is prominent on the left side, while several smaller ones are scattered throughout the field of view.

Cancer Treatment Delivery– Microcapsules (micro-balloons) for drug with desirable properties developed on the *International Space Station* were reproduced on Earth and were successful in targeting delivery of anti-cancer drugs to successfully shrink tumors in ground tests. A device to produce similar capsules on Earth has now been patented, and clinical trials of the drug delivery method are beginning.

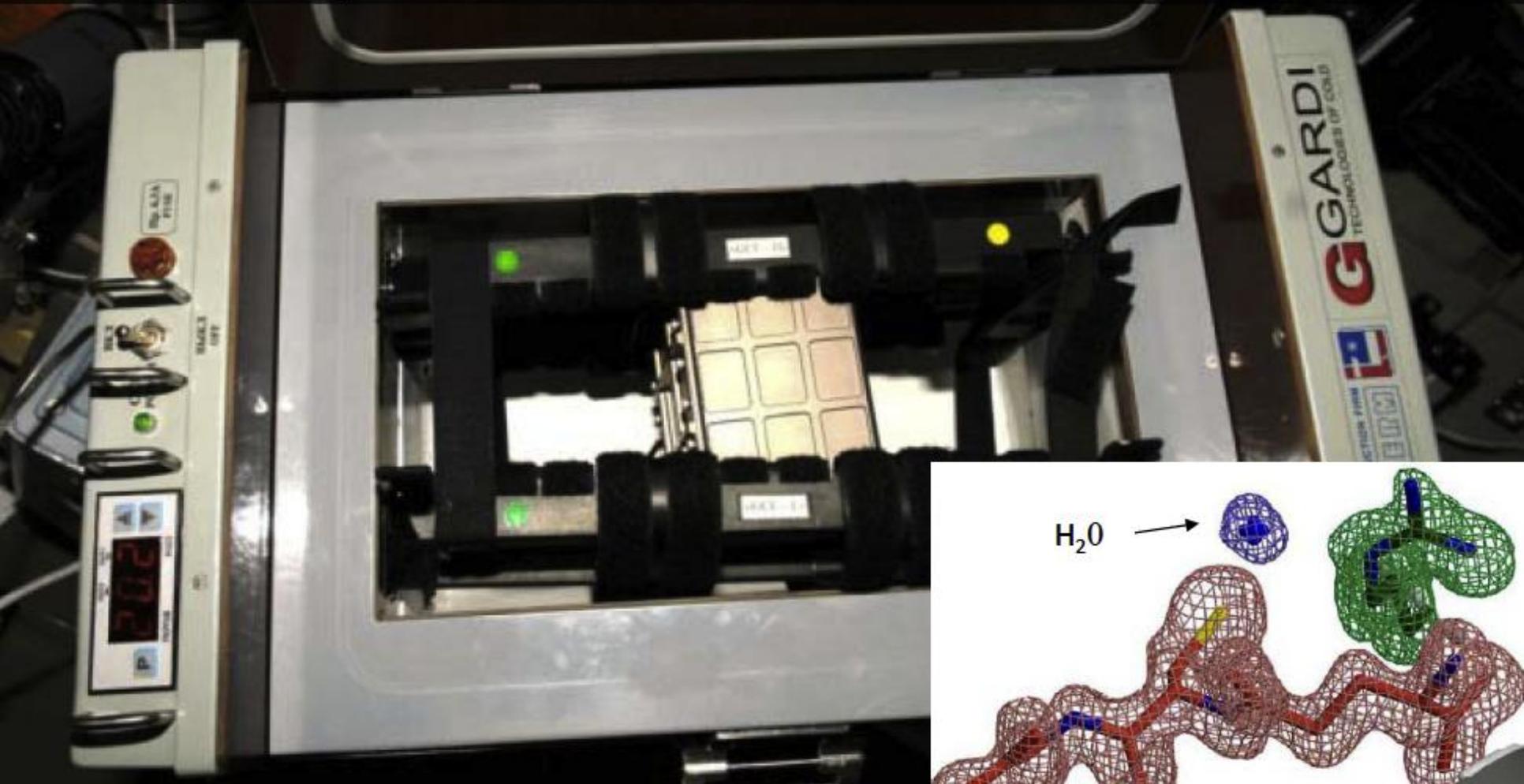
Source: ISS Program Scientist, NASA

Plant Growth – Numerous plant growth experiments have investigated both the effects of microgravity, as well as the capability for growing regenerable food supplies for crew. In addition, technology developed for the ADVASC™ greenhouse flown on the *International Space Station* led to a new technology that is widely used on Earth, killing 98% of airborne pathogens (including Anthrax) for food preservation, doctors' offices, homes and offices.

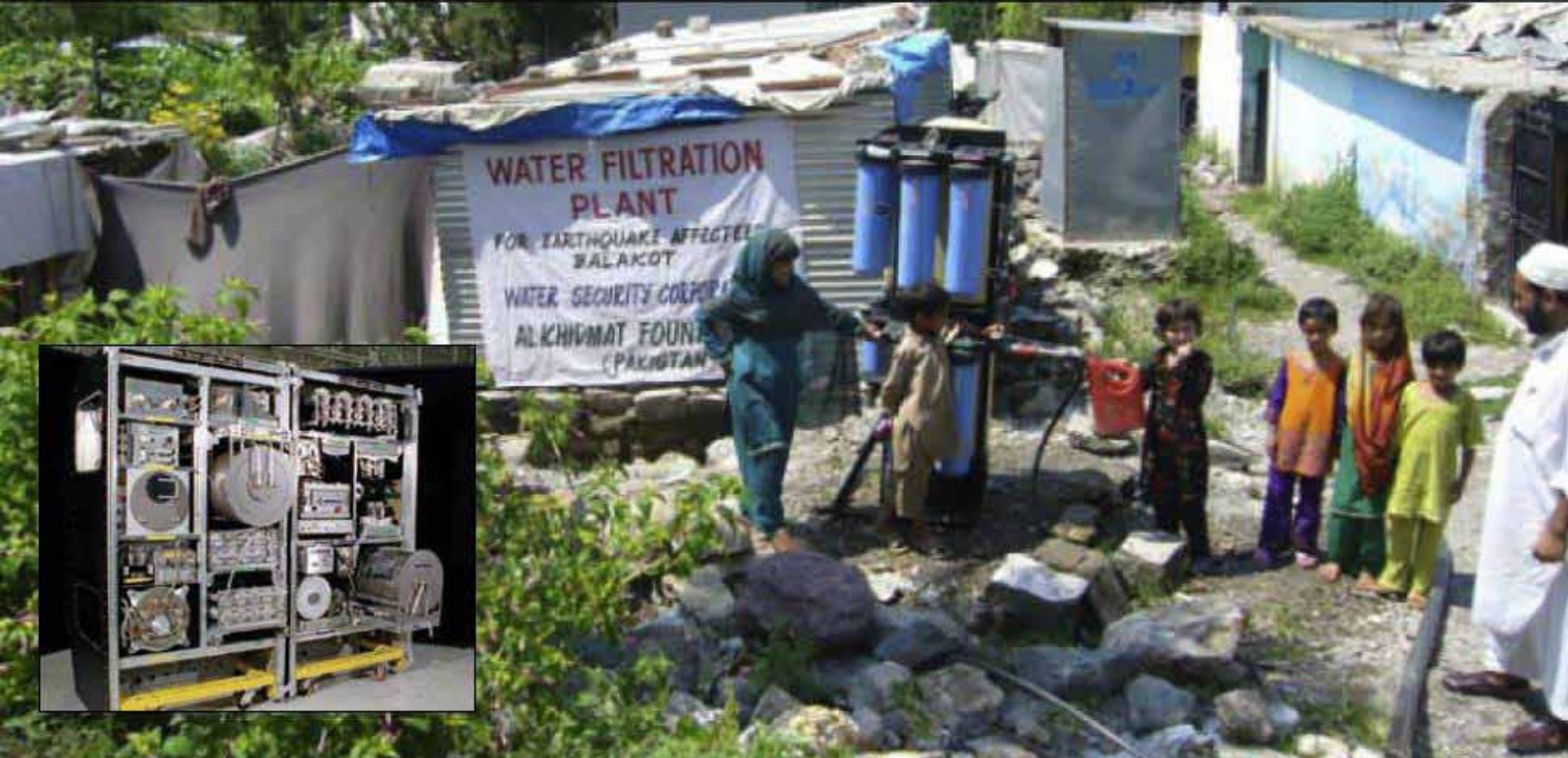


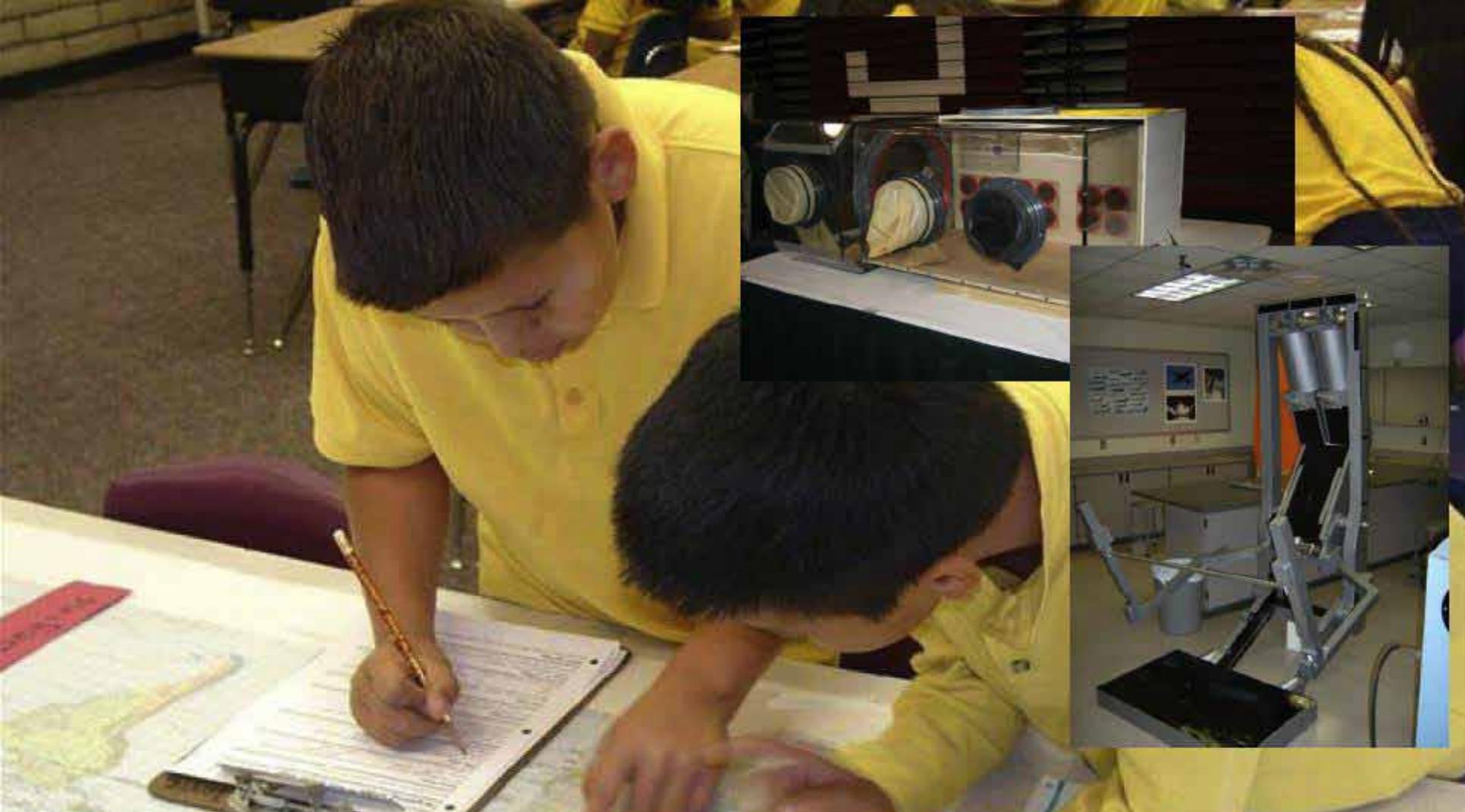
Source: ISS Program Scientist, NASA

Macromolecular Crystallization– A Japanese scientist crystallized HQL-79 (human prostaglandin D2 synthase inhibitor protein) on the *International Space Station*, identifying an improved structure and an associated water molecule that was not previously known. This protein is part of a candidate treatment for inhibiting the effects of Duchenne’s muscular dystrophy. Continuing work is looking at other proteins and viruses.



Regen ECLSS – Water recycling, oxygen generation, and carbon dioxide removal are critical technologies for reducing the logistics re-supply requirements for human spaceflight. The **International Space Station** demonstration project is applying lessons learned from operational experiences to next generation technologies. The resin used in the ISS water processor assembly have been developed as a commercial water filtration solution for use in disaster and humanitarian relief zones.



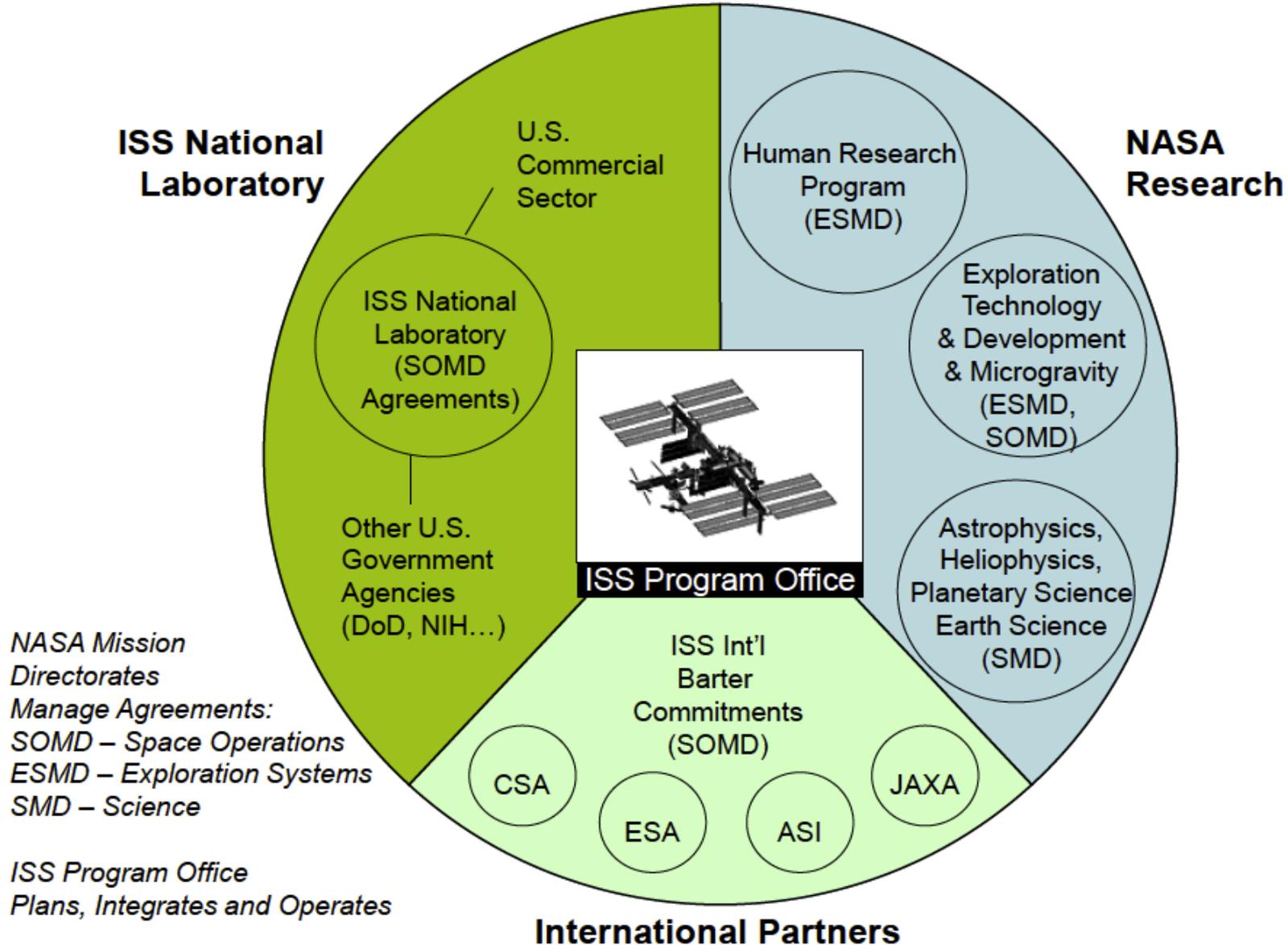


Education – *International Space Station* research has involved over 900,000 students in the U.S, and over 31 million more have participated in educational demonstrations performed by crewmembers onboard ISS.

ISS Utilization Overview

- Objectives for ISS
- Research Infrastructure as we near Assembly Complete
- Strategic utilization planning and 2009 *Consolidated Operations and Utilization Plan*
- Key research resources for ISS utilization and post-Shuttle logistics
 - Crew time for utilization with 6-crew
 - Utilization upmass status for 2010-2011
- ISS National Lab Update
- Accomplishments

Objectives for Research on ISS



Key Research Resources

- Upmass to orbit
- Addition of AMS flight on Space Shuttle added significant research upmass in 2010
- After Shuttle retires international fleet to service ISS
 - Progress, Soyuz
 - ATV, HTV
 - SpaceX, Orbital
- Crew of 6 (May 2009) insures 70+ hours/week of crew research after Assembly Complete
- Downmass provided by
 - Soyuz (minor)
 - SpaceX (substantial)

Overview Resource Constraints for Science on ISS

- General constraints (roughly in the order most likely to be limiting, post-assembly complete)
 - Upmass
 - Downmass
 - Crew time
 - Thermal
 - Data downlink
 - Facility throughput
 - Power
- Constraints unique to human research
 - Maintaining experimental controls for multiple human subject experiments (some experiments with conflicting requirements cannot use the same crewmember as a subject), approximate limit is 6 experiments per subject
 - Postflight baseline data collection during the first 7 days
 - Limits on blood collections (volume, frequency)
 - Informed consent requirements

ISS National Laboratory Development

- National Lab Pathfinders

- Launching on all remaining Shuttle flights
- Salmonella target vaccine undergoing application for IND (investigational new drug) classification at the Food and Drug Administration (FDA) in 2009
- STS-119, 125, 128 and 129 experiments surveyed next four candidate bacterial pathogens including MRSA (methicillin-resistant *Staphylococcus aureus*)



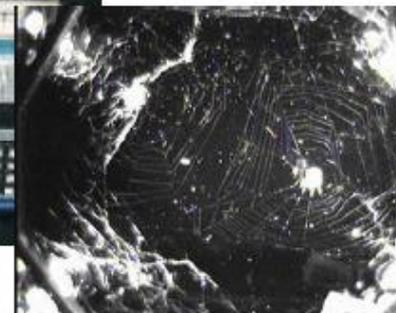
- National Institutes of Health

- Announcement released March 9, 2009
 - 9 Institutes participating
 - Focus on cellular and molecular biology
 - Scientific review completed by NIH and feasibility review completed by NASA
 - Award date July 1, 2010
- 2 more years of ongoing solicitation



- New Agreements

- Boeing SAA for software interface system called Stella flying on ULF5
- Microsoft SAA for Education project called Bliink
- NanoRacks LLC SAA for CubeLab flying on 19A

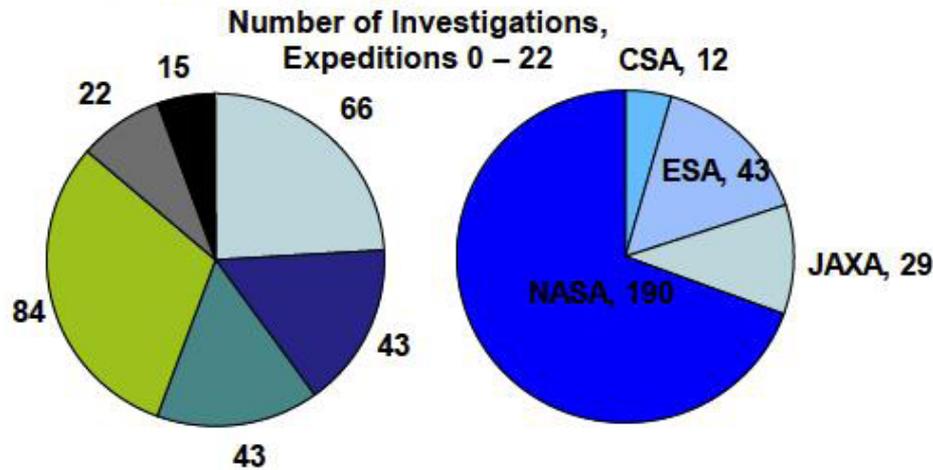
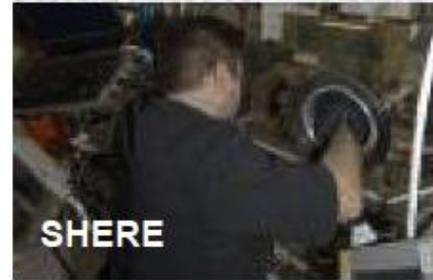


ISS Research Accomplishments



(Expeditions 0 – 22, September 2000 – March 2010, data as of April 12, 2010)

- Expeditions 0 – 22
 - 274 U.S.O.S.-integrated investigations
 - 145 completed investigations
 - 84 International Partner investigations
 - 17 National Lab Pathfinder investigations
 - > 900 scientists
 - 278+ scientific publications (international count ongoing)



Scientific Disciplines

- Human Research
- Technology
- Physical and Materials Science
- Biology and Biotechnology
- Education
- Earth and Space Sciences

Recommendation

Title: Ensuring ISS Capabilities Are More Widely Known

- Council recommends that NASA make the ISS capabilities, achievements, and potential services more widely known outside the NASA community, especially within the business world. Consideration should be given to new and innovative mechanisms.

Space Shuttle Transition & Retirement

Received briefings from:

- Space Shuttle Program Business Office
- Space Shuttle Program Human Capital Office
- Space Shuttle Program Transition and Retirement Lead





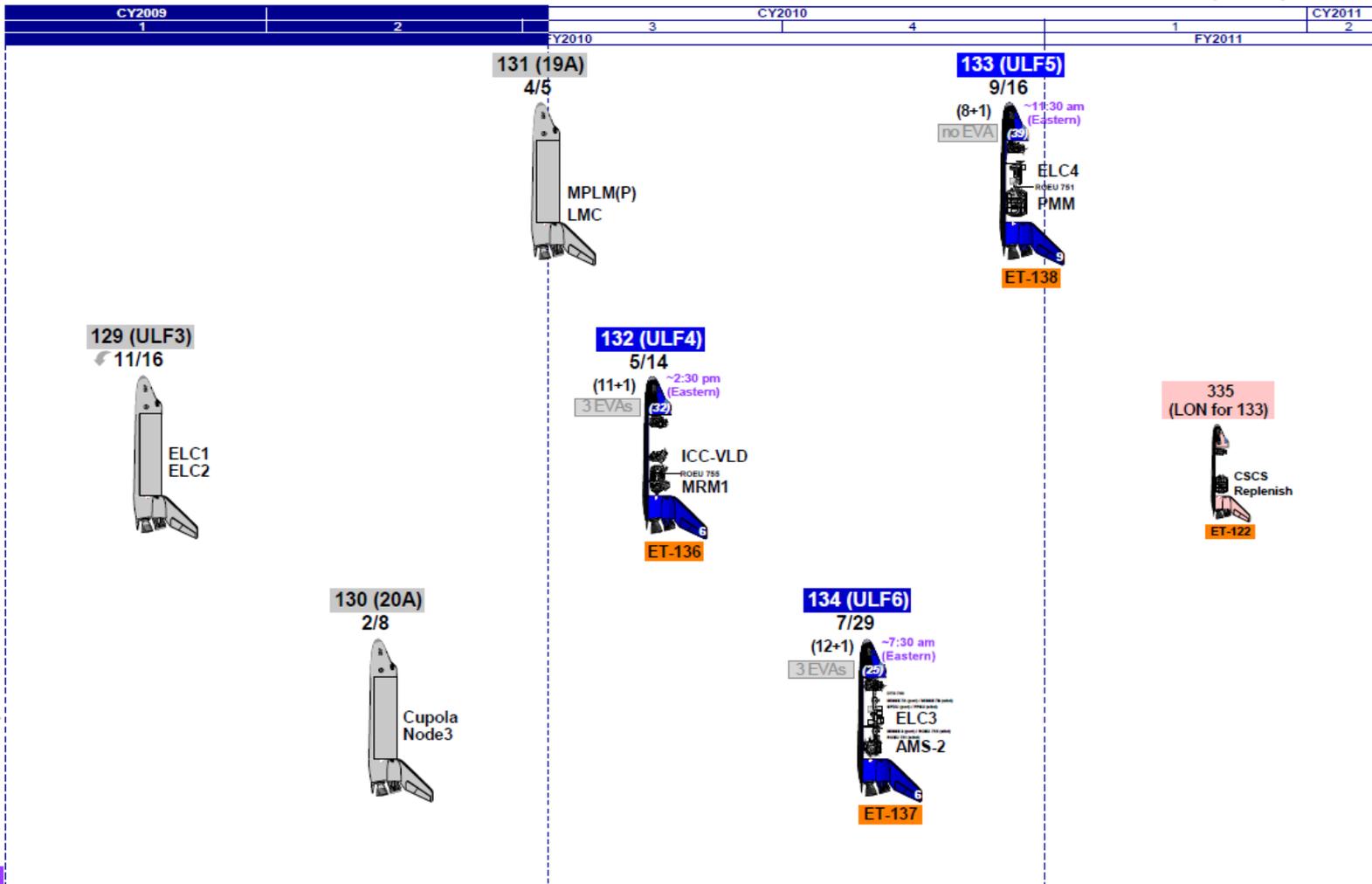
Space Shuttle Program (SSP) Manifest



103
 Discovery
 128 (17A)
 8/28/09
 MPLM (P)
 LMC

104
 Atlantis
 125 (HST)
 5/11/09
 SLIC, ORUC
 FSS, MULE

105
 Endeavour
 127 (2J/A)
 7/15/09
 JEM EF
 ELM-ES
 ICC-VLD



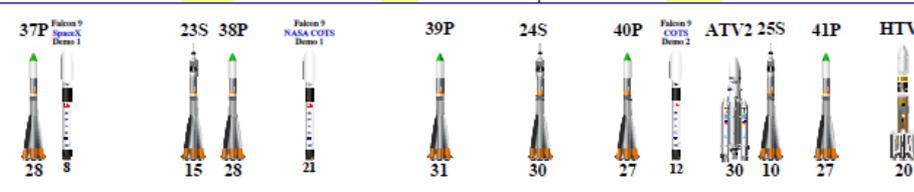
Launch Time is an approximation based on the reference trajectory's planar opening

Flight Rate:

Launch Beta Angle Cutouts[®]
 being above +44 degrees (for ISS/Orbit) during Orbiter/ISS combined mated period (3 days)

STSW (ISS#)
Launch Date
 Ground Roll
 Mission
 Number of EVAs
 Contingency LON Flight
 External Tank
 Progress (P)
 Automated Transfer Vehicle (ATV)
 Full Transfer Vehicle (FTV)

FY-8 / CY-6																					
Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan						
Beta Exceedance								13	β	28		13	β	24		8	β	25			



What is Transition?

Definition:

The careful planning, optimized utilization, and responsive disposition of processes, personnel, resources, and real and personal property, focused upon leveraging existing Shuttle and ISS assets for the safe and successful execution of NASA's future programs.

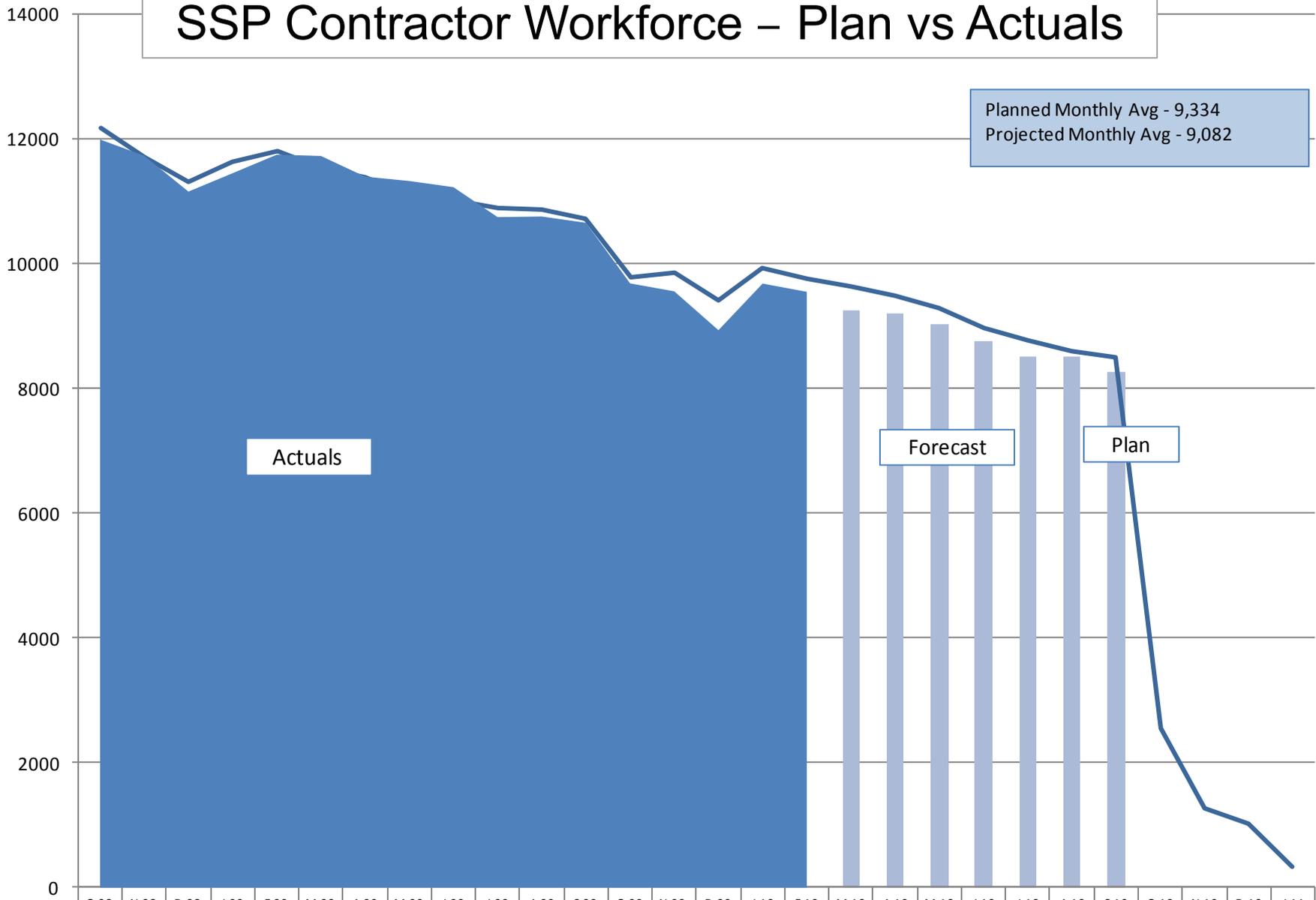
A number of concurrent activities are ongoing:

- Space Shuttle Program Transition & Retirement (SSP T&R)
- Constellation Transition Planning (CxT)
- ISS Program Shuttle Transition and Retirement (STaR)
- Commercial Orbital Transportation Services (COTS) Transition to ISS Cargo Resupply Services (CRS)

SSP 2010: ~1.2M Equipment Line Items, ~ 650 Facilities, ~1200 Suppliers, ~1700 FTE, ~ 10,000 WYE

Focus on 3: Workforce, Infrastructure/Property, Budget/Schedule

SSP Contractor Workforce – Plan vs Actuals



	O 08	N 08	D 08	J 09	F 09	M 09	A 09	M 09	J 09	J 09	A 09	S 09	O 09	N 09	D 09	J 10	F 10	M 10	A 10	M 10	J 10	J 10	A 10	S 10	O 10	N 10	D 10	J 11	
SSP Actuals	12001	11741	11166	11461	11758	11737	11406	11336	11237	10756	10766	10665	9693	9566	8942	9690	9558												
SSP Forecast																		9248	9197	9026	8765	8518	8509	8266					
SSP Plan	12183	11703	11308	11640	11816	11545	11387	11116	11008	10888	10875	10726	9786	9851	9404	9938	9768	9643	9477	9297	8967	8771	8596	8512	2551	1273	1025	332	

Workforce Transition

- NASA has used lessons from Titan, BRAC, Boeing and more.
- Had initial plan submitted to Congress in April 2006. NASA keeps this plan updated.
- NASA has done an aggressive job on T&R:
 - skills management and assessment
 - employee communication
 - partnering with contractors
 - maintaining metrics and surveys
 - met and briefed Departments of Labor and Commerce
 - community presentations in Florida, Louisiana, Mississippi, and Texas
 - opened a transition center at USA on February 1
- Original plan was for Shuttle to Constellation transition. Offices are now reevaluating in light of CxP cancellation.
- SSP funding in FY11 includes \$600 million to cover the minimally required workforce and infrastructure needed for safe ops through December 2010.

Commercial Space Committee Meeting

- Members of Space Ops Committee met with Commercial Space Committee on April 26th
- Operational Perspectives
- Commercial Providers:
 - Lessons learned from CAIB report, especially design compromises in Shuttle program development
 - Learn from NASA's Flight Readiness Review (FRR) and Mission Management Team (MMT) processes
 - End-of-Mission water vs land recovery
 - Concern for training of ISS crew on so many visiting vehicles (Soyuz, Progress, ATV, HTV, Orbital, SpaceX, and more)
 - Range Safety
- Space Ops Committee will review Human Rating Requirements

Summary and Challenges

- Utilizing ISS to its full capability
- Safe fly out of the Space Shuttle
- Extra shuttle flight?
- Minimum disruption to the human spaceflight workforce
- Future changes in Space Operations Mission Directorate?
 - How will SOMD budget be affected?
- Orion as a Crew Return Vehicle?
- Safe operational implementation of commercial spaceflight
 - Cargo & crew

Recommendation

Title: Operational Model for Commercial Space Vehicles

- Develop an operational model for commercial space vehicles that will enable NASA flight resources and crews to be committed to commercial space systems.

Recommendation

Title: Operational Plan for CRS firms

- Develop an operational plan for the Commercial Resupply Service firms from launch to end-of-mission.

Future Activities

- Meeting at Kennedy Space Center, July 27-28, 2010
- Briefings on:
 - 21st Century Space Launch Complex
 - ISS Logistics Plan (operational up-mass vs science up-mass)
 - Human Ratings Requirements for Commercial Providers
 - Update on COTS/CRS
 - CRS operational plan
- Site visits:
 - Launch Pad 39B (Shuttle/Ares), Pad 37 (Delta 4), Pad 40 (SpaceX), Pad 41 (Atlas)
 - KSC technology development work
 - Space Life Sciences Laboratory