Exploration Missions Communication and Tracking Systems

Cuong Tran
M.S. Electrical Engineering, Florida Atlantic University
Communications and Tracking Branch (NEXT)

Introduction to Exploration Mission

Overview

- Exploration Mission-1 (EM-1) will be the first integrated un-crew flight test of NASA's Deep Space Exploration Systems: the Orion spacecraft, Space Launch System (SLS) rocket, with the newly upgraded Exploration Ground Systems at Kennedy Space Center in Cape Canaveral, Florida.
- The primary operations goal of the mission is to assure a safe crew module entry, descent, splashdown, and recovery.
- In addition to sending Orion on its journey around the Moon, SLS will carry 13 small satellites that will perform their own science and technology investigations.

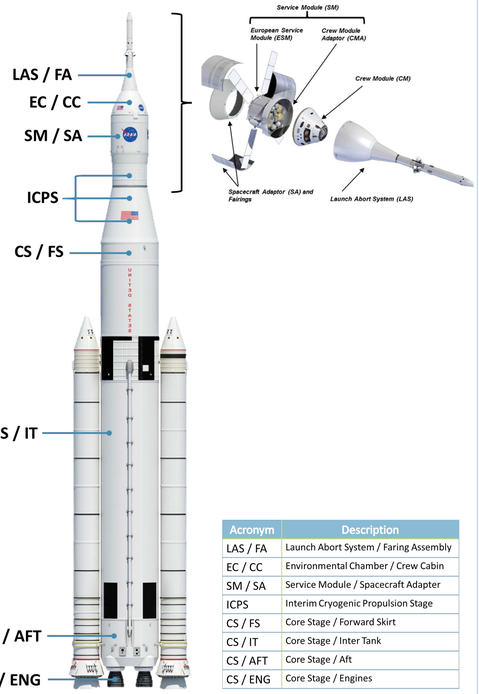

Figure 1. SLS Interfaces

Acronym	Description
LAS / FA	Launch Abort System / Faring Assembly
EC / CC	Environmental Chamber / Crew Cabin
SM / SA	Service Module / Spacecraft Adapter
ICPS	Interim Cryogenic Propulsion Stage
CS / FS	Core Stage / Forward Skirt
CS / IT	Core Stage / Inter Tank
CS / AFT	Core Stage / Aft
CS / ENG	Core Stage / Engines

Table 1: Acronym description

Questions?

- How do we communicate with the spaceship?
- How do we locate the spaceship when it is out in space?
- How do we get images from the spaceship?

Radio Frequency Communication Views

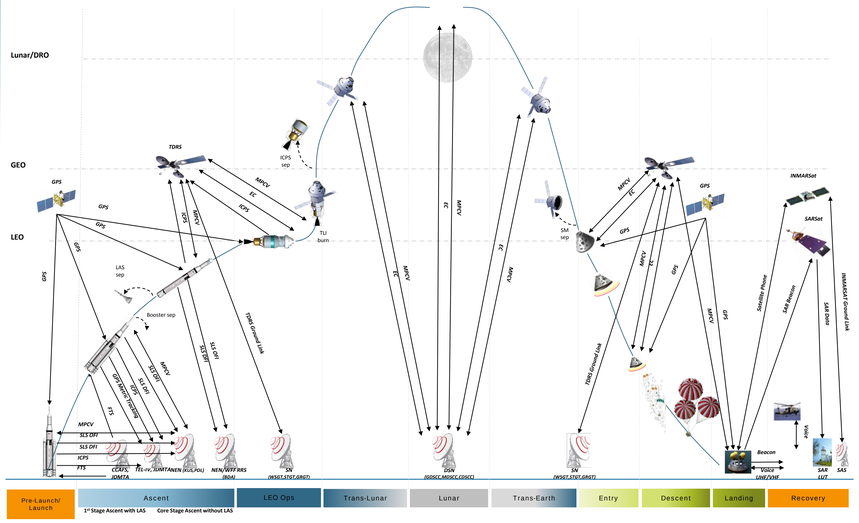

Figure 2: Launch to splashdown diagram

Video Architecture

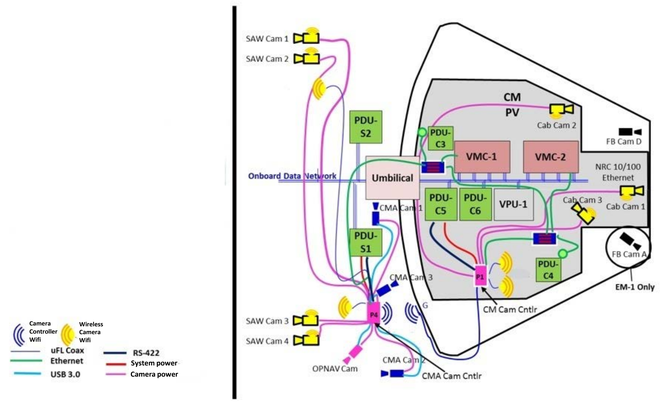

Figure 3: Video architecture for CM and CMA

Mission Phase	CM Cam 1-3	SAW Cam 1-4	CMA Cam 1-2	CMA Cam 3	FB Cam
Launch	X	X	X		
SM Fairing Jettison	X	X	X		
LAS Jettison	X	X	X		
Solar Array Deploy		X	X		
MPCV / ICPS Sep		X	X		
Inspection		X			
PAO Opportunities	X	X	X		
CM/SM Separation		X		X	
CM Entry Interface	X				X
CM Landing	X				X

Table 2: Camera purposes

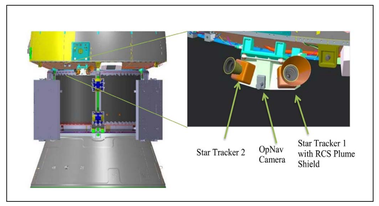

Figure 4: Optical Navigation camera and Star Trackers

Laboratories Tests

Orion simulation test

Figure 5: Transmitting and receiving communication signal diagram

Orion CMA antenna coax cable test

Figure 6: Connector – transmission line – antenna signal on network analyzer

Firing room test

Figure 7: Firing room 1 located in Launch Control Center

Future Missions

- EM – 2 will be the first crewed mission around the Moon orbit to deliver the first element of the Lunar Orbital Platform-Gateway (LOP-G) project.
- EM – 3-8 will bring astronauts back to the Moon orbit to complete the LOP-G project.

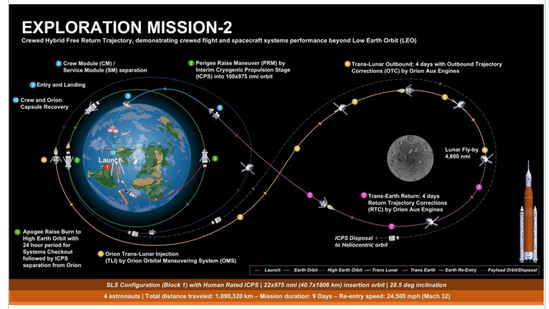

Figure 7: Exploration mission's free return trajectory

Accomplishments and Goals

Accomplishments:

- Familiarize with Kennedy Space Center's mission.
- Orion simulation testing at Radio frequency telemetry station (RFTS).
- Antenna coax cable on Orion Service Module testing.
- Support on updating and testing software at firing room.
- Update new training PowerPoint on the cameras.

Personal Goals:

- Graduate in December 2019 with my M.S Electrical Engineering and be a full time KSC Engineer to make meaningful contributions to bring human back to the Moon and onward to Mars!

Acknowledgements

- Mentors: David Wivholm
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Contact Information

Cuong Tran
NE_XT
Cuong.m.tran@nasa.gov
Phone #: (561) 412-6894 (cell)