National Aeronautics and Space Administration

NASA Advisory Council Presentation

Status of Exploration Systems Development

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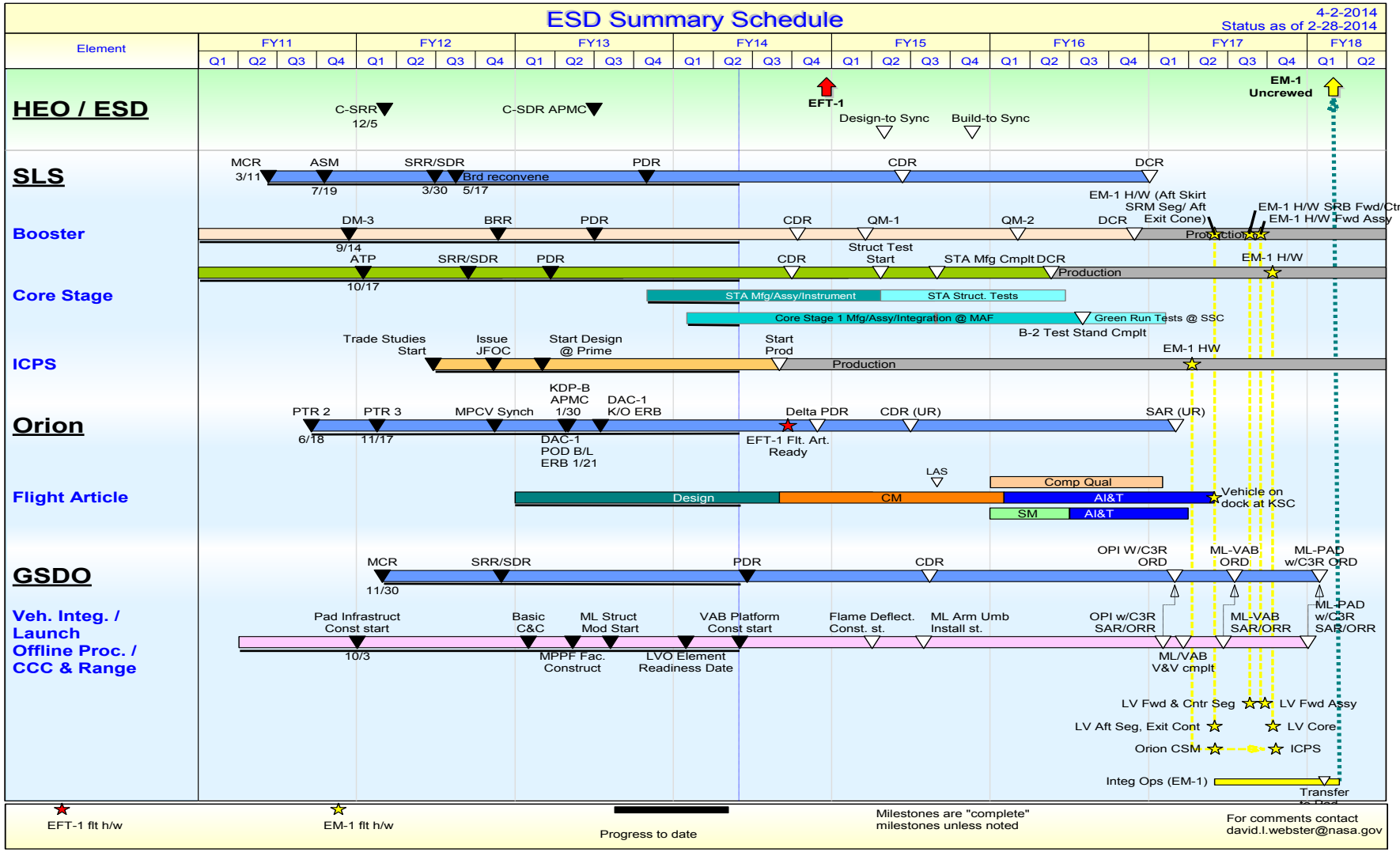
for Exploration Systems Development
April 15, 2014

Exploration Systems Development (ESD) Progress

Acing the Test

Watch the video at: http://youtu.be/pcj37jkpipU

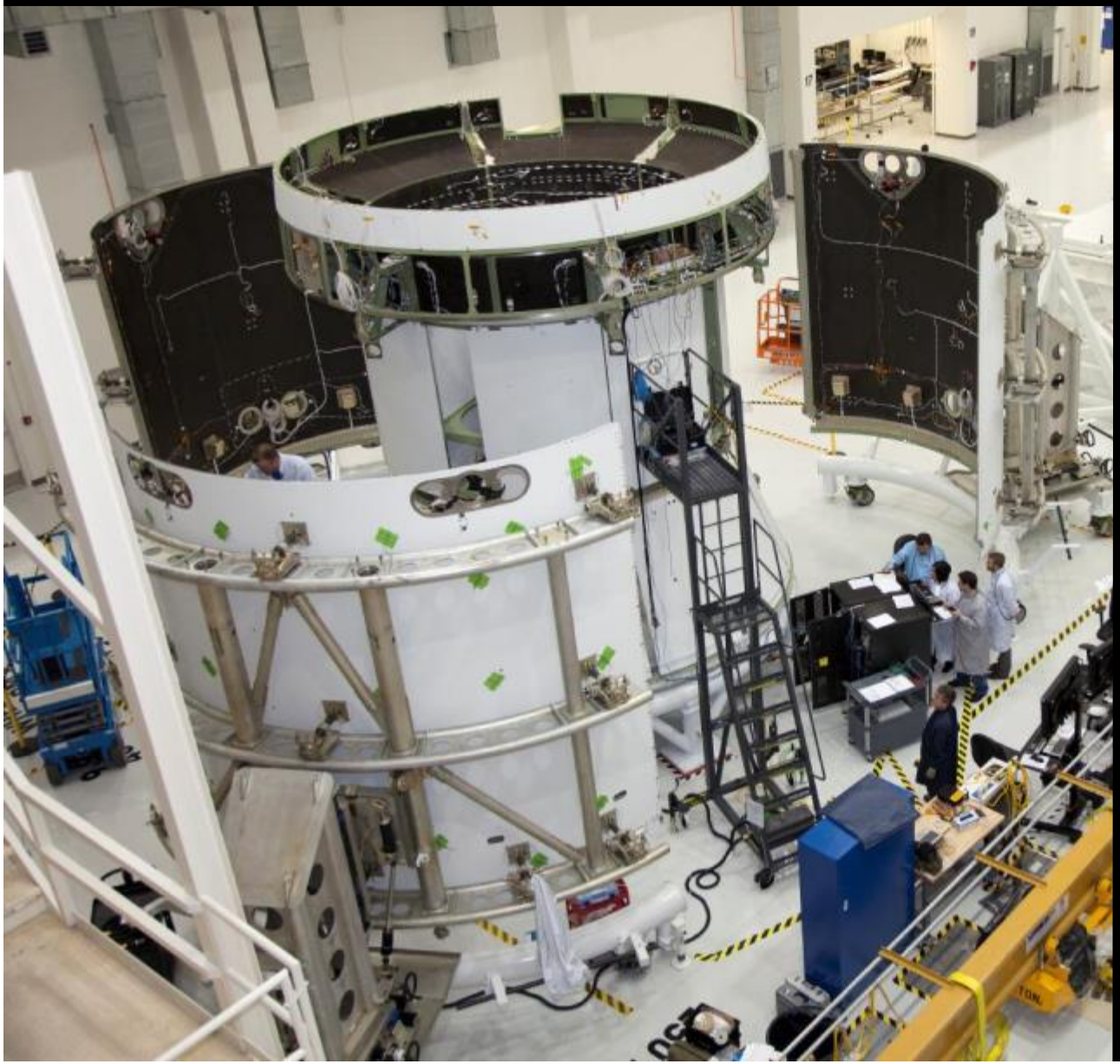

ESD Summary Schedule
4-2-2014
Status as of 2-28-2014
Element
FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18
Q1 Q2 Q3 Q4
HEO / ESD
C-SRR 12/5
C-SDR APMC
EFT-1
Design-to Sync
Build-to Sync
EM-1 Uncrewed
SLS
MCR 3/11
ASM 7/19
SRR/SDR 3/30
Brd reconvene 5/17
PDR
CDR
DCR
Booster
DM-3 9/14
BRR
PDR
CDR
QM-1
QM-2
DCR
EM-1 H/W (Aft Skirt SRM Seg/ Aft Exit Cone)
EM-1 H/W SRB Fwd/Ctr Segs
EM-1 H/W Fwd Assy
Production
Core Stage
ATP 10/17
SRR/SDR
PDR
CDR
Struct Test Start
STA Mfg Cmplt
DCR
EM-1 H/W
Production
STA Mfg/Assy/Instrument
STA Struct. Tests
Core Stage 1 Mfg/Assy/Integration @ MAF
Green Run Tests @ SSC
B-2 Test Stand Cmplt
ICPS
Trade Studies Start
Issue JFOC
Start Design @ Prime
Start Prod
EM-1 HW
Production
Orion
PTR 2 6/18
PTR 3 11/17
MPCV Synch
KDP-B APMC 1/30
DAC-1 K/O ERB
DAC-1 POD B/L ERB 1/21
Delta PDR
EFT-1 Flt. Art. Ready
CDR (UR)
SAR (UR)
Flight Article
LAS
Comp Qual
Design
CM
AI&T
Vehicle on dock at KSC
SM
AI&T
GSDO
MCR 11/30
SRR/SDR
PDR
CDR
OPI W/C3R ORD
ML-VAB ORD
ML-PAD w/C3R ORD
Veh. Integ. / Launch Offline Proc. / CCC & Range
Pad Infrastruct Const start 10/3
Basic C&C
ML Struct Mod Start
MPPF Fac. Construct
VAB Platform Const start
LVO Element Readiness Date
Flame Deflect. Const. st.
ML Arm Umb Install st.
OPI w/C3R SAR/ORR
ML/VAB V&V cmplt
ML-VAB SAR/ORR
ML-PAD w/C3R SAR/ORR
LV Fwd & Cntr Seg
LV Fwd Assy
LV Aft Seg, Exit Cont
LV Core
Orion CSM
ICPS
Integ Ops (EM-1)
Transfer
EFT-1 flt h/w
EM-1 flt h/w
Progress to date
Milestones are "complete" milestones unless noted
For comments contact david.l.webster@nasa.gov

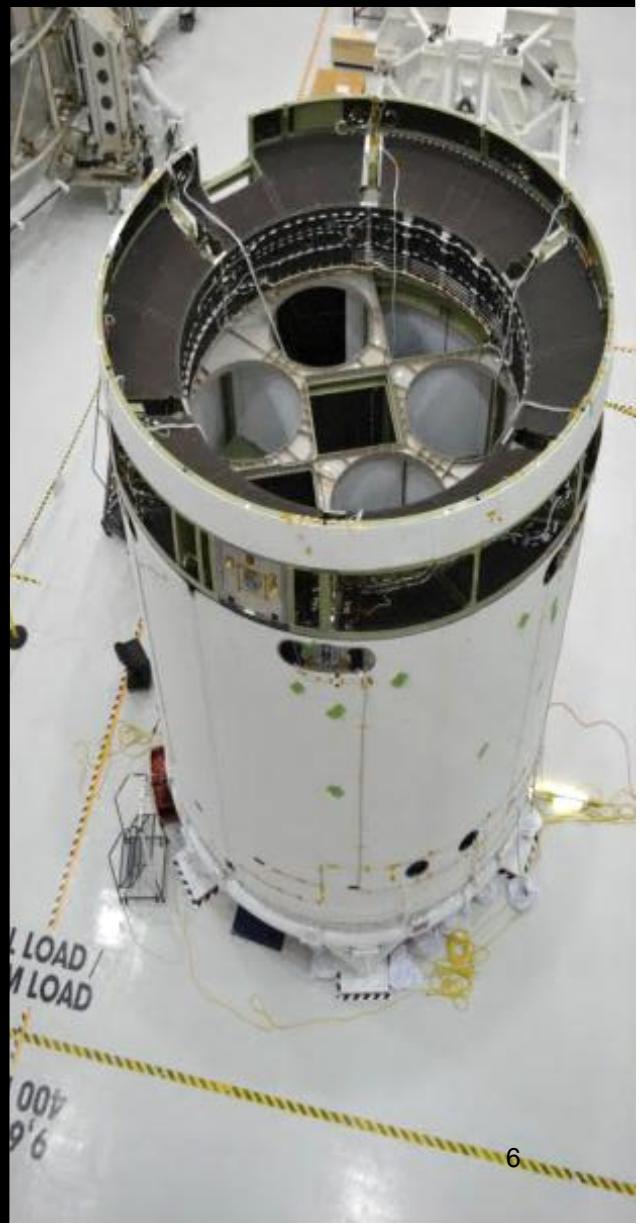
Orion Crew Module

Functional Testing Underway – On Track for May Delivery

Orion Service Module

Assembly Complete – Ready for Integration

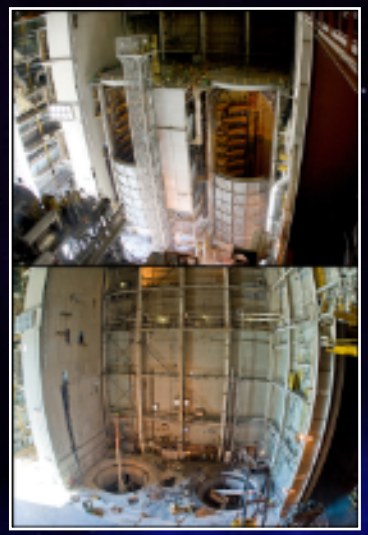




Orion Launch Abort System

Assembly Complete – Ready for Integration

SLS Core Stage Major Welding Tools at Michoud Assembly Facility



Building the world's largest rocket in a state-of-the-art facility.

SLS Core Stage Vertical Assembly Center Progress Tower Installation Complete in June 2014

SLS Core Stage/Main Engines Green-Run
B-2 Test Stand Progress

SLS Avionics Progress

Integrated and powered up hardware, software, and operating systems for an inaugural run.

SLS RS-25 Main Engine Test-Firing

Scheduled for summer 2014 at Stennis Space Center.

SLS Booster Progress

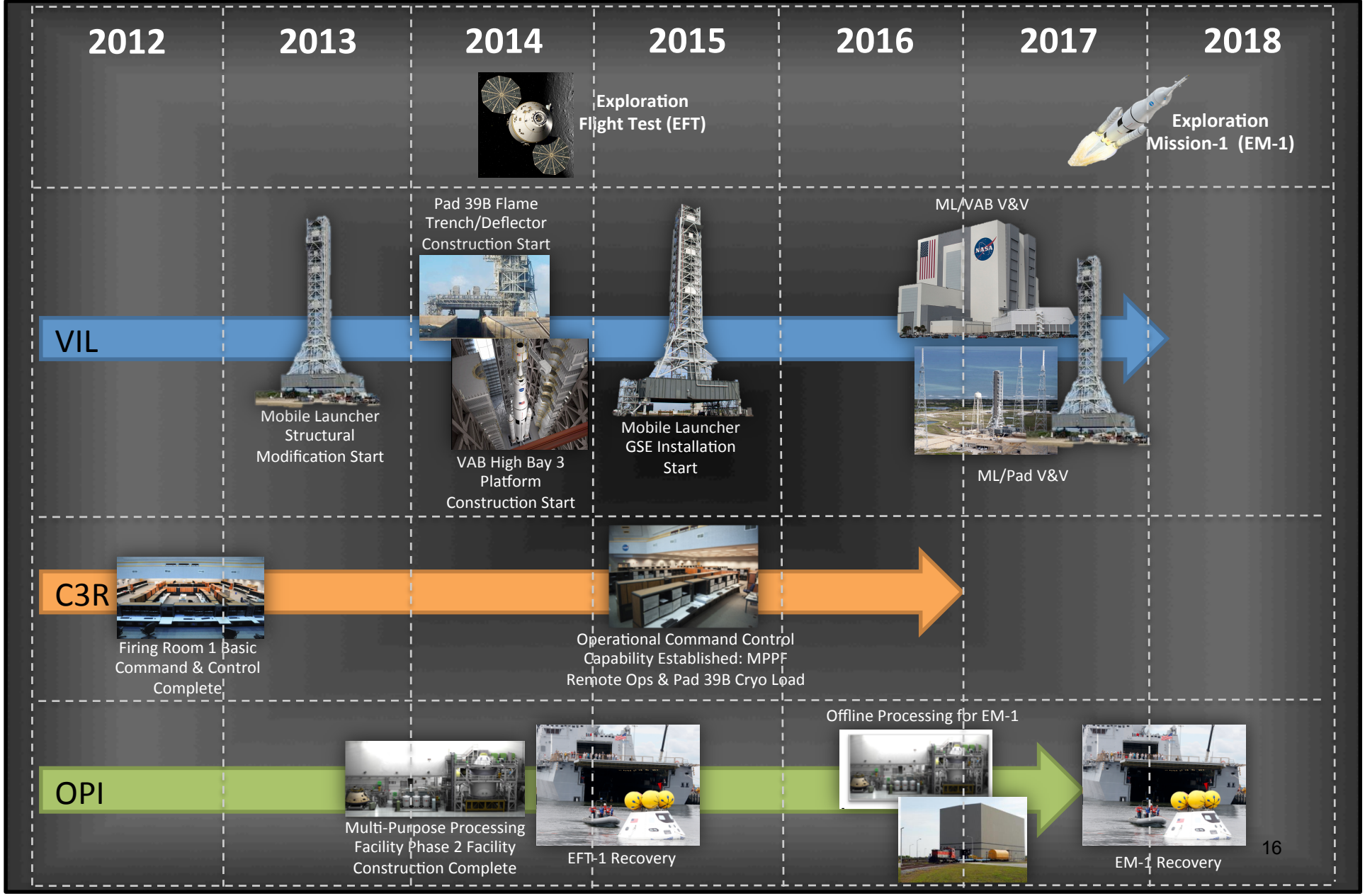
Testing upgrades for the solid rocket boosters.

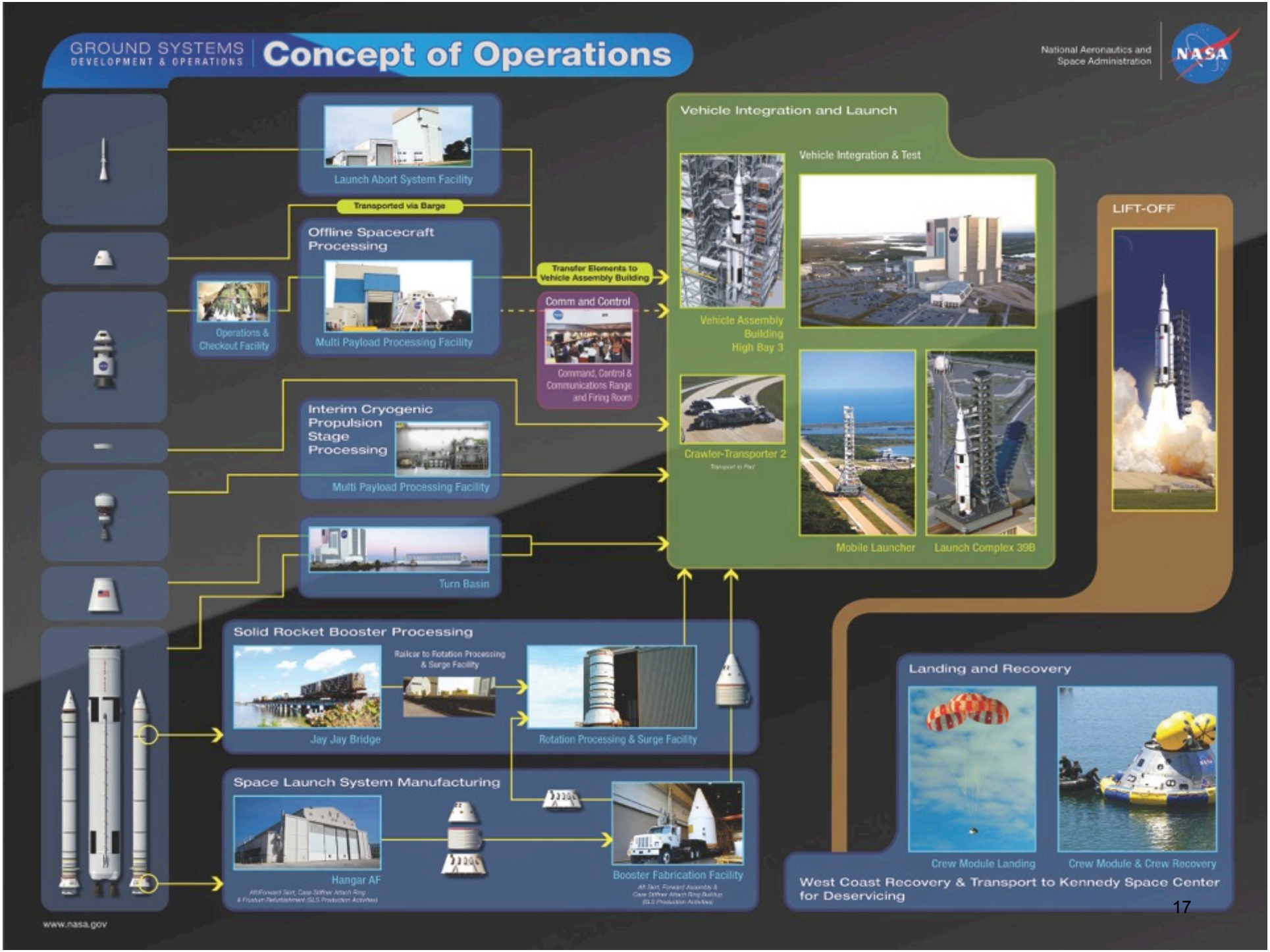
GSDO
GROUND SYSTEMS
DEVELOPMENT & OPERATIONS

14

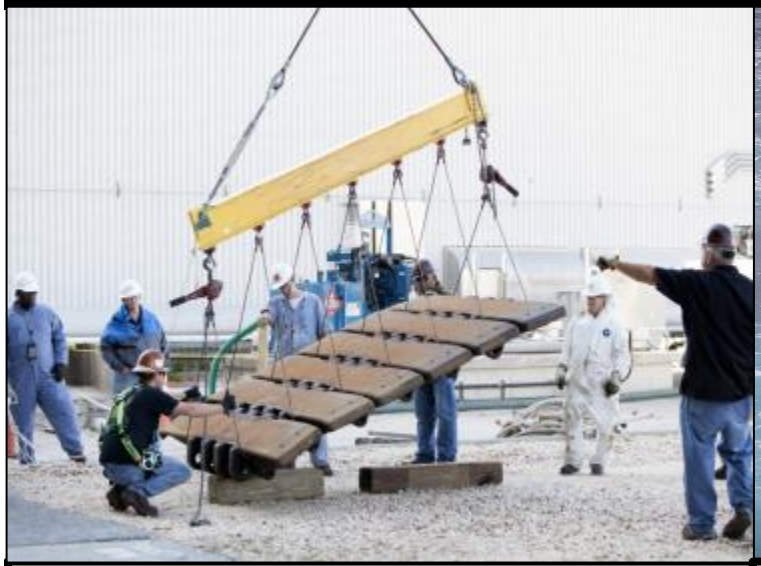
GSDO – Exploration Begins Here!

GSDO – Path to EM-1




GROUND SYSTEMS
DEVELOPMENT & OPERATIONS
Concept of Operations
National Aeronautics and Space Administration
NASA
Launch Abort System Facility
Transported via Barge
Offline Spacecraft Processing
Operations & Checkout Facility
Multi Payload Processing Facility
Transfer Elements to Vehicle Assembly Building
Comm and Control
Command, Control & Communications Range and Firing Room
Interim Cryogenic Propulsion Stage Processing
Multi Payload Processing Facility
Turn Basin
Vehicle Integration and Launch
Vehicle Integration & Test
Vehicle Assembly Building High Bay 3
Crawler-Transporter 2
Mobile Launcher
Launch Complex 39B
LIFT-OFF
Solid Rocket Booster Processing
Railcar to Rotation Processing & Surge Facility
Jay Jay Bridge
Rotation Processing & Surge Facility
Space Launch System Manufacturing
Hangar AF
Booster Fabrication Facility
Landing and Recovery
Crew Module Landing
Crew Module & Crew Recovery
West Coast Recovery & Transport to Kennedy Space Center for Deservicing
www.nasa.gov

GSDO Accomplishments

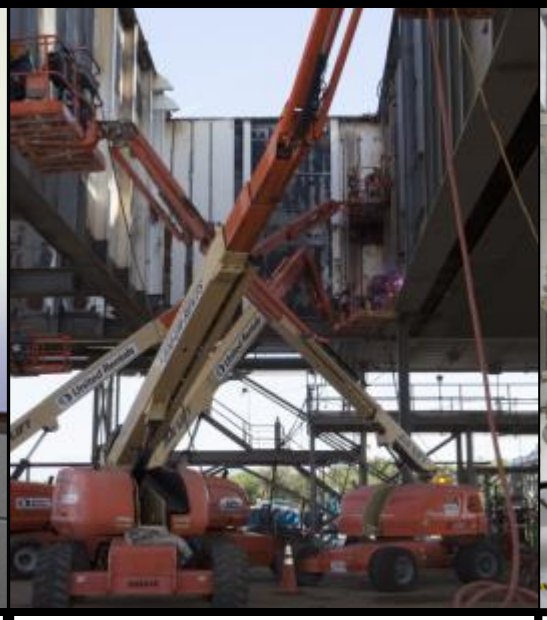


CT-2 Gear Box Removal

Orion Underway Recovery Test

CT-2 Roller Bearings

Preliminary Design Review



Mobile Launcher Upgrades

Orion Production

GSDO Accomplishments

MRAP

Record and Playback System

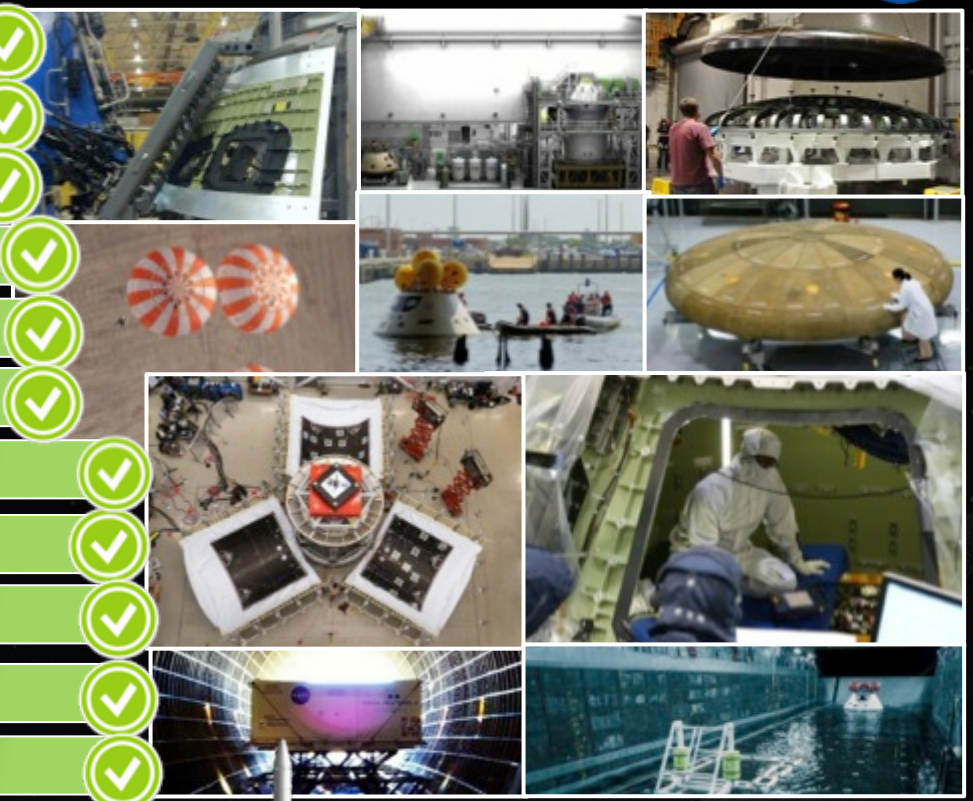
Telemetry Updates

Flight Following in FR1

Building to Exploration Flight Test-1

ACCOMPLISHMENTS

- 05/2012 Final crew module welding completed at Michoud
- 06/2012 Crew module to KSC
- 03/2013 Heat shield to Textron for Avcoat application
- 10/2011 - 7/2013 Nine successful parachute tests
- 08/2013 Stationary recovery test at Norfolk
- 09/2013 Avcoat application completed, testing begins
- 10/2013 Orion power-on at KSC
- 11/2013 Successful fairing separation test
- 12/2013 Heat shield shipment to KSC
- 02/2014 EFT-1 Service Module complete
- 02/2014 Underway Recover Test (URT)

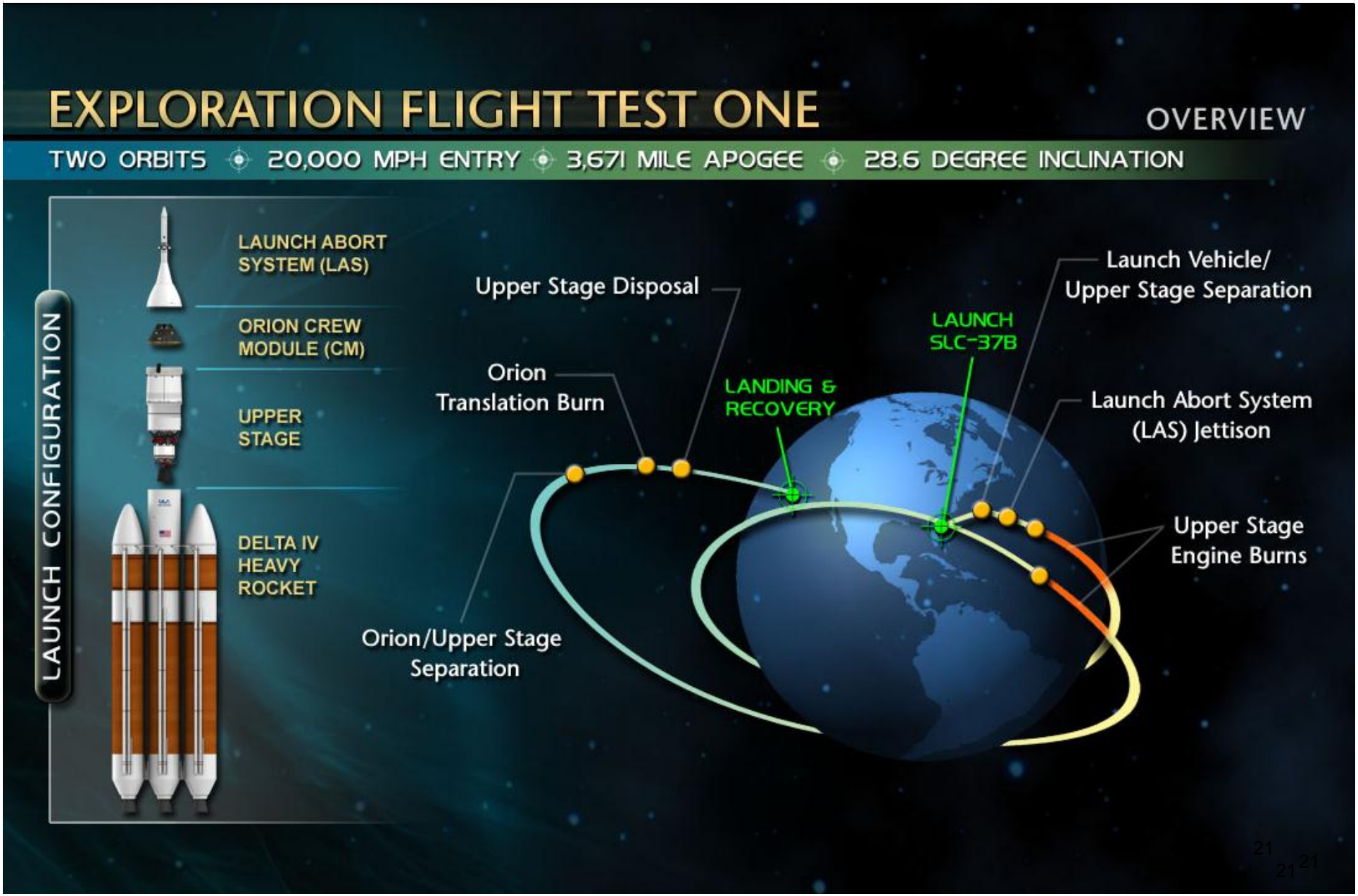


WHAT'S NEXT

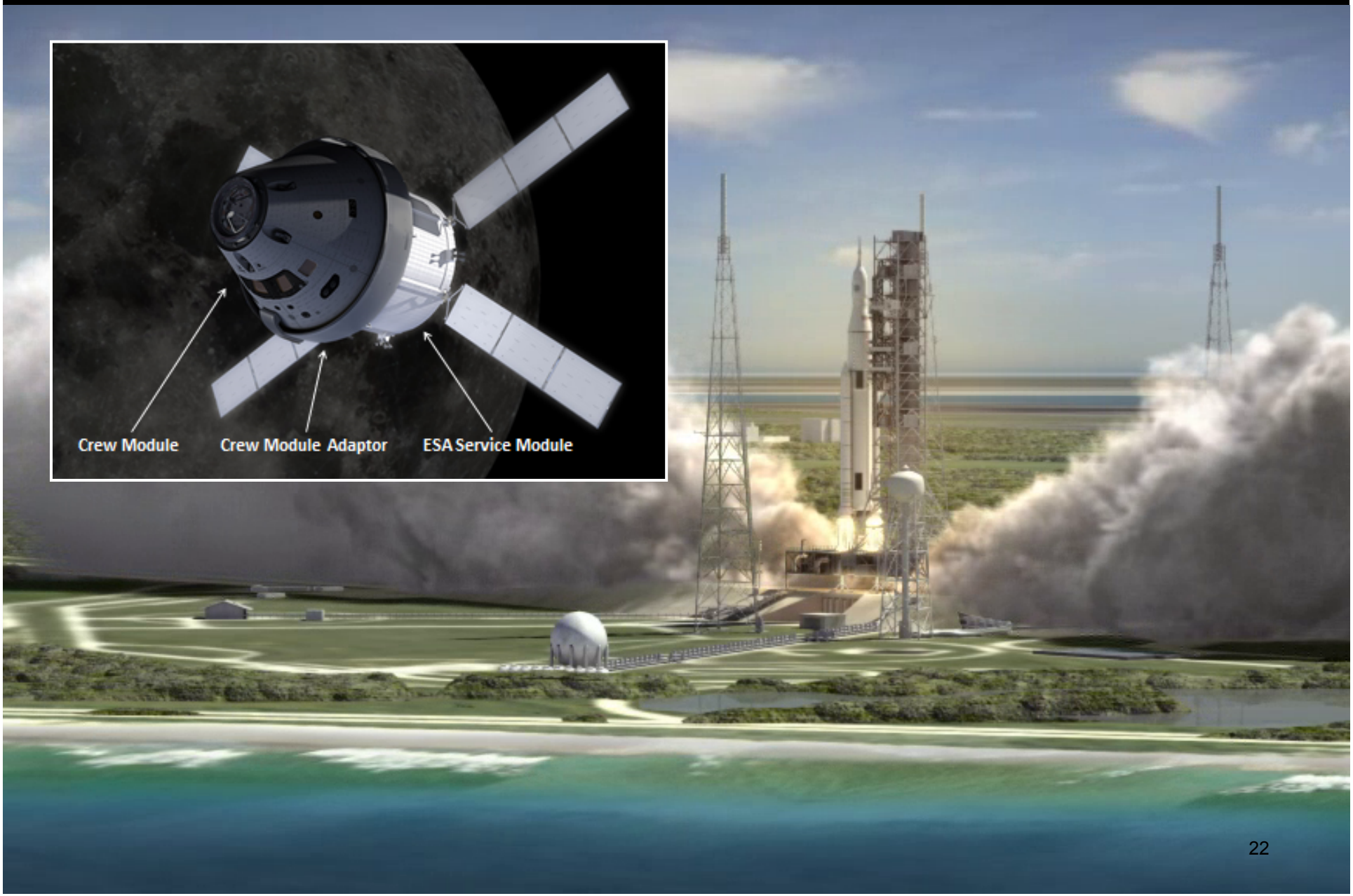
- 05/2014 Heat Shield installation at KSC
- 05/2014 EFT-1 Crew Module/Service Module mate, KSC
- 06/2014 Backshell panel installation to crew module, KSC
- 07/2014 Flight vehicle ready for ground operations

December 2014 EFT-1 launch, KSC
Orion recovery and return to KSC

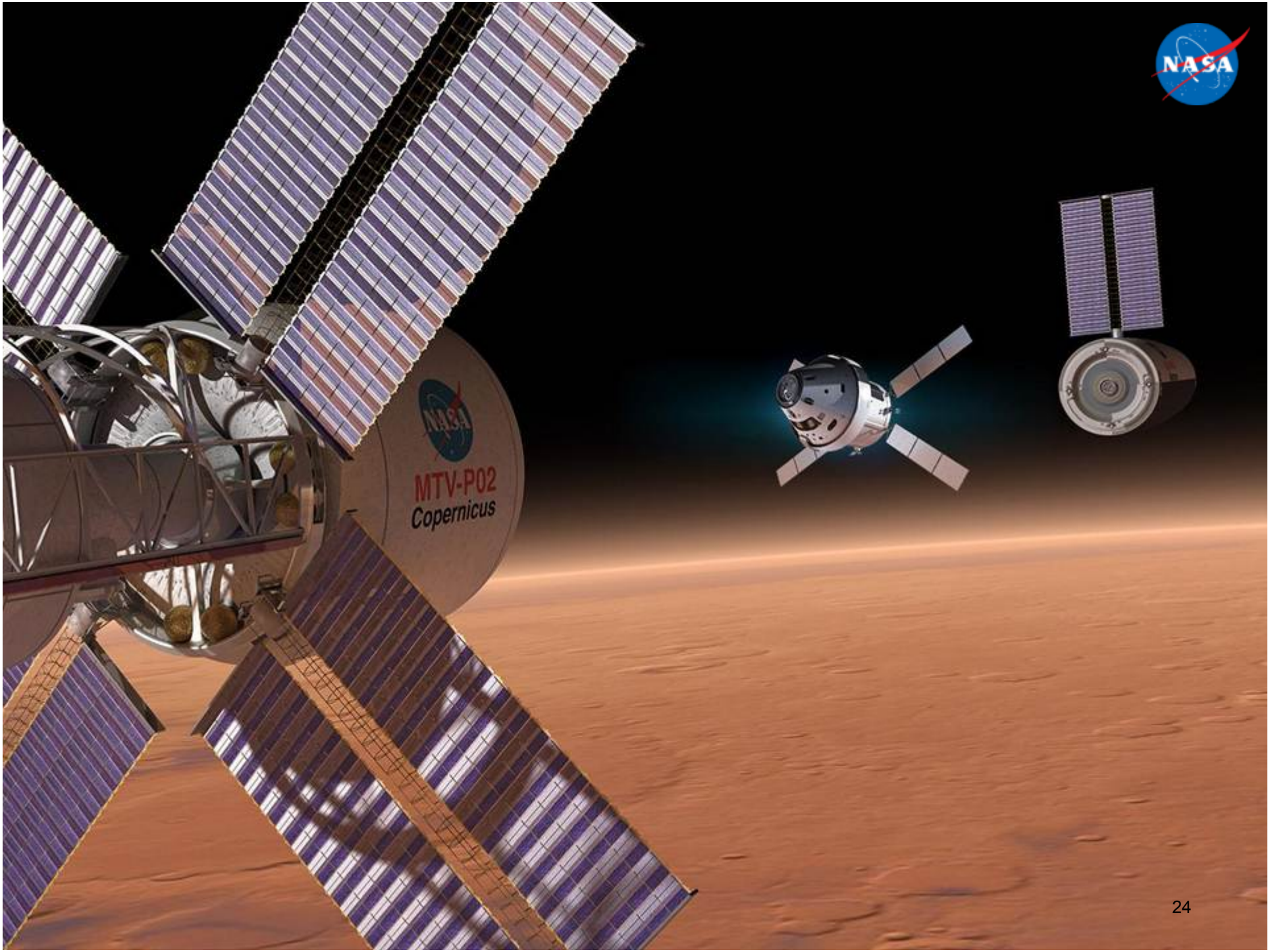
2014


EXPLORATION FLIGHT TEST ONE
OVERVIEW
TWO ORBITS
20,000 MPH ENTRY
3,671 MILE APOGEE
28.6 DEGREE INCLINATION
LAUNCH CONFIGURATION
LAUNCH ABORT SYSTEM (LAS)
ORION CREW MODULE (CM)
UPPER STAGE
DELTA IV HEAVY ROCKET
Upper Stage Disposal
Orion Translation Burn
Orion/Upper Stage Separation
LANDING & RECOVERY
LAUNCH SLC-37B
Launch Vehicle/ Upper Stage Separation
Launch Abort System (LAS) Jettison
Upper Stage Engine Burns

Exploration Missions 1 & 2



Asteroid Redirect Mission


MTV-P02
Copernicus

Partners & Suppliers in 48 States

25+ 10-25 <10

Current as of February 2014

Summary

- NASA continues to make great progress with SLS, Orion and GSDO
  - Orion/EFT-1 Crew Module functional testing is complete with Service Module and Launch Abort System assembly complete and ready for integration
  - SLS Core Stage fabrication and assembly facility development in process and test stand construction in work to support core stage/main engines testing
  - GSDO completed PDR in March 2014 and facility/GSE modifications on track to support operations

- SLS, Orion, and GSDO programs remain on track for the first integrated test flight, Exploration Mission-1.

List of Acronyms

CT-2	Crawler Transport #2
EFT-1	Exploration Flight Test #1
EM-1	Exploration Mission #1
ESA	European Space Agency
FR-1	Firing Room #1
GSDO	Ground Systems Development and Operations
ICPS	Interim Cryogenic Propulsion Stage
KSC	Kennedy Space Center
ML	Mobile Launcher
MPPF	Multi Payload Processing Facility
MRAP	Mine Resistant Ambush Protected
SLS	Space Launch System
VAB	Vehicle Assembly Building
V&V	Verification and Validation