

- JACQUESMOMO -

- PAPPY2 -

STS-66 MISSION

ATLAS-03

CRISTA-SPAS

SSBUV-7

ESCAPE II

PALET

MINI SATELLITE

EXPERIENCE

EXPERIENCE

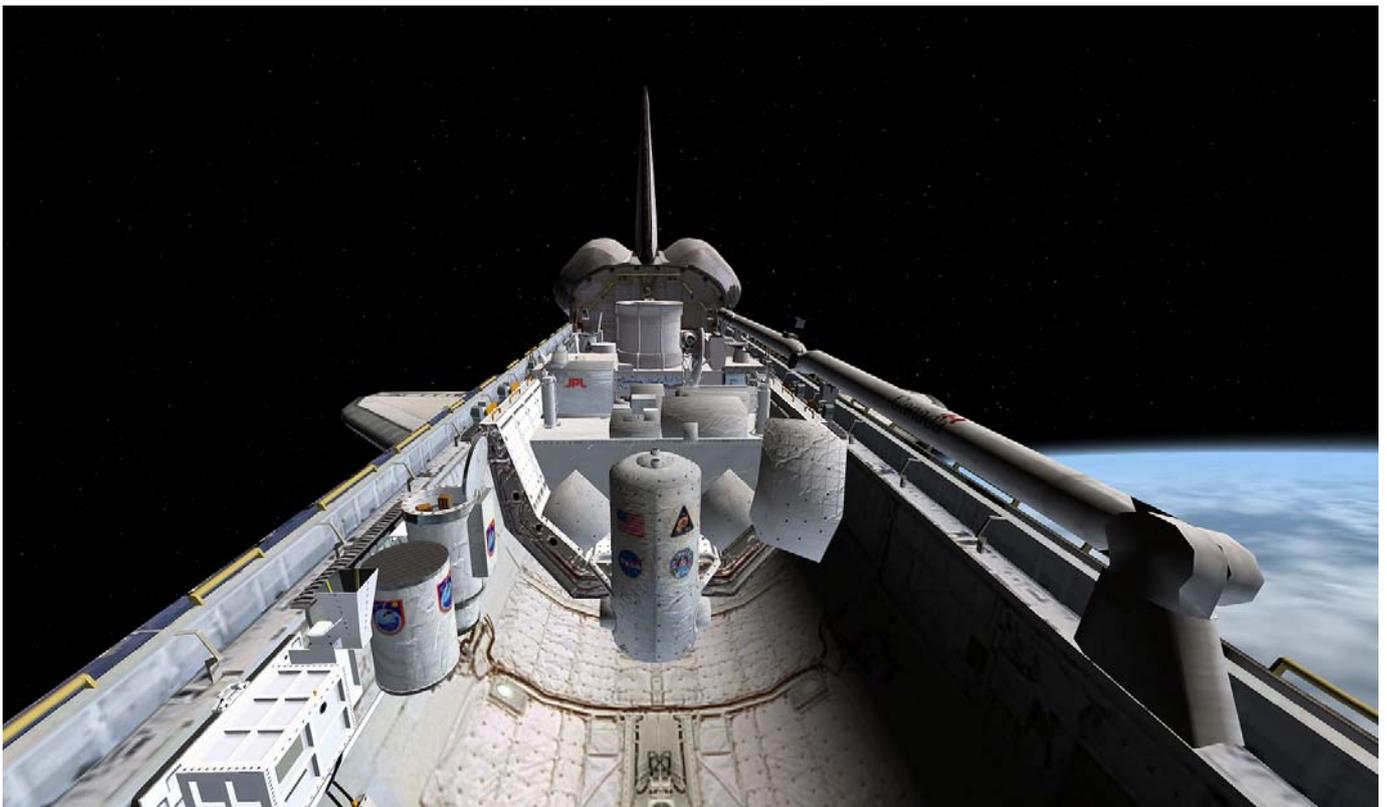
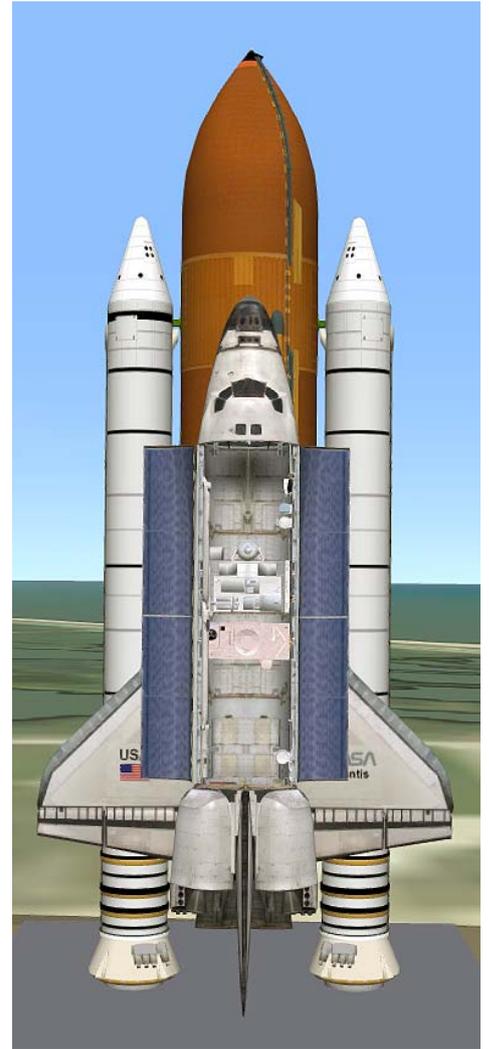
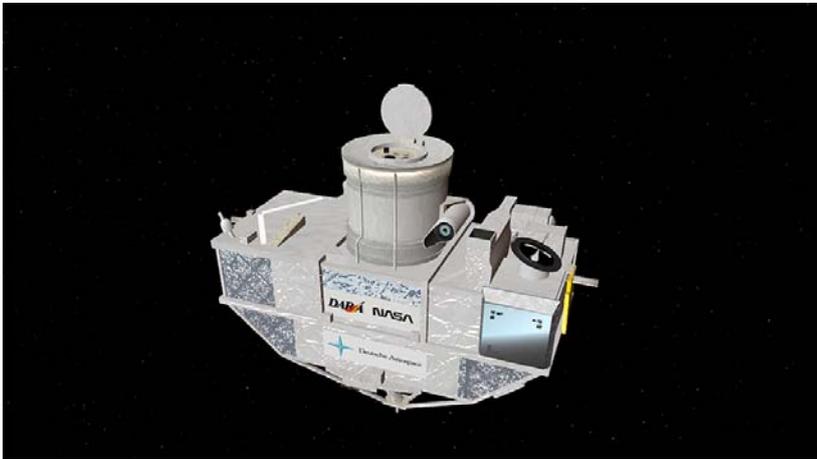


ADD-ON FOR ORBITER

USER MANUAL

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Credits and Acknowledgements :

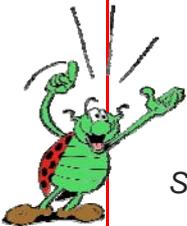
- Initiator for this Project : **Pappy2**
- Documentation : **Pappy2**
- 3D Models : **JacquesMomo**
- Textures : **JacquesMomo**
- Animations : **JacquesMomo**
- Scenarios : **Pappy2**
- Sounds : **JacquesMomo**
- Configuration files : **JacquesMomo**
- Tests, feedbacks and Suggestions : **Pappy2, Nulentout, Barrygolden**
- Writing of this tutorial : **JacquesMomo** et **Pappy2**
- Translation from French to English : **JacquesMomo**



Note : I apologize if this manual includes some errors in translation, as I'm not expert in English language...

And also huge thanks you to :

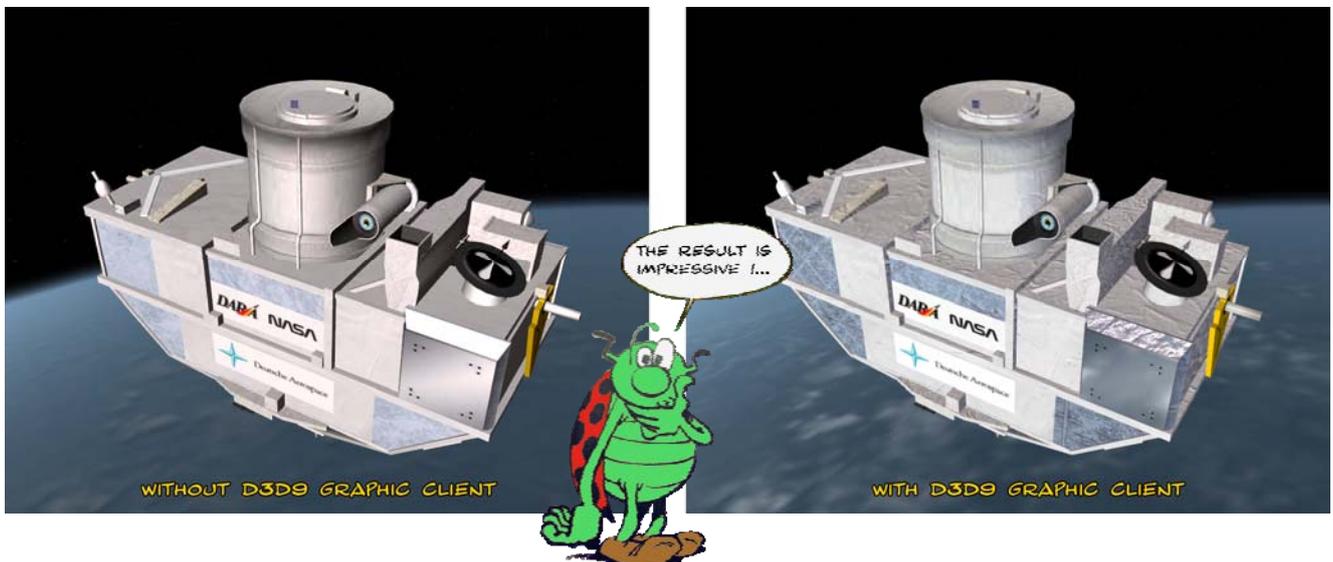
- **David413** for its wonderful **Shuttles**
- **Vinka** for its prodigious **Spacecraft3** module
- **DanSteph** for **OrbiterSound**
- **Dr Martin** for **Orbiter Space Simulator**



Note : This add-on is compatible with the D3D9 graphical client .

There are textures giving a special depth (*normal_map* textures) as well as textures for the reflection (*reflection_map* textures)

So it is recommended to use this graphical client for a better effect with this add-on.



I - INSTALLATION

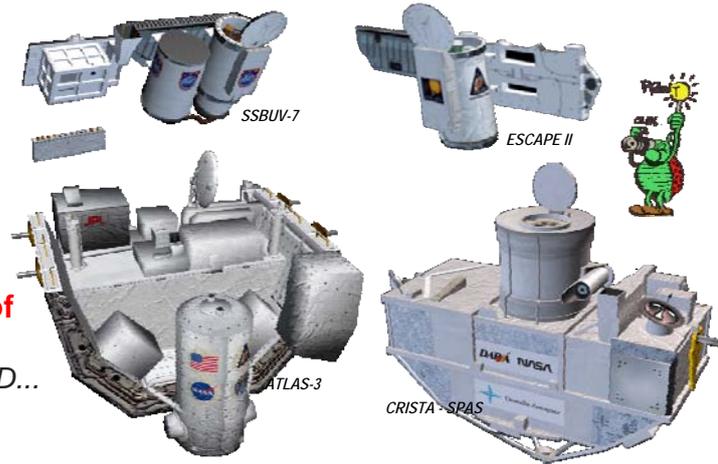
A) Description :

This add-on includes 4 separate parts :

- the SSBUV-7 experiment
- the ESCAPE II experiment
- the ATLAS-03 palette
- the CRISTA-SPAS mini-satellite

These 4 units REQUIRE to be used with one of the David413's Shuttles.

So, this add-on must be installed. If not, you'll get a CTD...



B) Installation :

You just have to unzip the file **STS-66_Mission.zip**

in the **root folder** of your **Orbiter**.

(Do not forget to check the option box " use folder name")

C) Mandatory add-ons :



- As said before, and even if repeating, all scenarios mandatory that you have already install the **Space Shuttle** (*Space Shuttle Fleet V4.8 Release 2*) de **David 413** available here :
<http://simaviation.com/1/browse-Orbiter+Addons-142-1> (**ShuttleFleetV4.8R2.zip** File).

- Of course you should also install **Dansteph's OrbiterSound**
You can find it right here : <http://orbiter.dansteph.com/forum/index.php?page=download>

- Also required : **Vinka's SpaceCraft3**.

But as his site seems "off" for now, I **included** it in my add-on...

So, it is not necessary to install it.

Just for information, there is a mirror site here:

<http://web.archive.org/web/20131206133940/http://users.swing.be/vinka/>

D) Optional add-ons :

- **D3D9 graphic client** (As I write this, now it is the **D3D9clientR15** version).
I would recommend you to install it, because you will save some frame rate (FPS) and also you can enjoy the visual enhancements with my special textures...
You will find it right here in the latest version : <http://d3d9client.codeplex.com/>
- The **Thorton's International Space Station** (**ISS_v3.2_07.09.10.rar** file)
available here : <http://www.orbithangar.com/searchid.php?ID=3737>
so you'll have a nicer launch tower ... but also you'll have an automatic launch (*1b scenario*).
- **Dansteph's UMmu 3.0** (if you want to take a little trip outside)...
available here : <http://orbiter.dansteph.com/forum/index.php?page=download>
- Optionally to enhance the landscape of the **Edwards Base**, the **Slat's** add-on.
(**LC39-EAFB 2006.3 - Lo-Res.zip** file) here : <http://www.orbithangar.com/searchid.php?ID=3005>
(see next page)

E) Provided scenarios :

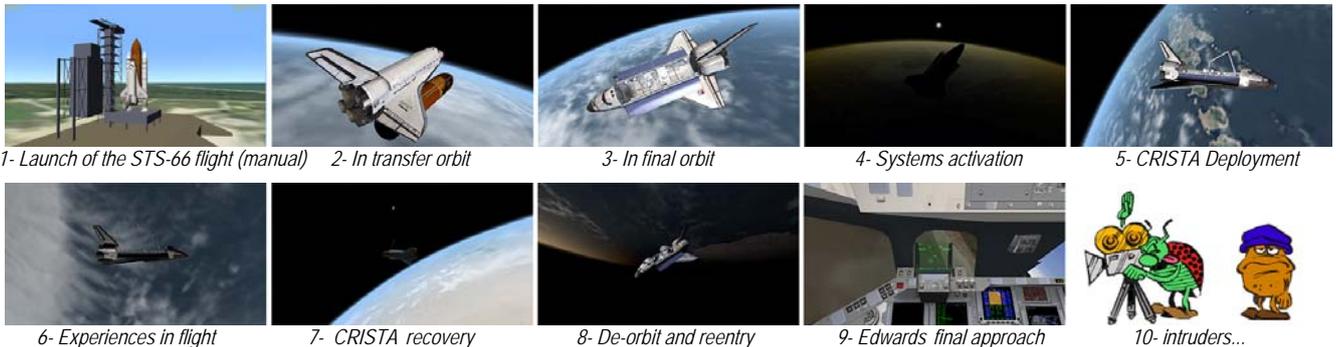
This add-on includes 10 scenarios you will find in the **\STS66-Mission** subfolder :

- (01) STS-66 Launch 03-11-1994
- (01b) STS-66 Launch 03-11-1994 * (see below)
- (02) STS-66 Transfer orbit
- (03) STS-66 Finale orbit
- (04) STS-66 Systems activation
- (05) STS-66 CRISTA deployment
- (06) STS-66 Experiences in flight
- (07) STS-66 CRISTA recovery
- (08) STS-66 De-orbit and reentry
- (09) STS-66 EDWARDS final approach



 All these scenarios require the installation of **David413's Shuttle_Fleet_v4.8R2** .

Below are the splash screens of all the scenarios :



 * This scenario requires **Thorton's ISS_v3.2_07.09.10** additional installation.



1b - Launch of the STS-66 flight (with automatic mode)
with the LC39 launch tower from Thorton's ISS add-on

This scenario has the benefit of allowing an automatic launching of Atlantis (you just have to wait and enjoy)... and it looks better !... But if you did not install the **Thorton's ISS add-on**, you'll get a **CTD** !

Note :

The Shuttle landing scenario to **EDWARDS** is rather ugly... 
If you wish a landscape amelioration, I would recommend you to install the **Slat's add-on LC39-EAFB 2006.3 (Lo-Res)** (file **LC39-EAFB 2006.3 - Lo-Res.zip**) available here :
<http://www.orbithangar.com/searchid.php?ID=3005>

Look for yourself :



If you install this add-on, to get the scenery and the mountains of **EDWARDS** base, simply edit all the scenarios and then modify in section **BEGIN_ENVIRONMENT(...)** **END_ENVIRONMENT** the line **System Sol** to **System SolSTS**.

II - COMMANDS (generalities)

A) Command keys :



- For the **David 413's Space Shuttle** :

Of course it is not my intention to list here all the control keys of this great vessel : please read the documentation included with this add-on... But I will nevertheless remind you some indispensable keys to know.

- K** ⇒ Open / Close the doors of the Atlantis cargo bay
- Ctrl + U** ⇒ Deploy / Store the "Ku-band" antenna (it is more realistic to do that)
- Ctrl + SPACE BAR** ⇒ Open the control window for the robotic arm (see further)
- Ctrl + J** ⇒ Close hatches of fuel links to external tank
- Inser** or **Del** ⇒ Pitch down / up (trim compensator))
- Ctrl + G** ⇒ Landing gear activation
- Shift + (** ⇒ Deploy speed brakes
- Shift +)** ⇒ Retract speed brakes
- ,** or **.** ⇒ Brakes Left / Right



- For **SSBUV-7 and ESCAPE-II** :

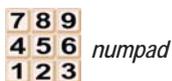
- K** ⇒ Open (or close) the covers of **SSBUV** and **ESCAPE-II**.

- For **ATLAS-3 pallet** :

- K** ⇒ Open (or close) the cover of **SOLCON**
- ⇒ Start (or stop) the scanning mode of the antenna **MAS**

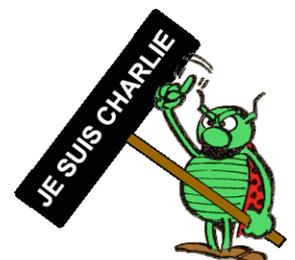
- For **CRISTA-SPAS satellite** :

- K** ⇒ Open (or close) the cover of the **CRISTA's** telescope



numpad

- ⇒ R.C.S. commands (*this mini satellite has rcs*)



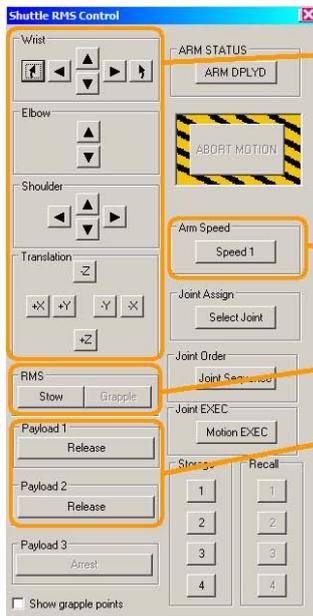
B) Control window for the Robotic Arm (RMS) and Payloads



Note : SRMS or RMS : Shuttle Remote Manipulator System



Here is the famous control window and its command buttons you have to know :
(For the others, consult the specific documentation of "Shuttle_Fleet" by David413)



Movements commands for the Robotic Arm

Note : Translation = combined movements :

X : movement forward / backward
Y : move to starboard side (right) / port side (left)
Z : move up / down

Movement speed of the Robotic Arm
(for pilot who is growing impatient...)

Release / Hooking by the Robotic Arm

Detach / Attach the payloads
from / to the Shuttle's cargo bay

- Payload 1 = CRISTA-SPAS
- Payload 2 = ATLAS

WARNING :

If you detach ATLAS, you will no longer be able to re-attach it
in the cargo bay, and then it will be lost for ever in deep space...
and in addition you will lose your pilot license ...



And here is an quick explanation of how you have to operate :



- ① CRISTA is in the cargo bay, hooked. The RMS is not near it.
- ② CRISTA is still hooked, the RMS is close to "grab" it:
press on **Grapple** then **Release** button change to **Arrest**.
You can extract CRISTA from the cargo bay with the RMS.
- ③ If you press **Release**, you release CRISTA.
If CRISTA is located near its location in the cargo bay, **Arrest** becomes *displayed*, so
you can release CRISTA from the RMS and it will *automatically* be fixed on the cargo bay.
- ④ CRISTA is just "stowed". As the RMS is necessarily close to it, the button **Grapple**
is active. The button **Stow** allows you to automatically store the RMS.

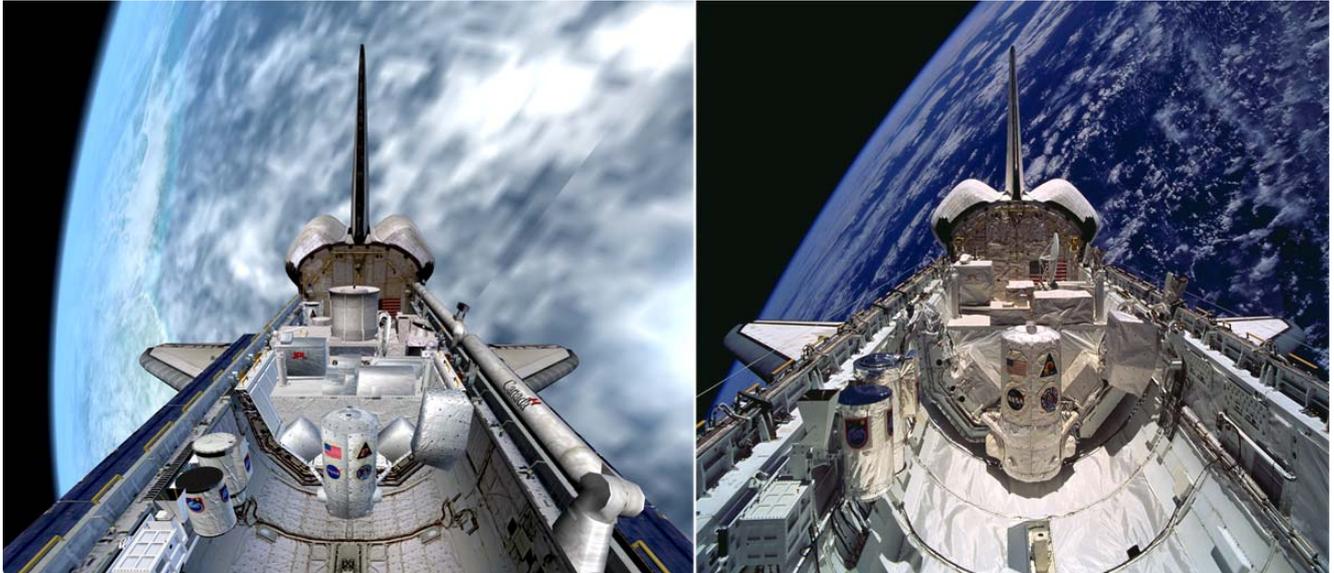


Correct position for the RMS
for gripping CRISTA



The guide pin can help you
to correctly position CRISTA...

III - PILOT'S LOG BOOK



1) Take off and Orbit insertion with the Shuttle

Launching is scheduled on November 3rd 1994 at 16h59 UT, from Cape Kennedy PAD 39-B.

To do that, it is very easy : select and start the scenario # 1.

At T Time, press simultaneously the two keys **Ctrl** and **+** (numpad) until you have the maximum power for the motors. Atlantis will take off.

Then all is automatic to the final engine shutdown.

Note : If you select the 1b scenario, you'll have nothing to do : everything is automatic !

The planned altitude for the orbit to reach, which is circular, is 304 km, inclined at 57 °.

Duration of the mission: 10 days, 22 hours, 34 minutes et 2 seconds.

Covered distance : 7 330 226 kilometers.

Number of completed orbits : 174.

2) Experiences activation

A) ATLANTIS

Open the doors of Atlantis' cargo bay with **K**, and then deploy the *KU-band antenna*.

D) SSBUV-7 et ESCAPE II

Here too, enable the experiences by opening the two covers together with **K**.

C) ATLAS-03

Activate the experiences of this platform with **K**.

B) CRISTA - SPAS

This mini-satellite should remain at a distance of 40 to 70 km behind Atlantis for eight days. Open the cover of its telescope with **K**. And do not forget to recover it before going back home...

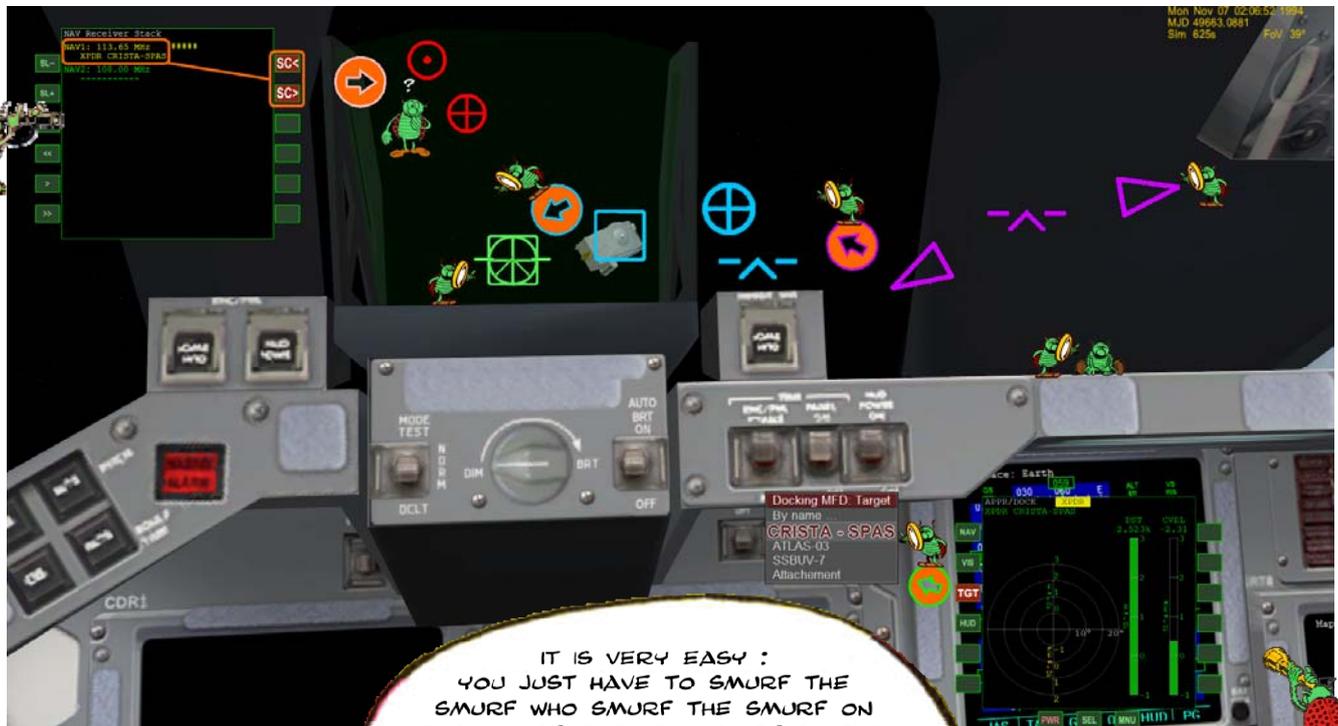


3) Deorbiting and Back to Earth with the Shuttle

- First of all, go and grab the mini satellite **CRISTA-SPAS**. To locate it easier it has a **transponder** (XPDR frequency = 113.65 MHz).



As a good drawing is often better than a thousand explanations, so look at this picture, because you must learn a little by yourself, we are not going to tell you everything, we also searched then is to you to go and recover it at last that damn TV because I do have many things else to do I want to go back home and then there is no reason and that's all it is not necessarily the themselves must stick to it and a thousand other legal people and I have not said anything



IT IS VERY EASY :
YOU JUST HAVE TO SMURF THE
SMURF WHO SMURF THE SMURF ON
THE SMURF, THEN TO SMURF TO THE
SMURF WHILE YOU SMURF WELL THE
SMURF AND THE OTHER SMURF AND THEN
YOU ONLY HAVE TO SMURF ON THE
SMURF OF THE SMURF ...

IT'S SIMPLE
AND CLEAR !..

I HAVE
UNDERSTOOD
NOTHING
AT ALL !..

AS AN EXPLANATION,
I HAVE ALREADY
SEEN BETTER ...

AND IT IS
SMURFED !
...

AH, IF IT WAS ME
WHO HAD MADE THIS
DOC, THE EXPLANATION
WOULD BE CLEARER
....

HÖÖÖÖÖÖME ?..

- Reinstall **CRISTA** exactly on its location in the cargo bay of Atlantis.
- Close all open covers of all current experiences (which should be completed)...
- Store the Atlantis's antenna, then close the doors of its cargo bay.
- And now proceed to the de-orbiting, then to the reentry into Earth's atmosphere, and then to the landing phase. It was planned to the **Kennedy Space Center**, but it was changed for the **Edwards AFB Base** because of the strong winds and rain in Florida brought about by the **Gordon Tropical Storm**.

Atlantis landed on November 14th, 1994 at 3:33:45 p.m. UTC on runway 22.



IV STS-66 MISSION (ATLAS - CRISTA - SSBUV etc...)



A) ATLAS - 3 laboratory :

The main purpose of **STS-66** (**AT**mospheric **L**aboratory for about solar energy and the way

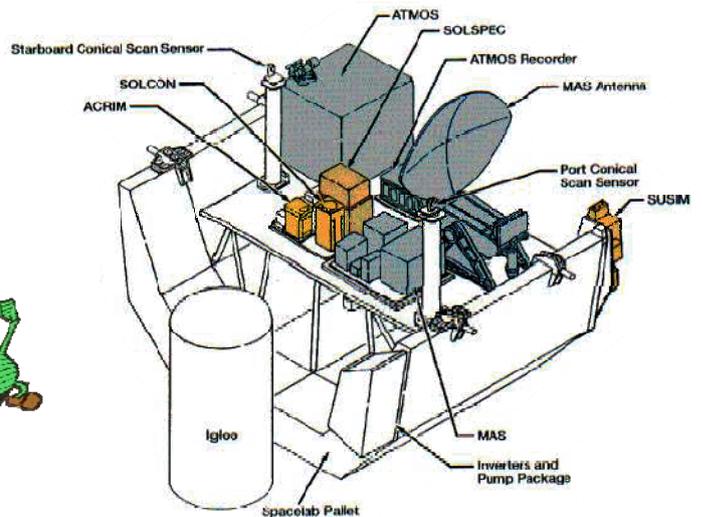
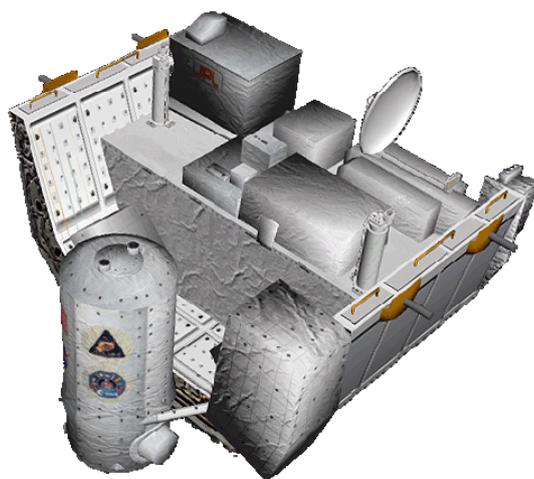
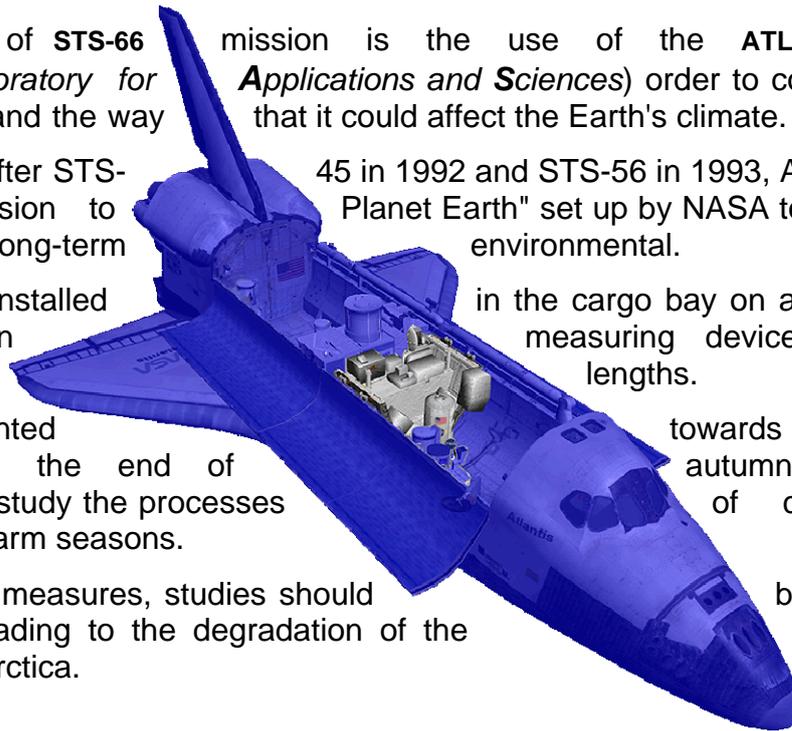
Third in the series after STS-45 in 1992 and STS-56 in 1993, ATLAS-3 is within the program "Mission to Planet Earth" set up by NASA to study the Earth and its long-term environmental.

This "laboratory" is installed in the cargo bay on a Spacelab pallet and has seven measuring devices operating in different wave lengths.

These must be oriented towards the northern hemisphere during the end of autumn in order to enable scientists to study the processes of climate change between cold and warm seasons.

In addition to these measures, studies should be conducted about processes leading to the degradation of the ozone layer, especially over Antarctica.

mission is the use of the **ATLAS-3** laboratory (**AT**mospheric **L**aboratory for **A**pplications and **S**ciences) order to collect information that it could affect the Earth's climate.



The six experiences on the Spacelab pallet

Here are the 7 experiences of the Atlas-3 Laboratory :

ACRIM (*Active Cavity Radiometer Irradiance Monitor*)

Extremely precise measurements of total solar radiation for 30 orbits.

<http://www.acrim.com/projects.htm>

SOLCON (*SOLar CONstant sensor*)

Solar intensity sensor manufactured by the Royal Meteorological Institute of Belgium.

http://www.cidehom.com/science_at_nasa.php?_a_id=108

ATMOS (*Atmospheric Trace MOlecule Spectroscopy*)

Data collection of trace of gases in the atmosphere. **ATMOS** has to see the sun through the stratosphere and thus measure the spectral absorption of the solar energy.

SOLSPEC (*SOLar SPECtrum*)

Franco-Belgian instrument for measuring the solar radiation depending on the wavelength, and ultraviolet radiation.

http://solspec.projet.latmos.ipsl.fr/Solspec_F/Accueil.html

MAS (*Millimeter-wave Atmospheric Sounder*)

Detection of thermal emission produced by ozone, water vapor, chlorine monoxide and oxygen at altitudes between 20 and 100 km. (*broken down on the 2nd day*).

<http://www.sat.ltu.se/projects/mas/>

SUSIM (*Solar Ultraviolet Spectral Irradiance Monitor*)

Measuring the absolute irradiance of the solar ultraviolet.

<http://www.solar.nrl.navy.mil/susim.html>



Irradiance is a term used in radiometry to quantify the power of electromagnetic radiation per unit area. In the international system of units, it is expressed in watts per square meter.

Starboard Conical Scan Sensor and Port Conical Scan Sensor

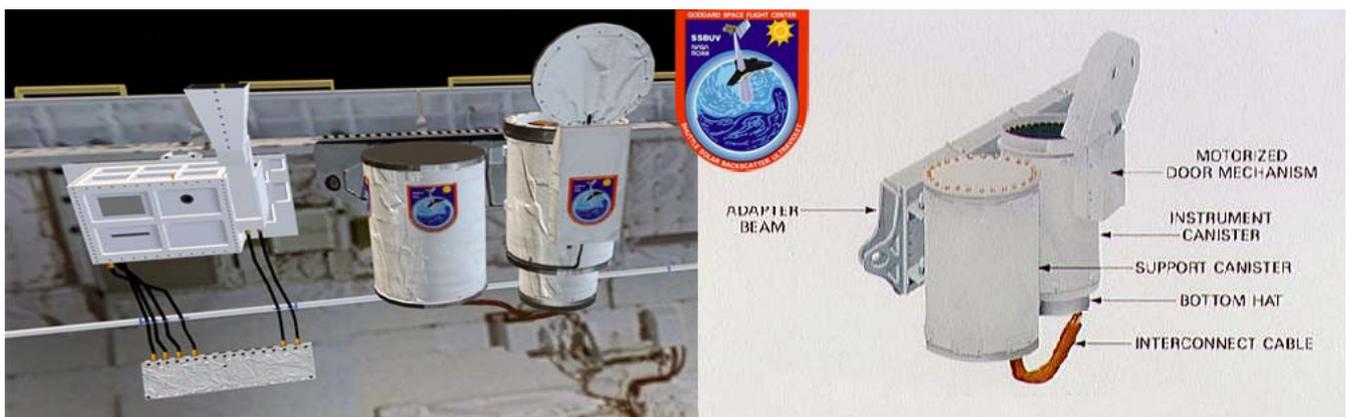
Conical scanning sensors for the transmission and reception of data to the ground and to the Shuttle. There are two: one on the starboard side of the pallet, and one on the port side.

B) SSBUV-7 :

This **SSBUV** set (*Shuttle Solar Backscatter UltraViolet spectrometer*) is fixed in the cargo bay of the Shuttle Atlantis, on the starboard side.

As the name suggests, it is the seventh of the series...

This is experiences about solar backscatter ultraviolet on the ozone layer.



This instrument has to take measures about ozone in the stratosphere and in the mesosphere from backscatter observations of ultraviolet rays.

During flight, **SSBUV-7** must compare its data with **METEOR 3** and **METEOR 6**, **TOMS**, **NOAA-11**, and **UARS** satellites.

This project is designed for flying on many Shuttle missions in order to provide additional calibration data about ozone layer for long-term.

<https://directory.eoportal.org/web/eoportal/satellite-missions/s/ssbuv>

C) THE RECOVERABLE SATELLITE CRISTA - SPAS 1



CRISTA = **CR**yogenic **I**nfrared **S**pectrometer **T**elescope for **A**tmosphere
SPAS = **S**huttle **P**allet **S**atellite

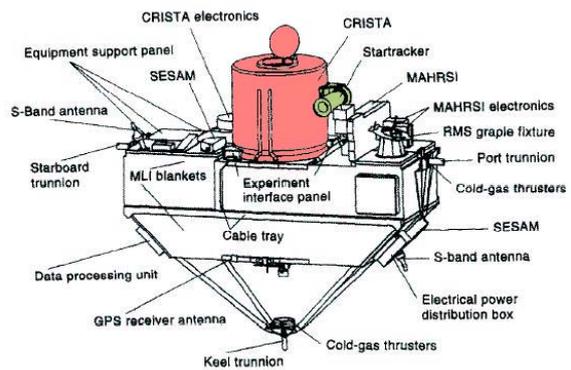
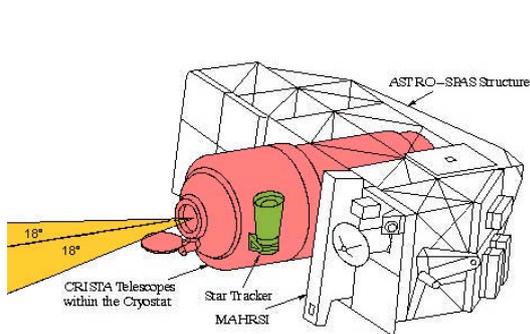


Natural supplement of **ATLAS-3**, the recoverable satellite **CRISTA** was designed to study the variability of the atmosphere and for measures which will complement those provided by the high atmosphere **UARS** satellite, deployed during the **STS-48** mission in 1991.

It is a vertical scanning satellite, designed and developed by the University of Wuppertal, for measuring the infrared emission from the Earth's atmosphere.

With three telescopes and four spectrometers cooled by liquid helium, **CRISTA** has to acquire global maps of gas temperature and atmospheric trace minerals with a very high horizontal and vertical resolution.

Its design allows observation of small-scale dynamic structures in altitudes between 15 and 150 km.



In order to be self-contained during the flight, **CRISTA** is mounted on the **SPAS** built by **Daimler-Chrysler Aerospace**. This is for that reason the ensemble is named **CRISTA-SPAS**.

CRISTA-SPAS has 2 meters of length, 4.6 meters of height and a weight of 3 400 kg. **CRISTA** (without **SPAS**) has 2.98 meters high and a diameter of 1.35 meters, for a mass of 1 350 kg.

<https://eoportal.org/web/eoportal/satellite-missions/a/atlas>



MAHRSI (Middle Atmosphere High Resolution Spectrograph Investigation)

Second experiment mounted on **CRISTA-SPAS**, **MAHRSI** was created by the *US Naval Research Laboratory*, in Washington DC.

MAHRSI was developed specifically to measure the vertical profiles of the density of hydroxyl (OH) and nitric oxide (NO) in the middle atmosphere. It gave the first complete world map of hydroxyl in the atmosphere.

<http://glennschoolwaip.blogspot.fr/2011/09/united-states-naval-research-laboratory.html>



SESAM (Surface Effects Sample Monitor)

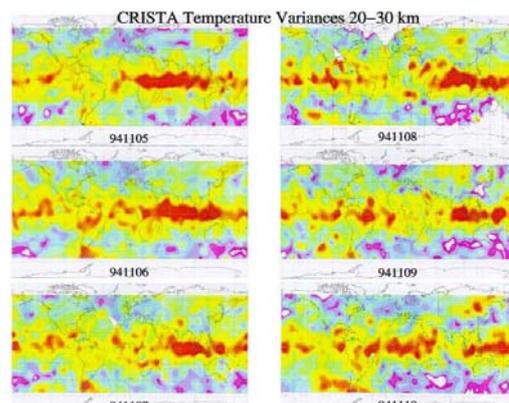
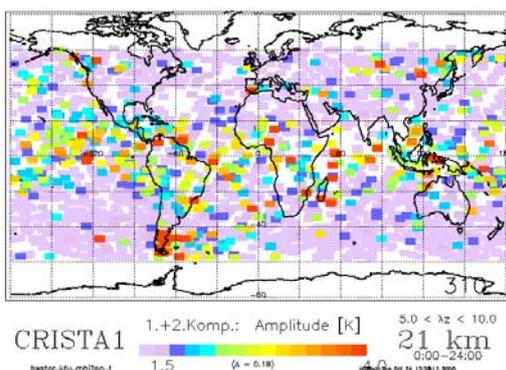
Third experiment mounted on **CRISTA-SPAS**, **SESAM** is intended to explore influence of atmospheric particles of atomic oxygen and ultraviolet on optical surfaces used in astronomy and exposed in the vacuum of space.

This instrument is going to test and exhibiting to the space vacuum about forty samples.

CRISTA-SPAS FLIGHT

CRISTA-SPAS has been deployed on the second day of the flight by the RMS robotic arm controlled by the French astronaut Jean-François CLERVOY.

flying behind Atlantis on the same orbit, at a distance between 40 and 70 km, it was able to collect during eight days data about the variety of the gas in the composition of atmosphere and about levels of nitric acid and hydroxide inside it.





During recovery of **CRISTA-SPAS**, a new approach system was tested. This system was designed to raise the security for future docking with the Russian Space Station **MIR**. Successfully completed, this approach was called « R-Bar ».

This will enable to save fuel for attitude and approach thrusters (**RCS**), while minimizing the risk of a contamination of **MIR**'s systems by the Shuttle's jets propulsion.

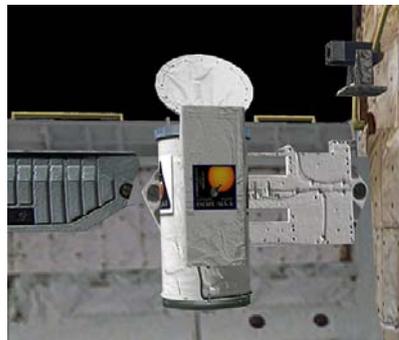
<https://eoportal.org/web/eoportal/satellite-missions/a/atlas>

D) THE OTHERS SCIENTIFIC EXPERIMENTS

Other scientific experiments were in the mission program and were installed in the Atlantis's cabin. They were implemented by the astronauts themselves.

ESCAPE II

Experience for completing the **ATLAS-3** observations by the study of solar radiation and its impacts on the atmosphere and the Earth environment.



PARE / NIR-R

Physiological and anatomical Study on rodents.

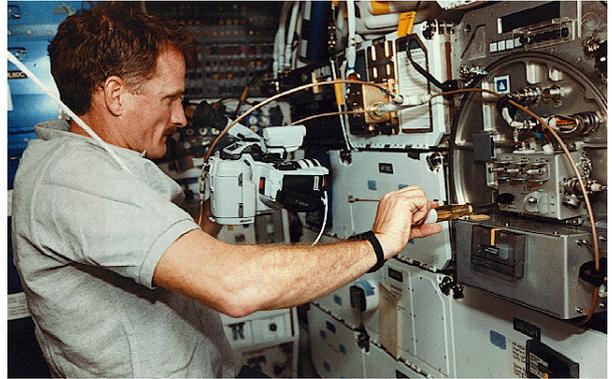
PCG-TON

Experience about the growth of protein crystals under microgravity.



SAMS

Study on how the microgravity environment can affect the experiments onboard of the Space Shuttle cabin.



STL / NIH-C

Study on tissue loss in space (National Institute of Health).



HPP-2

Study about thermal and dynamic performance of fluids.

E) THE SPACELAB LABORATORY

Spacelab is a modular space laboratory used during some flights of the American Space Shuttle to perform microgravity missions and to operate some instruments in the space vacuum. It includes several variety of components installed in the Shuttle's cargo bay. The main component is a *pressurized module* that allows scientists to complete some experiences.

Spacelab is the European contribution to the Space Shuttle program. Many laboratory components were included of more than 25 missions between 1981 and 2000.



1) The Spacelab pallets

The pallets are components like an "open U" which may be installed into the Shuttle cargo bay, and are intended for scientific experimentations that must be into direct contact with space vacuum. The Space Shuttle cargo bay can receive either one Spacelab pressurized module with two pallet, or five pallets.

Each pallet has a width of 4.35 meters and a length of 2.87 meters. Their mass is 725 kg, and these pallets can hold a 3.1 tons payload.

These pallets were manufactured *British Aerospace*.



2) The igloo

When the Space Shuttle carries pallets without pressurized modules, an uninhabited *pressurized module Igloo* is installed.

It contains all the equipment required for the operation of experience mounted on the pallets usually supported by the pressurized laboratory : power distribution, communications, and data processing.

This component is 2.5 meters high, 1.5 meter diameter, and weighs a little more than 2 tons.

The Igloo has been manufactured in two models by the Belgian company **SABCA**.



F) ASTRO-SPAS (Astronomy Platform - Shuttle Pallet Satellite)

ASTRO-SPAS is the generic name of this reusable platform designed and built by the German group *DaimlerChrysler Aerospace* (which will become later by fusion with other large groups **EADS**).

ASTRO-SPAS platform is used as an independent duty structure for payloads carried in the Shuttle for short-duration flight missions.

SPAS structure consists of several components of low weight and high rigidity that are carbon composite tubes with titanium nodes. Standardized mounting panels are provided for the equipment of the sub-system and for payloads.

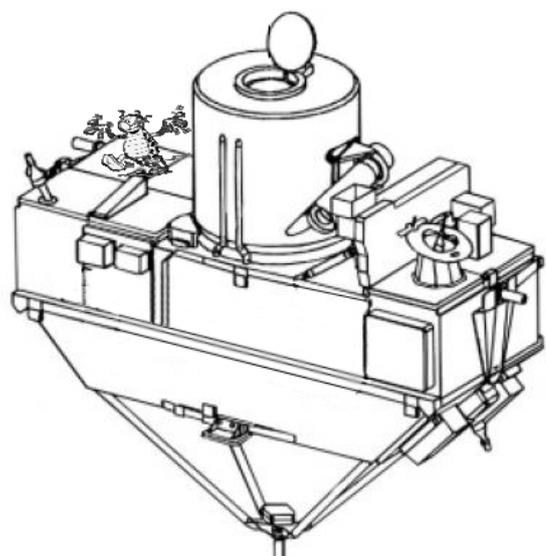
The platform is deployed and then recovered by the **RMS** (robotic arm of the Shuttle). In autonomous flight, it can perform a mission that can move it away from the Shuttle to a distance of about 100 km.

The overall size of the platform is 4.5 m x 1.75 m.

Its empty mass is about 1 240 kg (including service subsystems) and can carry a payload with a total weight of 3 600 kg.

The platform operates autonomously using the following subsystems :

- Electric power:
Up to 16 modular Li-So batteries with 110 kWh and with 40 kWh of energy available for all the instruments of the payload.
- Temperature control:
Passive with multi-layer insulation.
- Data management capabilities:
An onboard computer provides all data management functions, storage of these database to a recorder, processing telemetry data, attitude control, etc...



- Platform Stabilization :

A "three axes" stabilization is available. A very precise *star tracker* sets the benchmark for an accuracy pointing lower than 3 arc seconds towards astronomical targets. A **GPS** receiver system (*Tensor*) provides orbital position and attitude data of the platform. Attitude control (*Actuator*) is provided with a cold gas thruster system 12 with exhaust nozzle producing 100 mN of thrust...

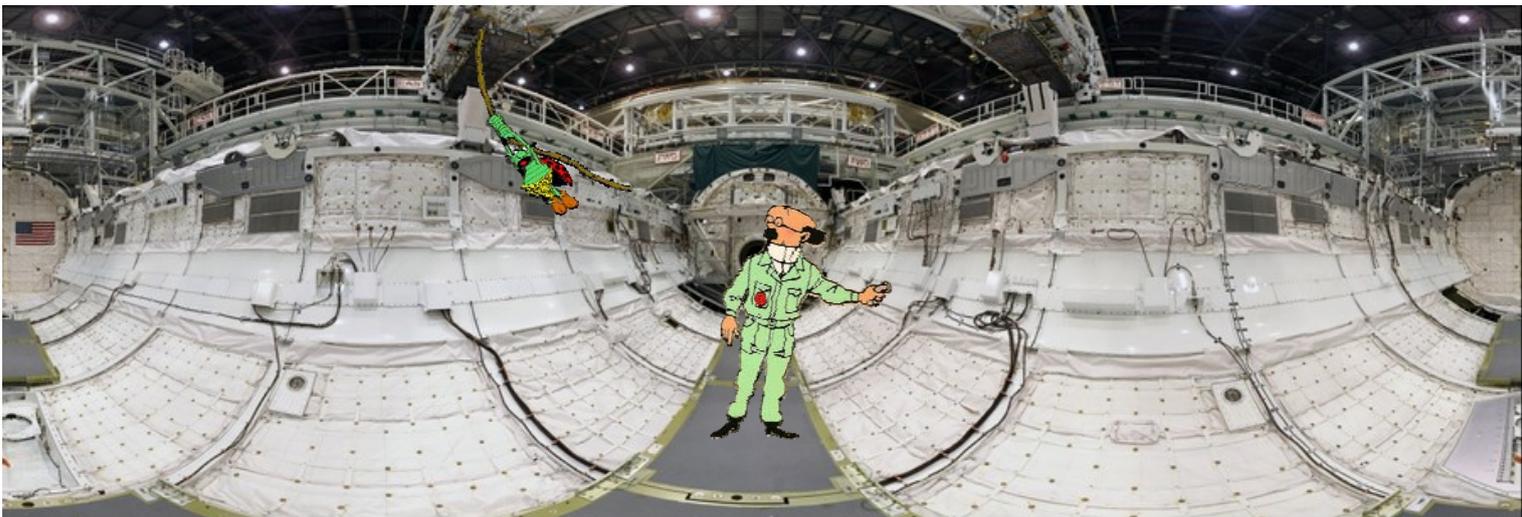
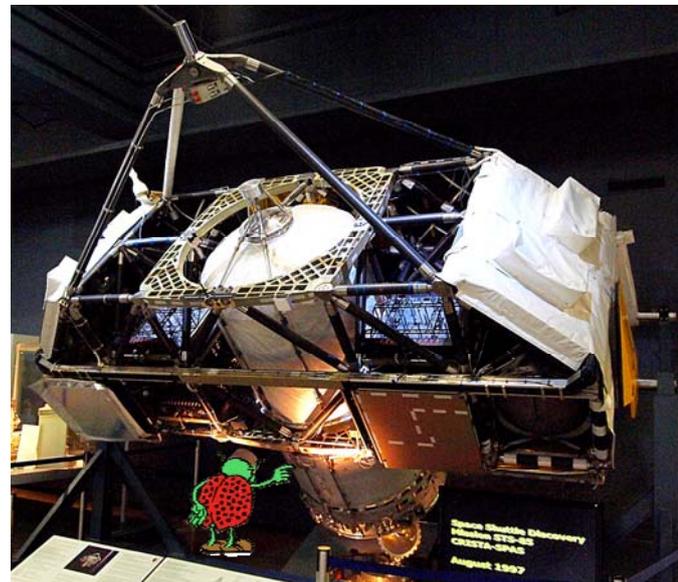
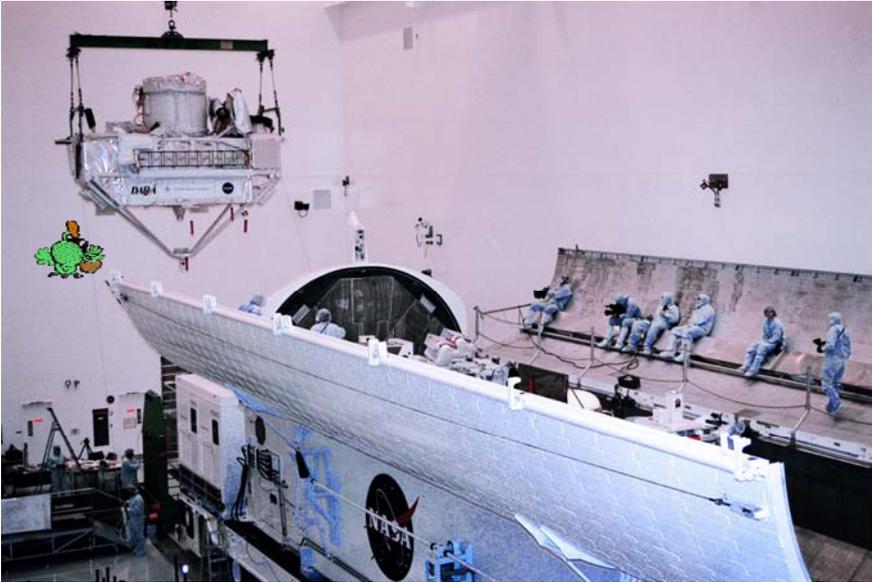
- Operating Modes :

There are 2 : "inertial pointing" and "orbital movement mode ".

- *Inertial pointing mode* is used for astronomical observations. The *star tracker* (CCD camera) measures a *three star guide position* in its field of view of $4.5^\circ \times 6^\circ$ and the *gyro package* detects rotations.

- The *orbital movement mode* is used for atmospheric research and "point" in a specific direction. One of the axis is pointed in a constant altitude (stabilized at ± 2 km). The GPS instrument (*Tensor*) and the *Stellar Sensor* provide the platform attitude, position and speed.

- A communication link with the Shuttle is provided by an **S-band transponder** with uplink data rates up to 2 kbit/s, and downlink data rates up to 16 kbit/s.



G) THE STS-66 CREW

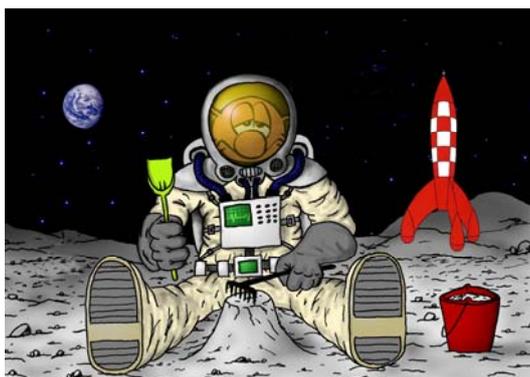
The crew of the American Space Shuttle **ATLANTIS** (OV-104), which take off was on Nov. 3rd, 1994 for its 13th flight (but also the 66th flight of a Space Shuttle), consists of the following astronauts : (from left to right on the group photo)

- | | | |
|-------------------------|------------|------------------------------|
| • Jean-François CLERVOY | (1 flight) | Specialist Mission #3 (CNES) |
| • Scott PARAZYNSKI | (1 flight) | Specialist Mission #4 |
| • Curtis BROWN | (2 flight) | Pilot |
| • Joseph TANNER | (1 flight) | Specialist Mission #2 |
| • Donald Mc MONAGLE | (3 flight) | Commander |
| • Ellen OCHOA | (2 flight) | Specialist Mission #1 |



Jean-François CLERVOY took part in a press conference about the STS-66 mission scientific objectives with many press representatives of European media

«... An important inputs data gathering was performed. These data belong to the community of scientists all around the world ... »



My experience will soon be completed...



I hope you'll enjoy this add-on...
JacquesMomo and Pappy2
(Mars 2015)



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Though nearly all add-ons here are made by me, few add-ons are made with the help of **Pappy2**, others with the help of **Papyref**. Lastly, some of them were made **by Papyref** with a modest contribution from me. Anyway, thanks to all of them !!!