Human Exploration and Operations Mission Directorate

FY 2013 Budget Overview
April 2012

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Associate Administrator

Human Exploration and Operations Mission Directorate

Human Exploration and Operations
Agenda

- **Human Exploration and Operations Overview**
- **Program Detail**
  - Exploration Systems Development
  - Commercial Spaceflight
  - Exploration Research and Development
  - International Space Station
  - Space Shuttle
  - Space and Flight Support

Overview

Human Exploration and Operations
FY 2013 Budget Overview

- **FY 2013 Budget Submit provides $7.946 billion for HEO to lead and manage human exploration in and beyond low Earth orbit (LEO)**
- **Implements program within budget and meets external commitments**
  - NASA's exploration goals are consistent with NASA Authorization Act of 2010, which calls for expanding permanent human presence beyond LEO to destinations such as near-earth asteroids, surface of the Moon, and Mars, while maintaining uninterrupted U.S. human space flight capability in LEO and beyond
  - Maintains two separate appropriations: Exploration and Space Operations accounts
- **Develops systems and capabilities required for human exploration of space beyond low Earth orbit including:**
  - Orion Multi-Purpose Crew Vehicle (MPCV) to carry humans beyond low Earth orbit (BEO)
  - Space Launch System (SLS) capable of lifting 70 metric tons before evolving to a lift capacity of 130 metric tons
  - Exploration Ground Systems (EGS) that include a focused set of investments to transform KSC to support future SLS/Orion MPCV missions
- **Supports U.S. commercial space industry to enable safe, reliable and cost effective access to low Earth orbit**

Human Exploration and Operations
FY 2013 Budget Overview

- **Sustains viability of the International Space Station (ISS)**
  - Provides for continued operations and support of utilization for research and enhanced functionality
  - Supports research, technology development, demonstration, as well as enhancements to ISS facility and operations
- **Pioneers new approaches for rapidly developing prototype systems, demonstrating key capabilities, and validating operational concepts for future human missions beyond Earth orbit**
- **Conducts research including ISS biomedical flight experiments to understand significant effects of long duration spaceflight on the human body**
- **In FY 2012, established Space Life and Physical Sciences Research and Applications Division (SLPSRA)**
  - In coordination with NASA Chief Scientist, establishes overall direction and scope, budget, and resource allocation for ISS Research and Human Research Program
- **Established Ground Systems Development and Operations (GSDO) program office to manage 21st Century Space Launch Complex (21st CSLC) content under Space Operations appropriation and EGS content under Exploration appropriation to provide cost-effective synergy between various user requirements, specifically:**
  - Supports assembly, test, launch and recovery of associated SLS and Orion MPCV elements
  - Modernizes launch and range infrastructure to support multiple customers

Human Exploration and Operations
FY 2013 Budget Overview

- **Provides Agency-level space and flight support capabilities critical to success of NASA missions and goals**
  - Sustains NASA's mission-critical space communications and navigation capabilities for current and future customers: science, ISS, and future crewed missions
    - Maintains space network capabilities into 2020s with purchase of an additional Tracking and Data Relay Satellite (TDRS) under a firm fixed price option to replace aging first-generation TDRS; replaces aging ground systems
  - Continues pace of replacing aging deep space network systems
  - Facilitates access to space by providing leadership, expertise and cost-effective expendable launch vehicle services for NASA missions
  - Maintains NASA's wide variety of test facilities for use by NASA, other agencies, and commercial partners
  - Ensures NASA's astronauts are fully prepared to safely carry out current and future missions
  - Provides focused set of investments to transform KSC into multi-user spaceport for NASA and non-NASA users
- **Continues Space Shuttle Transition and Retirement (T&R)**

Human Exploration and Operations
Challenges

- **Iran, North Korea, Syria Nonproliferation Act (INKSNA)**
  - As NASA has testified, some modification of the Iran, North Korea, Syria Non-proliferation Act (INKSNA) provisions will likely be required for the continued operation of ISS and other space programs after 2016; the Administration plans to propose appropriate provisions and looks forward to working with the Congress on their enactment
- **Exploration Systems Development (ESD)**
  - Developing a large human spaceflight program within budget and on schedule is a challenge
  - Limits on transfer authority for Construction of Facilities (CoF) projects inhibit ESD from implementing emerging requirements on a timely basis
- **Commercial Crew**
  - Due to lower than anticipated funding levels in FY 2012, transition to FAR-based contracts is delayed, which will prevent NASA from mandating compliance with certification requirements during the next phase

Human Exploration and Operations
Challenges

- **International Space Station**
  - Successfully working through multiple on-orbit anomalies to maintain functionality
  - Managing time phasing between commercial crew and Soyuz procurements
  - Phasing in operational commercial cargo transportation
- **Space Shuttle**
  - Completing transition and retirement in a timely manner
- **Space and Flight Support (SFS)**
  - TDRS constellation will soon be operating without on-orbit spare due to recent failure of TDRS-4 and rapidly failing TDRS-3
  - Certifying new launch service providers for medium class launch vehicles
  - Mitigating risk of visual impairment/increased intracranial pressure to astronauts during long duration spaceflight
  - Implementing Rocket Propulsion Testing (RPT) right-sizing study recommendations to properly size test infrastructure (critical skills and facilities) to meet existing and future test needs

Human Exploration and Operations
Program Financial Plan
FY 2013 President's Budget Request Structure

Budget Authority ($ in Millions)	FY 2011	FY 2012	FY 2013	Notional FY 2014	Notional FY 2015	Notional FY 2016	Notional FY 2017
Human Exploration and Operations (HEO)	**9,237.7**	**7,931.5**	**7,946.0**	**8,111.6**	**8,111.6**	**8,111.6**	**8,111.6**
Exploration	**3,925.3**	**3,724.3**	**3,932.8**	**4,076.5**	**4,076.5**	**4,076.5**	**4,076.5**
Exploration Systems Development (ESD)	2,982.1	3,007.5	2,769.4	2,913.1	2,913.1	2,913.1	2,913.1
Orion Multi-Purpose Crew Vehicle (MPCV)	1,196.0	1,200.0	1,024.9	1,028.2	1,028.2	1,028.2	1,028.2
Space Launch System (SLS)*	1,786.1	1,503.0	1,340.0	1,429.3	1,429.3	1,429.3	1,429.3
Exploration Ground Systems (EGS)		304.5	404.5	455.6	455.6	455.6	455.6
Commercial Spaceflight Program	606.8	406.0	829.7	829.7	829.7	829.7	829.7
Commercial Cargo	299.4						
Commercial Crew Program (CCP)	307.4	406.0	829.7	829.7	829.7	829.7	829.7
Exploration Research and Development (ERD)	336.4	310.8	333.7	333.7	333.7	333.7	333.7
Human Research Program (HRP)	154.7	157.7	164.7	164.7	164.7	164.7	164.7
Advanced Exploration Systems (AES)		153.1	169.0	169.0	169.0	169.0	169.0
Exploration Technology Development (ETD)	181.7						
Space Operations	**5,312.4**	**4,207.2**	**4,013.2**	**4,035.1**	**4,035.1**	**4,035.1**	**4,035.1**
International Space Station (ISS)	2,713.6	2,829.9	3,007.6	3,177.6	3,170.9	3,212.8	3,234.3
ISS Systems Operations and Maintenance	1,681.1	1,418.7	1,493.5				
ISS Research	175.7	225.5	229.3				
ISS Crew and Cargo Transportation	856.8	1,185.7	1,284.8				
Space Shuttle Program (SSP)	1,592.9	559.3	70.6				
Space and Flight Support (SFS)	1,005.9	818.0	935.0	857.5	864.2	822.3	800.8
Space Communications and Navigation (SCaN)	456.2	446.0	655.6	570.7	577.3	535.4	513.9
Launch Services Program (LSP)	83.3	81.0	81.2	82.8	82.8	82.8	82.8
Rocket Propulsion Test Program (RPT)	44.2	43.6	45.9	45.9	45.9	45.9	45.9
Human Space Flight Operations (HSFO)	112.5	107.6	111.1	111.1	111.1	111.1	111.1
21st Century Space Launch Complex (21st CSLC)	136.4	130.0	41.1	47.0	47.0	47.0	47.0
Space Technology Program	173.4	9.8					

*Total funding for SLS ($1,340.4M), EGS ($404.5M), and programmatic CoF ($140.4M) is $1,884.9M

Program Detail

Exploration Systems Development
Budget Overview

- **Programs aligned for first BEO uncrewed flight in December 2017, and first BEO crewed flight in August 2021**
  - Programs continue to refine schedule and cost estimates under current integrated approach to address budget challenges and assess near-term and long-term viability
  - Notional out-year budget for all three programs
- **Development cost and schedule commitments will be made at PDR for each program, with appropriate integration level**
- **Provides for cross-program ESD integration function**
  - Leverages work performed by programs through program-to-program working groups, creating synergies to minimize budget impact of ESD level integration task

Exploration Systems Development
FY 2012 Plans

- **FY 2012 Plans**
  - Complete cross-program systems requirement review (SRR)
  - Complete welding of Orion MPCV Exploration Flight Test 1 (EFT-1) primary structure at Michoud Assembly Facility; ship to KSC by May 2012 for final assembly, outfitting, and integration
  - Continue ground testing of J2-X qualification engines
  - Conduct SLS program level and component element SRR and system definition reviews (SDR)
  - Complete Exploration Ground Systems program level SRR and SDR, with completion of key decision point B (KDP-B) at end of fiscal year

Exploration Systems Development
FY 2013 Plans

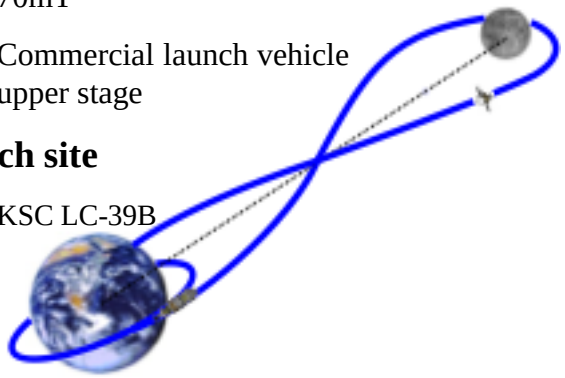
- **FY 2013 Plans**
  - Complete cross-program SDR
  - Begin next phase of Orion MPCV landing splash tests at Langley Research Center using ground test article
  - Focus on completing Orion MPCV EFT-1 flight test article for delivery to KSC for testing and planned 2014 launch

  - Complete SLS PDR (element level and program level); complete KDP-C
  - Award NASA Research Announcements for advanced booster engineering demonstration and risk reduction
  - Continue EGS development and planning, leading to planned PDR in early FY 2014
  - Carry out EGS modifications to LC39 complex and Vehicle Assembly Building (VAB); start mobile launcher structural facility and support modifications, enhance command, control and communication system

Exploration Systems Development
Current Integrated Flight Test Plan

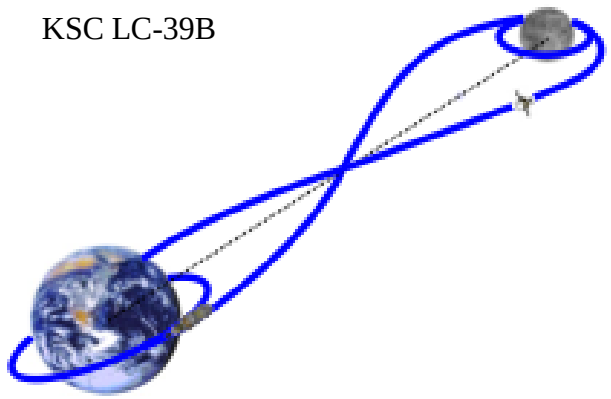
First Uncrewed BEO Flight (12/2017)

- **Mission objectives**
  - Demonstrate integrated spacecraft systems performance prior to crewed flight
  - Demonstrate high speed entry (~11 km/s) and thermal protection system prior to crewed flight
- **Mission description**
  - Uncrewed circumlunar flight – free return trajectory
  - Mission duration ~7 days
- **Spacecraft configuration**
  - Orion Block 0 BEO uncrewed
- **Launch vehicle *configuration***
  - SLS Block 0, 5-segment RSRMV, 3 RS-25D, 70mT
  - Commercial launch vehicle upper stage
- **Launch site**
  - KSC LC-39B

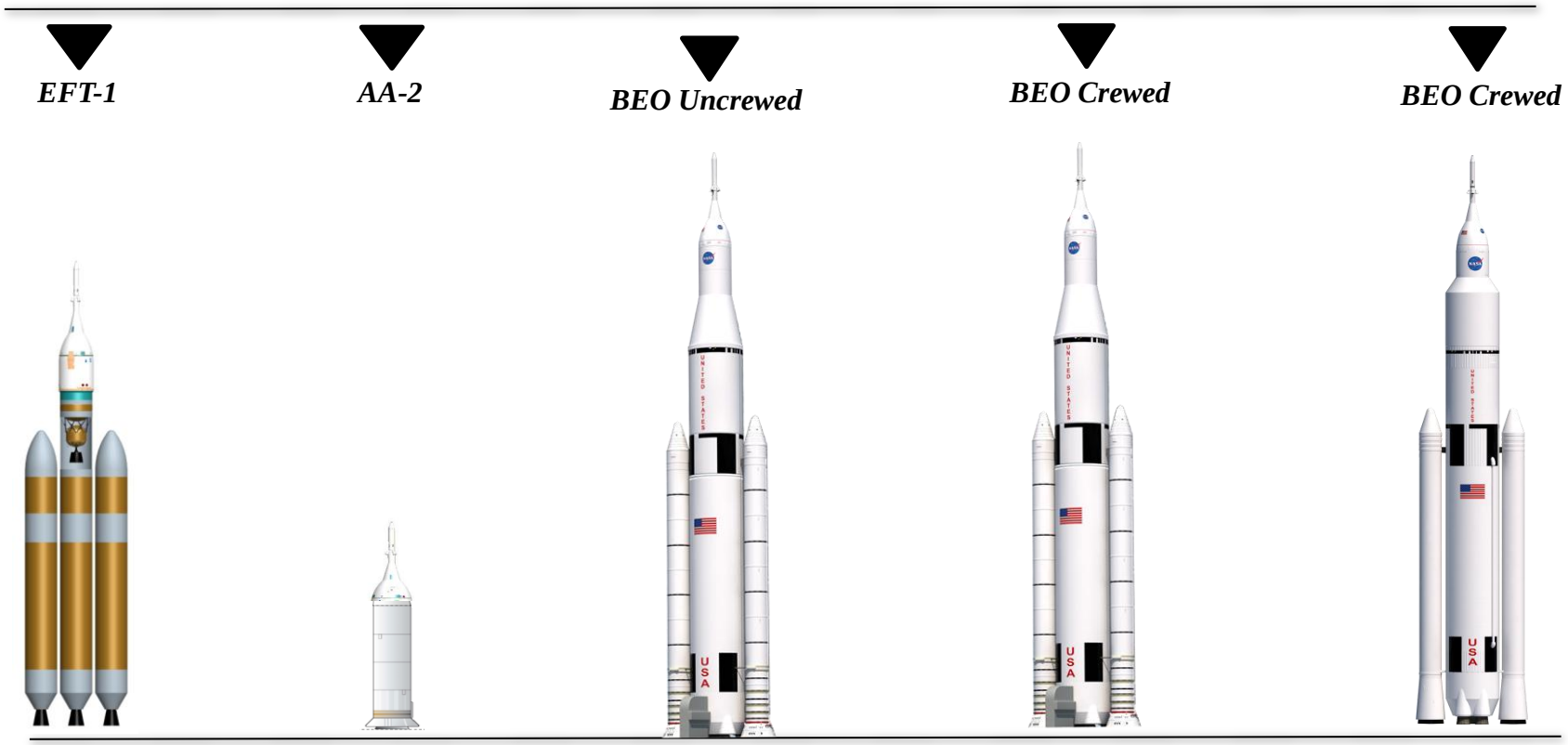


First Crewed BEO Flight (8/2021)

- **Mission objectives**
  - Demonstrate crewed flight beyond LEO
- **Mission description**
  - Crewed lunar orbit-capable or other destinations
  - Mission duration 10-14 days
- **Spacecraft configuration**
  - Orion Block 0 BEO crewed
- **Launch vehicle configuration**
  - SLS block 0, 5-segment RSRMV, 3 RS-25D, 70mT
  - Delta IV upper stage (with human rating enhancements)
- **Launch site**
  - KSC LC-39B



Exploration Systems Development
Integrated Manifest



2014
Test Article
Orion MPCV
Commercial
Launch Vehicle

2016
Launch Abort System
(LAS)
Test Article
Orion MPCV

December 2017
Block 0 BEO
Orion MPCV
SLS- 70 mT

August 2021
Block 0 BEO
Orion MPCV
SLS- 70 mT

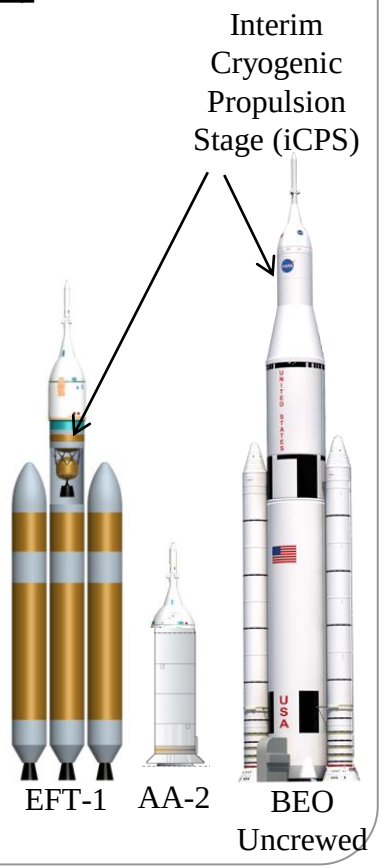
August 2023
Block 0 BEO
Orion MPCV
SLS- 105 mT
1st flt – competed boosters

Exploration Systems Development
Risk Reduction Strategy - Flight Tests

NASA is pursuing two flight tests to reduce risks to first uncrewed and crewed beyond Earth orbit (BEO) flights

Exploration Flight Test 1 (EFT-1)

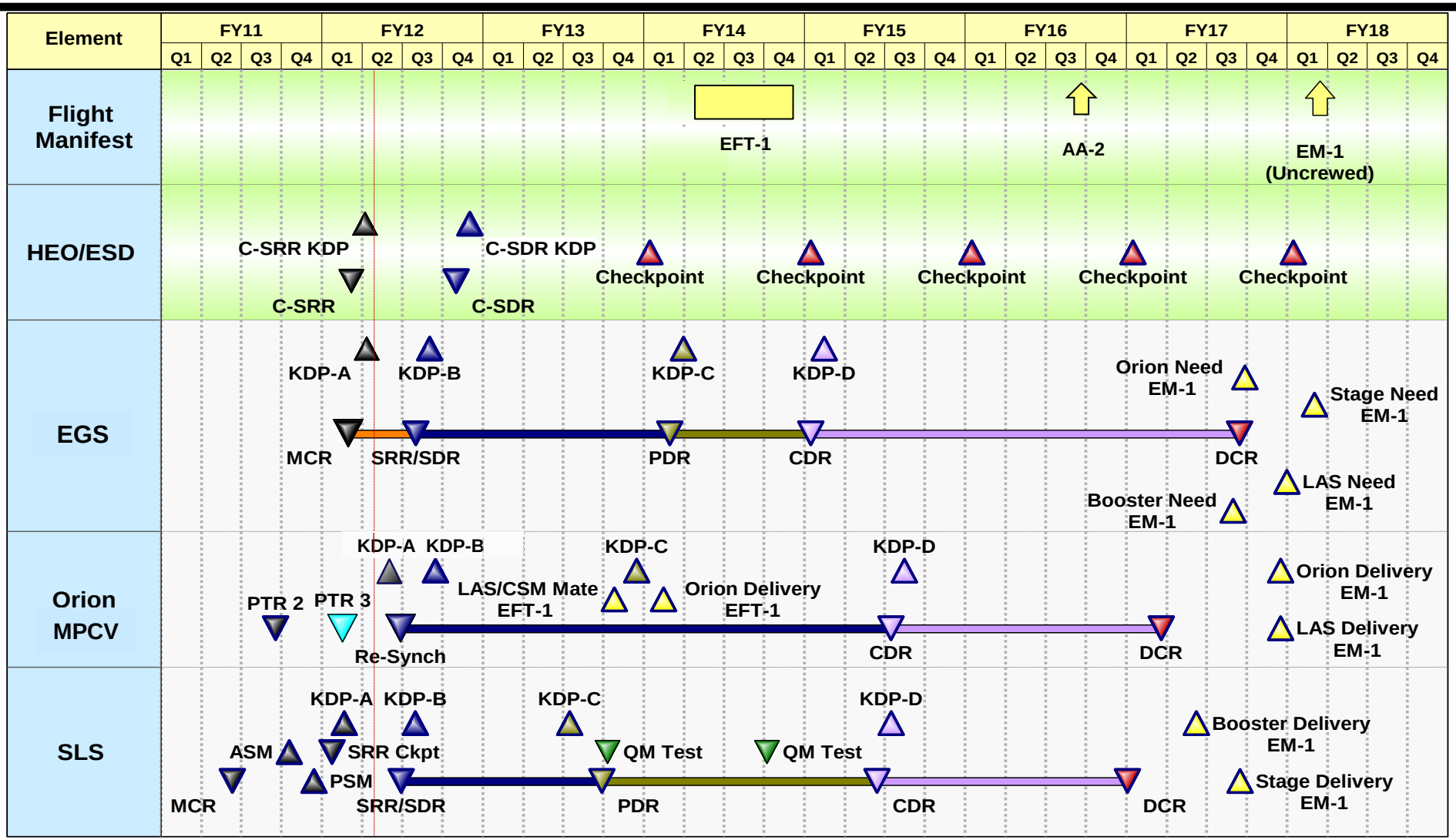
- Reduces risk for Orion MPCV by testing re-entry systems
- Reduces risk for first SLS flight by flying some elements (iCPS and Orion MPCV) early
- Reduces integrated stack risk (iCPS and Orion MPCV) for ground operations and on-orbit BEO flight phase
- Benefits mission operations skills
- Orion MPCV test article may be reused to later fly AA-2



Ascent Abort-2 (AA-2)

- Reduces risk for Orion MPCV by testing abort systems
- Reduces risk to Orion MPCV by testing water landing
- Reduces risk for ground operations by testing water landing and recovery operations
- Move to Cape Canaveral for launch benefits ground operations skills for future flights

Exploration Systems Development
Current Integrated Summary Schedule



Commercial Crew Program
FY 2012 and FY 2013 Plans

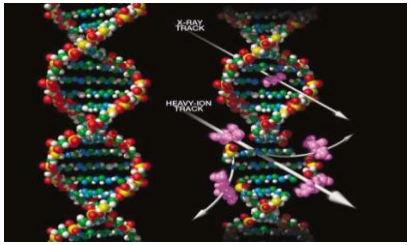
- **FY 2012 Plans**
  - Partners should complete planned milestones under the Commercial Crew Development 2 (CCDev-2) Space Act Agreements (SAA), including
    - Boeing parachute drop test demonstration (April)
    - Blue Origin Pusher escape pad escape test milestone (May)
    - Sierra Nevada Dream Chaser free-flight test milestone (July)
  - NASA reviewing proposals to initiate next phase, Commercial Crew integrated Capability (CCiCap); activity will facilitate industry integrated crew transportation system (CTS) development; expected to result in significant maturation of commercial CTS
  - July/August 2012: NASA intends to award multiple Space Act Agreements that best meet the CCiCap goals within available funding
- **FY 2013 Plans**
  - FY 2013 funds will support CCiCap milestones
  - By end of fiscal year, NASA plans to have made significant progress towards maturing design of multiple, end-to-end, integrated crew transportation systems
  - Initiate procurement planning process for certification phase

Commercial Spaceflight
Commercial Orbital Transportation Services

- **SpaceX FY 2012 Plans**
  - LIDAR sensor 6 degree of freedom test milestone, completed October 2011
  - Demonstration of enhanced powered cargo milestone, completed October 2011
  - Launch site infrastructure implementation milestone, completed October 2011
  - Production infrastructure implementation milestone, completed October 2011
  - COTS demonstration 2+ mission demonstration readiness review milestone, completed February 2012
  - COTS demonstration 2+ mission milestone, no earlier than (NET) April 30, 2012
  - COTS demonstration 3 mission, NET July 2012, if needed
- **Orbital FY 2012 Plans**
  - Service module initial comprehensive performance test milestone, completed December 2011
  - COTS maiden test flight milestone, NET June 2012
  - COTS system demonstration mission readiness review milestone, 3rd quarter 2012
  - COTS system demonstration mission milestone, September 2012

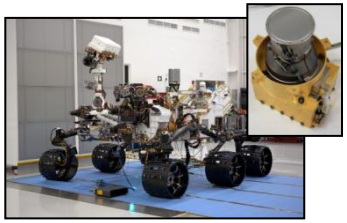
Human Research Program
FY 2012 and FY 2013 Plans

- **FY 2012 Plans**
  - Deliver updated space radiation health model to support human exploration mission design and improve crew protection for future exploration; National Academies-reviewed model will allow more accurate assessment of risks to crewmember health from effects of space radiation exposure
  - Review/select new research to address and mitigate risk to ISS crewmember vision from increased intracranial pressure when in the space environment
- **FY 2013 Plans**
  - Conduct ~10 to 15 ISS biomedical flight experiments each six-month mission to understand significant effects of long duration spaceflight on the human body
  - Complete ISS treadmill kinematics study final report to inform mission operations and improve exercise countermeasures for bone and muscle health
  - Complete ISS VO2max study final report to recommend update to health standards regarding astronaut aerobic capacities and inform mission operations on exercise effectiveness
  - Provide preliminary recommendation for updating immune standard based on outcome from integrated immune flight study
  - Continue evaluating increased risk of cancer from space radiation



Advanced Exploration Systems
FY 2012 Plans

- **FY 2012 Plans**
  - Launched radiation assessment detector (RAD) instrument on Mars Science Laboratory (MSL)
  - RAD's primary science objective is to characterize radiation environment on Mars surface, but instrument is on during cruise phase in order to measure radiation humans could be exposed to en route to the Red Planet
  - Conducted NASA extreme environment mission operations (NEEMO) underwater test in October 2011; another is planned in summer
    - Divers in spacesuits demonstrate methods of anchoring to and moving across the surface of an asteroid in microgravity
  - Piloted prototype crew excursion vehicle across air bearing floor to test techniques for docking and anchoring to a simulated asteroid surface
  - Goldstone Radar project has imaged five near-Earth asteroids to determine their size, shape, and spin rate
  - Conduct flight tests of autonomous precision landing and hazard avoidance system on small lander



RAD on MSL rover

NEEMO-15 underwater test

Crew excursion vehicle

Goldstone Radar

Advanced Exploration Systems
FY 2013 Plans

- **FY 2013 Plans**
  - Conduct vacuum chamber test of packaged portable life support system (PLSS) for advanced spacesuit (the next step in spacesuit development)
  - Demonstrate highly-reliable life support systems in ground testbed
  - Demonstrate software tools for automating mission operations to reduce crew workload
  - Ramp up Joint Robotic Precursor Activities with NASA's Science Mission Directorate to coordinate science and exploration objectives, reduce risk for future human missions, and develop robotic precursor missions
  - Identify set of strategic knowledge gaps for human exploration beyond low-Earth orbit, vetted by external research community; gaps will be used to plan robotic precursor missions to acquire critical data on potential destinations

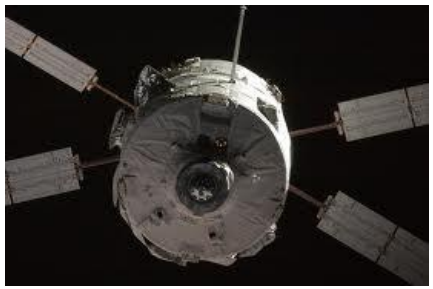
International Space Station
FY 2012 and FY 2013 Plans

- **Sustain and expand utilization of ISS as a National Laboratory for scientific, technological, and educational purposes**
  - Continue management transition of the non-NASA utilization of the ISS National Laboratory to the Center for the Advancement of Science in Space (CASIS)
  - Support CASIS efforts to raise external funding for ISS research projects
  - Build new capabilities for ISS research in biological sciences
  - Release solicitation for PI-developed research payloads
- **Demonstrate Commercial Cargo transport systems and begin services**
  - Commercial Orbital Transportation System (COTS) demonstration flights:
    - SpaceX – April 30, 2012; Orbital – September 2012
  - Commercial Resupply Services (CRS) flights:
    - SpaceX -1 – July 2012 (under review); Orbital-1 – 4th quarter 2012

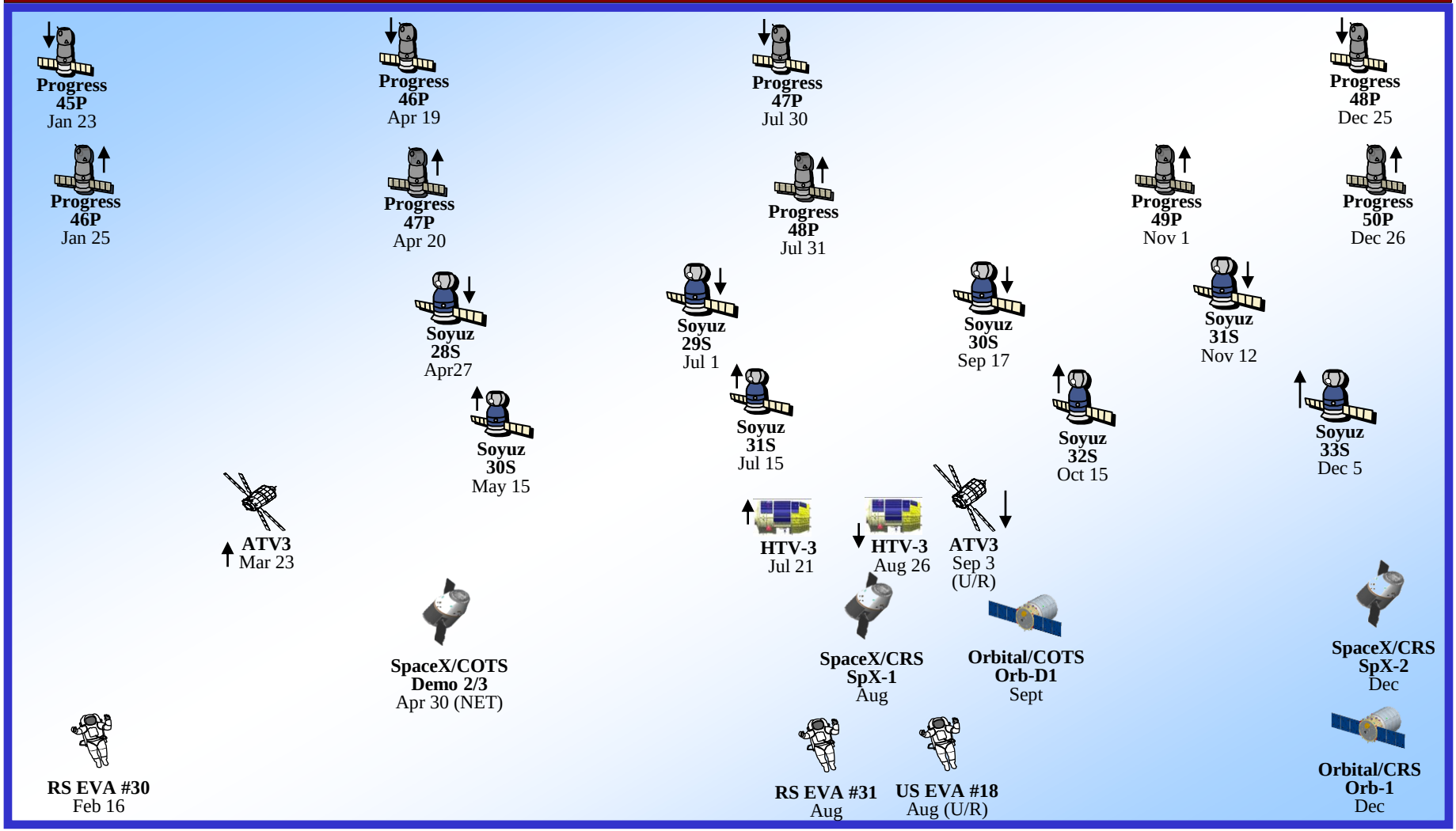
CASIS
Center for the Advancement of SCIENCE IN SPACE

International Space Station
FY 2012 and FY 2013 Plans

- **Utilize ISS for NASA exploration research and technology demonstrations**
  - Environment control, human health and performance, robotics, EVA, propulsion
- **Continue International Partner transportation**
  - Four Soyuz crew exchanges per year (6 Russian/6 non-Russian crew); 4-5 Progress resupply flights per year (primarily Russian logistics)
  - Continue Japanese Aerospace Exploration Agency (JAXA) H-II transfer vehicle (HTV) and European Space Agency (ESA) automated transfer vehicle (ATV) flights
- **Maximize crew time devoted to research and technology demonstrations**



International Space Station
CY 2012 Visiting Vehicle Plans*

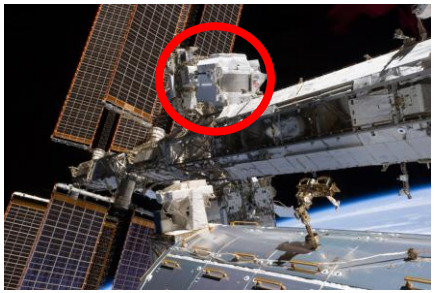


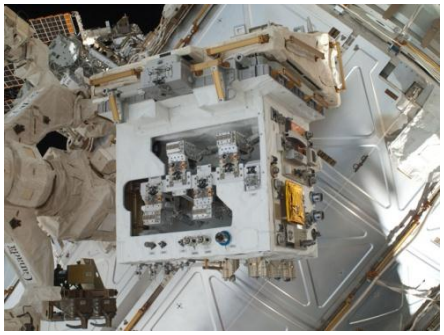
Launches: RS = 9 JAXA = 1 ESA = 1 SpaceX = 3 Orbital = 2

* As of March 28, 2012

International Space Station
ISS Research

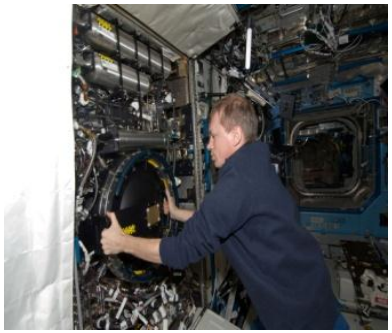
- **Sample Research Planned for FY2012/FY2013**
  - Conducting over 250 investigations on ISS supporting more than 500 scientists across the international partnership
  - Continuing investigations such as origin and structure of the universe with AMS-02 experiment (over 12 billion observations to date), mechanics of human immune and cardiovascular systems, inertial-capillary flows for key spacecraft systems, biomechanics of treadmill exercise, regenerated amine systems to remove carbon dioxide, laser communications, microbial biofilms, space radiation environment, and satellite servicing
  - Finishing flame extinguishment experiment to advance fire safety
  - Beginning new plant and microbiology experiments to understand how plants respond to gravity and contribute to engineering food supplies for long-duration missions
  - Completing experiments in boiling experiment facility and capillary channel flow apparatus to help engineers design lighter, more efficient fuel tanks and heat transfer devices for future space systems
  - Performing medical assessments of causes of intraocular pressure changes in crewmembers and develop countermeasures
  - Continuing robotic demonstration testbeds, including Robonaut and robotic refueling mission
  - Utilizing commercial cargo vehicles to support National Laboratory biotechnology users

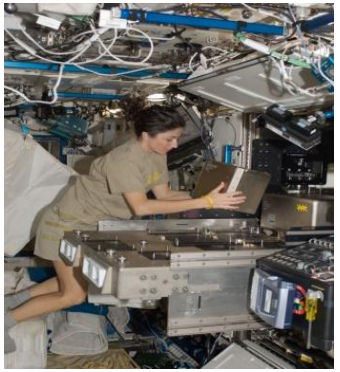


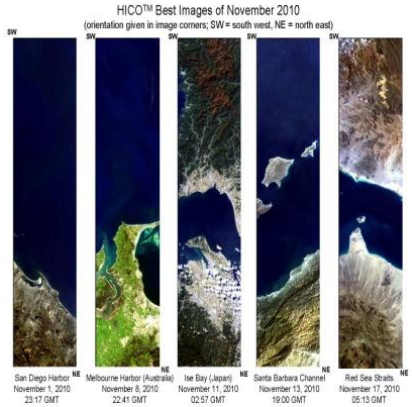


International Space Station
ISS Research

- **Sample Research Planned for FY2012/FY2013**
  - Initiate series of experiments in combustion rack to use absence of gravity to measure chemical kinetics of fuel combustion and model biofuel combustion in diesel engines
  - Collaborating with U.S. universities and Chung Nam National University (South Korea) to use fluids rack to understand processes of self-ordering systems and self-directed assembly in functional materials
  - Received thousands of two-minute video submissions in areas of physics or biology from more than 80 countries for first YouTube Space Lab global contest sponsored by YouTube, Lenovo Computers, and Space Adventures Inc., in cooperation with NASA, ESA, and JAXA; challenges 14-18 year-olds to design a science experiment that can be performed in space; top two experiments will be conducted on ISS
  - Continuing operation of specialized visible and near-infrared camera to detect, identify and quantify coastal features including the water depth, water clarity, chlorophyll content, and sea floor composition, using hyperspectral imager for coastal ocean (HREP-HICO) and Earth-observing payload from Naval Research Laboratory







Space Shuttle Program
FY 2012 and FY 2013 Plans

- **FY 2012 Plans**
  - Complete United Space Alliance (USA) pension settlement; next update expected April, payout late summer
  - Disposition of three Shuttle orbiters; display preparation and ferry costs covered by recipients
    - Discovery scheduled to reach National Air and Space Museum Udvar-Hazy Center by April 2012
    - Enterprise scheduled to move to Intrepid Air and Space Museum April 2012
    - Endeavour scheduled to arrive at California Science Center September 2012
  - Disposition of other program assets
    - Many items to be transferred to future exploration programs, primarily SLS
    - Space Shuttle property no longer required to support Agency priorities will be excessed in partnership with General Services Administration under existing authorities
- **FY 2013 Plans**
  - Atlantis to move to display location at KSC visitor's complex November 2012
  - Disposition remaining property
  - Complete other transition and retirement activities, including facility turnovers, archiving records and IT systems, and contract closeouts

Space Communications and Navigation

FY 2012 Plans

- **FY 2012 Plans**
  - Deliver mission-critical communication and navigation services to over 75 customer missions
    - Virtually all NASA science, crewed, suborbital and balloon missions require Space Communications and Navigation (SCaN) services for mission success
  - Deliver SCaN testbed for integration on JAXA (Japan) H-2 launch vehicle; launch, install on ISS, and check out by end of FY 2012
  - Exercised option for Tracking and Data Relay Satellite (TDRS) M (November 2011); Boeing began long lead item purchases
  - Finish integration and test on TDRS-K
    - Power distribution unit board failed during thermal vacuum test, root cause and recovery being analyzed; December 2012 Launch Readiness Date (LRD) still on schedule
  - Complete key decision point B (KDP-B) for Space Network Ground Segment Sustainment (SGSS), preliminary design review (PDR) scheduled June 2012
  - Continue development of lunar laser communication demonstrator (LLCD); begin integration into lunar atmospheric and dust environment explorer (LADEE) host spacecraft
  - Completed PDR for Deep Space Station-35 antenna (February 2012)
  - TDRS-4 failed and was placed in disposal orbit; TDRS-3 is rapidly failing
    - TDRS-6 will soon replace TDRS-3; operational and end of life plans being developed
    - This will temporarily leave us with no on-orbit spare
  - Recent fire at Boeing integration and test high bay contained within 15 minutes; TDRS-L covered with soot, has undergone cleaning and being inspected for damage

Space Communications and Navigation

FY 2013 Plans

- **FY 2013 Plans**
  - Deliver mission-critical communication and navigation services to customer missions
  - Complete critical design review (CDR) for DSS-35 antenna in November 2012
  - Complete TDRS-K for December 2012 launch readiness date; finish integration and test on TDRS-L
  - Complete CDR for TDRS-M in March 2013
  - Begin experimental operations of SCaN testbed on ISS and support TDRS-K on orbit checkout
  - Integrate Lunar Laser Communication Demonstration (LLCD) space terminal into LADEE spacecraft, deliver LLCD optical communications ground terminal, launch LADEE, and conduct laser communications demonstration
  - Complete CDRs on SGSS elements in preparation for system-level CDR in early FY 2014

Launch Services Program

FY 2012 and FY 2013 Plans

- **Oversee full range of civil space launch needs**
  - Provide safe, reliable, cost effective and on-time launch services for NASA and NASA-sponsored payloads using expendable launch vehicles
  - Provide expertise to other government agencies and launch industry to ensure launch opportunities available on a range of launch systems
  - Work with launch service providers on emerging vehicles for future use
- **Provide for core government and contractor workforce supporting NASA launches, conduct engineering analysis and integration support for ~35 NASA missions**
- **Conduct four planned launches of NASA payloads in FY 2012:**
  - National polar-orbiting operational environmental satellite system (NPOESS) preparatory project (NPP) – Delta II, Cape Canaveral Air Force Station (CCAFS), FL: launched Oct 2011
  - Mars Science Laboratory (MSL) – Atlas V, CCAFS, FL: launched November 2011
  - Nuclear spectroscopic telescope array (NuSTAR) – Pegasus XL, Kwajalein Atoll: TBD
  - Radiation belt storm probes (RBSP) – Atlas V, CCAFS, FL: NET August 2012
- **Conduct three planned launches of NASA payloads in FY 2013:**
  - Interface region imaging spectrograph (IRIS) – Pegasus XL, Vandenberg Air Force Base (VAFB), CA: December 2012
  - TDRS-K – Atlas V, CCAFS, FL: no earlier than December 2012
  - Landsat data continuity mission (LDCM) – Atlas V, VAFB, CA: no earlier than January 2013

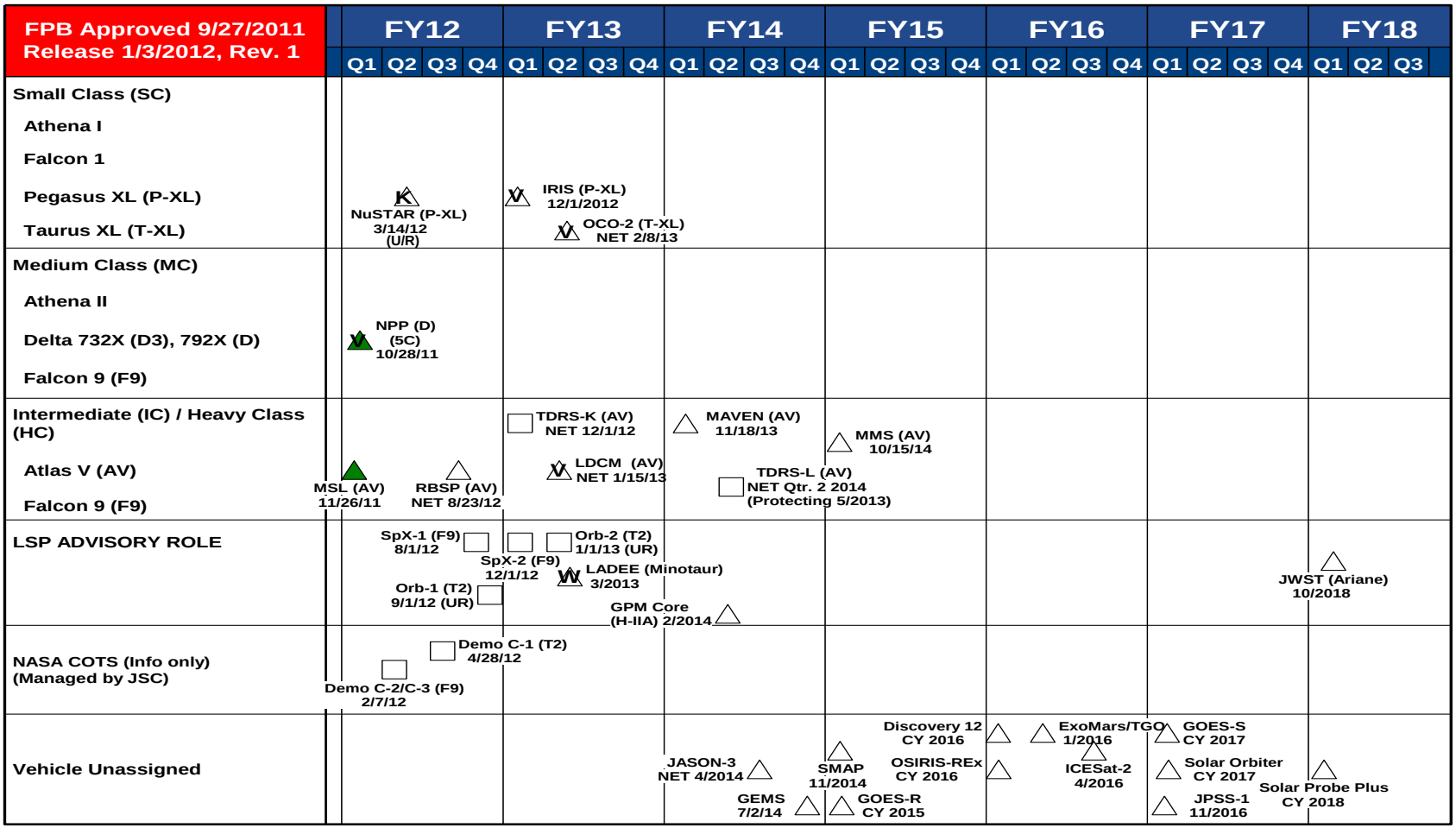
Launch Services Program

FY 2012 and FY 2013 Plans

- **Release multi-mission request for launch services proposal no later than Feb 2012:**
  - Soil moisture active-passive (SMAP)
  - Joint polar satellite system (JPSS)-1
  - Orbiting carbon observatory (OCO)-2
- **Three launch services task orders in work via NASA Launch Services II contract:**
  - Geostationary operational environmental satellite (GOES)-R and GOES-S
  - Gravity and extreme magnetism small explorer mission (GEMS)
- **Provide advisory support to:**
  - Lunar atmosphere and dust environment explorer (LADEE) mission
  - Exploration flight test (EFT-1) mission
  - ISS commercial resupply services (CRS and Commercial Crew)
  - Continue assessments for Falcon 9 block 1 and Antares using CRS contract data products
- **Provide support to commercial/national security launches**
  - Provide launch support personnel during major tests and on launch day; receive, process, and send telemetry; provide support and accommodations for live commercial launch broadcasts

Launch Services Program

NASA Launch Services Manifest



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△ = SCIENCE ◇ = DOD REIMBURSABLE ☐ = HUMAN EXPLORATION AND OPERATIONS

ER = EASTERN RANGE-CCAFS K = KWAJALEIN W = WALLOPS LAUNCH WR = WESTERN RANGE-VAFB * = MISSION UNSUCCESSFUL UR = UNDER REVIEW C = CubeSat

Rocket Propulsion Test
FY 2012 and FY 2013 Plans

- **Maximize RPT resources for NASA, DoD, and commercial test programs**
  - Right-sizing study complete; implementation of recommendations will be done through the FY 2014 budget process
  - Continue to support, organize, and coordinate the National Rocket Propulsion Test Alliance in order to eliminate duplication of efforts and share infrastructure
  - Complete test stand 303, 405, and 406 transition to mothball state at White Sands Test Facility (WSTF)
- **Manage and monitor maintenance on critical infrastructure investments**
  - Stennis Space Center (SSC) high pressure industrial water distribution system
  - SSC B Stand Liquid Hydrogen (LH_2) dock
  - Refurbish critical LH_2 and liquid nitrogen (LN_2) systems at Glenn Research Center, Plum Brook Station
- **Continue to support testing for Agency programs**
  - J2-X testing for the SLS upper stage

Rocket Propulsion Test
FY 2012 and FY 2013 Plans

- **Provide critical testing facilities vital to NASA programs as well as DoD and commercial partners**
  - AJ-26 engine testing at SSC for Orbital Antares launch vehicle
  - RS-68 engine testing at SSC for Pratt & Whitney Rocketdyne and U.S. Air Force
  - Missile Defense Agency testing at WSTF
  - Blue Origin engine testing at SSC
  - Minuteman testing at WSTF for U.S. Air Force
- **Engage commercial and international customers to provide high quality propulsion test services on reimbursable basis**
  - European Space Agency (ESA) testing of Ariane 5 mid-life extension upper stage at Plum Brook Station space propulsion research facility (PBS-B2)
  - Solaren LOx/Rp testing at MSFC
  - Boeing hypergolic testing at WSTF

Human Space Flight Operations
FY 2012 and FY 2013 Plans

- **Ensure that NASA's astronauts are fully prepared to safely carry out current and future missions**
  - Provide support and training for astronauts preparing for ISS and technical/safety crew expertise for future human space systems development
  - Oversee aircraft operations at JSC, primarily composed of T-38 astronaut trainers
  - Conducted NRC independent review of the HSFO planning for the post Shuttle era
  - Provide qualified astronauts and operations/development expertise for NASA human spaceflight endeavors, including Commercial Crew, Orion MPCV and SLS programs
  - Continue to operate and conduct scientific research and experiments on board ISS; complete four crew rotations annually
  - Select 2013 astronaut class (9 – 15 candidates from over 6,300 applications); training to begin in June 2013; eligible for flight assignment in early 2015
  - Maintain spaceflight readiness training and implement new firm fixed price aircraft maintenance and operations contract
  - Merge space medicine occupational health and bioastronautics consolidated contracts to better align space medicine with occupational medicine through an occupational health surveillance approach
  - Complete visual impairment/intracranial pressure studies to aid development of mitigation strategies for possible microgravity effects on vision

21st Century Space Launch Complex
FY 2012 and FY 2013 Plans

- **FY 2012 Plans**
  - Modify launch complex-39
    - Develop requirements for flame trench refurbishment and relocation
    - Develop ignition over pressure and sound suppression systems
  - Modify vehicle assembly building
    - Requirements development for reuse of heritage ground support equipment
    - Portable environmental control system architecture and ordinance closeout
  - Upgrade crawlerway transition areas
  - Conduct spacecraft processing studies
  - Upgrade hypergol fuel and specialty facility and equipment
  - Upgrade cryogenic and high pressure gas facility and equipment
  - Upgrade and refurbish of gaseous nitrogen pipeline
  - Upgrade uninterruptable power supply
  - Modify multi-purpose processing facility (Phase 2)
  - Perform repairs to industrial area chiller plant
  - Conduct environmental studies and obtain permitting
  - Upgrade select heritage facility temperature and lighting
  - Perform maintenance of advanced ground systems

21st Century Space Launch Complex
FY 2012 and FY 2013 Plans

- **FY 2013 Plans**
  - Continue upgrade of crawlerway transitions
  - Continue upgrades of select heritage facility temperature and lighting
  - Complete wastewater facility designs
  - Upgrade radio frequency testing station
  - Continue launch complex-39 upgrades
    - Complete NASA initiated studies and designs at launch complex 39B for multi-use emergency egress systems, RP-1 servicing capability, and environmental control system
    - Continue/complete modifications and upgrades to pad infrastructure, cryogenic systems and water systems
    - Continue/complete/studies and designs for mobile launcher umbilical systems and access arms; also began removing ground support equipment items from an existing Shuttle mobile launcher platform for reuse on new mobile launcher
    - Continue/complete crawler transporter life extension modifications