NASA Advisory Council
Space Operations Committee

NASA Headquarters

February 19, 2010

Space Operations Committee

Meeting at NASA HQ, February 17, 2010

- Col. Eileen Collins, Chair
  - Former NASA Astronaut, Space Shuttle Commander
- 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, International Space Station Commander
- *Mr. Tommy Holloway*
  - Former Space Shuttle and International Space Station Program Manager
- *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

- Space Operations Mission Directorate 2010 Budget Overview
- Space Shuttle Program Status
- International Space Station
  - Operational Status
  - Utilization Status
- Commercial Resupply Services Status
- No Recommendations
- Next meeting in April at Johnson Space Center

2010 Space Ops Committee Workplan

1. *ISS Operations*, *and Science and Technology Development for Utilization:*

How can we best make use of this National Laboratory? In particular, review ISS utility for earth and climate science, biomedical science, and technologies that will enable human exploration beyond LEO. Are they executable from an operational perspective?

(with Exploration and/or Science committee)

2010 Space Ops Committee Workplan

2. *Space Shuttle:*
• end of operations
• technical capability of adding more flights to the manifest, if directed by national policy.

3. *Transition of shuttle to the next human launch system:*
• ground ops
• training
• in-flight mission operations

2010 Space Ops Committee Workplan

4. *Commercial launch of cargo to ISS and LEO.*

(with Commercial and/or Exploration committee)

5. *Commercial launch of NASA astronauts.*

- Human Rating Requirements

(with Commercial and/or Exploration committee)

2010 Space Ops Committee Workplan

6. *Spacecraft Communication and Navigation (SCAN)*
• future concepts and requirements development
(with Science committee)

7. *Human operations onboard future spacecraft:*
• extravehicular activity
• rendezvous and docking
• displays and controls

8. *Micro-meteorite protection for human spaceflight*

9. *Radiation protection for human spaceflight*

10. *Human operations beyond low Earth orbit from an operational perspective*
(with Exploration committee)

2010 Space Ops Committee Workplan

Dropped issues from 2009:

Space Flight Human System Standards (SFHSS) and Human Integration Design Handbook (HIDH).

- Reviewed satisfactorily in 2009.

Expendable medium launch vehicles, long term availability.

- Thoroughly briefed on NASA's current plan.

SOMD FY2011 Priorities

- Safely fly the Space Shuttle through retirement
- Meet our International Partner commitments
- Complete assembly and research outfitting of the ISS by the end of 2010
- Plan for ISS full utilization through 2020
    - National Laboratory availability will be up to 50% of planned U.S. utilization
- Establish the 21st Century Space Launch Complex at Kennedy Space Center
- Continue to provide launch services and space communications to our customers

SOMD FY2011 Challenges

- Maintain a high-quality Space Shuttle workforce through end of program
- Complete Shuttle retirement in a cost-effective manner
- Establish a robust ISS cargo and crew transportation capability
  - Russian Progress vehicles will be utilized through 2011
  - Japanese H-II Transfer Vehicle (HTV) and European Automated Transfer Vehicle (ATV) have each flown once
  - Commercial demonstration flights schedule for Space Exploration Technologies (SpaceX) in 2010/2011 and Orbital Sciences Corporation (OSC) in 2011
  - First Commercial Resupply Service (CRS) flights in 2011
  - Budgeted $6 billion in ESMD over the next five years to develop U.S. commercial crew transportation

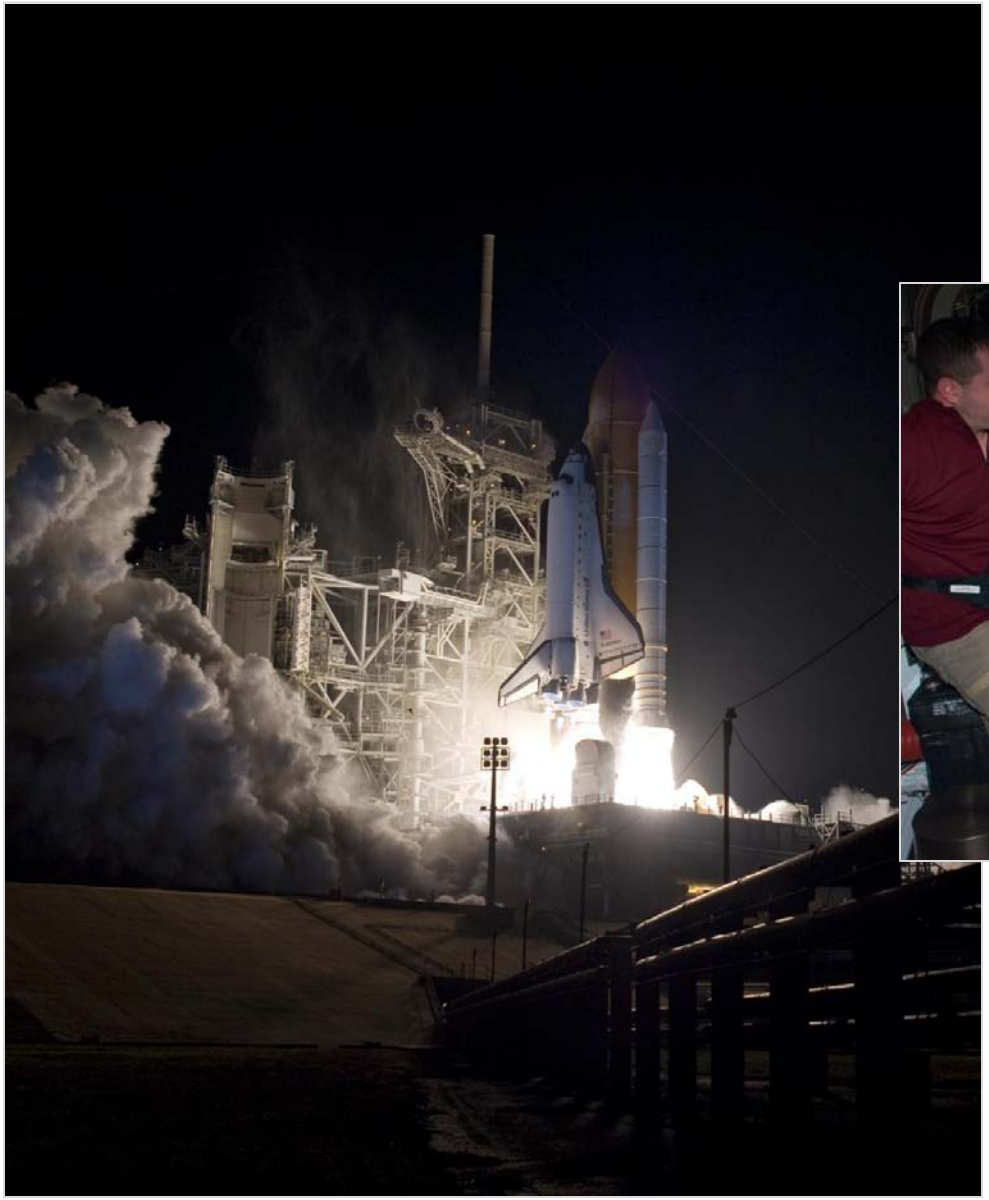
SOMD 2010 Budget

RY $ in Millions	FY 2009*	FY 2010*	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
FY 2011 President's Budget Request*	**5,764.7**	**6,180.6**	**4,887.8**	**4,290.2**	**4,253.3**	**4,362.6**	**4,130.5**
Space Shuttle	2,979.5	3,139.4	989.1	86.1	0.0	0.0	0.0
International Space Station	2,060.2	2,317.0	2,779.8	2,983.6	3,129.4	3,221.9	3,182.8
Space and Flight Support	725.0	724.2	1,119.0	1,220.6	1,123.9	1,140.7	947.7
Space Communications and Navigation	582.9	485.3	452.9	478.0	479.5	488.4	489.6
21st Century Space Launch Complex	0.0	0.0	428.6	500.0	400.0	400.0	200.0
Launch Services	91.7	83.8	78.9	82.6	82.5	86.0	87.9
Rocket Propulsion Testing	41.8	44.3	44.3	44.2	44.2	48.2	49.2
Crew Health and Safety	8.6	8.6	0.0	0.0	0.0	0.0	0.0
Human Space Flight Operations	0.0	102.3	114.4	115.8	117.7	118.1	121.0

May be off due to rounding

** FY 2011 President's Budget Request depicts the July 2009 Operating Plan including American Recovery and Reinvestment Act for the FY 2009 Actual column, and the Consolidated Appropriations Act, 2010 (P.L. 111-117) without the Administrative transfers for the FY 2010 enacted column*

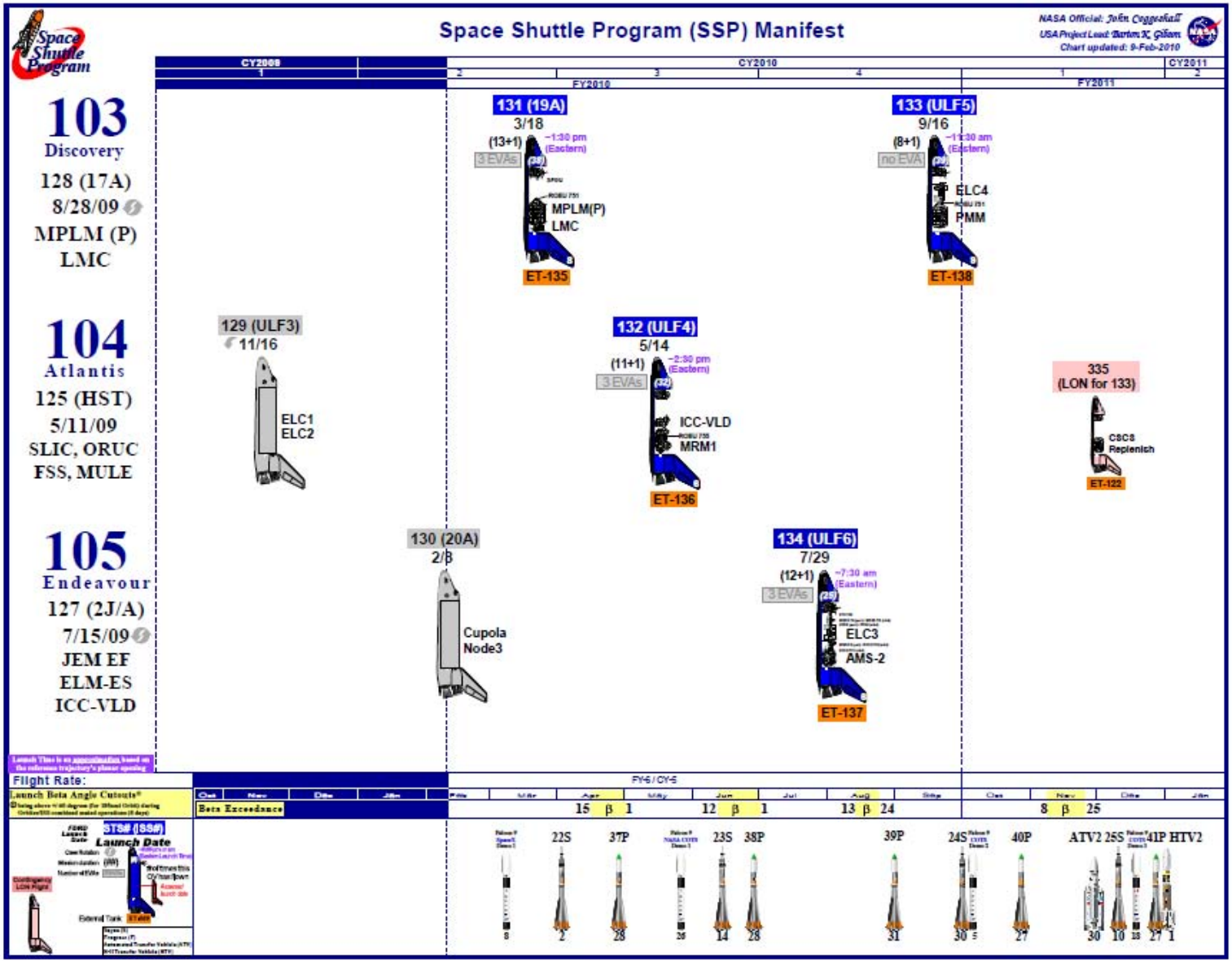
Space Shuttle Program Status



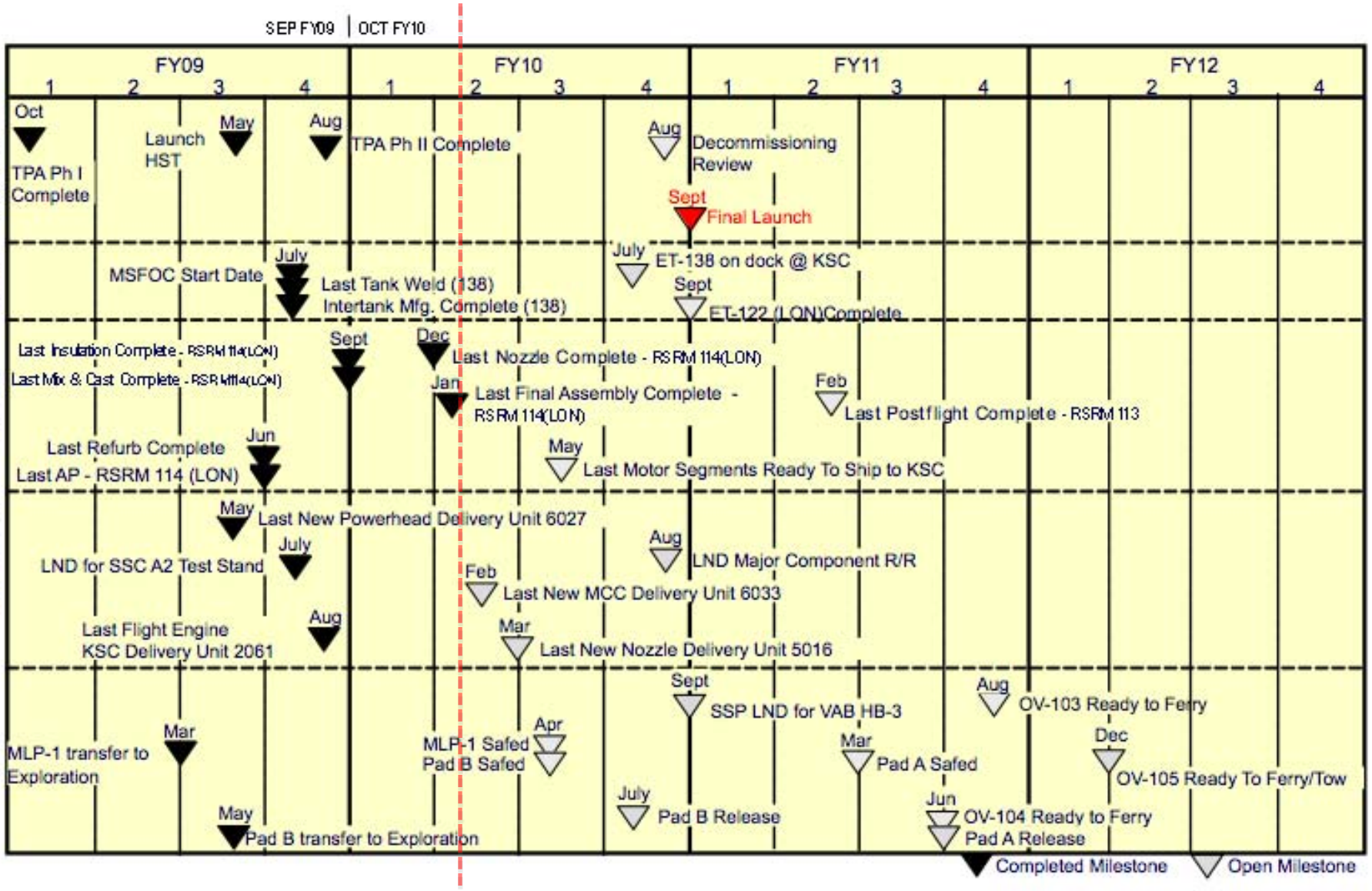
STS-130 Launch: February 8, 2010

View from the Cupola (Sahara Desert)

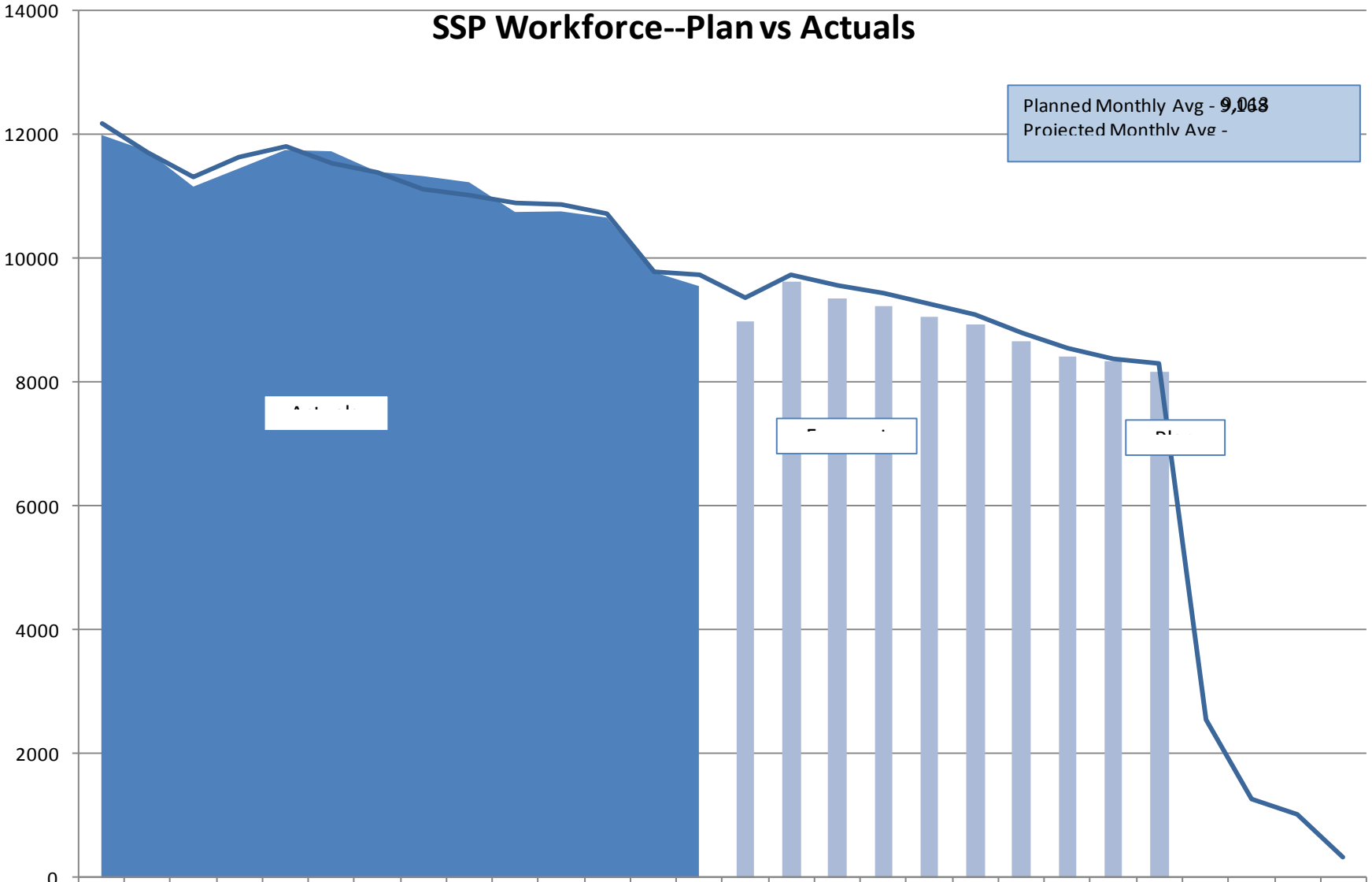
Space Shuttle Manifest



Space Shuttle Retirement Major Milestones



Space Shuttle Combined Contractor Workforce



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SSP Actuals	12001	11741	1116(	1146:	1175{	11737	1140(	1133(	11237	1075(	1076(	1066{	978{	955{														
SSP Forecast															899(	963{	936(	923{	905{	892{	866{	842{	834{	817{				
SSP Plan	1218{	1170{	1130{	1164(	1181(	1154{	1138{	1111(	1100{	1088{	1087{	1072(	978(	974{	937{	972{	955{	943{	926{	908{	880{	855{	838{	829{	255{	127{	102{	332

Space Shuttle Program Completed Layoffs

	Layoff Dates	#Reduced (voluntary & involuntary)	WARN Act Notices		Notes
			Date	Number	
Lockheed Martin (LM)	Oct 2008	40			
LM	Feb 2009	112	Dec 2008	19	
Alliant Techsystems (ATK)	April 2009	50			
LM	May 2009	176	Feb 2008	160	
LM	June 26, 2009 July 2, 2009	79	April 23, 2009 April 30, 2009	66 33	
LM	June 30, 2009	190	April 29, 2009	190 (MOM)	Jacobs hired 164 MOM emp + 28 other LM emp
Pratt, Whitney, Rocketdyne (PWR)	Aug 2009	0		30 to 50	Not required
PWR	Sept 2009	0		10	Not required
LM	October 2009	53 laid off 72 other	July 27 – 31, 2009	129	72 other includes voluntary attrition and those placed in other parts of the company
United Space Alliance (USA)	October 2009	280 FL 96 TX	No WARN, Ltr to employees July 2009	~400	Self nominated—FL 258, TX 51 Invol Layoffs—FL 22; TX 45
PWR	October 2009	46		20	CP-31, WPB-14, SSC-1 Retired-12, Laid off-31
ATK	October 2009	414 direct (264 layoffs + 150 placed)	No WARN, Ltr to employees July 2009		Shuttle directs reduced by 414—264 laid off and 150 placed. Plus 104 indirects laid off. Total of 370 laid off
ATK	January 2010	~450 to 500 direct and indirect	No WARN, Ltr to employees fall 2009		Total of ~450 to 500 laid off, which includes direct Shuttle and Minuteman and indirect employees.
LM	January 2010	90	Nov 2009	173	

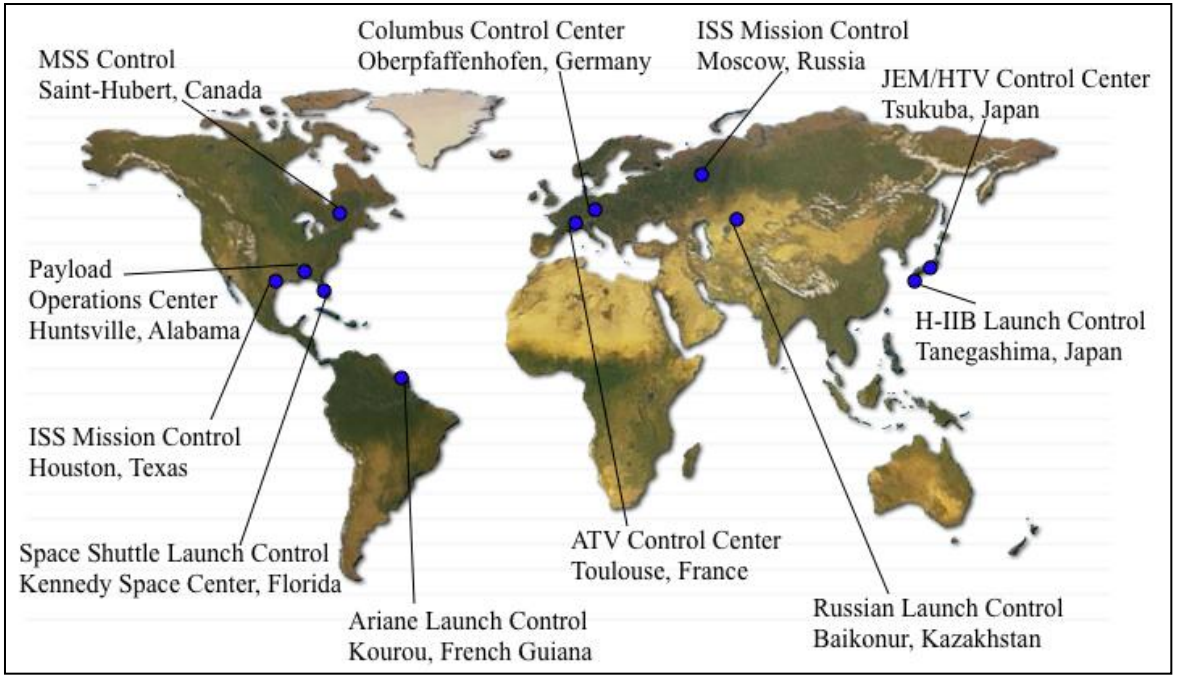
20

Space Shuttle Program Pending Contractor Layoffs

- Production Sites (current ~2,000 contractor employees)
  - NASA understands there will be periodic, moderately-sized (40-400), involuntary layoffs throughout 2010 as production work is completed
  - Depending on voluntary attrition rates, production sites plan layoffs so workforce levels keep to the planned levels
  - Contractors are required to maintain a certain level of sustaining engineering through last flight
  - As part of retention planning, all Lockheed Martin employees have a —last need" date. Monthly layoffs at MAF are planned and WARN Act notifications have been given to employees affected in February and March
  - ATK conducted a layoff in January, and there will likely be further layoffs later this year
- Operational Sites (~8,000 contractor employees)
  - Large layoffs will occur after the completion of the last flight

International Space Station

- International in-space research and technology development endeavor in partnership with 5 space agencies
  - U.S., Russian, European, Japanese and Canadian space agencies
- In orbit since November 1998 with the launch of the first ISS element *FGB* from Baikonur, Kazakhstan
- Permanently crewed since November 2000 with Expedition 1
- Ground control, training, operations and launch facilities in 8 countries
- ISS 90% complete by mass; 98% complete by volume



Synopsis of ISS Experiments (Expeditions 1-22)

- ASSURING THE SURVIVAL OF HUMANS TRAVELING FAR FROM EARTH

Radiation Studies
Physiological Studies—bone & muscle, pulmonary function
Physiological Studies—other effects of space flight - telemedicine, countermeasures immunosuppressant, decompression sickness, drug delivery, diagnostic medicine
Psycho-Social Studies

- EXPANDING OUR UNDERSTANDING OF THE LAWS OF NATURE AND ENRICHING LIVES ON EARTH: Long term physical effects in the absence of gravity.

Microgravity Studies - fluids, particle growth, colloids, crystals, proteins, magnetic fields, enhanced materials, dust particles, biophysical and biochemical processes
Role of gravity on living systems - cellular biology, genetic changes, microbes
Effects of gravity on plant life – tissue growth, food sources

- CREATING TECHNOLOGY TO ENABLE THE NEXT EXPLORERS TO GO Beyond Where WE HAVE BEEN

Adaptive technologies, materials and coatings, computer networks, vibration measurements and isolations, fabrication and repair, rendezvous and docking, autonomous formation flight, engine plume modeling

- EDUCATING AND INSPIRING THE NEXT GENERATION TO TAKE THE JOURNEY

Education demonstrations, Earth photography

Examples of Planned 2010/2011 Research Activities

- **Alpha Magnetic Spectrometer**, developed by an international team of 60 institutions from 16 countries, will collect information from cosmic sources emanating from stars and galaxies millions of light years beyond the Milky Way
- **Microheater Array Boiling Experiment** will allow precise calculations of heat transfer coefficients in microgravity which are important for developing cooling systems for use in future spacecraft (BXF-MABE)
- **Studies of T-cell** (mature white blood cells from the thymus) activation to better understand astronaut immune system function (PAthway DIfferent ACtivators, PADIAC)
- Tests of a new technique to **generate IV fluid from potable water**— critical for Exploration medical care (IVGEN)
- Tests of managing **dietary protein and potassium as a countermeasure** for bone loss in astronauts (ProK)
- **Integrated Resistance and Aerobic Training Study** will use the capabilities of the new exercise hardware to evaluate whether high intensity, low volume exercise training can minimize effects of low gravity on loss of muscle, bone, and cardiovascular function (iRATS)

Commercial Orbital Transportation System (COTS) and Commercial Resupply Services (CRS)

COTS (ESMD)

- **SpaceX**
  - Demo 1 July 2010
  - Demo 2 Nov 2010
  - Demo 3 Feb 2011
    - Berthing to ISS
- **Orbital Sciences Corps**
  - Demo Mar 2011
    - Berthing to ISS

CRS (SOMD)

- **SpaceX**
  - CRSX 1 May 2011
  - CRSX 2 Oct 2011
  - CRSX 3 to be established
- **Orbital Sciences Corps**
  - CRSO 1 to be established
  - CRSO 2 to be established

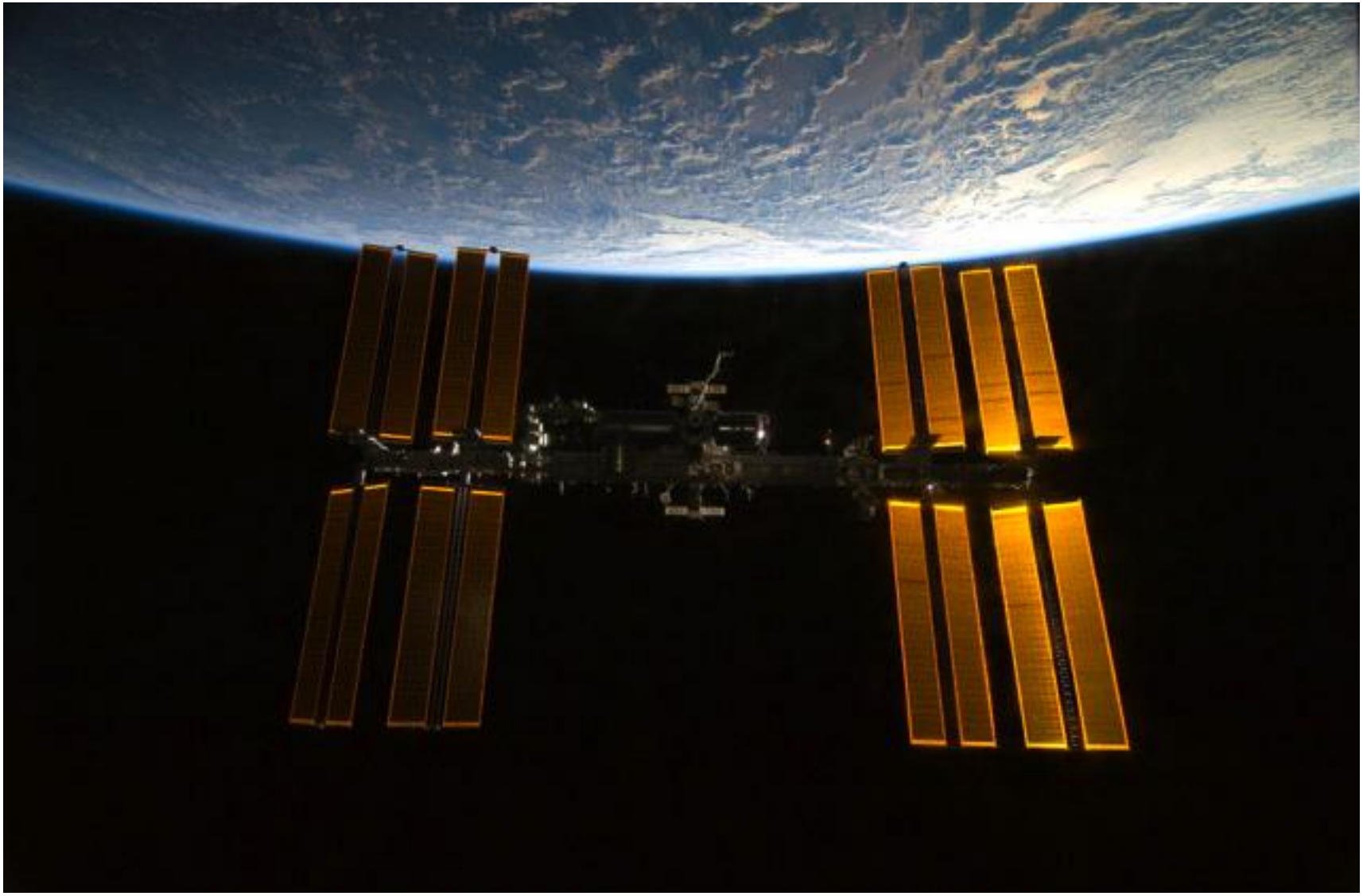
- SpaceX flights launched from Cape Canaveral Air Force Station (FL)
- Orbital Sciences flights launched from Wallops Flight Facility (VA)
- ISS Program supporting new FAA field office at Johnson Space Center (TX)

Current ISS Transportation Arrangements

- ISS has contracted with Roscosmos for 5.3MT of cargo through 2011
- NASA has authority to purchase crew transportation and rescue services from Roscosmos through July 2016 via INKSNA
  - Currently contracted through 2013/2014
- ISS has bartered cargo transportation services with ESA and JAXA through 2015
  - ESA's Automated Transfer Vehicle and JAXA's H-II Transfer Vehicle have both flown once
- ISS is contracted with SpaceX and Orbital Sciences Corp for cargo transportation through CY2015 via the Commercial Resupply Services (CRS) contract
  - Minimum of 20MT upmass each year
  - Minimum of 1.5MT downmass per year
  - ISS Program is heavily engaged with both contractors to integrate the operational, technical and safety aspects of their on-orbit vehicle with the ISS

Next Meeting – April @ JSC

- International Space Station Utilization
- Space Shuttle Status- transition & retirement
- Commercial Orbital Transportation System / Commercial Resupply Service (COTS/CRS)
  - Human Rating Requirements (with Commercial and Exploration Committees)
- FACA and Ethics Briefings
- JSC site visit



The ISS as seen from Shuttle *Endeavour* on February 9, 2010