ORBITER
Gemini Titan 2 Version 4.50

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**Special Thanks to John Bisney, and Dr Lance Erickson
Both of whom provided extensive documentation
on the Gemini and Agena.
Special Thanks to Dr. Martin Schweiger
who made it all possible and fun**
http://www.orbitersim.com
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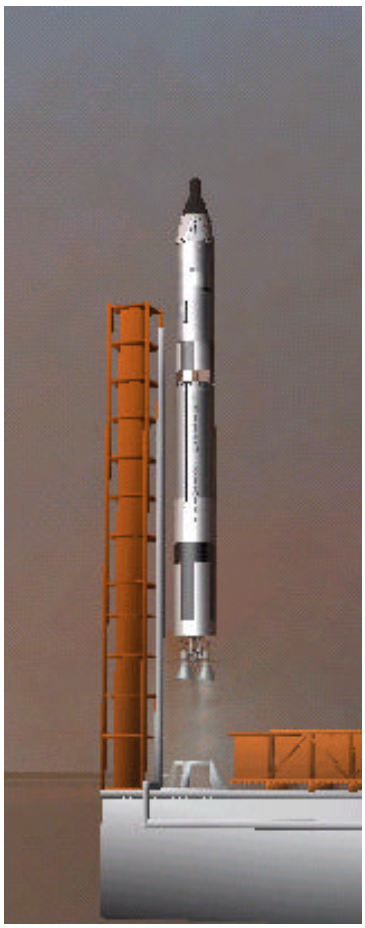


Meadville Space Center

1. INTRODUCTION

This document explains how to use and operate the Gemini Titan 2 module for Orbiter. We will be talking about launch, orbital maneuvers, EVA, and re-entry. The next several versions of this document will continue to get more detailed about all aspects of the Gemini Titan 2 module

2. SPECIFICATIONS

To added later.

3. VERSION HISTORY

Version 1.1 fixes
*Added Mode I abort (ejection seat below 56 kPa pressure)
*Added E key for Eject
*Added Accurate placement of thrusters
*Added S Key to select between RCS Thrusters and OAMS thrusters
*Improved placement of agena in the scenario.
*Improved Flight Plan

Version 1.2 fixes
*Fixed problem with refueling while switching between RCS and OAMS mode
*Added McDope's meshes for Ejecting Astronauts Seats
*Added EVA Mode. Type E to EVA and switch back.
*Added McDope's meshes for Gemini EVA
*Added Gemini 3 & 4

Version 2.0 fixes
*Thanks to Brad for his excellent Gemini Mesh.
* Gemini Orbiter has separate equipment, adapter, stage
* Various fixes to EVA included animated pilot door opening.
* Retro mode implemented
* All Abort modes implemented
* Re-entry mode implemented with Re-entry flames
* Parachutes added

Version 3.0 fixes
* Updated Gemini meshes with fixes from Brad Hodges
* Added Limited RCS and OAMS Fuel
* Updated for the latest version of Orbiter
* Added Two point suspension for parachutes
* Put the ejection set under manual control
* better re-entry algorithm
* Added Rolling re-entry
* EVA is now tethered (graphics in next version)
* Add Titan 2 autopilot.
* Added Docked Agena Mode

Version 3.01 fixes
* Fixed problems with the auto-pilot
* Updated Manual
* Fixed problems with EVA with the agena attached.

Version 4.0 fixes
* Incorporated Scott Oehlerking's new meshes
* Changed over to the new thruster model.
* Version 2 of Multi-Stage SDK implemented which will allow multiple Gemini in a single scenario.
* Consolidated the various Gemini "stages" into a single Gemini module to prepare for the control panel.
* Added better tether physics to the EVA astronaut.
* Added better simulation of the Ejection Seats and improved their stability.
* Agena now a separate vessel using the vessel to vessel docking feature. Also uses the messaging capability of Version 2 of the Multi-Stage SDK for control.
* Titan 2 launch profile is now historically accurate.
* Historical commands are now used to control the Agena
* Micrometeoroid package is now part of the Agena and can be retrieved.
* Rendezvous beacon now has a transponder frequency enabling the used of the Docking MFD and Hud.

Version 4.1 fixes
* Fixed the docking position on the Agena
* Added roll capabilities to the Titan 2 second stage.
* Added Gemini X scenario
* Added accurate parachute animation sequence
* Kick force applied by astronaut to detach micrometeoroid package has been tripled.

Version 4.2 fixes
- Used Roger Long's exhaust texture to add flame and smoke to the titan.

Version 4.5 fixes
- Added a Virtual Cockpit using Don’s excellent capsule meshes.
- Added some 2D panel graphics courtesy of Jim Williams.
- Added controls for switching attitude modes via the control panel
- Added ADI ball with working rate needles courtesy of Radu Poenaru.

4. LAUNCH

The Titan 2 is a 2 stage ICBM adapted for use in the manned Gemini program. It was built as a backup for the Atlas Program and its descendents became a successful series of launchers for commercial, scientific, and military use. The flight plan is included for those who don't want to use the auto-pilot.

MANUAL FLIGHT PLAN

MET+0	Launch
MET+2	HUD To Surface Mode
MET+4	Bring up Surface Mode MFD
MET+10	Pitch to 85 degrees
MET+20	Pitch to 80 degrees
MET+30	Pitch to 75 degrees
MET+40	Pitch to 70 degrees
MET+50	Pitch to 65 degrees
MET+60	Pitch to 60 degrees
MET+70	Pitch to 55 degrees
MET+80	Pitch to 50 degrees
MET+90	Pitch to 45 degrees
MET+100	Pitch to 40 degrees
MET+110	Pitch to 35 degrees
MET+120	Pitch to 30 degrees
MET+130	Pitch to 25 degrees
MET+140	Pitch to 20 degrees
MET+148	BECO
MET+150	Pitch to 15 degrees
MET+160	Pitch to 10 degrees
MET+200	Pitch to 0 degrees
MET+300	Pitch to -10 degrees
	Hold -10 degree pitch until vertical speed drop to 0.
MET+321	Pitch to 0 degrees
MET+340	SECO

ABORT MODES

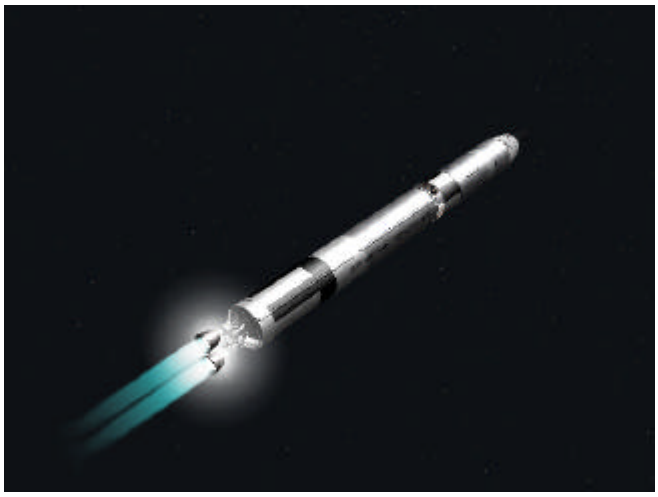
Mode I	Ejection	Atmospheric Pressure > 56000 Pa
Mode Iia	Retro Salvo	Atmospheric Pressure < 56000 Pa
Mode Iib	Retro Salvo	Atmospheric Pressure < 5000 Pa and speed < 6330 m/sec
Mode III	Normal Re-entry	Atmospheric Pressure < 5000 Pa and speec > 6330 m/sec

KEYBOARD

J	Jettison Stage	Stage 1 -> Stage 2 (drops mid section) -> Gemini Orbiter
E	Abort Eject	See above section
P	AutoPilot	Toggles the Auto Pilot on and off

EJECTION

If you eject below 1700 meters the seat will be jettisoned after 1.1 seconds and the chute deployed after 2.3 seconds. If you eject above 2200 meters a ballute will deploy stabilizing you. When you hit 1700 meters your seat will jettisoned and 1.2 seconds later the chute will be deployed.



5. ORBIT

LIMITED RCS & OAMS FUEL

Every thing now takes up fuel. There is 420 kg in the OAMS Tanks and 35 kg in the RCS tanks. Once you use up one of the tank you will not be able to maneuver at all.

OAMS Aft	2 * 45.35 kgf Thrusters
OAMS Linear	1 * 45 35 kgf Thrusters
OAMS Retro	2 * 38.55 kgf Thrusters
OAMS Attitude	2 * 11.34 kgf Thrusters
RCS Attitude	4 * 11.34 kgf Thrusters

HISTORICAL M+4 MANUEVERS

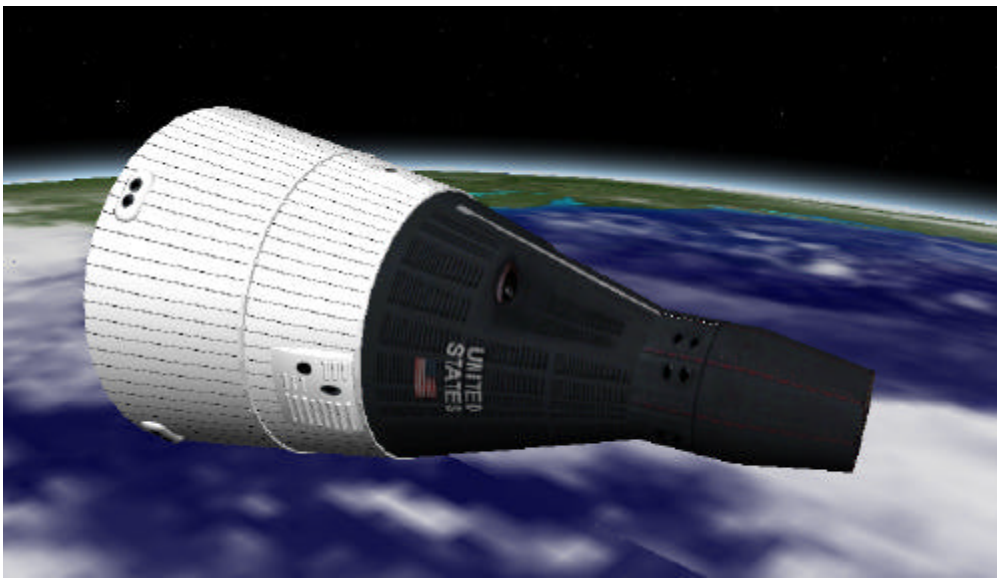
(For use in Gemini VIII Launch and Dock Scenario)

Orbit 1	Insertion	apogee to 311 km	6.682
Orbit 1	Apogee	185 km by 311 km	6.556 by 6.682
Orbit 2	Apogee	248 km by 311 km	6.619 by 6.682
Orbit 3	Apogee	311 km by 311 km	6.682 by 6.682
Orbit 4	Perigee	311 km by 342 km	6.682 by 6.713

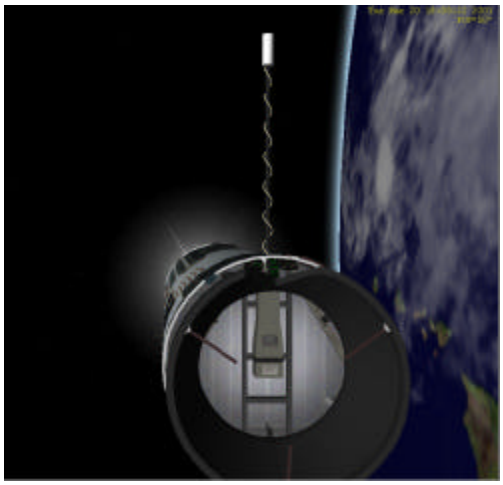
KEYBOARD

J	Jettison Stage	Orbiter -> Retro -> Re-entry Capsule
E	EVA	See EVA Section. Need Pilot Door open to EVA
S	SWITCH	OAMS Thrusters <-> RCS Thrusters
P	Pilot Door	Opens and Closes Pilot Door
B	Beacon	Release Rendezvous Beacon
L	Lock-on Agena	Only use when docked with a GATV
D	Detach Package	Detaches the Micro-Meteoroid package from the Agena

NOTE: Retro and Re-entry Capsule only have RCS Thrusters
See section on attitude control for special notes on the joystick and keyboard.



DOCKED WITH AGENA



Primary Propulsion System firing.

When you dock with the agena you will need to tap L to activate the Agena. This will connect the Agena to the Gemini and you can now send commands to the Agena.

Each command is a three digit number. For example 501 ignites the primary propulsion system and 500 shuts it off. You start a new command by tapping the letter B and then the three number. When you are ready to send tap the letter T. If you made a mistake then you can use C to clear the command buffer and start over.

.NOTE: Your attitude jets is in OAMS mode and uses up OAMS fuel.

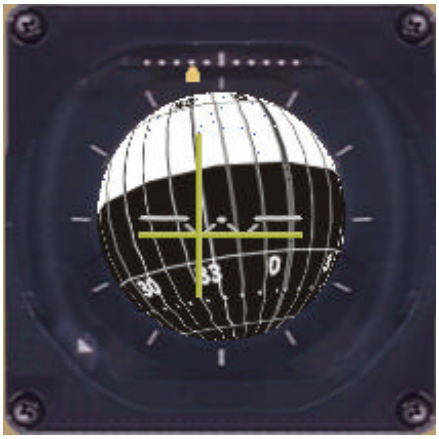
KEYBOARD

J	Jettison Agena	Gemini-Agena -> Orbiter
B	Begin Agena Command	This needs to preface all commands.
0-9	Agena Command	Each command is a three digit number
C	Clear Command	Resets the command if you make a mistake.
T	Transmit Command	Transmit the Command the Agena. A response will occur.
E	EVA	See EVA Section. Need Pilot Door open to EVA
P	Pilot Door	Opens and Closes Pilot Door

Agena Commands

501	Ignite Primary Propulsion System
500	Shutdown PPS.
560	Ignite Secondary Propulsion System 90 kg thrusters
551	Ignite SPS 7 kg thrusters
550	Shutdown SPS.
410	Set Pitch/Yaw Mode to Minus Rotation (Down or to the Left)
411	Set Pitch/Yaw Mode to Plus Rotation (Up or to the Right)
441	Yaw Thrusters On
440	Yaw Thrusters Off
431	Pitch Thrusters On
430	Pitch Thrusters Off

ADI Ball



This instrument tells your orientation in space. In addition the top indicator show your roll rate, the vertical yellow bar shows your yaw rate, and the horizontal yellow bar shows your pitch rate. To null your rates just use your joystick or keyboard to move all three indicators to the center position

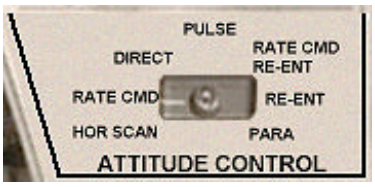
Attitude Modes

Joystick and Keyboard

The joystick is always set for attitude control. Using the '/' key has no effect on the joystick mode. The keypad will switch between attitude mode and translation mode normally. When the Gemini spacecraft is first loaded, the initial mode is set to translation mode. It is intended that you be able to use the joystick with one hand, and the keypad with the other hand. This will give you simultaneous control over attitude and translation.

Attitude Control Switch

You can set the attitude mode via the center control panel.



Currently implemented are: Rate cmd, Direct, Pulse, Rate Cmd Re-ent, Re-ent, and Platform

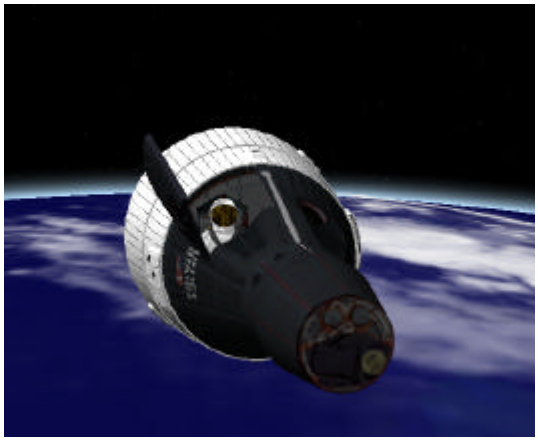
Rate Cmd	Full Extension of the joystick will command 10 deg/sec for the pitch and yaw axis, 15 deg/sec for the roll axis. Centering the joystick will command zero rate for any axis. Extending the joystick halfway will command half of the full rate for any axis.
Direct	Extension of the joystick beyond 25% will turn on the solenoid for the thruster(s) for that axis. The thruster will remain on until the joystick is returned back to center.
Pulse	Extension of the joystick beyond 25% will cause the thruster to fire for 20 milliseconds. The thruster will not fire again until the joystick is re-centered and extended again.
Rate Cmd Re-Ent	Full extension of the joystick will command 10 deg/sec for pitch, and 15 deg/sec for the roll axis. The yaw axis is cross-coupled with the roll axis to minimize yaw dispersion due to any commanded roll.
Re-Ent	This will cause a 5 deg/sec roll and zero the rates for pitch and yaw.
Platform	This will command a zero rate for all three axis in whatever direction the spacecraft is currently pointing at.
Horizon Scan	Not Implemented

6. EVA

EVA SEQUENCE

Tap P to open Pilot Door
Wait until Door is complete open
Tap E to begin EVA.
Maneuver
Dock onto Micrometeoroid package
Tap D to Detach package
Return to Gemini
Tap E to end EVA
Tap E to strap back in.
Tap P to close Pilot Door

While the graphics are not done yet, this module simulated the fact you are tethered to the Gemini. If you try to go beyond 7.62 meters you will stop and start rotating around the Gemini. Note: if you are trying to station keep will doing EVA coming to the end of the tether will not just stop you but cause the Gemini to move in relation to the object you are trying to keep station next too.



7. RETRO FIRE

RETRO FIRE SEQUENCE

Switch HUD to Orbital Mode
Orient to Retro-grade marker
Turn on Surface MFD
Turn on Orbit MFD
Switch HUD to Surface Mode
Pitch to -40
Tap D to prime Retro Fire
Tap D to initiate Retro Fire
The Four Retro rockets will fire in sequence.
At the end of the Retro Sequence Tap J to Jettison Adapter
Pitch to 0 degree

KEYBOARD

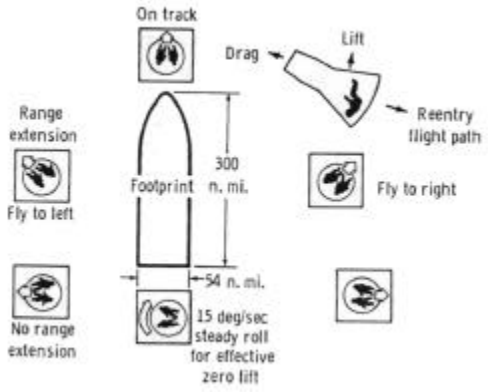
J	Jettison	Retro -> Capsule

8. RE-ENTRY

RE-ENTRY SEQUENCE

Note: When you get to about 60 km you want to roll so that your rate of descent is about 50 m/sec. this minimizes excessive heating in the lower part of the atmosphere. You may have to roll right and left to stay on track.

You want to put the attitude mode in re-entry for automatic control or rate cmd re-entry if you want to control the landing point.



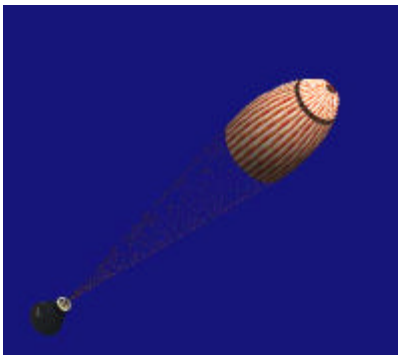
KEYBOARD

J	Jettison	Drogue-> Main -> Backup
P	Parachute	Deploy Backup Parachute
D	Drop	Drops to the Two Point Suspension if the mains are deployed.

LIFTING CAPSULE

The Gemini Capsule has lift. When you roll or pitch the capsule you will either gain or lose vertical velocity. By doing this you can precisely aim the Gemini Capsule to a pin point landing. I left a diagnostic in so you can see the lift in action. If you tap F1 to look at the exterior of the capsule you will notice the Retro Thrust varying. This is a the lift value being used by the capsule. Negative values will mean that will be losing vertical velocity and positive values means you will be gaining vertical velocity. When panels are put in I will switch this to a panel.

PARACHUTE



The Gemini main and drogue parachutes are accurately simulated. Both have an animated unfolding sequence with the drag factor correctly modeled at each step.
The sequence is as follows:
1) The drogue unfurls into a reefed position at 50,000 ft (15000m)
2) 16 seconds later the reefing lines are cut and the drogue is fully deploys
3) At about 9750 feet (3000m) the drogue and the nose are jettisoned dragging out the main chute.
4) The main chute is unfurled to the reefed position
5) 10 seconds later the reefing lines are cut and the main chute unfurls to full deployment.

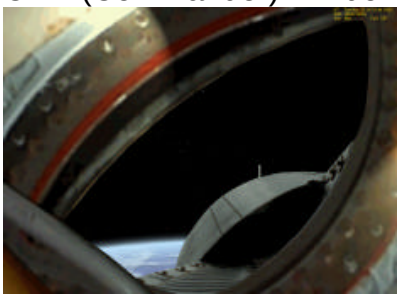
After the mains are deployed you now drop to a two point suspension by tapping the D key. The Parachute will also now be jettisoned when you hit ground.

If the main chute doesn't deploy you can activate the ejection seats by tapping E.

8. CONTROL PANELS

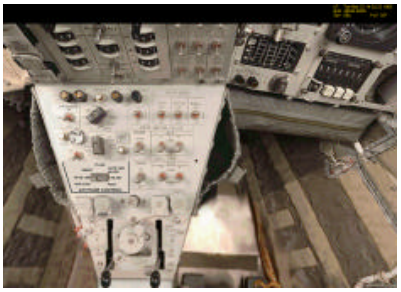
Panels are accessed by tapping the F8 key from the internal view of Orbiter. You switch panels by using <CTRL><ARROW>.

CDR (Commander) Window



Up	
Left	
Right	
Down	CDR Panel

Lower Center



Up	
Left	CDR Panel
Right	
Down	

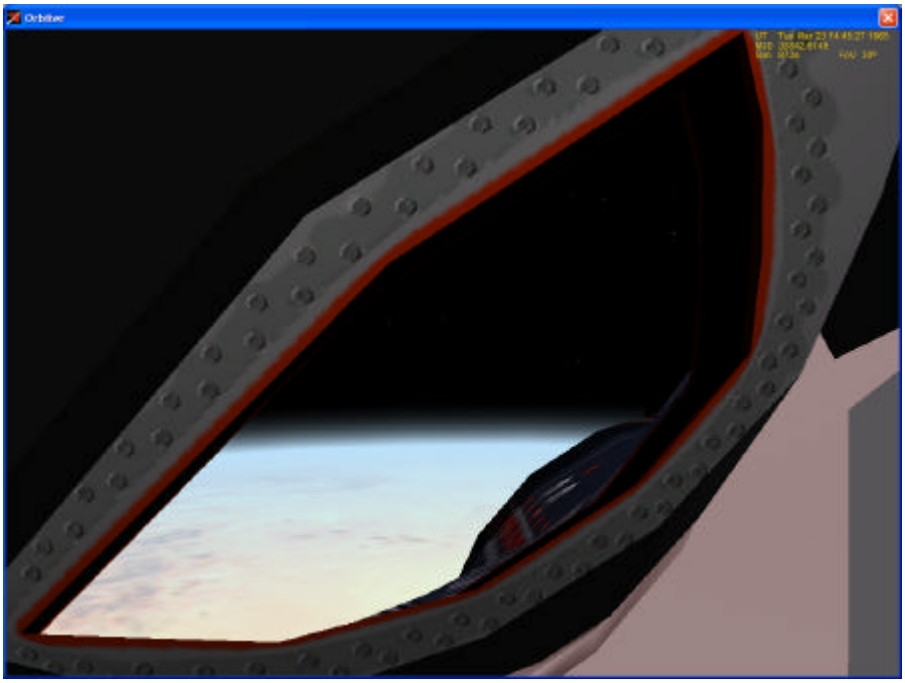
CDR Panel

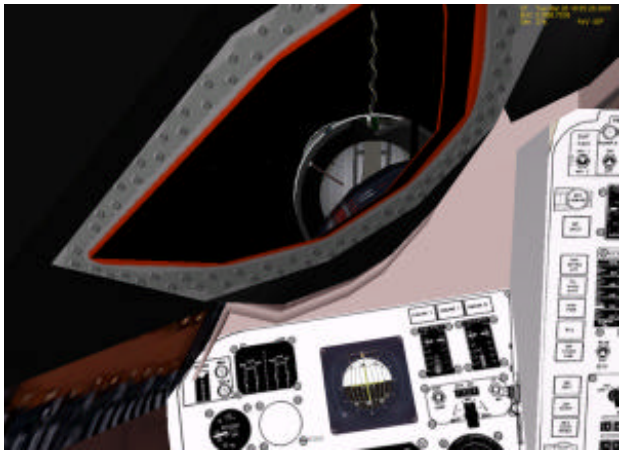
Up	CDR Window
Left	
Right	Lower Center
Down	

9. VIRTUAL COCKPIT

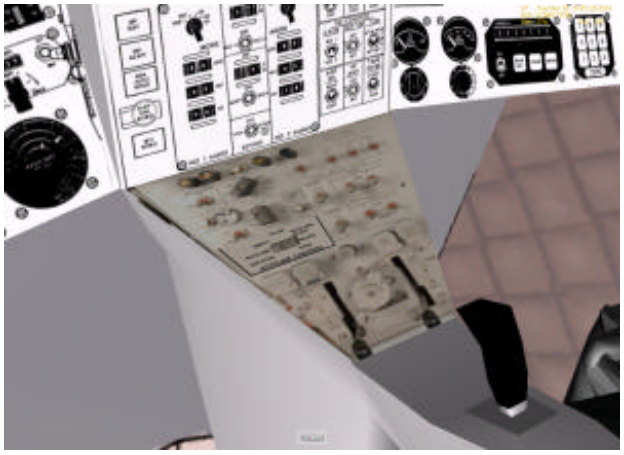
The Virtual Cockpit is accessed by tapping the F8 key from the panel view of Orbiter. You can view around the virtual cockpit by using either using <ALT> arrow key or using the hat switch on a joystick.

Currently the ADI ball and the center panel are both have working displays.



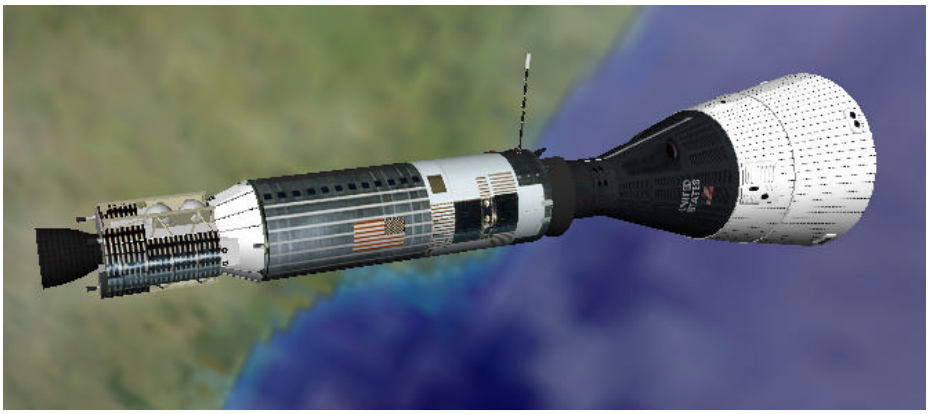


CDR Panel with ADI Ball



Lower Center Panel

10. SCENARIO NOTES



GEMINI X

Gemini X, flown by John Young and Michael Collins, was an ambitious mission. To successfully complete this mission you have to do the following

Dock with GATV-5005
Using GATV-5005 a 294 km by 763 km orbit. Enjoy the view!
Using GATV-5005 setup a rendezvous with GATV-5003.
Undock from GATV-5005 and complete the rendezvous with GATV-5005
Perform an EVA to retrieve the micrometeoroid package from GATV-5003.
Return home safely

GATV-5003 is left over from Gemini VIII and is completely dead. It is not possible to safely dock with it. There are no transponders to home on it so you will have to use the sync orbit MFD to execute the rendezvous.