



World of Colliers

Version 2.02

By Erik Anderson aka Sputnik
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Thanks to:

Missleman01, for many many meshes – Johnston buildings, moon ships, and much more.

Rjcroy, for the guidance routine, and to Daver for showing me how to use it for launches other than Baikonur.

McDope, who developed the Soyuz code on which the ferry rocket is based, for making it open-source and suitable for projects such as this one.

Estar, for the basis of the space suit code, and for much else.

Daver, for showing me how to modify the Soyuz code into a class to allow multiple instances.

MrBatman and X-Viila, for help getting the Johnston Atoll texture placed and colored properly.

Christophe Chabot, for the RealExhaust texture.

And, above all, many thanks go to Martin Schweiger, for actually developing the simulator I used to daydream about in astrodynamics classes!

Unpacking:

Use Winzip to put each subfolder in its matching Orbiter folder.

Changes since last time:

Version 1.6 and previous came with one (and only one) scenario. To stick with what you're used to, that scenario is now renamed "3 – Circumlunar". There are also (obviously enough) other scenarios along von Braun's grand conquest-of-space timeline. The first is to launch a satellite, the second is to build the station, and #4 is to fly the moon ships to the moon! This pretty much summarizes the major changes to Version 2.0: new ships, new scenarios, and the moon awaits you.

Minor changes:

You can "destroy" an EVA instance (i.e., return to the ship you came from).

The ferry rocket is now a CVE-Lite launcher, so you can put payloads atop it. The third stage is also a CVEL payload, so you can launch it on other vehicles.

Baby Satellite Operation:

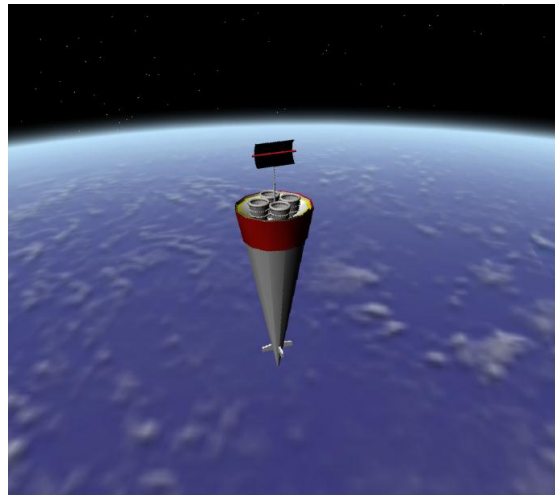
Scenario #1 only. The Baby Satellite is to be man's first orbiting satellite. This Colliers vehicle was to be a 20% scale model of the ferry rocket itself, launching an automated station proof-of-concept. Once on orbit, the station will extend a solar boiler and antennae, point nose-down, and transmit scientific data to the ground.

The Baby Satellite borrows code from the Ferry Rocket, and so operates similarly. You're only aiming for about 250 km up, though, unlike the Ferry Rocket which is headed much higher.

Keys:

J - Jettison a stage.

O - Toggle the autopilot.



Third stage only:

K - Toggle the solar boiler to extend/retract.

The autopilot will extend the solar boiler at the appropriate point. It will also turn the satellite to point the nose at the Earth for observation and transmission. This mode of the autopilot is very unstable under time compression, so it automatically turns itself off if you activate time compression while this mode is active. After that, you have to point at the Earth yourself! Properly, the base at Johnston Atoll should not yet have launch pads for the Ferry Rocket at the time this satellite is launched. It didn't seem worth generating a whole new sol.cfg just for that, though.

Ferry Rocket Operation:

You start from a pad at Johnston Atoll. The station will be overhead soon, so now is the time to launch.

Hit "O" to start the autopilot doing its thing, or:

Initiate the takeoff with your + key. Go to full power.

At about 15 km, pull "up" to pitch toward the horizontal. Roll to make your heading 067.5. This assumes you want to go to orbit heads-down; I don't know for certain which way the "historical" 3-stage Ferry flew.

Once you have a good (>1000 m/sec) hiyaka climb going, you can set your pitch level with the horizon.

Keep burning. Once you're flying the third stage, continue burning while pulling up the Orbit Sync MFD. You'll want to cut off your engines when you're sync'ed up with the Wheel station. The autopilot shuts off here.

IMPORTANT: DO NOT burn the third stage to depletion! The third stage fuel is also your rendezvous, docking, and de-orbit fuel. Save some!

If you're as good as the autopilot, your timing and inclination are good to match with the Wheel.

Keys:

J - Jettison a stage.

O - Toggle the autopilot.

Third stage only:

G - Toggle the landing gear.

K - Toggle the payload bay doors.

E - EVA in a suit (see EVA section)

B - Toggle brakes (wheel brakes and speedbrake)

There are three stages to this rocket. From beginning to last, they are:

1 - The First stage is enormous -- 88 feet across, with 51 main engines!

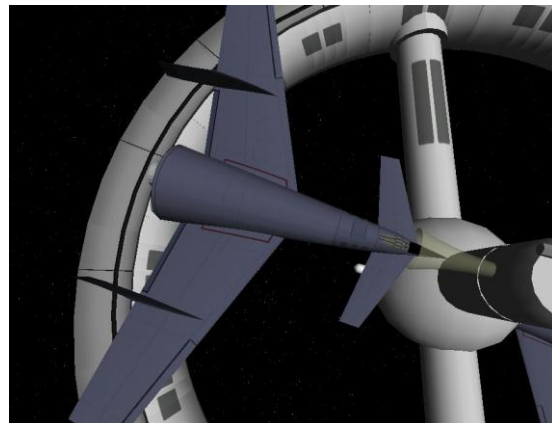
2 - The Second Stage is also huge by any normal standard.

3 - The Third Stage is winged. It accomplishes the final burn into orbit, the rendezvous, and can de-orbit and land. It has landing gear, a docking port, and a payload bay. It's a very capable spaceship.

You can amuse yourself by shifting focus to one of the spent stages and watching as it deploys its drag chute, re-enters, and fires its retro-rockets to cushion the touchdown. It should land within sight of the tugboat that is to tow it back to Johnston atoll.

Rendezvous and docking: the ferry rocket didn't have a true docking port as we think of it. Instead, the nose pushed into a mesh affair which held the rocket in place. Later, a transfer tube would be placed over a nearby exit hatch. I've modeled this as a pretty standard docking port.

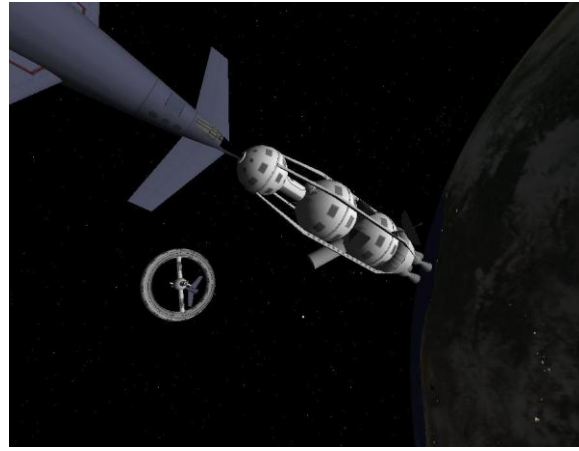
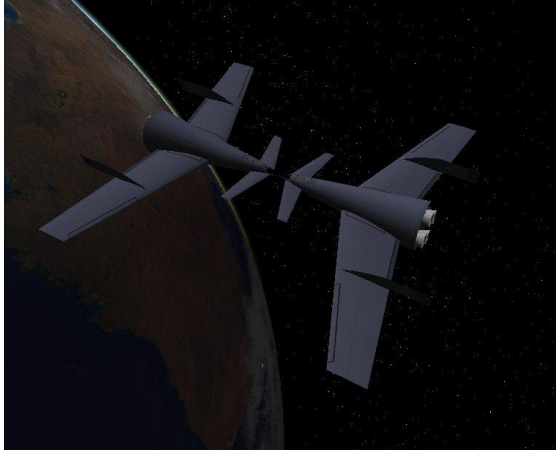
The disadvantage of this system is that it allows you to dock in ways that would have been completely impossible for the "real" ferry rocket. For example, you can dock two ferries nose-to-



nose.... or you can dock with the forward port of the circumlunar ship.

It's up to the user to ensure you use the ferry in a "realistic" manner. In "reality" it could dock with the funnels at the station, and nowhere else.

EXAMPLES OF UNREALISTIC ABUSE OF THE DOCKING PORT:



The purpose of the ferry rocket is to deliver cargo, and your cargo is carried in several forms. There are people, who you'll drop off at the station. There is a bundle of building materials, which you'll eject from the payload bay near the station. And there are fluids (fuel and water) which you'll offload using FuelMFD. In detail, these are:

People - Dock with the Wheel. Your vehicle will get lighter by the mass of your passengers and their bags.

Materials - Open the payload bay ("K"). Jettison the payload with the "J" key. It's a tight fit, and it'll come out slowly. The best place to do this is when already docked with the Wheel, where there will be construction crews to catch and make use of it.

Fuel - Use the FuelMFD to offload as much fuel as you can spare onto the station. Getting propellant into orbit, for later use by moon ships, is a key part of your mission, and your place in the pilot pecking order will be determined partially by how much more fuel you can deliver than your compatriots. If you don't want to be stuck flying the runs on Christmas AND Thanksgiving, you'd better offload as much as you can. You can make it home with about 7% remaining in the tanks.

Water - As important as the fuel, water is needed for the conquest of space. You will also use the FuelMFD to offload this. Your ferry rocket includes a #2 tank which is not tapped by any engines; it holds water only. Likewise, the Wheel has a #2 tank. Change your Source (Shift-S) and Target (Shift-T) tanks to #2, and offload again. Important: Orbiter and FuelMFD don't contain any logic to prevent you from matching your #1 tank to the Wheel's #2, or vice versa. In reality, though, the only thing worse than water in your propellant is having hydrazine in your water supply. DON'T cross the streams!

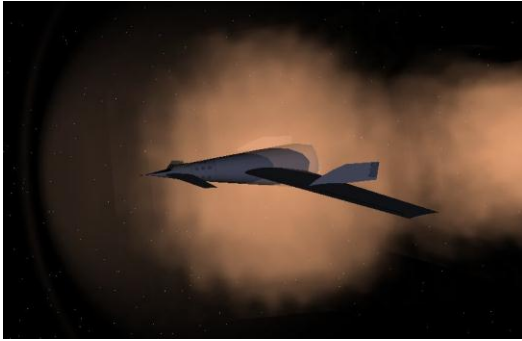
Fuel Mgt VB-01 (vbFerry)		
Pump Mode: Unload (TGT => SRC)		
Pump Rate: High		
Target Tank 1 (of 2)		
9529 kg	10.85%	87800 kg
Source Tank 1 (of 2)		
253054 kg	50.61%	500000 kg
Docking Port 1 (of 1)		
Docked To: Wheel		

Fuel Mgt VB-01 (vbFerry)		
Pump Mode: Unload (TGT => SRC)		
Pump Rate: High		
Target Tank 2 (of 2)		
7728 kg	77.28%	10000 kg
Source Tank 2 (of 2)		
102272 kg	51.14%	200000 kg
Docking Port 1 (of 1)		
Docked To: Wheel		

For re-entry, you have a LOT of L/D capability. In 1952 we didn't understand hypersonic wave

drag much better than we did hypersonic heating. The von Braun Ferry model achieves performance predicted in 1952, so...enjoy the great glide ratio. You'll actually find this to be a problem, as it will be easy to skip off the atmosphere and it will take a while to slow down. You'll have to slalom (90-degree banked pulls, first one direction, then the other) to slow down.

Once in sensible atmosphere, kill your RCS with the CTL-/ key. The aero controls work fine.



Don't forget to set trim with the INS and DEL keys. They really help!

If you overshoot, you can do a hypersonic 180° to get back to where you were going. Really.

Try to establish a base leg (90 degrees to final) at 150 m/s, about 8 degrees nose-down. Drop the gear and pull yourself onto final. Your glidepath will be about 6 degrees and 110 m/s. Try to pass over the runway threshold at about 90 m/s.

You should not need the brakes, but they're there if you need them. Touch down straight and slow. Use rudder to keep yourself on centerline. Leave the ailerons

centered...you've just come back from orbit; it would be a shame to ground loop.

The Ferry Rocket is now a CVEL launcher. To put a payload on instead of the third stage, set the parameter THIRDDSTG 0 in the scenario file. This gets rid of the winged third stage. Then put your substitute payload on using a standard CVEL payload or stage string.

The Ferry Rocket is now also a viable CVEL payload! To use it, invoke the ferry rocket as a CVEL string; it will assume you want only the third stage. For example:

```
PAYLOAD VB-01 vbFerryS3 vbFerry 0 0 3.85 145000.0 0.0 1.0
```

Wheel Station Operation:

The wheel station is the destination for your ferry rockets, and the starting point for all your missions further into the solar system.

75 meters in diameter, with a population of around 80, the station rotates once every 22 seconds to generate one-third G of centrifugal gravity.

Power is provided by a steam-boiler plant on the sunward side of the wheel; the ring-shaped mirror focuses sunlight onto a steam pipe, which is run through a turbine.

In Orbiter, the station is inertially fixed in orientation (KILLROT mode always on), so it will tend to drift slowly away from the ideal sun-centered facing as time goes on. This is preferable to having the station change facing randomly due to jostling from arriving and departing ships!



The station's two-hour orbit is chosen to allow a launch opportunity (actually, two opportunities) from Johnston, every day. The orbit's inclination and longitude of ascending node are chosen to be coplanar with the moon, so as to ease access.

The station is focus-enabled (you can shift view to it) for one reason: so you can EVA from it!

Keys:

E - EVA from the station.

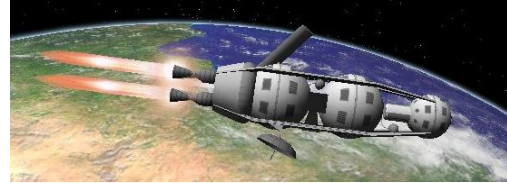
Circumlunar Ship Operation:

For all of human history, the lunar far side lay, tantalizingly near, yet unseen and unknown. The purpose of the circumlunar ship is, simply, to get a look at it and come home.

Historically, of course, this was done with robotic probes. But in 1952, this must have seemed more unlikely than just flying by and taking the photographs by hand.

The circumlunar ship is built from the tanks of a ferry rocket. It is designed to support a crew of 10 for the trip around the moon and return. It has the delta-V to eject from Earth to a free-return trajectory, and then to propulsively brake back into Earth orbit and rendezvous with the Wheel station.

There is no evidence that the circumlunar ship was supposed to have a docking port, but one has been included. What fun is a spaceship that can't dock?



Keys:

E - EVA from the ship.

To employ the circumlunar ship, use your favorite navigation program to plot a free-return trajectory. Failing that, the good old Shift-X will do in a pinch; just ensure that you'll pass slightly "forward" of the moon in its orbit. Inside the moon's sphere of influence, use translational thrusters to adjust your trajectory to match the planned one. A perilune of about 4000 km works well.

Once the flyby is complete and you're away from the moon, adjust again to make your perigee equal to the station's (8078 km). Then, use the Plane-Change MFD (Shift-A) to ensure you're matched with the Wheel's orbit.

At perigee, retrofire to reduce your apogee. Once you're in an elliptical orbit, pull up the SyncMFD (Shift-Y) and check out your phasing opportunities with the Wheel. Stop thrusting when an opportunity presents itself. In this way, your phasing orbit costs no additional fuel.

Phasing orbits done, rendezvous with the station. You should finish with about 3% in the tanks.



Moon Lander Operation:

There are two types of moon lander: the personnel ferry and the cargo ship. Both, actually, carry personnel to the moon (the personnel ships carry 50; the cargo ships "only" 20). They differ in that, instead of carrying return fuel, the cargo ship carries a great deal more cargo, and of course must remain behind on the moon.

Until it comes time to depart the moon, though, the two ships are functionally identical.

Power for the moon ships is provided via the Collier's-standard solar mercury boiler.

Like the circumlunar ship, the moon landers are largely made of inflatable structures. Docking at the nose is not possible because that's where the navigation instruments reside, under a clear dome. Instead, the moon ships have docking ports next to the personnel lock, underneath the personnel sphere. There's a hard dock for a Space Taxi, and a mesh funnel for a ferry rocket.

The landers were designed without any attitude jets – attitude adjustments were made with gyros only! To simulate this, the ship has an RCS of very high efficiency, and very weak jets. Give the gyros time to work. This simulation also includes translational thrusters (with a reasonable lsp) to allow fine maneuvers, but for the most “realism” you should not use them!

To help with the maneuvers, the outboard main engines were mounted on one-dimensional gimbals. Under thrust, then, these will thrust-vector as commanded. In addition, if the KILLROT navmode is commanded while under thrust, the main thrusters will swivel to kill rotational velocity, which will work much faster than the gyros.

Keys:

- G** - Toggle the landing gear.
- E** - EVA from the ship.
- V** - Toggle the viewpoint (straight ahead or out the side for landing)
- J** - Jettison the next stage.

The landing gear has five legs; four “outrigger” gear and a central, main load-bearing leg which partially retracts on ground contact. This was intended to compensate for deep dust or any other unknown surface condition, since there would be no robotic precursor mission.

The jettison feature will first dump the large spherical outboard tanks. The next jettison will drop the smaller side tanks, and the landing gear. (If the ship is landed on the gear at the time, which is when this stage should be activated, the legs will not fall off until the ship has lifted off again).

In the Collier's concept, the ships did not jettison the tanks with explosive bolts. Instead, crews exited the airlock with wrenches, unbolted all connections, and pushed the tanks away! A very time- and manpower-intensive operation, though it is simplified in this simulation.

For the passenger ships, there are no further jettison modes. The last three sets of tanks (for lunar launch, Earth orbit insertion, and reserve) are amalgamated into one large propellant resource. Use it wisely!

For the cargo vessel, a third jettison will dump the cargo module on the lunar surface in two halves, and will drop other carried cargo at the same time. The cargo module halves are now lunar base habitation modules.

Your normal viewpoint is forward, among the navigational instruments in the nose. Press V to switch to a viewpoint looking out the side of the dome, which should help a bit with landing.

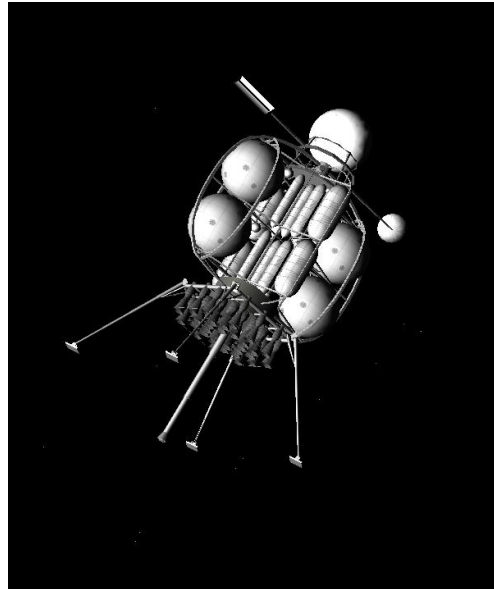
To employ the moon lander, initiate your TLI using the navigation program of your choice. Your engines are surprisingly weak compared to the tremendous mass of the fully fueled ship; your TLI burn will take 2000 seconds to complete! Plan accordingly.

Maneuver to impact the moon. Yes; the design technique for the landers was to imitate Ranger by streaking in for a lunar impact, then the engines were to fire to brake at the last instant. Fun! Using MapMFD, put your orbital path over the Sinus Roris landing site, and put the impact point just downrange of it. Point retrograde. Fire the engines at full throttle at about 640km altitude.

To better gauge the altitude to start braking, the moon landers incorporate a small estimation routine. If you're close to the right parameters, the ship will drop you out of time compression and give you a 5-second countdown to the retro burn. Don't have the time compression TOO high (over 100x), or the ship will skip right over this period and you won't be able to save it. The routine has a little margin for error built in; it should bring you to a stop at around 10 km altitude. Before this happens, throttle back and land manually.

EVA. Congratulations, you're on the moon! Drop off your lunar cargo and set up the base. The idea was to place the hab modules under an overhang to provide radiation protection. There's a shortage of projecting overhangs on the moon, however....

The return trip is the reverse of the outbound one. Direct-return opportunities with the minimum



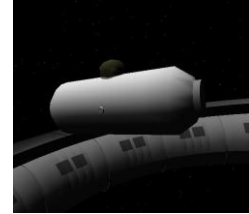
plane change occur about two weeks after initial launch, and every two weeks thereafter. You'll need to return at a time close to this, because you can't afford much plane change.

Launch directly at Earth; do not stop in lunar orbit. Unless, of course, you want to, or need to for navigational purposes. But the von Braun plan was for a direct return.

Plane change to match the Wheel, and propulsively brake into orbit, stopping in a phasing orbit as necessary.

Space Taxi Operation:

The Space Taxi looks like a spacegoing propane tank, and this is a good indication of its level of complexity. It's simple and rugged. Its job is to assist in the construction progress by providing a pressurized vessel to operate from, supervise, and move heavier equipment. It is also used to ferry crews and equipment from the Wheel to other vessels parked nearby.



Space Suit (EVA) Operation:

EVA in the days when the acronym EVA hadn't been invented yet!

The suit is exactly what it pretends to be: a space-suited astronaut, equipped to work in space. Naturally, this includes a thruster package complete with rotation and translational thrusters. They're cold-gas thrusters, though, so they're not very efficient. Use them wisely.

An EVA suit is spawned by hitting the "E" key on the Wheel station (80 EVA suits max), the Circumlunar Ship (10 EVA suits max), a moon lander (50 EVA suits max, or only 20 for a cargo lander), or a Ferry Rocket (12 EVA suits max).

To remove the suit, be within 100 meters of the ship it spawned from and hit "E" again. This will return you safe and snug inside the larger spacecraft. Whew!

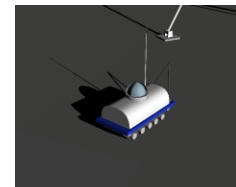
To walk around on a planetary surface, controls are the same as NASSP. Use the numbers, NOT the keypad. (But hitting Num Lock will work).

- 1 turns you left
- 2 walks backwards
- 3 turns you right
- 4 walks to the left
- 6 walks to the right
- 8 walks forward



Rover Operation:

Two rovers are dropped from the cargo lander at the same time the cargo is dropped. They are stored "inside" the cargo modules; just drive them right out. The rovers are powered by diesel engines, with oxidizer supplied by on-board hydrogen peroxide tanks. They're used for clearing lunar soil and for towing the cargo modules to a suitable area to be converted into the lunar base.



To move around on a planetary surface, controls are the same as NASSP. Use the numbers, NOT the keypad. (But hitting Num Lock will work).

- 1 turns you left
 - 2 walks backwards
 - 3 turns you right
 - 4 walks to the left
 - 6 walks to the right
 - 8 walks forward
-

Sinus Roris Base:

Sinus Roris was the preferred destination of the von Braun landers. It was chosen because it was near a flat area, but also adjacent to foothills which might provide overhead shelter for the hab modules. As we now know today, actual overhead shelter would be extremely unlikely, though there's no reason the von Braun expedition's pressurized bulldozers couldn't provide radiation protection by dumping six feet of lunar soil atop the habs.

At this time, there is no surface mesh for Sinus Roris, so you'll have to make do with the flat landing area.

There are now two variants of the sol.CFG file. Sol_1952.CFG, as we're used to, contains Johnston Atoll and a Sinus Roris that is nothing more than a landing target.

Sol_1952_2.CFG uses the same Johnston Atoll, but the moon now has a Sinus Roris base which is a going concern. Note the two hab modules, the dome which is adapted from the inflatable personnel sphere of the cargo lander, and the communications center which is among the cargo carried inside. Sinus Roris base also has landing pads, but these are invisible, and are specified only to make it easier to launch a rocket from the vicinity of the base. Land anywhere flat near the base; if it's in tractor range, your friends will come out and get you.

The only scenario to be based in Sol_1952_2 (and thus to have a full-up Sinus Roris base) is scenario #5, with the semi-regular moon shuttle. Note the vast amount of hardware and fuel which is expended to provide the moon base with mail and fresh vittles....

Known Issues:

Trevor John's FuelMFD is not yet working under Orbiter 2010. There are perfectly good substitutes, but I have not rewritten the documentation to use them.

Shutdown hangs, or crashes, on the default shutdown setting only when there are 3 or more vehicles in the scenario. I don't know why. To prevent this, change your Orbiter shutdown option (Extra, Debugging Options, Orbiter Shutdown Options) to "Respawn Orbiter Process". Sorry about that.

Notes:

This add-on attempts to faithfully recreate the world of the 1952 Colliers magazine series. We now have a Bonestell-designed graceful, finned, pointy-nosed spaceship of ludicrous size, a launching base, a space station destination, a moon ship, and a grandiose plan to use 'em.

Unfortunately, this retro-tech vision wouldn't work, at least not exactly as imagined. The pointy nose would melt, as would the sharp wings. There are other problems, nicely detailed in a recent article on www.astronautix.com. See "von Braun rockets of the 1950's - technical progress or public relations fraud?" at <http://www.astronautix.com/lvfam/vonbraun.htm>

For this add-on, I have taken much inspiration from the Man Conquers Space web site at <http://www.users.bigpond.net.au/surfacesrendered/MCSHomepage.html>. While I enjoy this site immensely, and would like this add-on to be able to recreate events in the forthcoming movie, I have no connection with the Man Conquers Space project. Certainly I have not appropriated any of their models, which should be obvious enough if you compare their renderings with my much-

less-detailed offerings....

My primary source for the moon landers was the invaluable "Spaceship Handbook" by Jack Hagerty and Jon C. Rogers. This was key to modeling the ships correctly, and understanding the difference between the 1952 ships, and the 1956 ships (and using Bonestell paintings as reference can be hazardous, as it's easy to find yourself using the wrong one!). The blame for adding the docking ports on the moonships is mine, however. You can hardly do without a dock in Orbiter, but no docking ports are drawn. There IS a Das Marsprojekt drawing that shows a Mars ship with a docking funnel where I've put it, however. The docking funnel might just be for the Mars ship, but given how much fuel the moon ships take aboard, it seems they'd almost have to be able to dock with a ferry rocket directly.

Future releases will add the Das Marsprojekt ships.

My cunning plan was to tow the cargo/hab modules around the lunar surface using TetherMFD. Alas, this doesn't work right when both tethered vessels are landed. Pity.

There is a fourth, "invisible" pad at Johnston Atoll. If you want to add other ships to the site, that's where they should go.

A note on nomenclature: Some sources (ilke the Man Conquers Space site) refer to the three-stage ferry rocket as the "Saturn Shuttle". This is a pretty enough name, but I reject it as unnecessarily confusing. In our history, we've built a Saturn, we've built a Shuttle, and there were even some short-lived proposals that combined hardware from the two. The Colliers articles called it the "Three-Stage Ferry Rocket" and I'll put a "von Braun's" in front of it as clarification, and that's what it will be known as in this add-on.

Version history:

V2.02

Re-compile for Orbiter 2010

v2.01

Included combase and dome meshes, which should have been in v2.0 release

v2.0

Added moon ships (meshes by Missleman01 and Sputnik)

Added Sinus Roris base

Added "Baby Satellite Station" and scenario (mesh by Missleman01)

All rockets now use RealExhaust texture (by Christophe Chabot)

Converted ferry rocket to be CVEL compatible

Added vbSuit code (adapted from Lunar Gemini project)

Upgraded EVA-spawning code fleet-wide to spawn & un-spawn correctly

v1.6

Added ground base meshes provided by Missleman01

Tweaked autopilot. More reliability, allows launch heading to differ from launch azimuth, and wing leveler added

Space Taxi is less heavy (same as in Orion add-on)

v1.51

Added transponders to Wheel

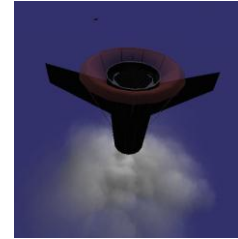
Removed unnecessary files

v1.5

Added second (H2O) propellant tank

Added speedbrakes and wheel brakes (Ferry rocket)

Changed landing gear routine to sit on fuselage and wing if gear-up
Added Wheel station
Added Space Taxi vessels
Added Circumlunar spacecraft
Added EVA suited astronauts from wheel, circumlunar, ferries
Shifted station orbit to accommodate lunar missions
Dropped stages now implement drag, aerodynamics, animation, and retro-fire
Scenery improvements (buildings, tugboats)



v1.01

Updated Johnston tile texture for better color matching (Provided thanks to MrBatman)
Camera positions added (thanks to emdot)

v1.0

Initial release
Created Earth_1952 environment and Johnston Atoll to launch from.
Tweaked flight characteristics
Fixed left aileron (now it deflects the RIGHT WAY)
Touched up the ferry textures
Made shroud lines visible from behind
Added an autopilot and it WORKS! (Thanks rjcroy AND daver)

v0.9

Initial beta release
Implemented as a Class to allow multiple instances.
Orbiter's stock Wheel serves as substitution for von Braun Wheel station.
Launched from Canaveral (this will change to Johnston Atoll)
Ran under separate .DLL

v0.1

Ran, sort of, under multistage.ini
Never released