MS3 – Lunar General Information

MS3-Lunar provides support for a "next generation" mission to the Moon and back, based on the original concepts of the Constellation program. MS3-Lunar can be adapted to other missions such as an ISS rendezvous or Mars landing. In its current configuration, the mission profile includes:

- Prelaunch and ascent of the Orion on a two stage booster,
- Rendezvous with an earth-to-moon transfer vehicle,
- Docking and extraction of a lunar lander and flight to the moon,
- Undocking, descent and landing of the lander on the moon,
- Ascent from the lunar surface and re-docking with Orion,
- Return to the earth, and
- Orion undocking, reentry and splashdown.

MS3 – Lunar
Program Functionality

The software support for the lunar mission takes advantage of the existing MS3 architecture. Essentially, the new mission is a series of reset points associated with the Lunar profile. The instructor user interface is the same as for a Shuttle mission. The MCC consists of flight controller and simulation control workstations and a "vis-mcc". The flight deck offers out-the-window views as well as crew data monitoring and entry screens and "glass cockpit" instrumentation.

Architectural/Hardware

- New software based on MS3-Shuttle.
- Lunar/other missions exist as reset points in MS3.
- User interfaces similar to MS3-Shuttle with enhancements.
- All screens will be *16x9 aspect ratio*, 1920x1080 resolution.
- Dual-purpose Single mission control.
- 4 mission control positions.
- MCC interfaces with Capsule/Orion and Lander/Altair cockpits.
- No physical switches, though Switch/DDD interface hardware is same as MS3.
- No platform motion.
- 1-10 Gbps network connectivity.
- Sound available as in MS3.
- User displays support touch screens.
- May be able to run multiple screens off a single computer.

Missions/Reset Points Supported

- Pre-launch for pad activities.
- Launch of Ares-equivalent/Orion to MECO (fixed 1st stage, modeled Ascent guidance for second stage).
- Rendezvous with Earth Departure Stage (EDS)/Altair.
- Trans-lunar injection maneuver; separation of mated Altair/Orion.
- Trans-lunar coast modeling from earth to approximately 25000 miles from earth will be provided. (Simple out-the-window views from the spacecraft, such as star fields are employed).
- Altair/Orion separation and descent to Lunar surface outpost located at TBD.
- Ascent from outpost and re-rendezvous with Orion; Earth return maneuver.
- Initial trans-earth coast modeling; reset to reentry-5m point.
- Reentry, chute deploy and Orion splashdown.
- Mission software functionality ends at "splashdown" (capsule will continue to float in the water).

Mission Control Center (MCC)

- Up to 5 Controller Positions.
- The MCC is dual-purpose, providing for mission control from the lunar base as well as mission control from Earth.
- 1 Sim instructor station with Malfunction Control. (up to 10 TBD anomalies as structured in current MS3).
- Approximate 25 new Orion/Altair displays accessible by controllers. Widescreen displays with dynamic digital and plot trend data, as well as camera views.
- 1 or 2 MCC Visual screens presenting camera views as well as trajectory plots and dynamic data.
- Sim control, malfunction insertion and monitoring, etc. as experienced today with available enhancements.

Capsule (Orion) Flight Deck

- 4 camera/scene views (windows, "tv's").
- 2 multipurpose glass cockpit/instrumentation/data entry computer/screens (16x9 widescreen).
- Approximate 25 new Orion/Altair displays accessible by controllers. Widescreen displays with dynamic digital and plot trend data.
- 1 or 2 MCC Visual screens presenting camera views as well as trajectory plots and dynamic data.
- 3 Keypads/2 joysticks (RHC and THC).
- Manual control will be offered for all rendezvous and separation operations (1-6DOF).

Graphical Models

- Where applicable, existing MS3 scenery is used.
- KSC terrain area modeled as in MS3-Shuttle with enhancements.
- Launch and Lightning Towers modeled per configuration for Ares.
- Customizable first/second stages.
- Launch from pad 39A.
- Current Orion model for capsule.
- Altair (with Orion for lunar orbit) ascent/descent stages for descent and ascent.
- Simple lunar base if desired.
- Clementine and LRO imagery for lunar terrain.
- Clementine and LRO topographic data as applicable.
- Earth Departure Stage for Altair rendezvous/extraction and TLI maneuver.
- Reentry plasma effects modeled for graphical use only.
- Simplified chute models.
- Ocean "splashdown", *no* land, ships, aircraft.
- Star fields, as appropriate, for orbit sequences.
- Pending availability and acceptability of imagery/topographic data, lunar base to be located at TBD.
- Translunar coasting.

System/Physics Models

- Derived from MS3.
- Provides for both earth and lunar gravitational effects.
- Now uses solar ephemeris for lighting models.
- Simple system models to support displays and malfunctions.
- 3-6 DOF dynamics models.
- Canned traj for 1st stage ascent.
- Guidance and navigation for 2nd stage through rendezvous, TLI maneuver, LOI, lunar descent, lunar ascent, and earth orbit insertion.
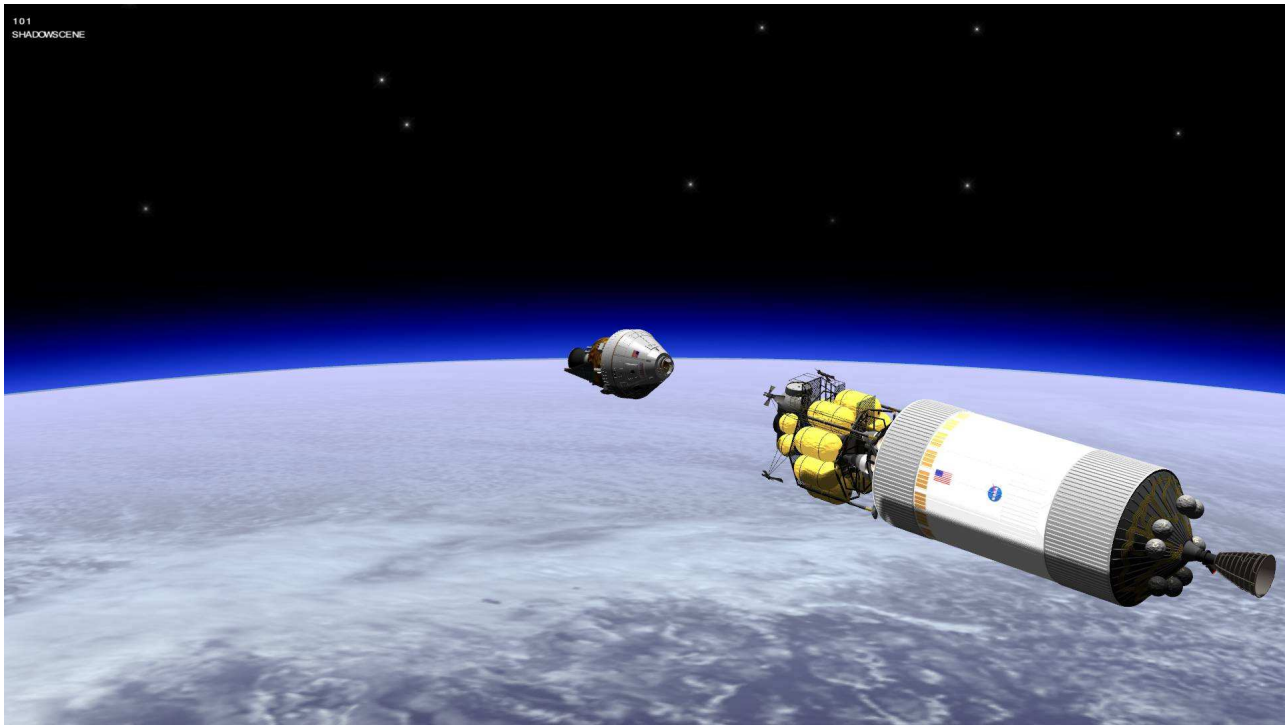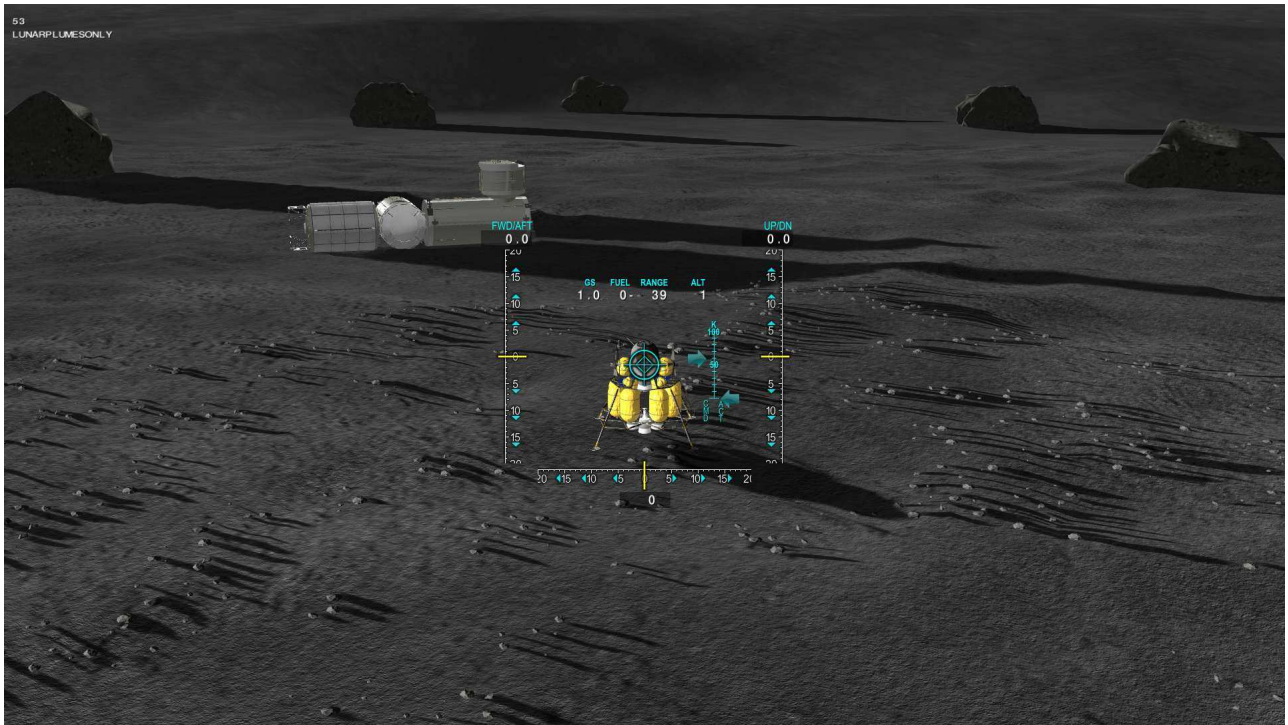- "Canned" "pre-defined" traj through splashdown.
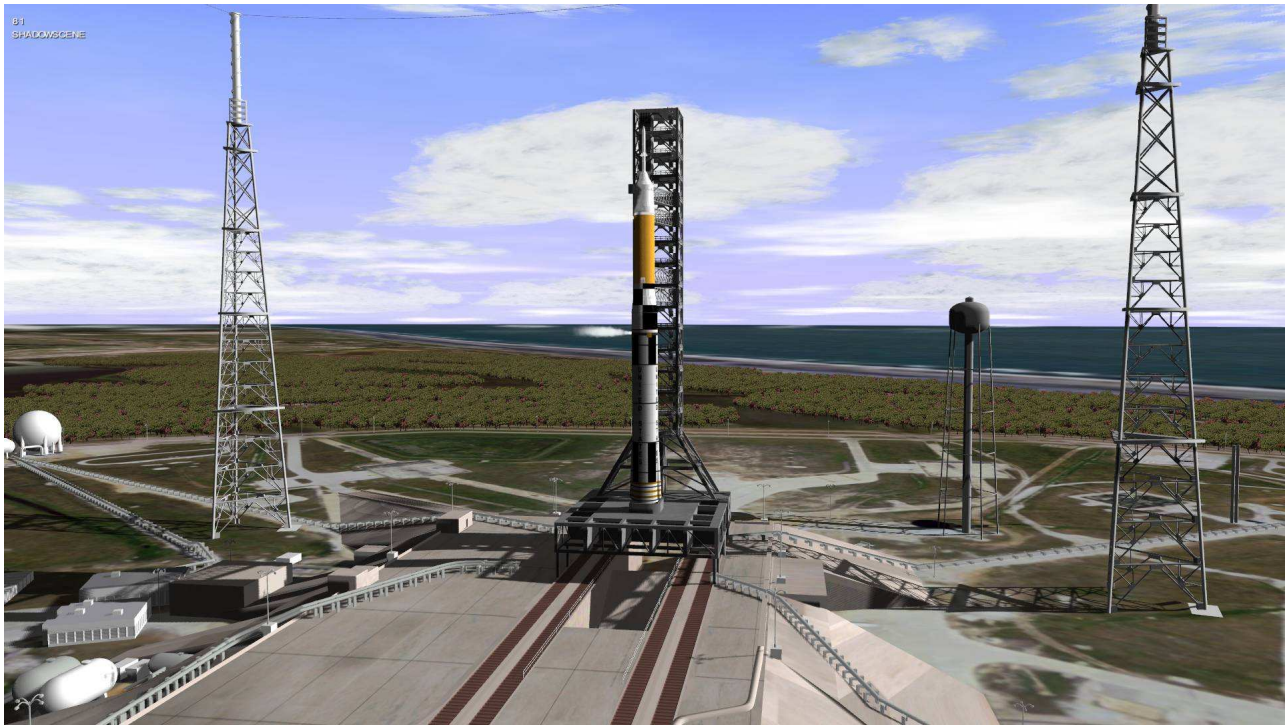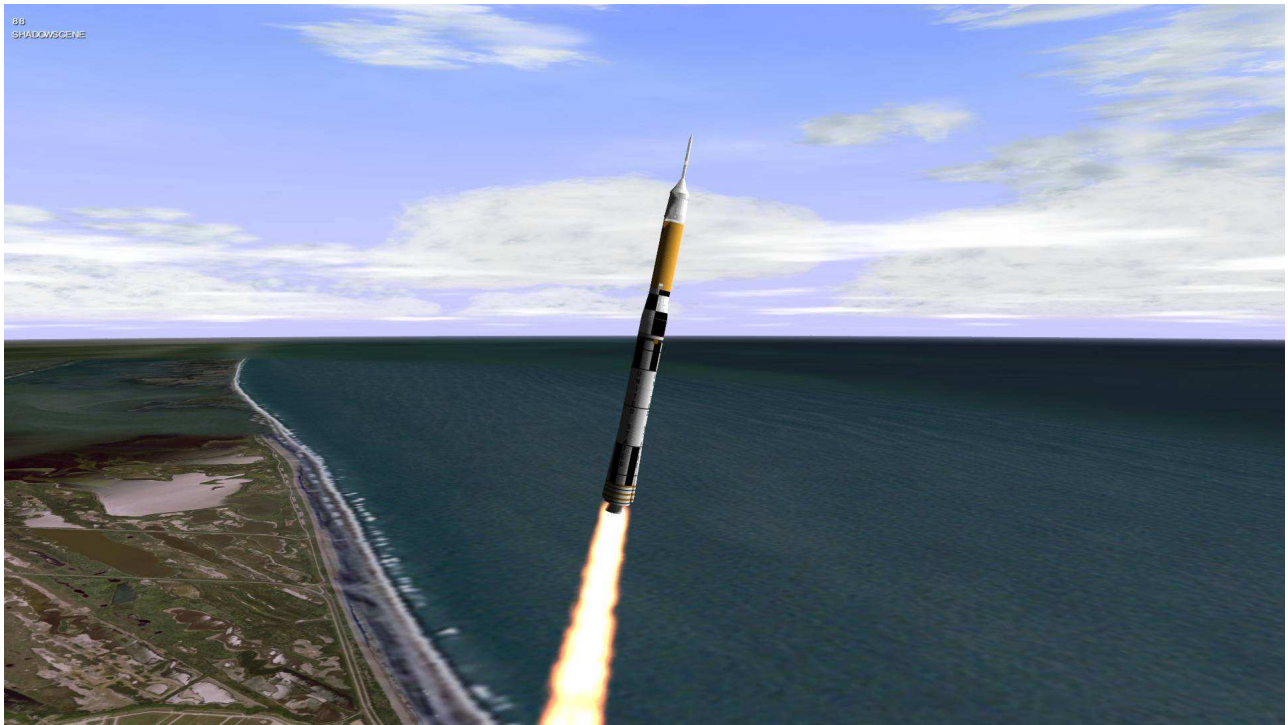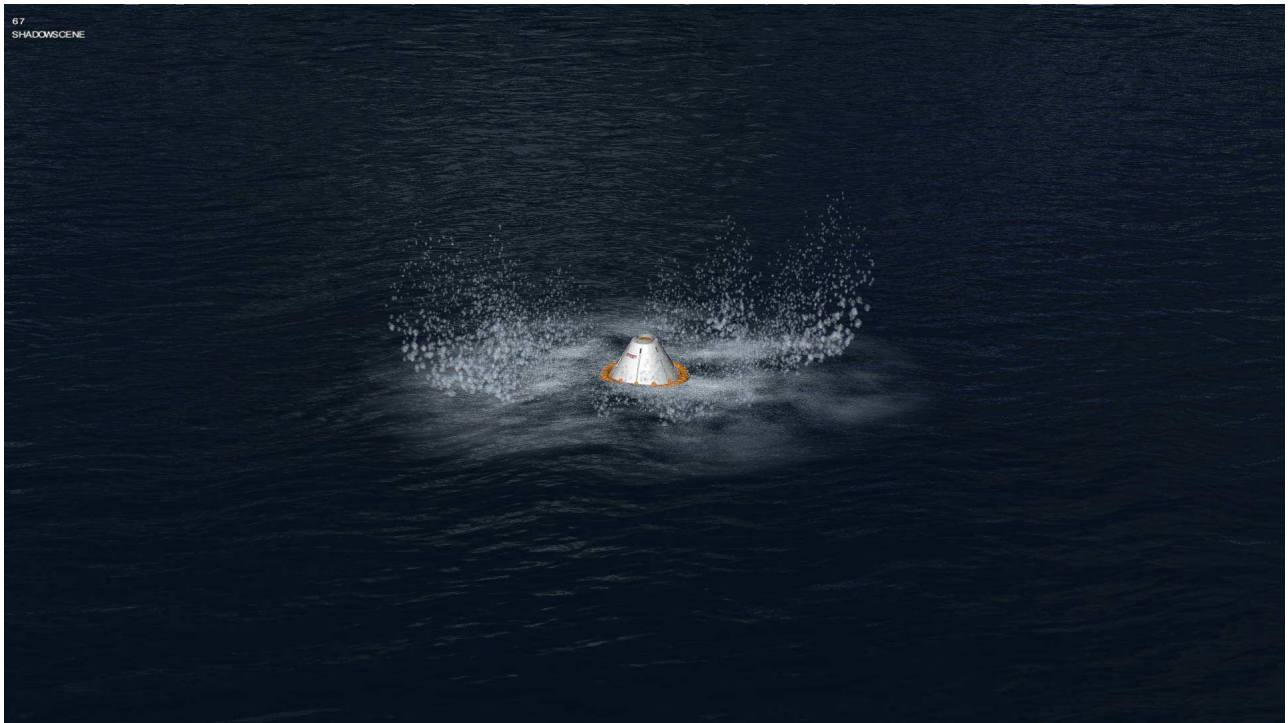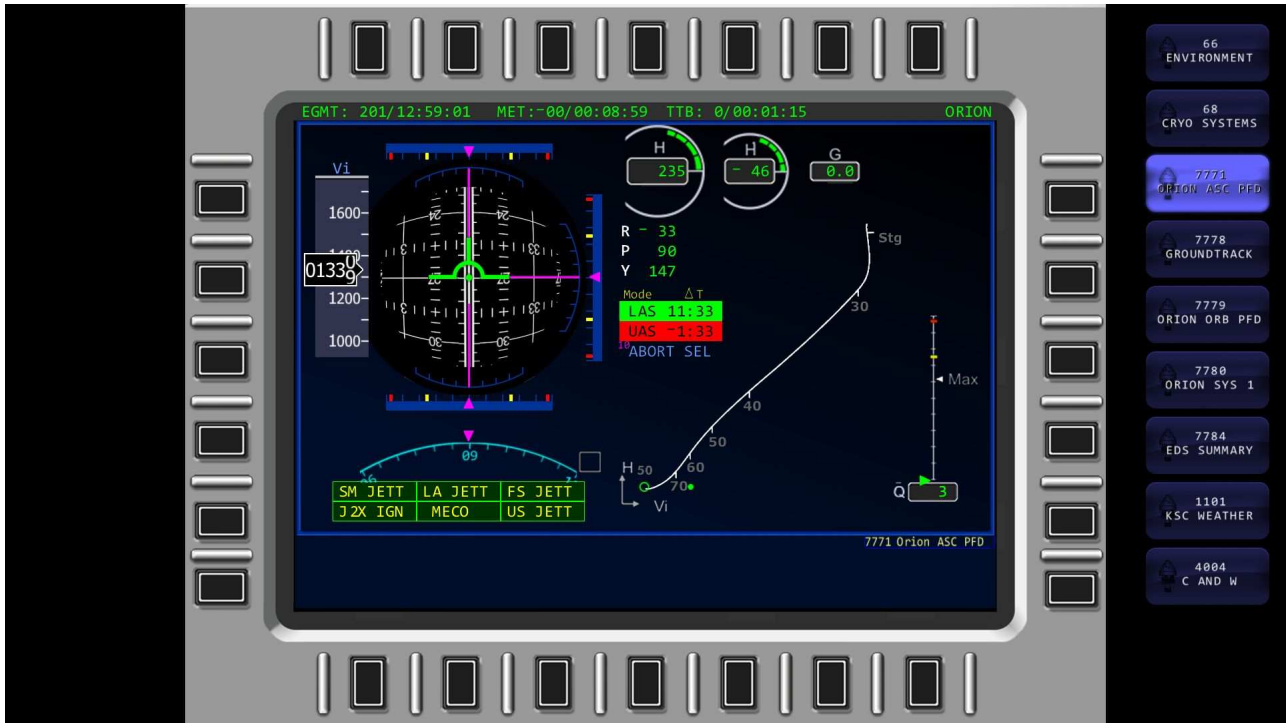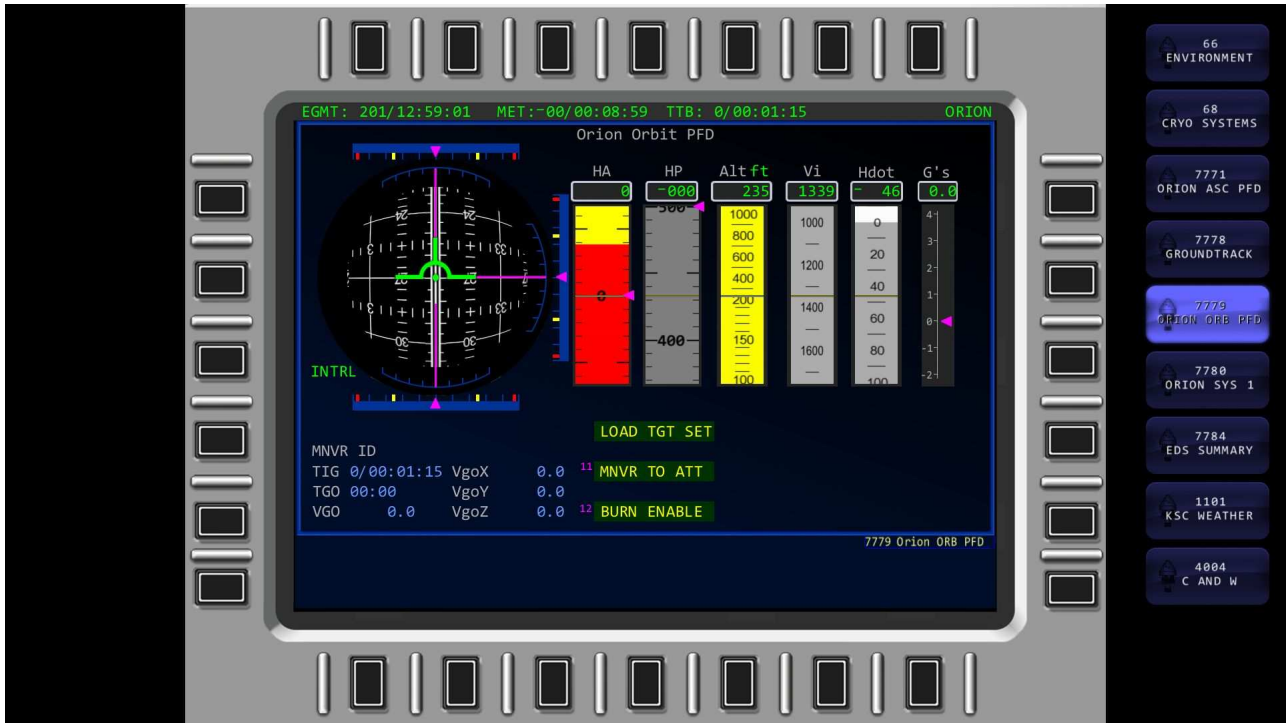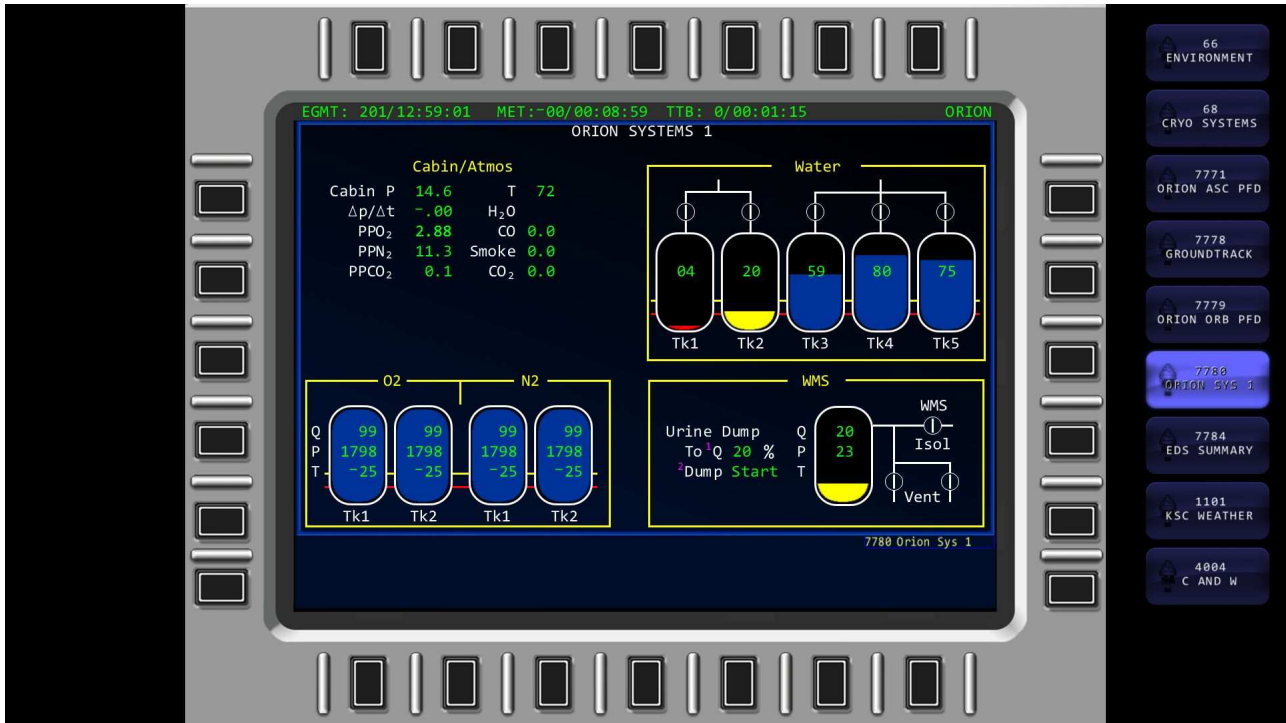
66 ENVIRONMENT
68 CRYO SYSTEMS
7771 ORION ASC PFD
7778 GROUNDTRACK
7779 ORION ORB PFD
7780 ORION SYS 1
7784 EDS SUMMARY
1101 KSC WEATHER
4004 C AND W

EGMT: 201/12:59:01   MET:-00/00:08:59   TTB: 0/00:01:15   ORION

ORION SYSTEMS 1

Cabin/Atmos

Cabin P   14.6   T   72
$\Delta p/\Delta t$ -.00 H_2O
PPO$_2$ 2.88   CO   0.0
PPN$_2$ 11.3   Smoke 0.0
PPCO$_2$ 0.1 CO_2 0.0

Water

Tk1 04   Tk2 20   Tk3 59   Tk4 80   Tk5 75

O2   N2

	Tk1	Tk2	Tk1	Tk2
Q	99	99	99	99
P	1798	1798	1798	1798
T	-25	-25	-25	-25

WMS

Urine Dump
To [1]Q 20 %
[2]Dump Start

WMS
Q 20
P 23
T
Isol
Vent

7780 Orion Sys 1

Mission Simulation Support Software

EGMT: 201/13:22:29   MET:+00/00:14:29 TTB: 0/00:06:38   ORION

ORION EPS

Crew Module Batteries

C1a   300.0 V   C1b   300.0
      120.9 A   120.9
      70.0   %   70.0
BCC C1a   BCC C1b

Crew Module Batteries

C2a   300.0 V   C2b   300.0
      120.9 A   120.9
      70.0   %   70.0
BCC C2a   BCC C2b

CM
SM

Service Module Batteries

S1a   300.0 V   S1b   300.0
      120.9 A   120.9
      70.0   %   70.0
BCC S1a   BCC S1b

CMD
[10]Port STP
[11]Stbd STP

Service Module Solar Arrays

Port   Stbd
STP   STP
0.0%   0.0%
6.4kW   6.4kW

7781 Orion EPS

MS3_LUNAR_2011_G...   displays   C:\Windows\system3...   Mission Simulation S...   8:32 AM

EGMT: 201/13:24:05   MET:+00/00:16:05   TTB: 0/00:05:03   ORION

7774 Orion Video

EGMT: 201/13:20:01   MET:+00/00:12:01   TTB: 0/00:09:06   ORION

CM/SM Prop

He A   He B   He A   He B
0   P   0   0   P   0

Fu A   Fu B   Ox A   Ox B
0   %   0   0   %   0
0   P   0   0   P   0

S1XA   S2XA   S3XA   S4XA   OME   S1XB   S2XB   S3XB   S4XB

7782 Orion Prop

66
ENVIRONMENT

69
FUEL CELLS

7773
MISSION PLAN

7776
EARTH MOON

7779
ORION ORB PFD

7780
ORION SYS 1

7782
ORION PROP

7783
UNIVERSAL PTG

4004
C AND W