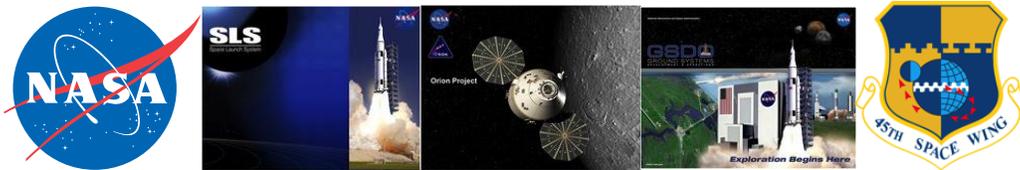


C. Johnson Space Center (JSC)

1. Human Exploration Range Safety Panel (HERSP)

The Human Exploration Range Safety Panel (HERSP) continued to manage range safety activities for SLS, MPCV/Orion, and GSDO Programs within the Human Exploration and Operations Mission Directorate. Co-chaired by NASA and the USAF 45 SW and with strong representation across all three NASA programs, the JSC Astronaut Office, Safety and Mission Assurance, NASA Range Safety, and Air Force Range Safety, the HERSP works technical issues through its three associated working groups: Flight Analysis, Flight Safety System, and Range Ground Operations.

Building upon the Program Introduction for Orion/SLS Exploration Missions (EM) that was presented to the USAF 45 SW in 2012, the HERSP continued its efforts towards tailoring requirements and planning public safety analyses for these flights. The requirements tailoring spans eight volumes, ultimately resulting in agreements between NASA and the USAF regarding policies and procedures, roles and responsibilities, and design/test plans across several aspects of ground operations, the SLS Flight Safety System, and SLS/MPCV trajectory design.



2. MPCV Exploration Flight Test 1 (EFT-1)

JSC continued to provide range safety expertise to the broader EFT-1 team, supporting safety meetings and reviewing analysis products, as focus has shifted towards operations for the upcoming flight test. In addition, JSC personnel continued to collaborate with the FAA to facilitate steps in the commercial licensing process and develop a better understanding of the unique licensing aspects of this flight.



FIGURE 17: PREPARATION FOR MPCV EXPLORATION FLIGHT TEST 1

3. Exploration Missions (EM) EM-1 and EM-2

In 2013, JSC began focusing considerable attention on the upcoming Exploration Missions. With crew scheduled to be flown on EM-2, several key crew safety issues have been considered. For instance, the Aborts and Range Safety communities worked together to begin assessments on FTS Delay. Ultimately, the objective of this effort is to ensure public safety while providing sufficient time for the crew to escape the vehicle if a scenario requiring flight termination presents itself. The community also began discussing other key operational issues that will need to be addressed as flight controllers in Mission Control work with their USAF Mission Flight Control Officer (MFCO) counterparts during future crewed missions.



FIGURE 18: MISSION CONTROL ROOM

4. Multi-Purpose Crew Vehicle (MPCV) Ascent Abort 2 (AA-2) Flight Test

The MPCV Flight Test Management Office has identified range safety as a discipline of focus for advancing Ascent Abort 2 (AA-2). Planning and preparation for the upcoming requirements tailoring and trajectory evaluations was a significant focus in 2013. The range flight safety analysis completed for this flight test will be extremely valuable in defining analysis expectations and methodologies that will be employed for future MPCV analyses for EM missions.



FIGURE 19: AA-2 ABORT TEST BOOSTER AND MPCV LAUNCH ABORT VEHICLE

5. Commercial Crew Program (CCP)

The range safety approach for CCP will be different from the traditional NASA programs such as the Space Shuttle. The plan is for range safety to be handled in two phases. During the

development and testing phase, the missions will be flown as NASA missions with a good deal of involvement by NASA. Once CCP transitions into the services phase, the missions will be executed under FAA licenses, and NASA's role will be to maintain insight of the range safety activities.

Given that CCP plans to launch under FAA license, and since these will be the first FAA-licensed launch to include astronauts on the vehicle, NASA has been working very closely with the FAA on a wide range of topics of mutual interest to ensure the success of CCP. Many of these topics are also of interest to the USAF, and the three agencies are in the initial stages of standing up a tri-agency steering group called the Launch and Entry Steering Group (LESG) chaired jointly by the FAA, USAF, and NASA. This group will provide a forum for the three agencies to establish consistent policies regarding range safety, crew safety, and public safety for CCP. The LESG charter is currently being circulated among the agencies for comment and approval with a goal of having the first meeting in 2014.

6. Morpheus Activities at JSC

After last year's failed free flight of the Morpheus 1.5 Vertical Test Bed, the engineers at JSC built a version 1.5B of the vehicle. The new vehicle incorporated a number of upgrades including improved cabling standards and a better isolated navigation sensor platform. Morpheus 1.5B successfully conducted 5 hot fire tests including 3 that were over the newly built flame trench, and 13 tether tests that included engine performance, software mode, backup Inertial Measurement Unit (IMU), Autonomous Landing and Hazard Avoidance Technology (ALHAT), and lateral motion testing. On November 7, 2013, the team conducted a tethered ground take-off and landing test using a specially rigged crane. Total engine burn time during these tests was ~712 seconds.

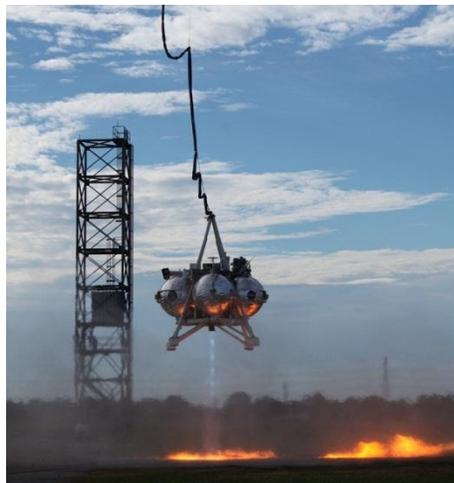


FIGURE 20: MORPHEUS TEST FLIGHT

Videos of Morpheus test flights at KSC are available [here](#) and [here](#).