LADEE
Add-On for Orbiter 2010-P1 (v.100830)

REQUIREMENTS
Launch scenario requires:
Vinka's "multistage2.dll" available at Vinka's website
http://users.swing.be/vinka/

RECOMMENDED
"StageDLL" for Orbiter2010 (fixes Vinka's stage.dll bug)
http://www.orbithangar.com/searchid.php?ID=4661

"Moon3D" (looks nice from low orbit :-)
http://www.orbithangar.com/searchid.php?ID=3570

Jarmonik's "InterplanetaryMFD (IMFD)" available at
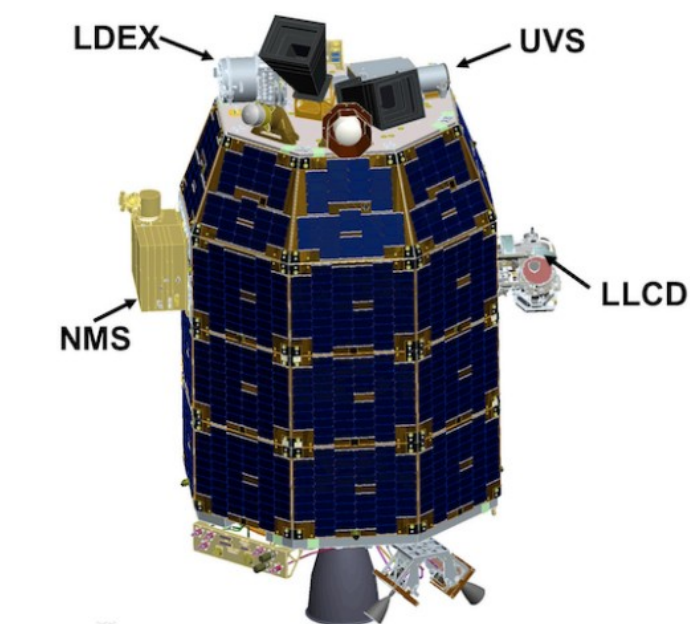http://koti.mbnet.fi/jarmonik/Orbiter.html

INSTALLATION
Extract all files to the root of your Orbiter program directory, preserving the directory structure. This should NOT overwrite anything in the standard Orbiter package.
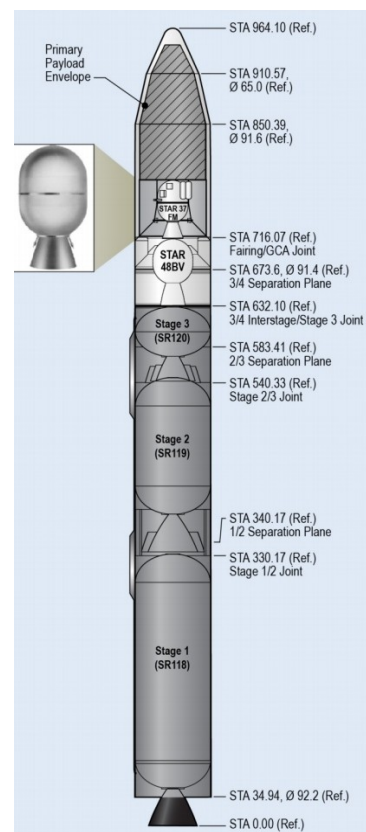
WHAT'S IN THIS ADD-ON?
The LADEE spacecraft, Minotaur V launcher and launch pad.
Launch and post-launch scenarios.

LADEE

Minotaur V

LAUNCHER AND SPACECRAFT CONTROLS

Minotaur V Launch Pad:
M = Move mobile service tower
Automatic illumination at night, extra launch smoke effects, auto self-delete after launch.
Attachment point at base of launcher.
Launcher released from pad when main engine reaches 80% thrust.

Minotaur V Stage1-3:
Stages 1-3 are controlled by "multistage2.dll" and have the normal controls:
F = Jettison Fairing
J = Jettison stage/payload
P = Ascent Auto-pilot (includes auto fairing/stage seperation)
Press P to start the auto-pilot countdown at T-10 seconds
Auto-pilot ends after Stage3 burnout.

Minotaur V Stage 4:
J = Jettison stage
Burn to depletion solid-fuel motor, no throttle. Rotation RCS only.
No auto-pilot.
dV info on HUD.

Minotaur V Stage5 "Star37FM":
J = Jettison payload
N = Ignite spin-motors
M = Deploy de-spin yoyos
Burn to depletion solid-fuel motor, no throttle. Rotation RCS only.
No auto-pilot.
dV info on HUD.
Use de-spin yoyos to decrease rotation after burn.

LADEE:
455N main engine, four 22N RCS thrusters.
Rotation RCS is unbalanced (rotation will give small dV in +Z direction) and does NOT
work well with standard Orbiter autopilots Prograde/Retrograde/OrbitNormal.
Linear RCS in +Z direction only, dV info on HUD.

LADEE also has Reaction Wheels for attitude control
Use [Shift]+[NumPad] controls to use Reaction Wheels:
[Shift]+[NumPad 2/8] = Pitch
[Shift]+[NumPad 1/3] = Yaw
[Shift]+[NumPad 4/6] = Bank
[Shift]+[NumPad 5] = KillRot
Reaction Wheel "KillRot" function status on HUD.

FLIGHT INFO
Launch: Wallops Island 07 September 2013, 03:27:00 UTC
Initial orbit 200km x 271000km, 37.7deg inc(equ), AgP 155deg
Gravity assist from Moon at 1st apogee - boosts perigee to aprox.2000km
Three phasing loops before final TCM burn at perigee to intercept Moon (should be possible to go direct without phasing loops)
LOI: 06 October 2013, 10:57 UTC
Final lunar science orbit 20km x 60km, 157deg inc(equ)

MORE INFO.....
http://www.nasa.gov/sites/default/files/files/LADEE-Press-Kit-08292013.pdf
http://www.orbital.com/NewsInfo/MissionUpdates/MinotaurV/files/LADEE-Mission-Overview.pdf

FLIGHT NOTES
Press P at T-10 to start ascent autopilot for Stages1-3.
The autopilot has an increasing throttle curve for Stage1 to simulate changing motor ISP and gives a better fit to the nominal ascent profile.
Autopilot ends after burnout of Stage3, you should be sub-orbital with apogee of aprox.260km.

Begin Stage4 prograde burn at apogee to raise perigee to 206km, apogee 550km, AgP 155deg. Perigee should be on next node.

Begin Star37FM(Stage 5) prograde burn just before perigee. I used IMFD "DeltaVelocity" and IMFD "Map[Plan View]" to set the time of the burn, targeting the lunar gravity assist at 1st apogee - this should pull the next perigee up to about 2000km alt.

After 1st apogee, IMFD "Course - Target Intercept" together with IMFD"Map[Plan View]" was used to set the final perigee burn to intercept the Moon. Small burns at the next two perigees can optimize the final perigee TLI burn considerably.

IMFD "DeltaVelocity" was used for the final LOI burns.

Have fun :-)
BrianJ
November 2013