

National Aeronautics and Space Administration



# Secondary Payloads Overview

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# Background



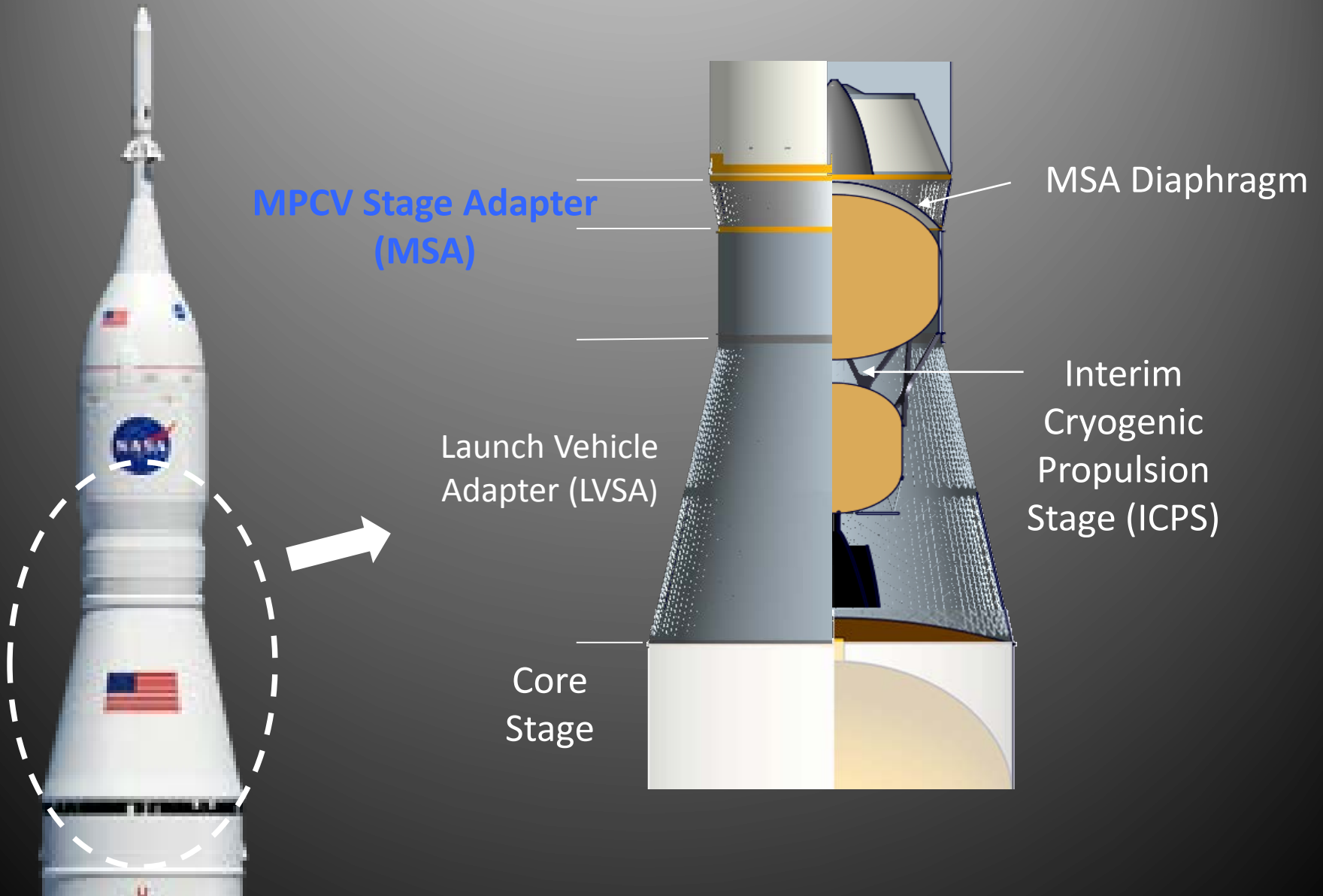
**On January 6th 2014, HEOMD approved Level I requirements for accommodating secondary payloads on SLS and Orion**

- Presentation included results of ~6 month study and overall integration approach

SLS followed Level I requirement approval with corresponding Level II and Level III requirement additions for accommodating and integrating secondary payloads.

**SLS is chartered to perform all its payload integration activities through the Spacecraft/Payload Integration and Evolution (SPIE) element office.**

# SLS Configuration



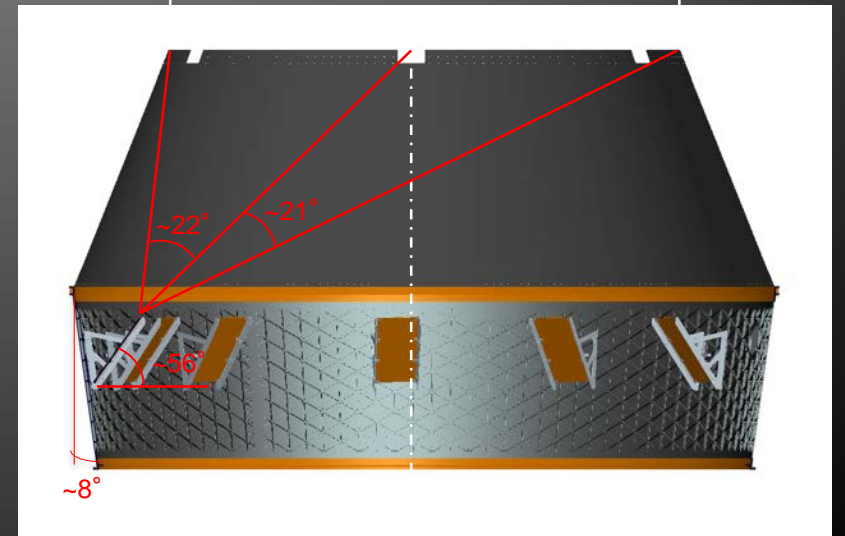
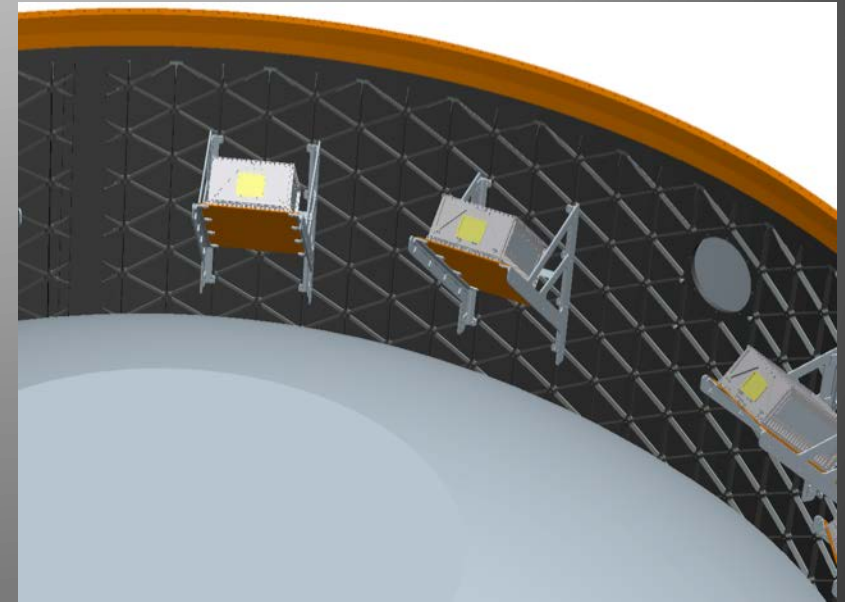
# SLS Secondary Payload Accommodations

Eleven 6U/12U payload locations  
6U volume/mass is the current standard (14 kg payload mass)

Payloads will be “powered off” from turnover through Orion separation and payload deployment

Payload Deployment System Sequencer; payload deployment will begin with pre-loaded sequence following MPCV separation and ICPS disposal burn

Payload requirements captured in Interface Definition and Requirements Document





# SLS Secondary Payload Accommodations



Payloads will provide deployers per NASA provided specifications

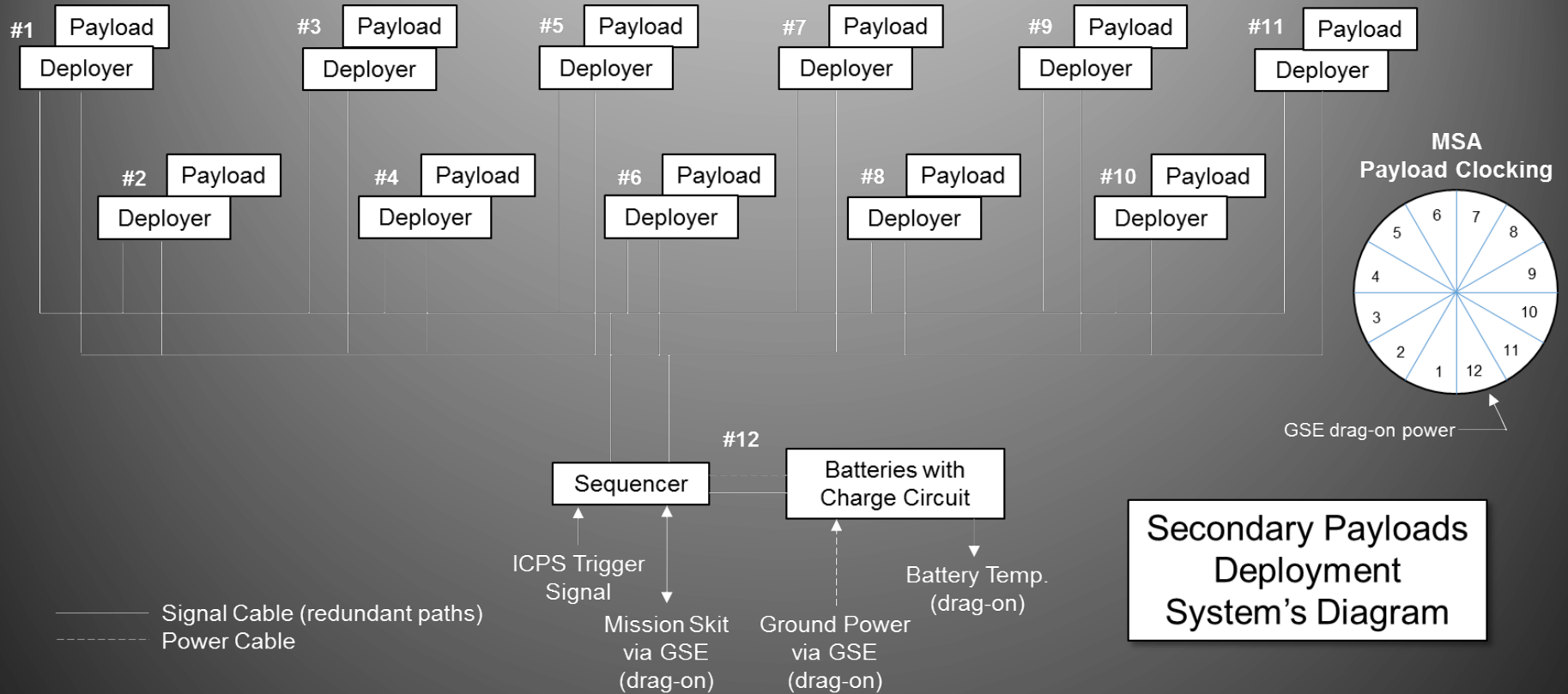
No resources or telemetry provided by launch vehicle once installed

State vector data at deployment will be provided to ground operators for predictions

Payloads responsible for acquiring communication and telemetry bandwidth



# Secondary Payload Deployment System (SPDS)





# Deployer Characteristics

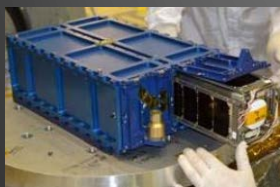
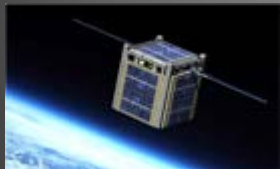
Deployer is 6U COTS w/modifications

- COTS Features
  - Externally accessible separation connector
  - Redundant signal for door activation
  - Accommodates 14 kg payloads
  - Spring jettison rate of 4.6 ft/sec
  - Access for battery charging, once integrated
  - No pyrotechnic devices
  - Existing GSE attachment/handling points
  - External conductive surface, chassis grounding
- Modifications
  - Addition of captive fasteners for mounting
  - Possible addition of vibration isolators
  - Possible addition of thermal blanket

Note: Last two modifications are payload driven based on their designs.

# Scope and Responsibility

## Payload Customers



Secondary Payloads proposed by AES, STMD, SMD and other stakeholders

Payload Hardware and Deployer

## ESD

Baseline Mission Objectives for each EM



Coordinate with Payload Sponsors to develop proposed manifest

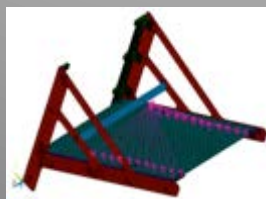


Coordinate inputs from Integration Team and payload sponsors to baseline flight manifest

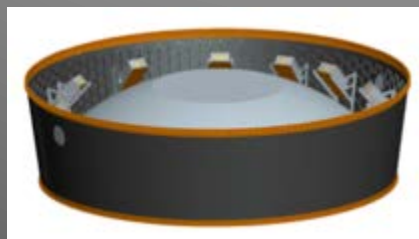
Level I Requirements

Payload & Hardware Integration Teams

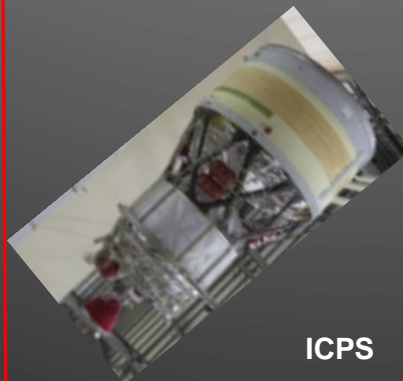
## Payload Mission Integration



Bracket DDT&E



MSA Modifications



ICPS

## SLS SPIE

Secondary Payload Integration Team

Payload Mission Integration (products, analysis, verification, etc)

Ancillary Hardware (Sequencer, Batteries, supporting cables)

Deployer Certification requirements

## SLS and ESD (vehicle & cross-program integration)



MPCV



Payload Complement

MSA

ICPS



GSDO



Integrated Spacecraft Payload Element

Integrated SLS

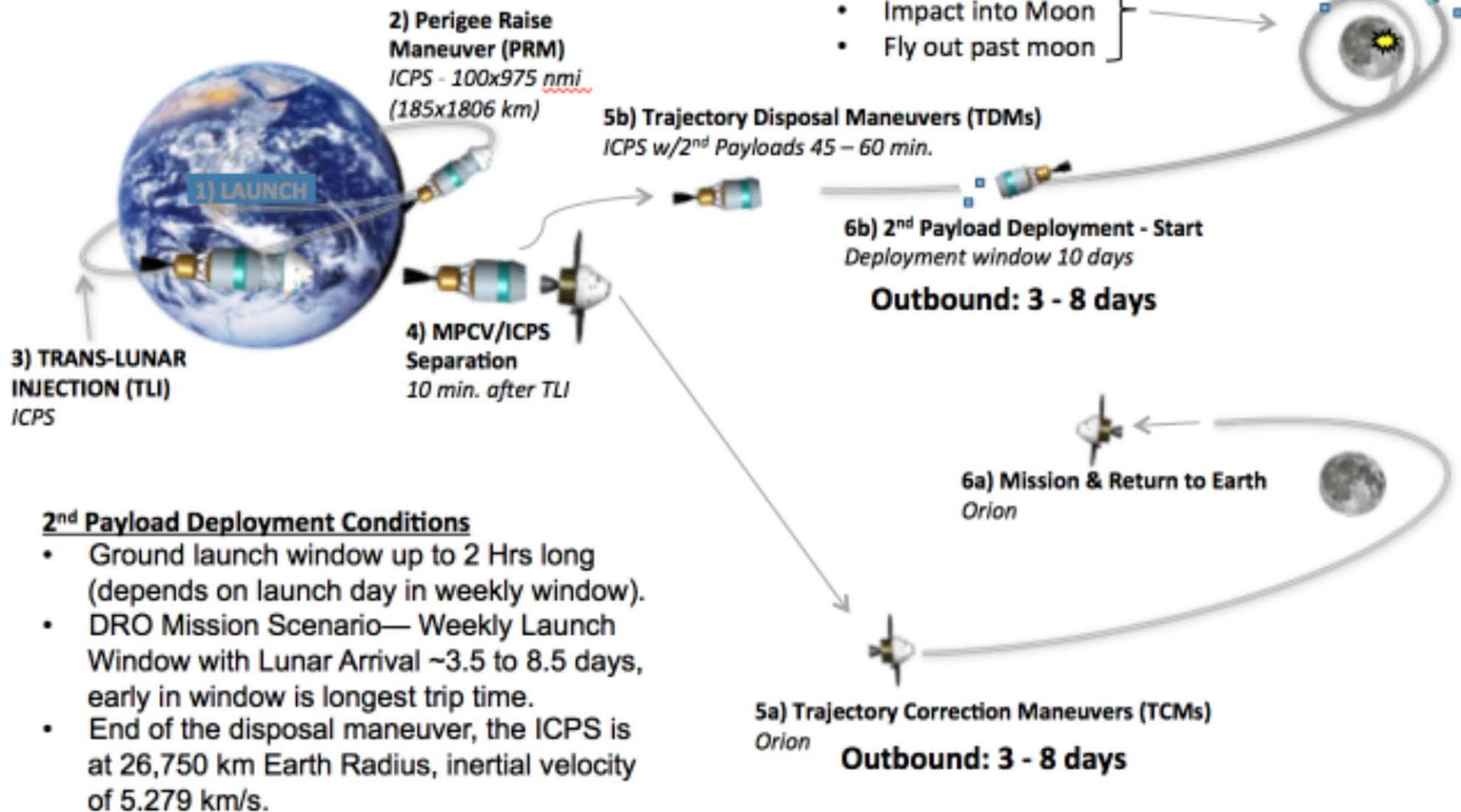


# Payload Deployment



## Total Payload Deployment System

Mission Duration: 10 days

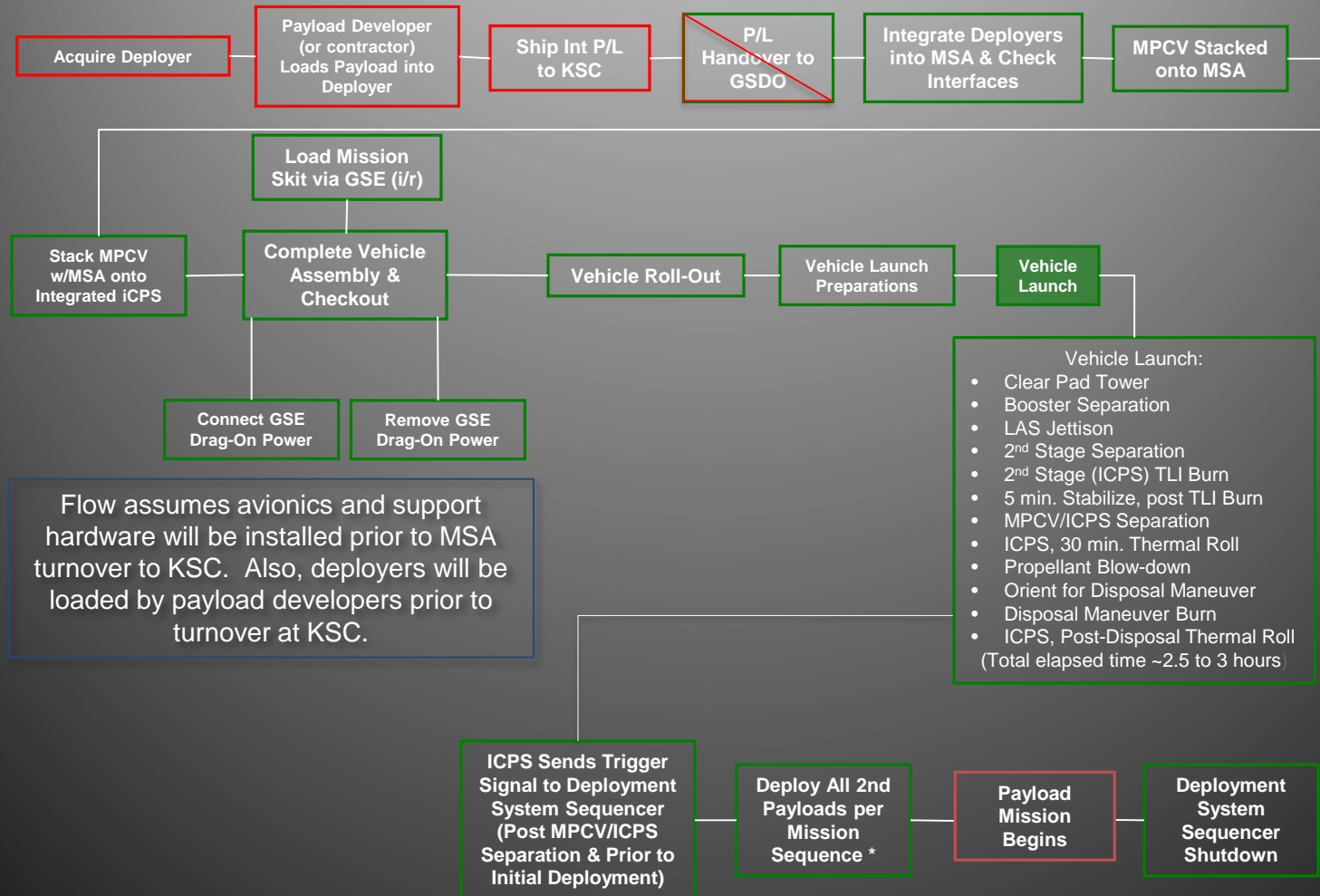


# Physical Integration and Operations Flow



Payload  
Actions

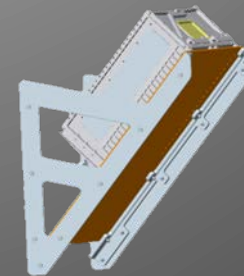
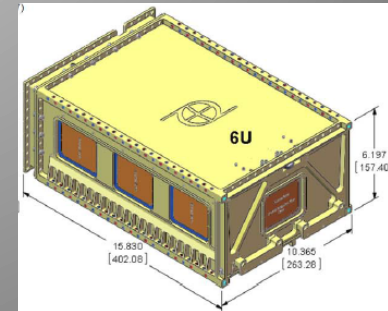
SLS/GSDO  
actions



\* Deployment sequence needs a delay between individual deployments to guard against payload collisions w/each other. Payload activation (envelope expansion & signal transmission) will be delayed to assure clearing ICPS.

# Payload Preparations w/MSA (ground ops)

- Integrated payload/deployers handed over to GSDO (DD1149)
- Deployers loaded into MSA & secured to bracket (crane ops)
- Electrical connections made & grounding/bonding test performed
- Orion mated to MSA
- Orion/MSA lifted & mated to ICPS
- During vehicle check out & prep. }  
payload batteries charged & mission skits loaded in sequencer } ~ 1 week
- Vehicle rolled out & wet rehearsal
- Vehicle rolled back for final prep.
- Vehicle rolled out & launched



**Note:** Access to ground connection in VAB is TBD

# Verification and CoFR



- **Payloads will be responsible for providing verification data for requirements and interfaces captured in ICD**
  - Direct Requirements flow down, Interface Requirements, Derived requirements
  - Deployer verification will be provided by LSP for payloads utilizing their procurement activity.
- **Safety verification will be accomplished through proposed safety review process, expected at Phase III review**
- **Verification will accomplish certification of deployer, payload and integrated payload certification for EM-1**
- **Certificate of Flight Readiness (CoFR) endorsements will be required from payloads to support integrated payload complement and vehicle flight readiness**

# Secondary Payloads Concept of Operations



- ◆ Payloads Manifested NLT Dec 2015 (based on Dec 2017 launch)
- ◆ ICD developed for each payload detailing interface and safety requirements and applicable verification requirements
- ◆ Phased Safety Reviews conducted
  - ◆ Phase 0/I (at PDR level design maturity)
  - ◆ Phase II (at CDR level design maturity)
  - ◆ Phase III (prior to payload delivery to KSC)
- ◆ Cubesat delivered to LSP integrator for integration into dispenser and final testing
- ◆ Final verifications complete
- ◆ Integrated Payload (dispenser/cubesat) delivered to GSDO
- ◆ Payload Integrated in MSA
- ◆ Final Battery charging prior to first rollout to pad



# Secondary Payloads Status

- ◆ **Key Documentation**

- ◆ **Increment Definition and Requirements Document**

- ◆ Direct requirements flow down, interface requirements, safety requirements
    - ◆ Generic Payload Verification Plan included

- ◆ **Secondary Payloads User's Guide**

- ◆ General capabilities, interfaces and processes
    - ◆ Intended to be publicly releasable