*ORBITER* Space Flight Simulator
**Crew Exploration Vehicle CEV-2**


**Contents**



## Version history

0.1 ... First release

*ORBITER* Space Flight Simulator
**Crew Exploration Vehicle CEV-2**

## 1. Introduction

The United States will begin developing a new manned exploration vehicle, called the Crew Exploration Vehicle (CEV). The first craft to explore beyond Earth orbit since the Apollo days, the spacecraft shall be developed and tested by 2008 and shall conduct its first manned mission no later than 2014. Though its main purpose will be to leave Earth orbit, the vehicle will also ferry astronauts to and from the International Space Station after the shuttle is retired.

This add-on is modeled after a concept showing a biconic vessel.
The concept drawing is shown on page 3.

### Main design features

-Transports a crew of 4-6 and supplies to the ISS.

-Is a versatile and safe crew transport system in future missions to the Moon and Mars.

-Accommodates as many as 6 persons for short trips, allowing evacuating a fully manned ISS if required.

-Launches on an Shuttle derived SRB launcher.

-Delta-v for orbital maneuvers is 1400 m/s.
(Note: This requires a separate lunar capture stage for moon missions.)

-Returns to earth on a parasail.

## 2. Commands

### 2.1 CEV Command & Resource Module

| | | |
|---|---|---|
| C [1)] | Deploy drogue chute | Deploys the drogue chute. The command is available if the speed is below 1000 m/s and the height is below 40 km. |
| C [2)] | Deploy main chute | Deploys the main chute. The command is available after the drogue chute has been deployed and the speed is below 110 m/s. |
| E | Perform EVA | Creates an EVA-astronaut outside the hatch. |
| J | Jettison | Jettisons the Resource Module |
| S | Solar panel | Deploys the solar panels and high-gain antenna. |

## 3. Flight Instructions

### 3.1 Launch on an SRB derived Booster

Note: This requires a separate SRB-launcher. See http://simcosmos.planetaclix.pt

| Altitude km | V m/s | Vspd m/s | Pitch ° | Remarks |
|---|---|---|---|---|
| 0 | - | - | - | Boosters ignite at full throttle<br>Roll to desired heading (42° for the ISS) |
| 1 | - | - | 90 | Push to tip over |
| 20 | - | - | 40 | Lower the nose |
| 30 | - | - | 30 | |
| 40 | - | 600 | 20 | |
| 70 | - | 200 | 12 | |
| 100 | 6500 | 120 | 10 | MECO; 2nd stage ignites; check orbit inclination |
| 130 | 7900 | 0 | 0 | SECO |



*ORBITER* Space Flight Simulator
**Crew Exploration Vehicle CEV-2**

### 3.2 Earth Return

Start the reentry burn when 18.000 km from the target.
Aim for a perigee of 6400 km.

Jettison the resource module at 200 km height.
Before reentry (at 150 km height) orient prograde and level horizontal.
Set trim to +0.2.
Equilibrium glide altitude is about 65 km.

Over the landing area release first the drogue chute, then the main chute. It is recommended to deploy the main chute below 3 km, otherwise the glide will take very long.
The airbags inflate when the main chute is deployed.
Touch down with a vertical speed less than 10 m/s.

## 4. Scenarios

**Docked at ISS**
The biconic CEV2 docked at the ISS. Undock and try re-docking. Swivel the inboard view direction around to look back to the docking port.

When looking back remember the up-down thruster work normally, but the left-right thruster are inverted.

This orbit passes close over Cape Canaveral. Perform a reentry burn over Australias west coast, aim for a perigee of 6400 km.

**Drop test**
Drop test: The CEV2 on final into KSC with the main chute already depoyed. Trim up slightly and aim short of the runway.

At 100m start trimming up more, but do not stall the chute too early. The landing shall be with a vertical speed of less than 10 m, horizontal speed 10 - 20 m/s.

**Launch scenarios**
These are included with the SRB launcher (see link above).

## 5. Technical Details

Crew size: std. 4, max. 6

Dry mass: 12 ton (CM+RM)
Fuel mass: 5.5 ton (RM fuel)

Engines:
Main: 2 x 9 kN
RCS: 0,5 kN each

Fuel: UDMH / $N_2O_4$
ISP: 3421 m/s
dV: 1.4 km/s

Lift / drag: ~ 1,5
(CM only)

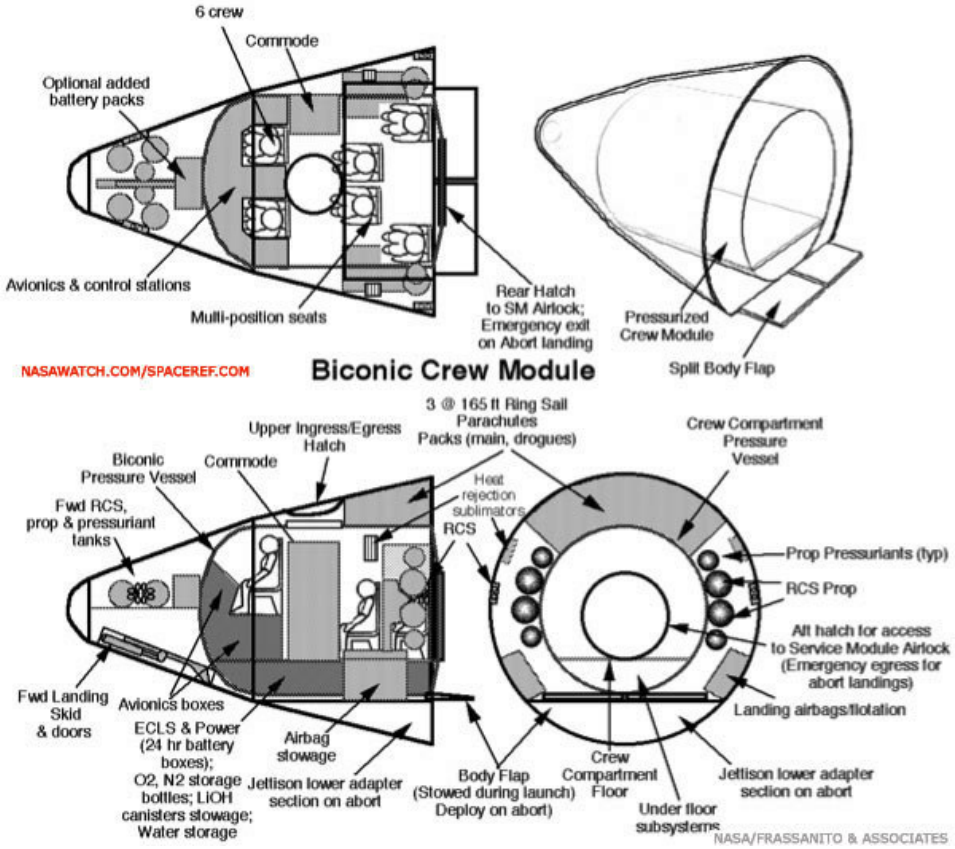
CM ... Command Module
RM ... Resource Module

The double-engine design was chosen for safety reasons. The resource module is actually split in two functional units; both are capable to work independently. This is to survive an ‚Apollo 13' scenario and bring the crew home save with the remaining engine.

The fuel systems are independent, but the supply lines can be crossed-over. In case of a single engine failure, the remaining fuel can be burned in the good engine. The RCS-system uses the same tanks as the main engines.

*ORBITER* Space Flight Simulator
**Crew Exploration Vehicle CEV-2**

The RM contains a center tunnel leading to the docking system, which is locating aft. The tunnel can also be used as an airlock to perform EVAs (when not docked).



*ORBITER* Space Flight Simulator
**Crew Exploration Vehicle CEV-2**

## 6. Credits

Urwumpe for all his information on lift and drag values, both of the biconic body and the parasail.

Simcosmos for his SRB launcher, to give the CEV wings ☺

Roger "Frying Tiger" Long for his great looking Astronaut figure, and the team of the shuttle Atlantis for the Ku-band antenna.

Alexander Blass (Mindblast) for his mesh import/export tools, opening the power of Gmax for all Orbiter modelers.

All the members of the Orbiter community who contribute to the development by test flying and helping me to do things right ☺

Special thanks to Martin Schweiger, who made all this possible with his *Orbiter Space Flight Simulator.* www.orbitersim.com