National Aeronautics and Space Administration

NASA Advisory Council Presentation

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April 2013

Topics

- Program Status and Schedule
- EFT-1 Update
- ESA Service Module
- Summary
- Quarterly Progress Video

ESD Status and Schedule

Orion Accomplishments

Completed heatshield ready for transport to Textron in Boston, MA for Avcoat application

Inert Abort motor delivered to Operations and Checkout Building at KSC

Launch Abort System Ogive panel work at the Michoud Assembly Facility

Backshell panel drilling at the Operations and Checkout Building at KSC

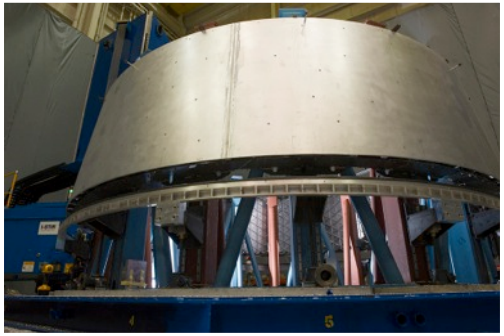
Service module assembly at the Operations and Checkout Building at KSC

Super Guppy carrying the Orion Heat Shield arriving at Hanscom Air Force Base in Boston

SLS Accomplishments

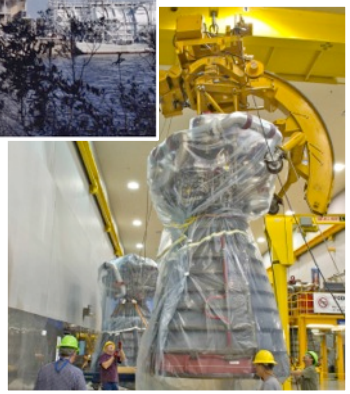
Systems Engineering & Integration SLS model wind tunnel testing at Langley Research Center
Nov 2012

J-2X upper stage engine hot-fire test at Stennis Space Center
Feb 2013



Multi-Purpose Crew Vehicle Stage Adapter (MSA) Flight Hardware at Marshall Space Flight Center
March 2013

Kennedy Space Center Pad 39B (artist's concept) with new crawler transporter and control room
Jan 2013



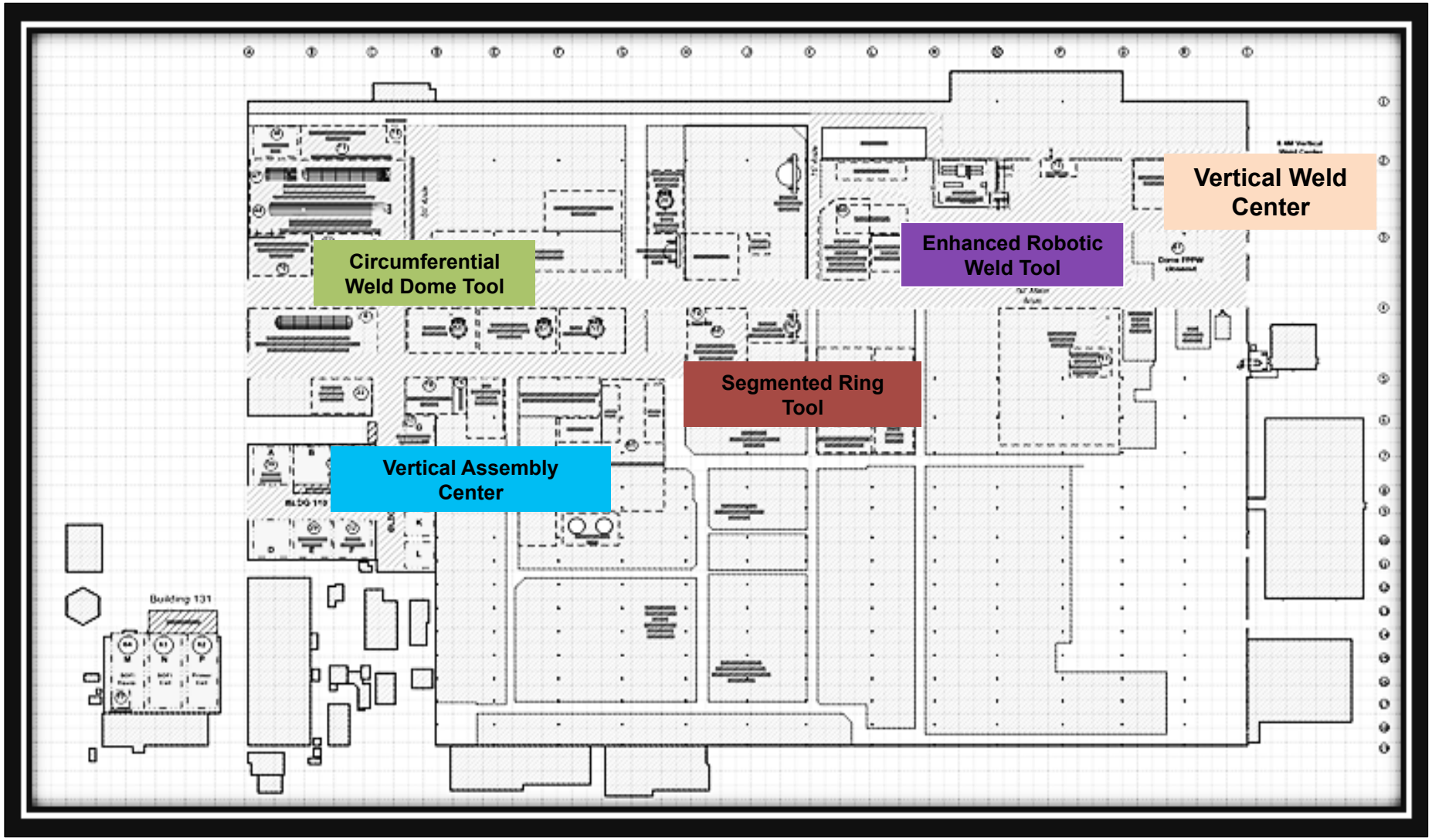
RS-25 Engines at Stennis Space Center Oct 2012, shown with future RS-25 Test Stand A1

F-1 engine gas generator – technology demonstration for an optional Advanced Booster concept – hot-fire test at Marshall Space Flight Center, Jan 2013

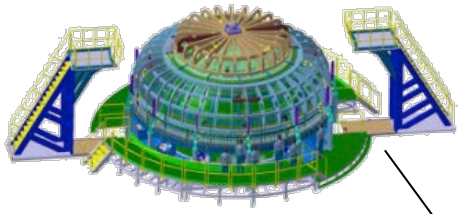
Qualification Motor 1 casting at ATK
Oct 2012

System Requirements Review/System Definition Review Completed

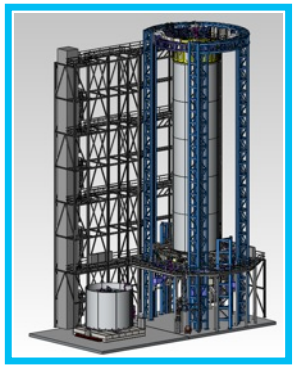
Michoud Assembly Facility (MAF), LA

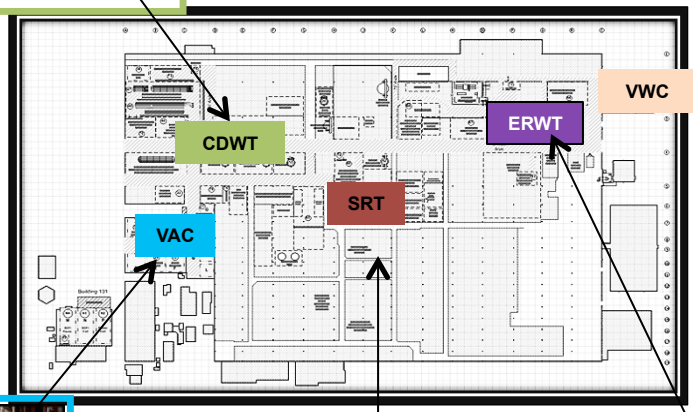


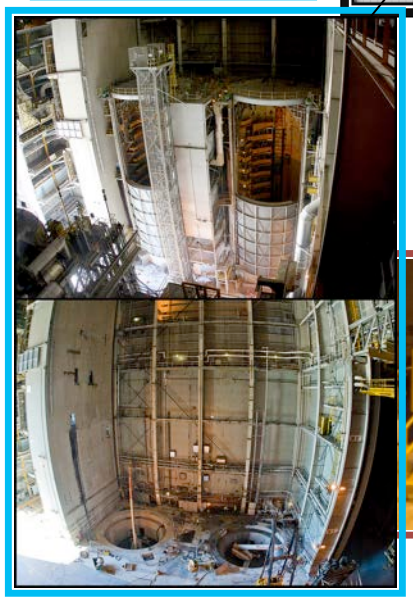
Stages Manufacturing, Assembly, & Production/ Operations Snapshot at MAF

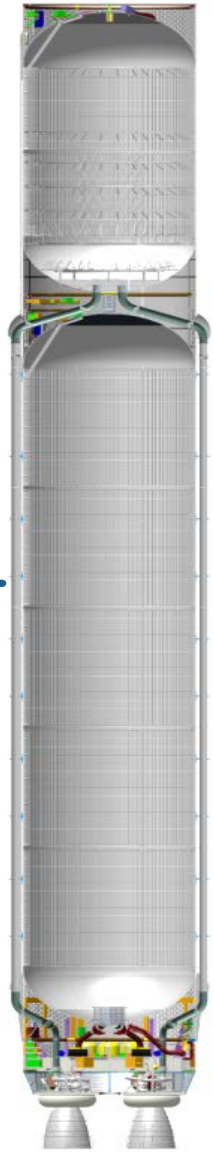


Next Big Step	
Tooling Availability	May- Enhanced Robotic Weld Tool (ERWT) June- Vertical Weld Center (VWC)







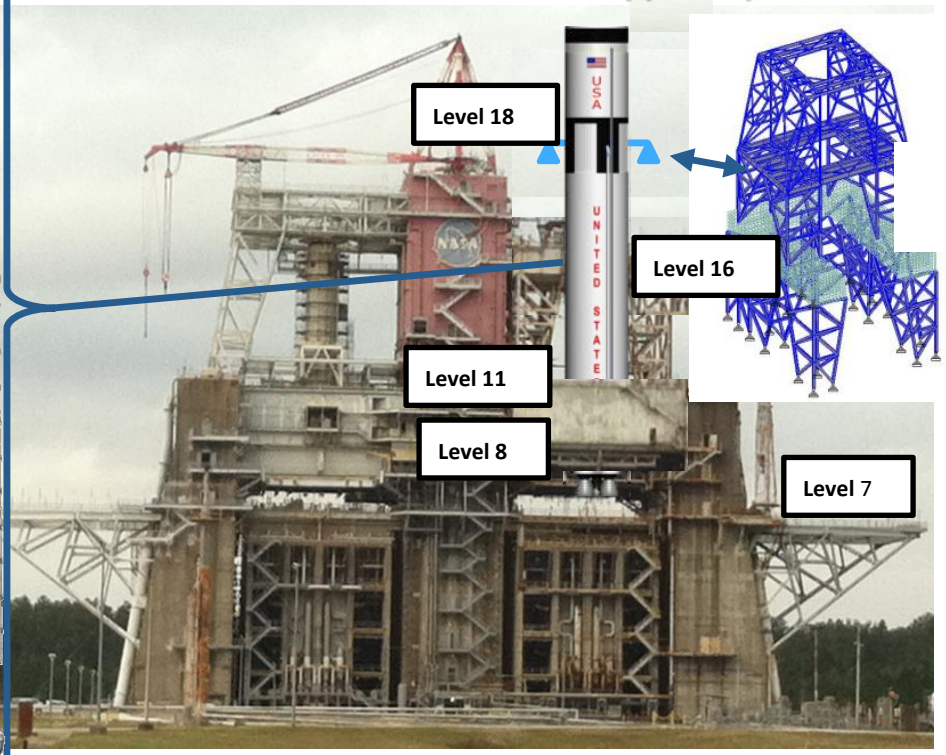


Stages "Green Run" Test Buildup at SSC B-2

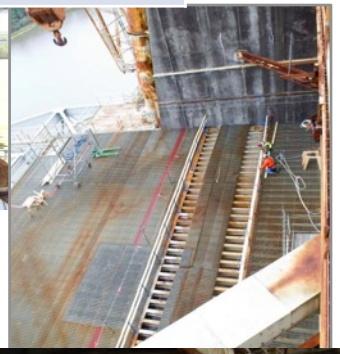
Stage is 211" Tall

Next Big Step	
Stages Testing	April 30% Design on Structural Build- Out & Electrical Restoration June Work Package 3 of 5 Awarded

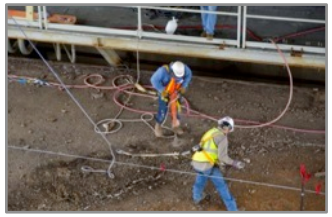
Upper Superstructure

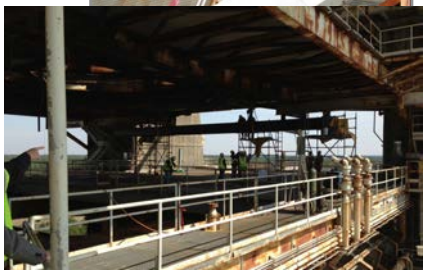


NASA Stennis Space Center, MS
Test Stand B-2 Stages Green Run



Level 7 Side After Demo & LOX Transfer Line





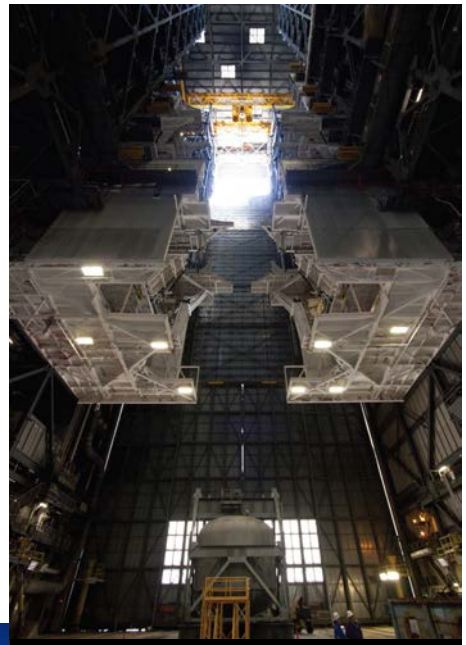
Above: Aspirator and Level 7 Demolition

Left: B-2 Flame Deflector Flow Testing

GSDO Accomplishments

Crawler-transporter Modifications

Crawlerway Modifications



VAB Modifications

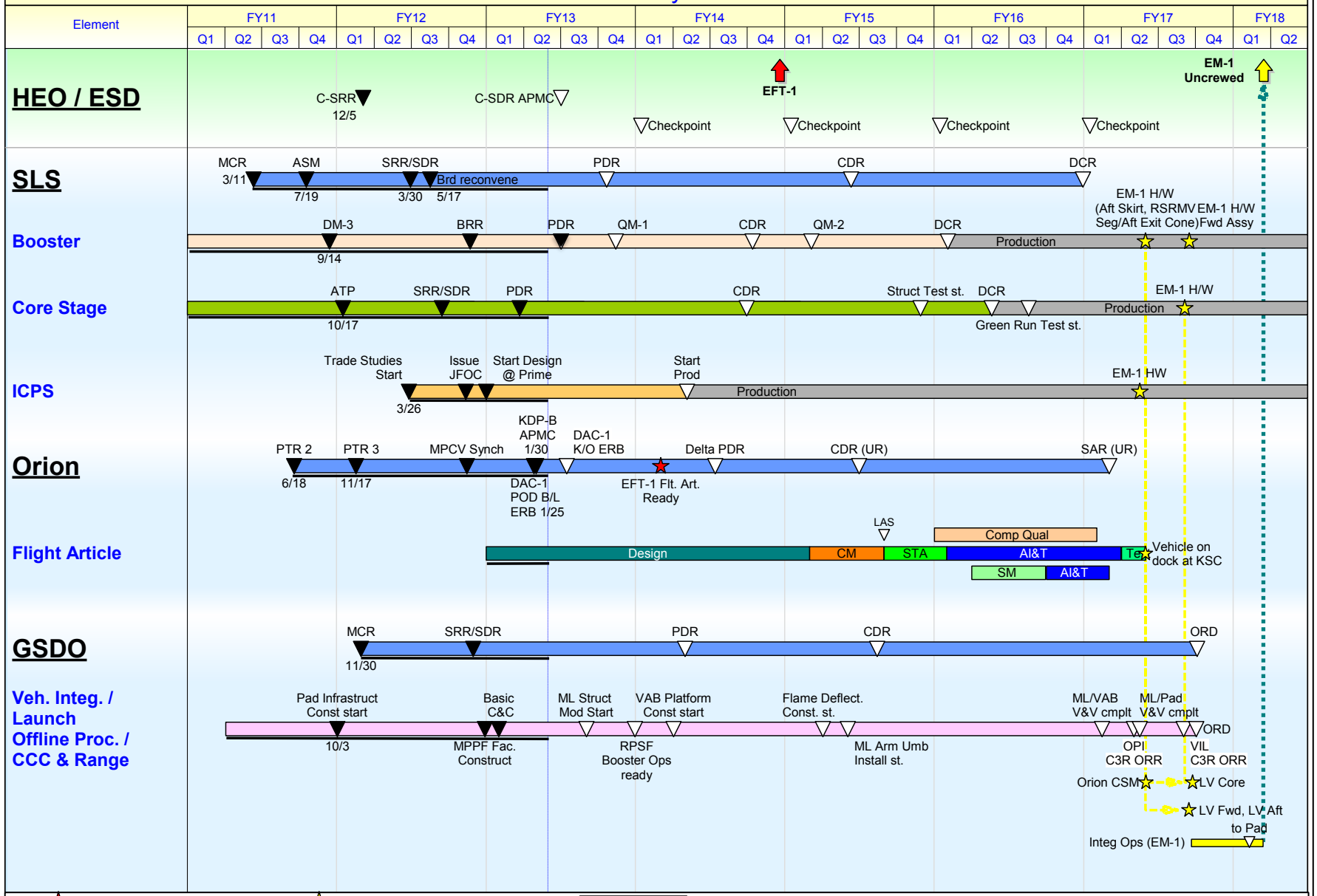
Pad 39B Modifications including new hydraulic elevators

Testing of Crawler-Transporter 2

Pad 39B new interface connections

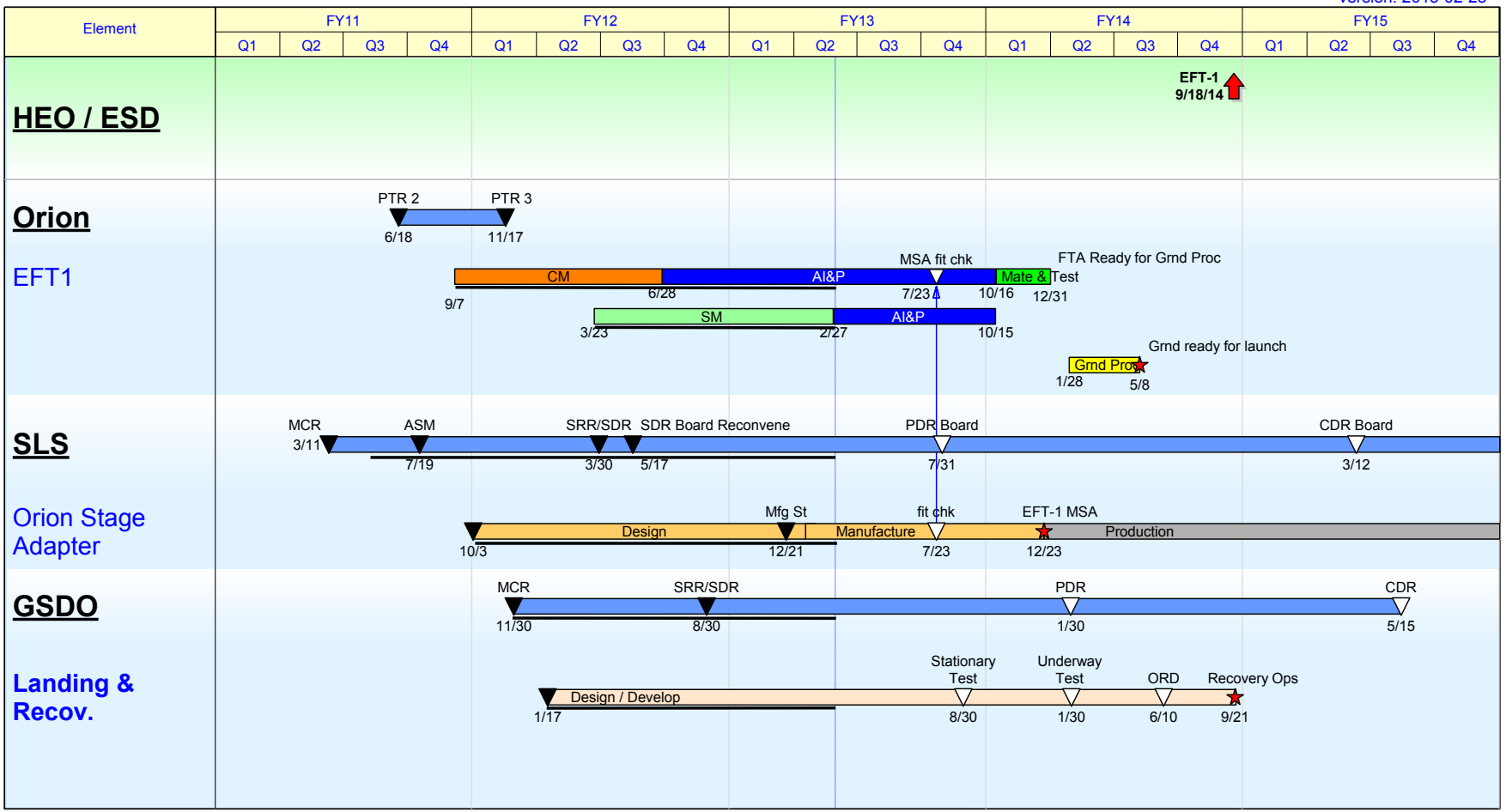
ESD Summary Schedule

version: 2013-2-28



ESD EFT-1 PPBE14 Integrated Schedule

version: 2013-02-28



Element tests

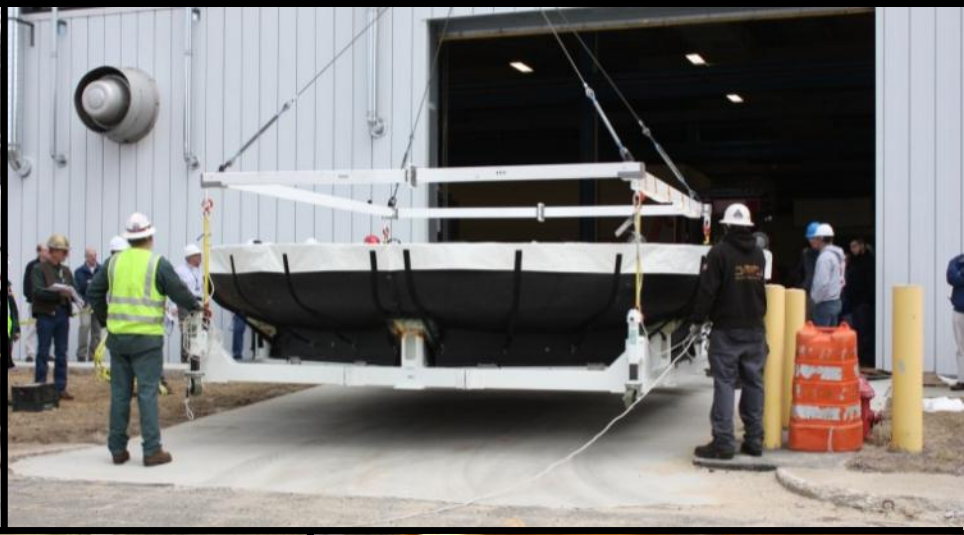
EFT-1 Flt h/w

Milestones are "complete" milestones unless noted

EFT-1 Update

Heatshield Arrival at Textron

- Heatshield transport and unpacking complete



Service Module
Shear Web Assembly Installation

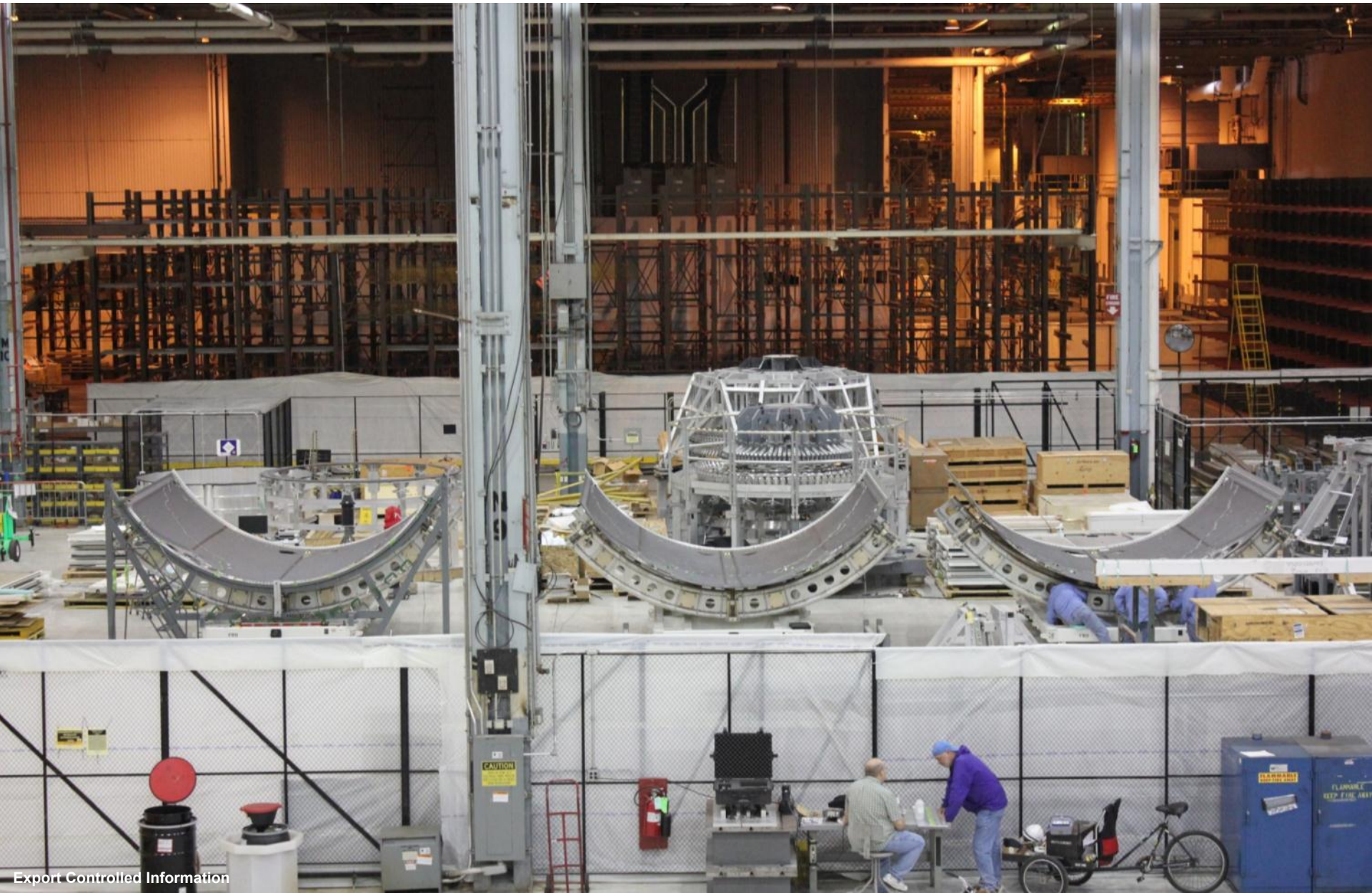
Service Module Available

Service Module Bulkhead Alignment / Fit Check

Separation Test Fairing Status
SAJ Fairing Panel 3, Removal From Sep Test Tool

Export Controlled Information

Separation Test Fairing Status:
SAJ Fairing Panels in Preparation for May Sep Test

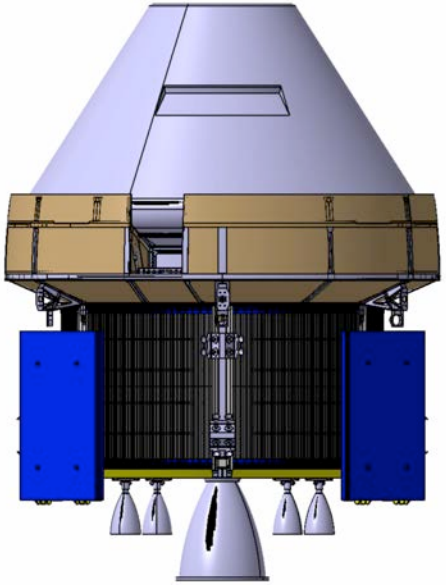


Export Controlled Information

ESA Service Module

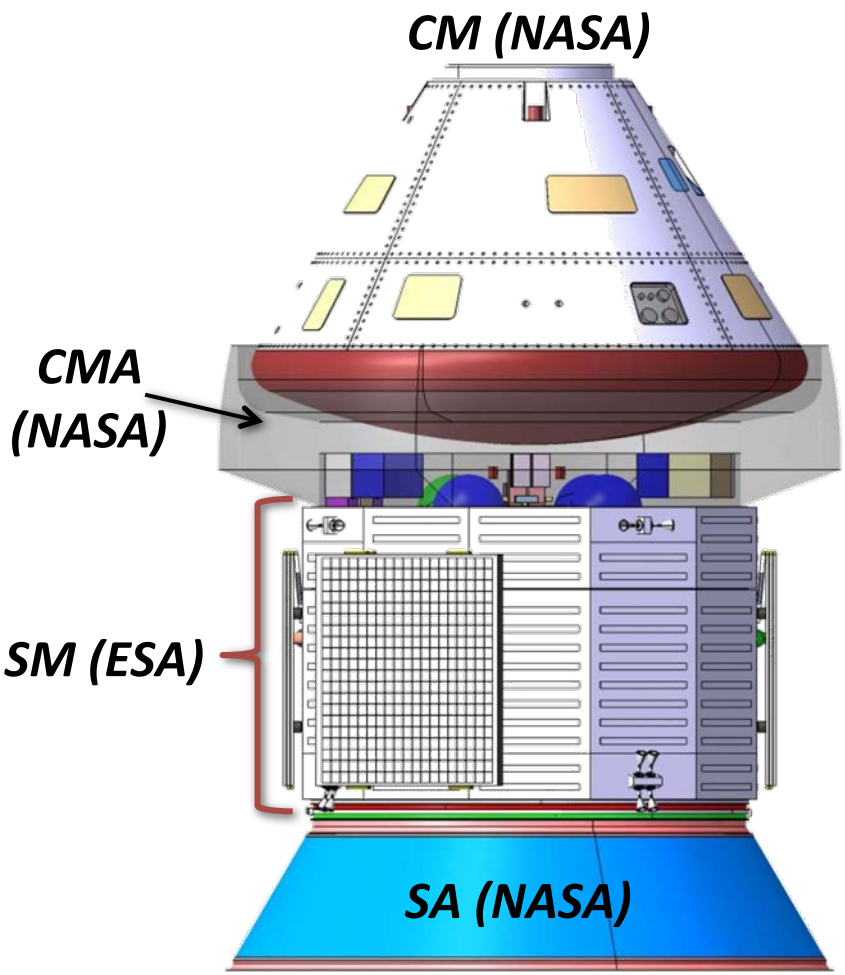
Orion Service Module/ESA Partnership

- NASA signed an agreement in December 2012 for the European Space Agency (ESA) to provide a service module for the Orion spacecraft's Exploration Mission-1 in 2017.
- The agreement primarily maps out a plan for ESA to fulfill its share of operational costs and additional supporting services for the International Space Station by providing the Orion service module and necessary elements of its design for NASA's Exploration Mission-1 in 2017.
- The service module will:
  - house power, thermal and propulsion systems
  - contain in-space propulsion capability for orbital transfer, attitude control and high-altitude ascent aborts
  - generate and store power and provide thermal control, water and air for the astronauts
  - remain connected to the crew module until just before the capsule returns to Earth



ESA Service Module Overview

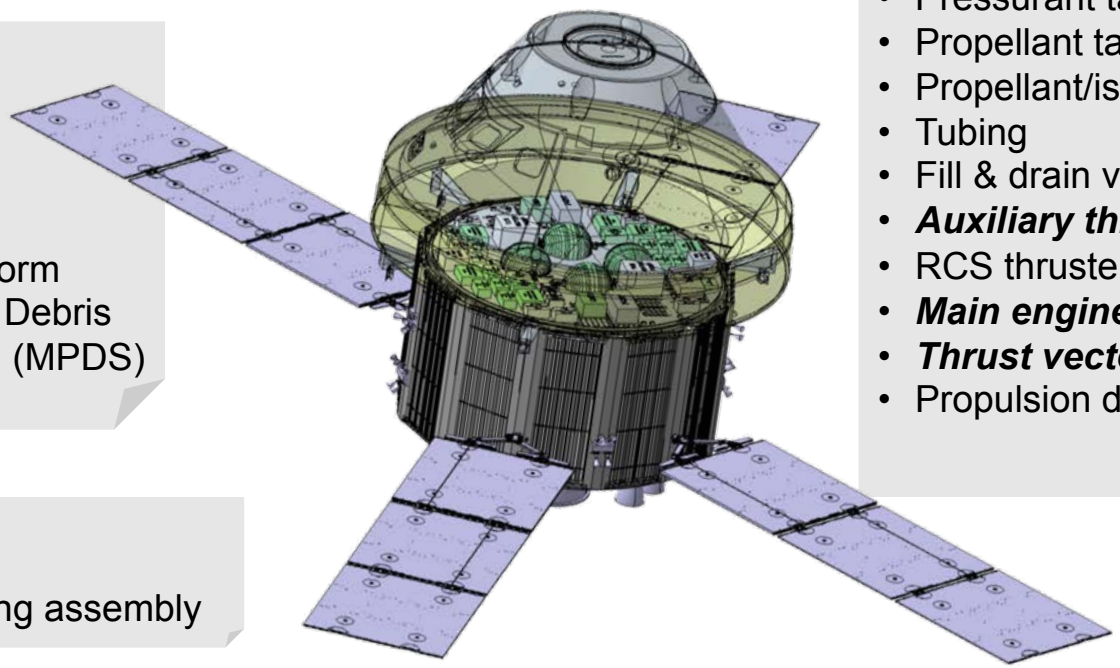
- The Crew Module (CM) and SM will physically interface via an interface ring called the Crew Module Adapter (CMA).
- The SM and CMA is attached to the CM from launch until just prior to the entry interface.
- NASA will be responsible for the CM, CMA, Spacecraft Adapter & Separation Mechanism (SA), SAJ (jettisonable fairings), and the Launch Abort System.
- ESA will be responsible for the SM consisting of:
  - Load bearing primary structure
  - Gas and water consumable storage tanks
  - 2 coolant loop 24 m2 fluid radiators
  - 4 Solar Arrays
  - Propulsion subsystem based on:
    - Orbital Maneuvering System Engine (OMS-E), 8 Auxiliary thrusters, 24 Reaction Control Systems thrusters
    - 4 propellant tanks + 2 Helium pressurization tanks



MPCV roles

ESA SM Reference Configuration

Structure
- Upper cylinder
- Tank platform
- Main cylinder
- Lower platform
- Equipment platform
- Micrometeoroid Debris Protection System (MPDS)



Propulsion
- Pressure control assembly
- Pressurant tanks
- Propellant tanks
- Propellant/isolation system
- Tubing
- Fill & drain valves
- ***Auxiliary thrusters***
- RCS thrusters
- ***Main engine***
- ***Thrust vector control***
- Propulsion drive electronics

Solar Generator
- ***Solar cells***
- Solar array wing assembly

Solar array drive assembly
- Solar array drive mechanism
- Solar array drive electronics

Data Management
- Command & management unit
- ***Network Interface Cards***

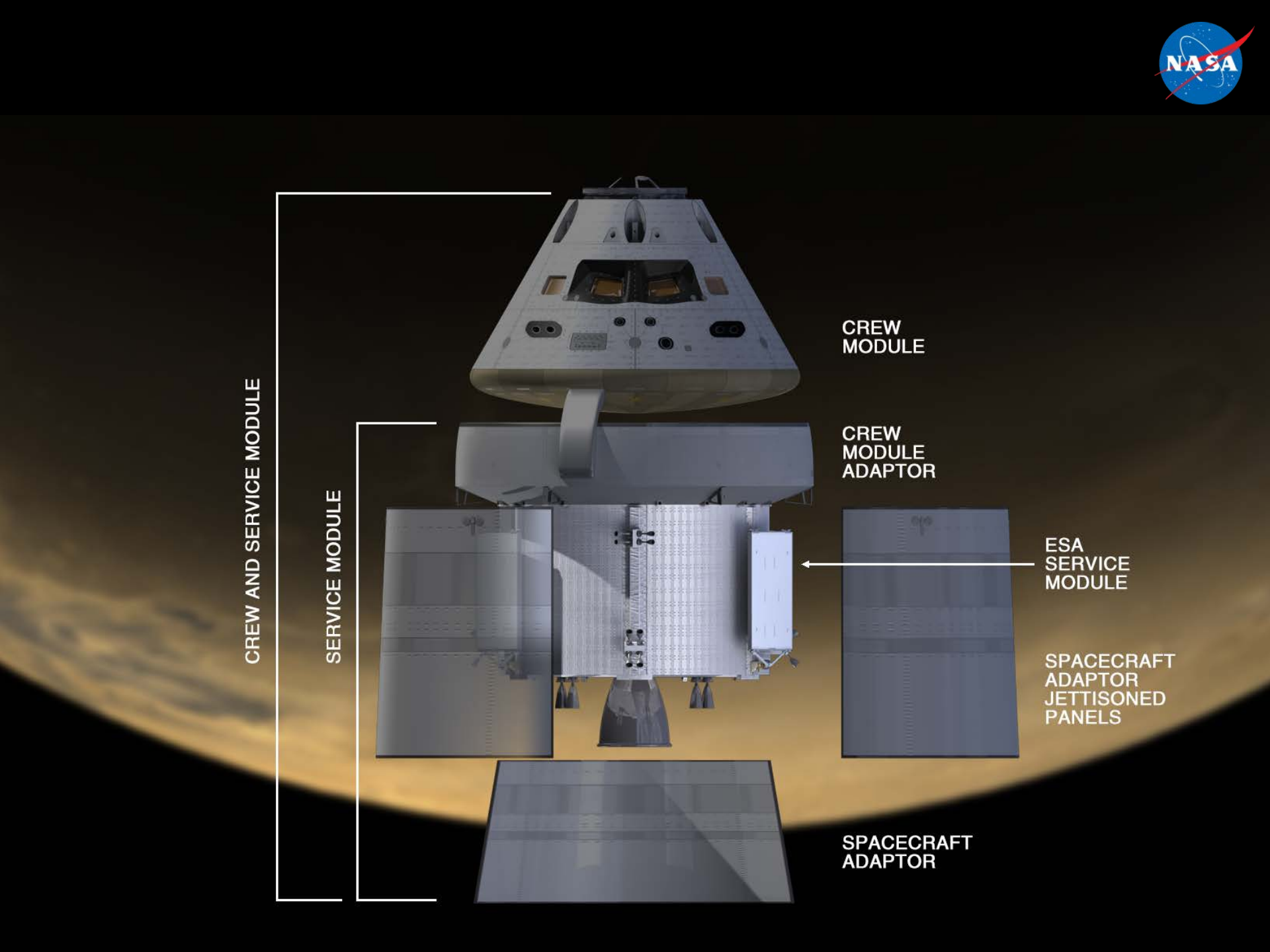
SM Harness

Thermal Control
- Passive thermal control
- Active thermal control
- Thermal control unit

Consumable Storage
- Water delivery system
- Gas delivery system

Electrical Power
- Power control & distribution unit

Note: Items in bold italic are the agreed to NASA contributions to the ESA SM


CREW AND SERVICE MODULE
SERVICE MODULE
CREW MODULE
CREW MODULE ADAPTOR
ESA SERVICE MODULE
SPACECRAFT ADAPTOR JETTISONED PANELS
SPACECRAFT ADAPTOR

Summary

- NASA continues to make great progress with SLS, Orion and GSDO
  - SLS PDR planned for summer 2013
  - GSDO preparing for PDR early 2014
  - Orion on track for EFT-1 in 2014

- SLS, Orion, and GSDO programs remain on track for 2017

Watch the Exploration Systems Development Division Quarterly at
http://www.nasa.gov/multimedia/videogallery/index.html?media_id=161836271