The ARIANE 6 rocket

The first Ariane 6 rocket was launched on July 9, 2024 at 7:00 p.m. UT
from the ELA 4 zone of the Kourou Guiana Space Center
specially built for it.

This add-on is for Open Orbiter 2024

CONTENTS

I - THE ARIANE 6 ROCKET

A) Overall composition of the rocket

1) **ESR (*E*quipped *S*olid *R*ocket) PC120C** (Boosters)
These are monobloc thrusters with a composite envelope. There are two of them for this version, which is therefore named Ariane 6.2 (the future rocket which will include 4 boosters will be an Ariane 6.4) and operate with solid propellant. Their operating time is approximately 135 seconds, helping the first stage to propel the rocket to an altitude of 70 km.

2) **LLPM (*L*ower *L*iquid *P*ropulsion *M*odule) H150** (first stage or main stage)
Thrust is provided by a ***Vulcain 2.1*** engine running on a mixture of liquid oxygen and hydrogen. Its operating time is 460 seconds.

3) **IFS (*I*nter*F*ace *S*tructure)** ("skirt" above **LLPM** and below **ULPM**)
Carbon fiber structure serving as an intermediate piece between the 1st and 2nd stages.

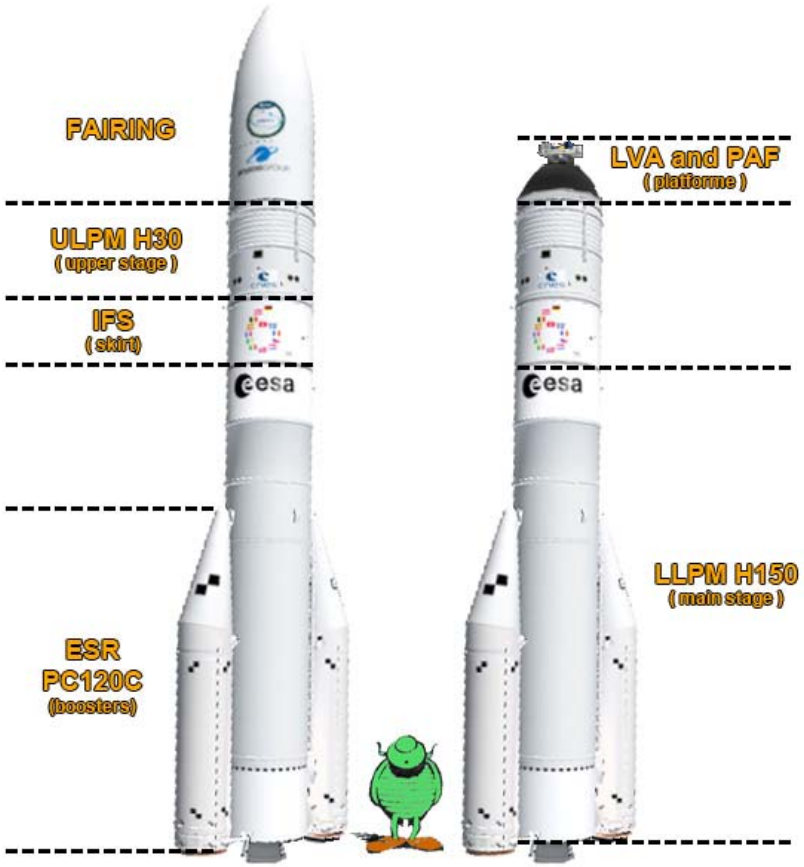
4) **ULPM (*U*pper *L*iquid *P*ropulsion *M*odule) H30** (second stage or upper stage)
Cryogenic stage powered by a ***Vinci*** engine running with a mixture of liquid oxygen and hydrogen. Its special feature is that it can be re-ignited during flight. Its operating time will vary depending on the mission and can be up to 900 seconds.

5) **FAIRING**
These are two half-shells forming the top of the launcher and which give it its aerodynamic shape.
Their separation in flight is ensured by pyrotechnic charges

6) **LVA** (*Launch Vehicle Adapter*)
Structure providing the transition between the ***ULPM*** and the ***Main Passenger Payload Adapter*** (or *PAF*)

7) **PAF** (*Payload Adaptator Fitting*)
It is a structure consisting of a kind of adapters for payloads

8) **APU** (*Auxiliary Power Unit*)
These are small thrusters that correct the attitude of the upper stage. They are part of the main innovation of the Ariane 6 rocket to allow it to maneuver between different orbital planes.



B) Characteristics of the Ariane 6 rocket and its components

IMPORTANT to note : *All the values listed in these tables are only approximations, which I hope are as realistic as possible. All the values entered come from my research, but some are either imprecise or have several different values depending on the websites consulted. Values followed by a question mark (?) are uncertain....*

THE ARIANE 6 ROCKET *as a whole*

Launcher version	**Ariane 62 - flight 262**	**Ariane 62 - flight 263**	**Ariane 62**	**Ariane 64**
Number of stages	2 *(main and superior)*	2 *(main and superior)*	2 *(main and superior)*	2 *(main and superior)*
Number of Boosters	2	2	2	4
Total height	56 m (short fairing)	56 m (short fairing)	56 m (short fairing)	62 m (long fairing)
Height without fairing	42 m	42 m	42 m	42 m
Fairing Height	14 m (short fairing)	14 m (short fairing)	14 m (short fairing)	20 m (long fairing)
Diameter	5.4 m	5.4 m	5.4 m	5.4 m
Lift off mass	540 000 kg	530 000 kg		870 000 kg
Lift off thrust	8 400 000 N (?)			
Payload	about 3 337 Kg			

ESR (P120C) *Equipped Solid Rocket (or Auxiliary thrusters or Boosters)*

(For each booster)	**P120C**	**P120C**		**P160C (future)**
Total weight	154 600 kg	150 000 kg		167 000 kg
Empty weight	25 000 kg (?)	11 000 kg		10 000 kg
Propergols	111 000 kg (?)	143 600 kg		157 000 kg
Diameter	3.4 m	3.4 m		
Height *(cylindrical part)*	7 to 8 m	7 to 8 m		8.5 m
Total Height *(with fairing)*	11.7 m (?)	13.5 m (?)		12.5
Thrust	3 500 000 N (?)	4 500 000 N		4 700 000 N
Operating time	137 s	130 s or 135 s ?		135 s
Separation altitude	70 km			
Acceleration	4.320 m/s			2.731 m/s

LLPM (H150) *Lower Liquid Propulsion Module (or 1st stage or main)*

Total weight	177 000 kg	140 to 154 000 kg		
Empty weight	25 000 kg (?)	23 000 kg		23 000 kg
Propergols	140 000 kg (?)	154 000 kg		140 000 kg
Diameter	5.4 m			
Height	35 m (?)			
Thrust	1 350 000 N			1 359 000 N
Operating time	458 s			460 s
Separation altitude	275 km			
Acceleration	4.122 m/s			4.228 m/s

ULPM (H30) *Upper Liquid Propulsion Module (or 2nd stage or upper)*

Total weight	30 000 kg (?)	38 000 kg		
Empty weight	3 500 kg	7 000 kg		7 000 kg
Propergols	26 000 kg	31 000 kg		31 000 kg
Diameter	5.4 m	5.4 m		
Height	6 m (?)	or 8.7 m (?)	11.5 m (?)	
Height with nozzle	11.5 m			
Thrust	48 000 N (?)	180 000 N		180 000
Operating time	900 s *(depending mission)*	900 s *(depending mission)*		900 s
Acceleration	1.728 m/s			4.484 m/s

IFS *InterFace Structure* *(or skirt above the LLPM and skirt below the ULPM)*

Carbon fiber structures that serve, from a structural point of view, as intermediate parts between the 1st and 2nd stages.

Weight *(of each of them)*	1 200 kg		
Height *(of each of them)*	6.2 m		
Diameter *(of each of them)*	5.4 m		

LVA *Launch Vehicle Adapter*

It provides the transition between the **ULPM** and the main Passenger Payload Adapter (**PAF**) in a single-launch configuration, or the lower passenger payload adapter in a dual-launch configuration. It is a truncated cone.

Weight	457 kg			
Upper diameter	?			
lower diameter	5.4 m			
Height of the cone	1.9 m			

DLS *Dual Launch Structure) (or SYLDA)*

The **DLS** is placed on the **LVA**, which is placed above the upper stage.

Sylda lower cone				
	BASIC VERSION	**7.8 m VERSION**	**8.8 m VERSION**	**9.8 m VERSION**
Total weight	440 kg	590 kg	640 kg	690 kg
Heights	?	7.8 m	8.8 m	9.8 m
Diameter	4.561 m	4.5 m	4.5 m	4.5 m
59 cm high and 5.4 m diameter Cone				
Sylda upper cone *(allows adjustment for the upper payload)*				
Height	1 m			
Diameter	2.6 m			

PAF *Payload Adaptator Fitting*

A whole series of Payload Adapters (**PAF**s) have been developed for Ariane 6.

	BASIC VERSION	**OTHER**		
Weight	440 kg	1 000 kg		
Diameter	5.4 m			
Height	6.2 m			

FAIRINGS

Two half-shells form the nose cone of the Ariane launcher and give it its aerodynamic shape.
Separation in flight is ensured by pyrotechnic charges.

	1 SHORT FAIRING	**2 SHORT FAIRINGS**	**1 LONG FAIRING**	**2 LONG FAIRINGS**
Weight	400 kg (?) or 900 (?)	1 800 kg	1 300 kg	2 600 kg
Diameter		5.4 m		5.4 m
Height	14 m	14 m	20 m	20 m
Separation altitude	118 km	118 km		

PAYLOAD *MAXIMUM WEIGHT*

Nature of Orbits		**ARIANE 62 + adapter**	**ARIANE 62 without adapter**
LEO Low orbit	(200 km)	21 600 kg	20 000 kg
GTO Orbit	(250 x 35 786 km)	10 500 kg	9 500 kg
SSO Sun-synchronous orbit	(700 km and 98°)	7 000 kg	6 500 kg
GE direct Orbit	(35 786 km and 0°)	4 500 kg	4 000 kg

Nature of Orbits		**ARIANE 64 + adapter**	**ARIANE 64 without adapter**
LEO Low orbit	(200 km)	35 000 kg	33 000 kg
GTO Orbit	(250 x 35 786 km)	21 600 kg	20 000 kg
SSO Sun-synchronous orbit	(700 km and 98°)	11 500 kg	11 000 kg
GE direct Orbit	(35 786 km and 0°)	8 500 kg	8 000 kg

C) Rocket control keys

P Manual engagement of the Auto **P**ilot (automatic launch and rocket guidance program).

NOTE : *A second press on the key* **P** *pauses the rocket's automatic guidance program. If you decide to take back manual control of the rocket (especially the upper stage after orbit) before the end of the program, you risk ending up with uncontrollable RCS operation. So, in this case, consider disabling the automatic guidance system.*

F Manual control for **F**airing separation.

J Manual control for **J**ettison (boosters, then upper stage, then satellites).

VERY IMPORTANT : *The release (or jettison) of the satellite(s) must only be done after having stabilized (if necessary) the upper stage of Ariane6, because if the rocket is in rotation (or acceleration), the ejection will not be done realistically.*

Here is a very easy method to properly orient and stabilize the rocket :

- depending on the case, it may be necessary to deactivate the autopilot by pressing the **P** *key.*
- press on the [key (*or on the* PRO GRD key i*n* internal *view*).
- wait until the capsule stabilizes on its “prograde” axis.
- then proceed the ejection of the cube-sats.

D) Overall SEQUENCES of an Ariane 6 flight

Note : Since the missions of the Ariane 6 rocket are all different and specific, this is only a general overview.

Step 1 : from Earth to space

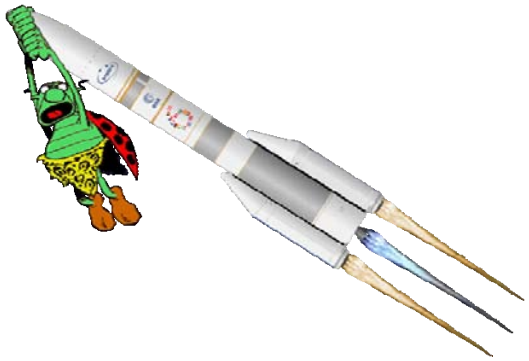
The first phase of an Ariane 6 flight allows the rocket to leave Earth and enter Space thanks to the thrust of the main stage, powered by the Vulcain 2.1 engine, and the thrust of its two powerful P120C boosters.
This phase includes the separation of the main stage and the first burn of the Vinci engine in the upper stage to place the rocket and its passengers into an elliptical orbit above the Earth.
Ariane 6 can replicate the typical flight profile of its predecessor, the **ECA** version of Ariane 5.

Step 2 : Deployment of satellites

The first reignition of the rocket's second stage is generally followed by the deployment of one or more satellites. At this step, Ariane 6 has completed its nominal mission by reigniting its upper stage and deploying all of its payload satellites..

Step 3 : technical demonstrations and deorbiting

The final phase of an Ariane 6 flight involves pushing the cryogenic upper stage to its limits. This upper stage must reignite after its longest period of inactivity in space, under microgravity, and begin its controlled deorbiting into Earth's atmosphere above the ***NEMO*** **(*)** ***point*** located in the South Pacific. A final command will be sent to the rocket to "passivate" (or deactivate) the upper stage before it burns up in the atmosphere. The purpose of this passivation is to eliminate all energy on board in order to prevent any uncontrolled explosions during descent. This series of steps (reigniting the Vinci engine, reorienting the trajectory for deorbiting, and then safely descending into the atmosphere) is an innovation designed to preserve space by preventing the Ariane 6 upper stage from becoming additional space debris.



E) Flight timeline (summary table)

Note : *- the numbers written in **red** are to be read in the "Multistage" timing* **MET** *(at the bottom and left of your screen)*
*- the numbers written in **blue** are to be read in the "Orbiter" timing* **Sim** *(at the top and right of your screen)*
*- the numbers written in **green** are just announcements (there is no "multistage" or OrbiterSound" commands)*
MET *and* **Sim** *values are <u>different</u> because :*
- MET *is initialized to 0 when the rocket takes off*
- Sim *is initialized to 0 at the start of the scenario launch (when the simulation begin)*

Timeline (seconds)	**Timeline** (h : mn : s)	Timeline of **ORBITER**	**Event**
- 7	**- 00:00:07**	- 4	**Vulcain** 2.1 main stage engine ignition
0	**00:00:00**	0	Boosters engines ignition and liftoff
137	**00:02:16**	137	Boosters jettison
220	**00:03:39**	220	Fairing jettison
455	**00:07:35**	455	**Vulcain** 2.1 main stage engine cutoff
461	**00:07:41**	461	Main stage jettison
470	**00:07:50**	470	**Vinci** upper stage engine ignition N# 1
533	**00:08:53**	533	First **APU** start-up
1112	**00:18:32**	1102 ✸	**Vinci** upper stage engine cutoff (✸:*This value may be different depending on the case*)
3380	**00:56:20**	3546	**Vinci** upper stage engine ignition N# 2
3402	**00:56:42**	3574	**Vinci** upper stage engine cutoff
3936	**01:05:36**	3936	First **APU** shutdown
From here on, the timing varies greatly depending on the mission.			Separation command for the onboard **satellite**(s)
			Second **APU** start-up
			APU second shutdown
			Third **APU** start-up (**ULPM** stage retrograde orientation)
			Vinci upper stage engine ignition N# 3 (ignition duration 28 seconds)
			Vinci upper stage engine cutoff
			APU third shutdown
			ULPM upper stage passivation operation
			End of mission
			Re-entry of the **ULPM** upper stage

II - THE ARIANE 6 ROCKETS (named "generics")

A) The two Ariane 6 rockets in 62 and 64 versions

Two so-called "generic" **Ariane 6** rockets are available for a small fee:
- a **6.2** version (with 2 boosters and a ***short*** fairing)
- a **6.4** version (with 2 boosters and a ***long*** fairing). **NEW** *the "long" fairing is now present.*

You will find these two rockets by launching the scenarios located in the folder ...\ Scenarios \ **Ariane 6**

- Ariane 6.2 (Generic)
- Ariane 6.4 (Generic)

These rockets carry one or more *generic payloads* that you can easily replace with the *payload* of your *choice*. You can use either version of this rocket to **customize** it and install an other payload or satellite.

NEW

If you want to customize the Ariane 6 rocket fairing, and
if you want to install another satellite under its fairing :
This topic is now in another document. :
Ariane6 (customization).pdf *file.*

B) The Ariane 6 rockets of flights 263 to 266 NEW

These aren't exactly new rockets (they reuse the 3D elements and configuration files of the generic rockets), but the fairings are customized for each flight. These are the Ariane 6 rockets from flights 263, 264, 265, and 266.

You will find a scenario for each of them in the **...\ Scenarios \ Ariane 6 \ Historic Flights** folder

- v263 - Automatic (T-10s)
- v264 - Automatic (T-10s)
- v265 - Automatic (T-10s)
- v266 - Automatic (T-10s)

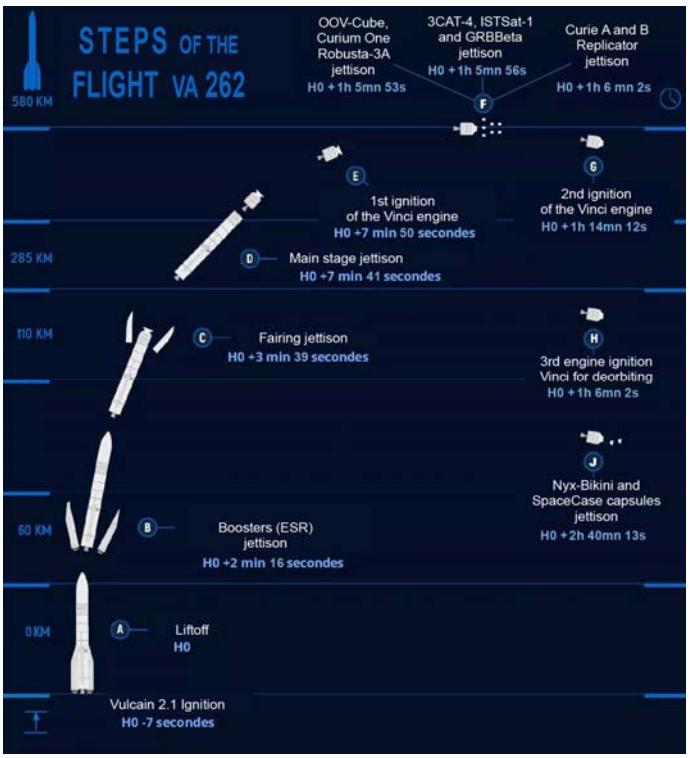
All these scenarios are programmed to ensure that the day and time of takeoff are as close to reality as possible.
Text will appear on the screen to inform you or assist you with any necessary maneuvers.

A discrepancy is always possible, as coordinating the timing isn't always easy... and it takes time...

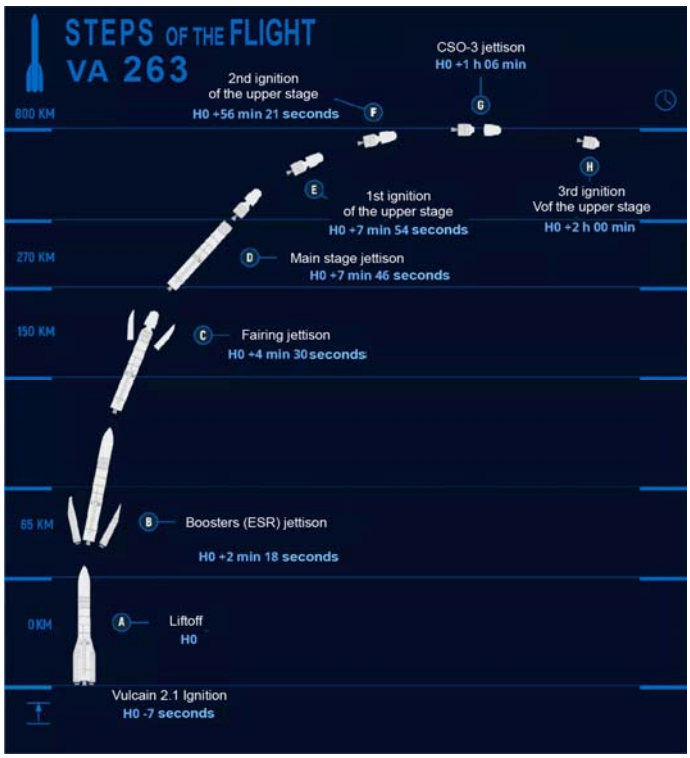
These flights do not carry the "real" onboard satellite, but one of the generic satellites whose description you will find further on.

Note : Since flight VA 266 had not yet taken place at the time this document was printed, the fairing design and flight plan may be incorrect...

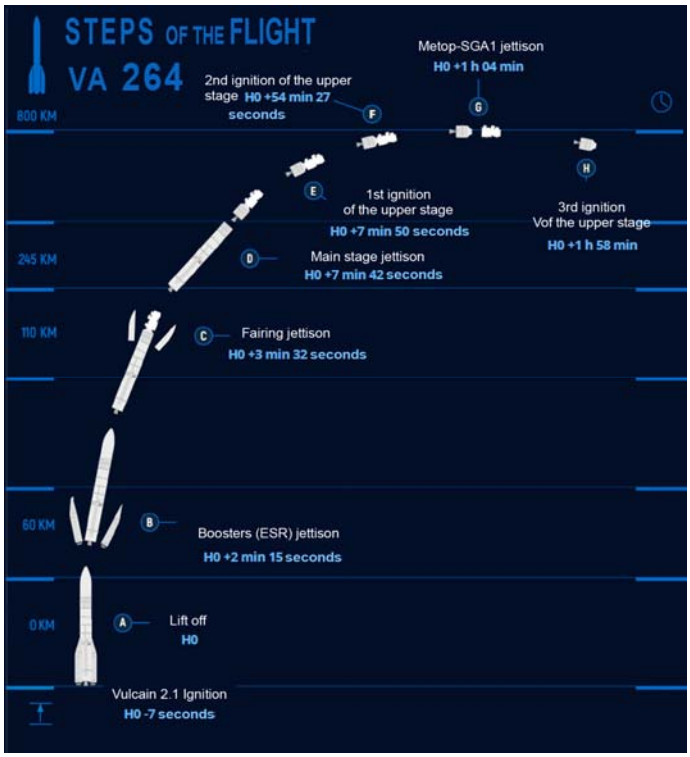
Here is just a brief graphical summary of flights 262, 263, 264 and 265.



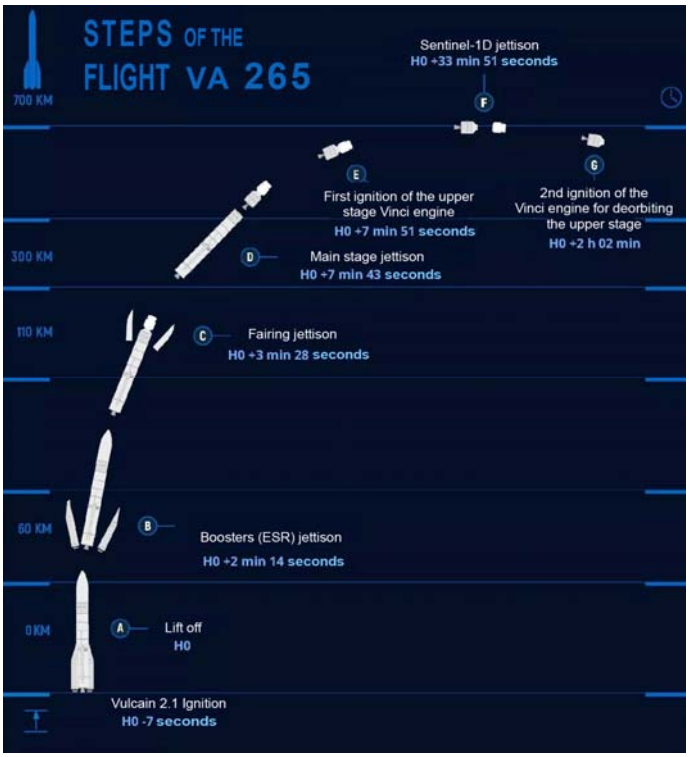
Ariane 262 flight



Ariane 263 flight



Ariane 264 flight



Ariane 265 flight

III - Dual Launch Structures or SYLDA

With the Sylda (or **A**riane **D**ouble **L**aunch **SY**stem = **SY**stem **D**ouble **L**aunch **A**riane), an element already used for Ariane 5, Ariane 6 can put two large satellites into orbit during a single launch..

The **DLS** or **SYLDA** is placed on the **LVA** (Launch Vehicle Adapter), which is placed on top of the upper level..

IV - GENERICS SATELLITES

Except for the first satellite described, which actually exists (an inert mass was used for ground testing), the other satellites are products of my imagination. Any resemblance to real satellites would be purely coincidental and would not allow me to claim copyright or file a plagiarism lawsuit, which would be both unexpected and highly improbable..

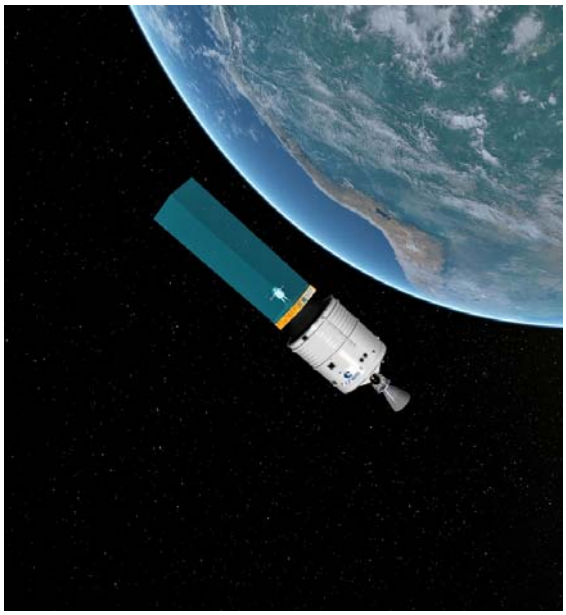
A) SATELLITE PAYLOAD-1

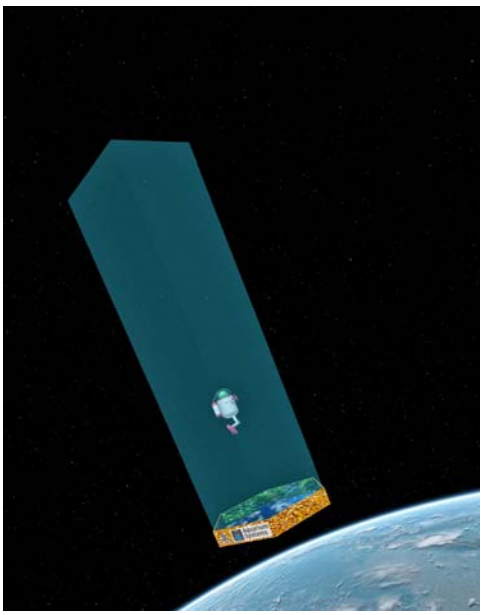
This inert payload is carried on board the generic rocket (6.2 version) as well as on flights VA263, VA264 and VA265.

There are two stowaways hidden in this cargo. It's up to you to find them....

B) SATELLITE PAYLOAD-2

This very particular payload is carried by the 6.4 version generic rocket.





C) SATELLITES MOMO 11 and 12

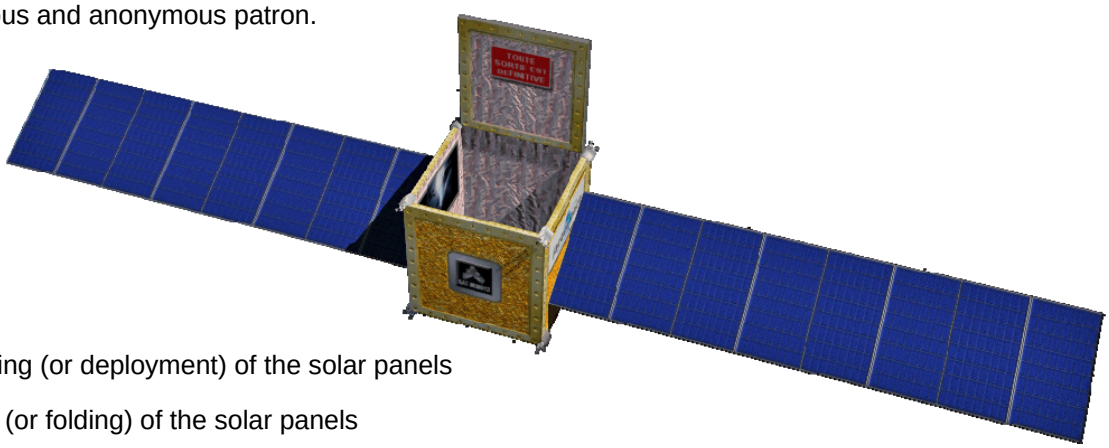
These two satellites are on board the rocket used for flight VA266.

1) Sat-M0M011

A small, cubic satellite, approximately 1.5 meters on each side, with foldable solar panels. It has functional **RCS** (Remote Control System) and can therefore perform orientation maneuvers.

2) Sat-M0M012

Identical to the previous one, its only difference is an exterior gold plating, thanks to a donation from a generous and anonymous patron.



O Manual **O**pening (or deployment) of the solar panels

K Manual closing (or folding) of the solar panels

NOTE : *The solar panels deploy automatically a few seconds after the satellites are ejected. These controls are only used here if you want to experiment with folding or redeploying the panels.*

Shift + **G** *or* **Ctrl** + **Shift** + **G** Solar panel orientation

E Passenger **E**jection (or **E**VA)

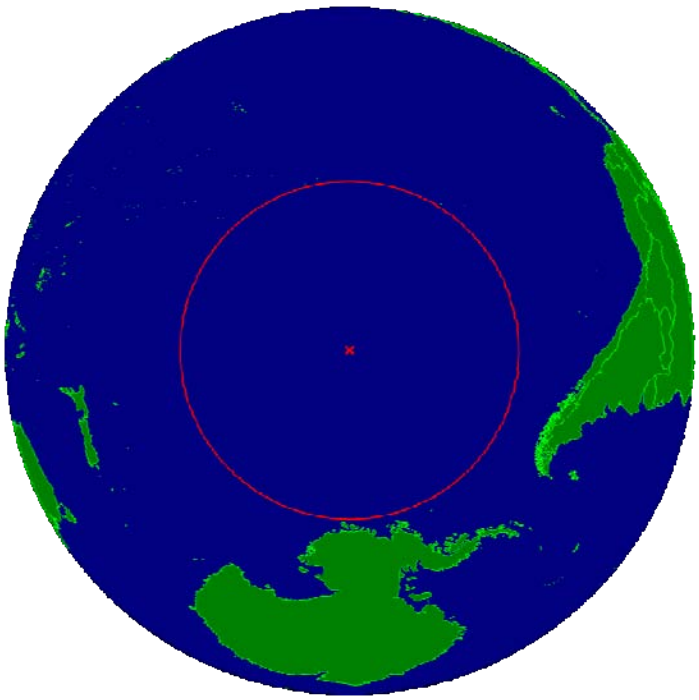
C **C**lose the Hatch

V - SOME USEFUL INFORMATIONS

B) Nemo point

The ***Nemo Point*** is the maritime pole of inaccessibility, that is, the point of the ocean furthest from any landmass on planet Earth. Located in the South Pacific off the coast of Chile, its coordinates were calculated in 1992 by the Canadian-Croatian geodesic engineer Hrvoje Lukatela. This point is named as Captain Nemo, the hero of Jules Verne's *Twenty Thousand Leagues Under the Sea*, whose name Nemo in Latin means "nobody".

This vast area of the South Pacific is used as a vast graveyard to house the remains of still controllable obsolete space vessels



B) Scenarios

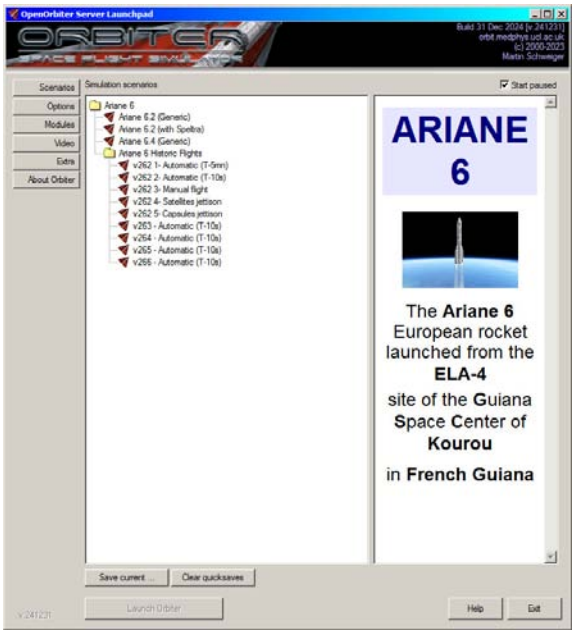
12 scenarios are provided :

a) Folder ...\ Scenarios \ Ariane 6

- Ariane 6.2 (Generic)
- Ariane 6.2 (with Sylda) **NEW**
- Ariane 6.4 (Generic)

b) Folder...\ Scenarios \Ariane 6 \ Historic Flights

- VA 262 1- Automatic (T-5mn)
- VA 262 2- Automatic (T-10s)
- VA 262 3- Manual flight
- VA 262 4- Satellites jettison
- VA 262 5- Capsules jettison
- VA 263 - Automatic (T-10s) **NEW**
- VA 264 - Automatic (T-10s) **NEW**
- VA 265 - Automatic (T-10s) **NEW**
- VA 266 - Automatic (T-10s) **NEW**



Descriptions are... in the relevant scenario(s) !

It should be noted that the two *"automatic flight"* scenarios are programmed to obtain a final orbit as close as possible to that of the first real flight of the rocket. But, due to some issues related to ***Orbiter*** as well as the ***Multistage*** *guide file*, this final orbit may be different, depending on the launches.
In addition, if you use the *acceleration mode*, this may give bad influence on the final result.

Sometimes the Ariane 6 upper stage does not cut its Vinci engine while the final orbit seems to have been reached, and then the stage will start spinning !

The only way :
- cut the engine immediately (* key on the numeric keypad)
- deactivate the autopilot (P key)

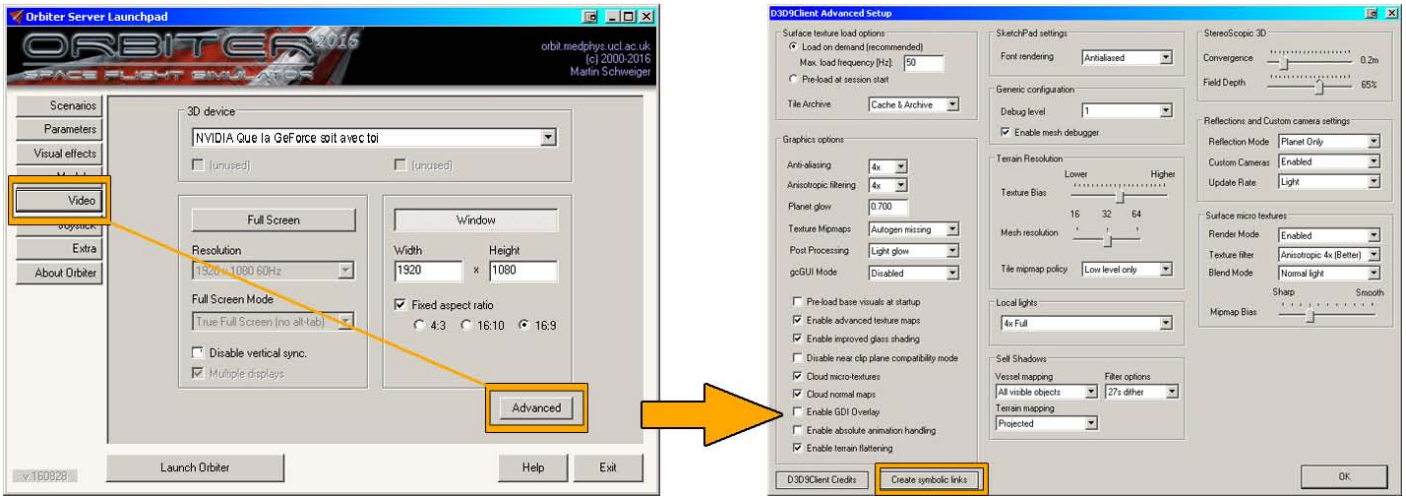
But sometimes it doesn't work: the **RCS** refuse to cut off...
And so you can consider that your mission is a failure, and you will have to pay back the European Space Agency (**ESA**) about € 85 million...

You can use the simulation acceleration (T key) at x10 and even x100. Above this value, it will be at your own risk...
During certain important and delicate maneuvers, the acceleration will (in principle) be neutralized. Wait a little for the rest of the events before starting to accelerate Orbiter again.

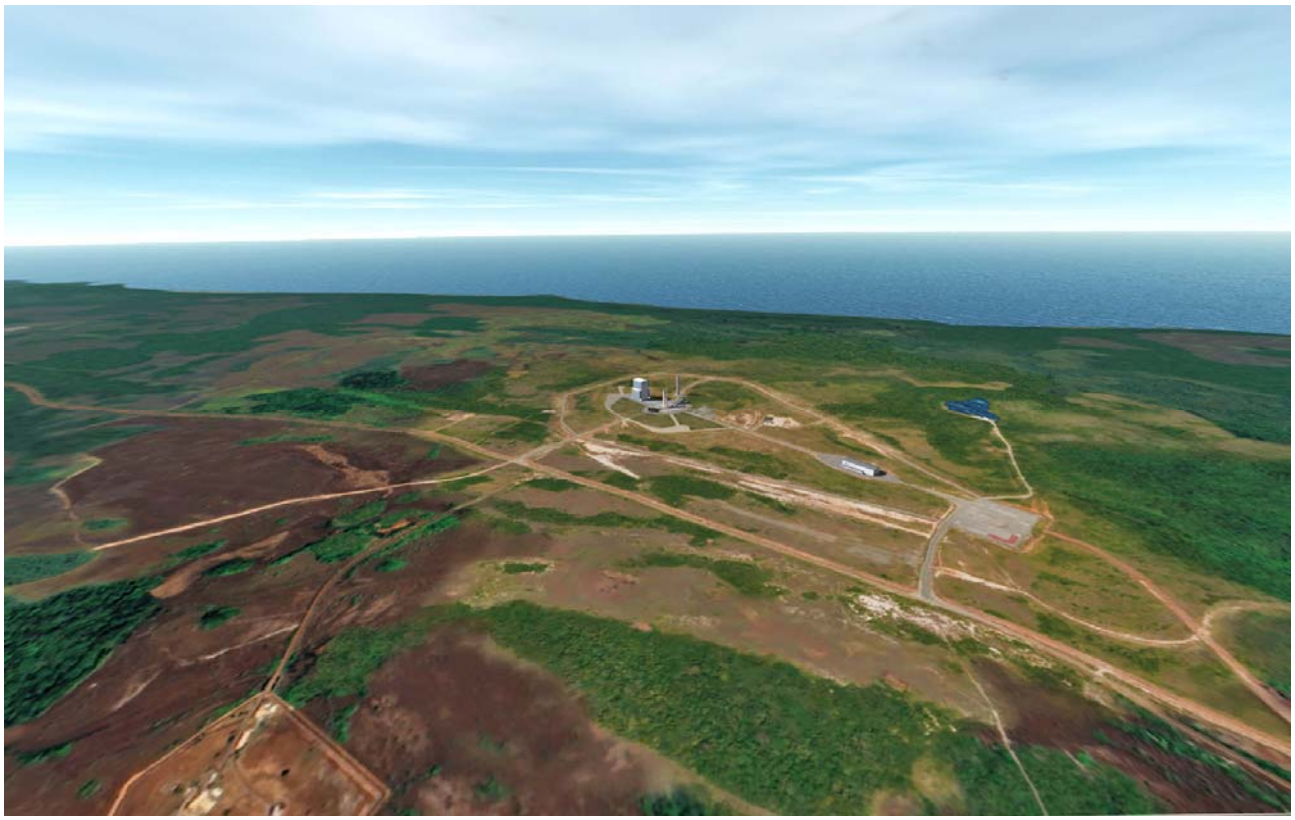
The flight director and the author of these notes decline all responsibility in case of mission failure due to a fault in the autopilot, or for any malfunction of the piloting program. In case of loss of satellites or for any claim, please write your claims on the forum, my lawyer will think about the next steps.

VI - ABOUT INSTALLATION

As this add-on includes some additional modules *(Spacecraft by **Vinka** as well as Multistage2015 and VesselBuilder by **Fred18**)* remember to create the "link" ***(Create symbolic links)*** as shown in the following images :



My ***ARIANE LAUNCH COMPLEX N.4*** add-on ***(ELA-4)*** is mandatory.
You need to install this add-on for this rocket to function.
Otherwise, all scenarios will result in a **CTD**.
(Except those with only satellite cubes and capsules ejection)



ADD-ON by jacquesmomo

JacquesMomo 2025