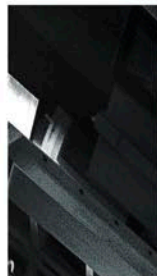
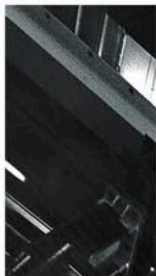
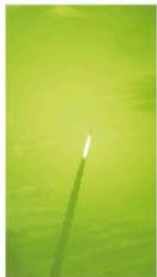


February
2015



VV 04

IXV





▼ FOURTH VEGA LAUNCH FROM THE GUIANA SPACE CENTER

The fourth Vega launch from the Guiana Space Center (CSG) in French Guiana, will orbit the European Space Agency's IXV atmospheric reentry demonstrator."

The IXV (Intermediate eXperimental Vehicle) is an atmospheric reentry demonstrator built by Thales Alenia Space as prime contractor on behalf of the European Space Agency (ESA).

The IXV will separate from the Vega launcher at an altitude of 320 km, then continue to climb, reaching an altitude of 412 km, when the reentry phase will start.

This mission will last about 1 hour and 40 minutes, ending with a splashdown in the Pacific Ocean. The IXV demonstrator will be recovered by a specially outfitted ship.

The capability of returning from space is a cornerstone for enabling ambitious plans in reusable launcher stages, sample return from other planets and crew return from orbital infrastructures. The IXV mission will pioneer a series of system and technology aspects, performing a full atmospheric reentry mission with a lifting-body, incorporating the simplicity of a capsule and the performance of a winged vehicle with high controllability and manoeuvrability for precision landing. It will verify the most advanced thermal protection concepts and guidance navigation and control techniques, along with aerothermodynamic experiments, using more than 300 payload sensors.

The Vega VV04-IXV launch, initially scheduled for November 2014, was pushed back to February 2015 to allow time for additional analyses of the flight trajectory for this mission.

Vega is designed to place payloads in the 1,500 kg class into orbit at an altitude of 700 km. It gives Europe a launcher that is ideally suited for all types of scientific and governmental missions, along with commercial launches.

Vega is a European Space Agency (ESA) program, jointly financed by Italy, France, Germany, Spain, Belgium, the Netherlands, Switzerland and Sweden. ELV, an Italian company jointly owned by Avio (70%) and the Italian space agency ASI (30%), is the launcher design authority and prime contractor, while Arianespace handles launch operations.

With Soyuz, Ariane 5 and Vega all operating at the Guiana Space Center, Arianespace is the only launch services provider in the world capable of launching all types of payloads to all orbits, from the smallest to the largest geostationary satellites, along with clusters of satellites for constellations and missions to support the International Space Station (ISS).



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VV 04 IXV



MISSION DESCRIPTION

The fourth Vega launch from the Guiana Space Center (CSG) will place ESA's IXV (Intermediate eXperimental Vehicle) on a suborbital orbit at an altitude of approximately 320 km.

The launcher will be carrying a total payload of 1 932 kg, including 1 845 kg for the experimental vehicle.

The launch will be from the Vega Launch Complex (SLV) in Kourou, French Guiana.

Orbit	: LEO (suborbital flight)
Apogee altitude	: 416 km
Perigee altitude	: 76 km
Inclination	: 5.4 °

Liftoff is scheduled for **February 11, 2015**, between:

- 10:00 and 11:43 am (local time in French Guiana), on February 11, 2015,
- 08:00 and 09:43 am (Washington, DC),
- 01:00 and 02:43 pm (UTC),
- 02:00 and 03:43 pm (Paris).

The launch at a glance

Following liftoff from the Guiana Space Center, the powered phase of the first three stages of Vega will last 6 minutes and 37 seconds. After this first phase, the launcher's third stage will separate from the upper composite, which includes the AVUM upper stage, a payload adapter and the satellite. The lower three stages will fall back to sea.

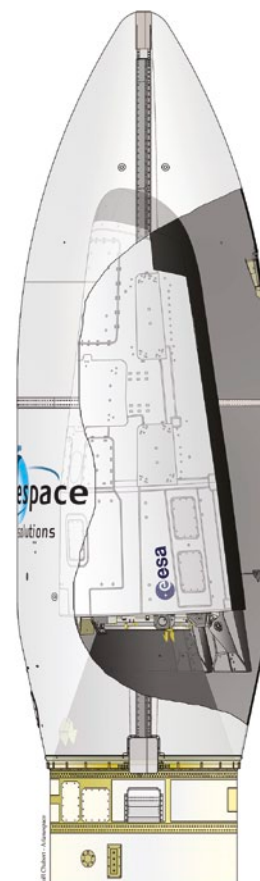
The AVUM upper stage will ignite its engine for the first time, operating for about 6 minutes

The IXV demonstrator will separate from the launcher 17 minutes and 59 seconds after lift-off, at an altitude of 340 km. The IXV will continue to climb to an altitude of 412 km. At that point it will start its atmospheric re-entry, reaching a speed during its descent of 7.5 km/s at an altitude of 120 km. The mission will finish with a splashdown in the Pacific Ocean.

About 31 minutes after lift-off, the AVUM will ignite its engine a second time for a 15 second burn, prior to igniting one last time for a minute, one hour and 49 minutes after lift-off.

Vega payload Configuration

ESA's Intermediate eXperimental Vehicle was designed and built by Thales Alenia Space, integrating competences from around 40 other Europeans companies, universities and research institutes.



Mission length

The nominal length of the mission (from liftoff to separation of the experimental vehicle) is **17 minutes and 59 seconds.**





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▼ The IXV REENTRY DEMONSTRATOR



Customer	European Space Agency (ESA)
Manufacturer	Thales Alenia Space
Mission	Atmospheric reentry demonstrator
Mass	Total mass at lift-off 1,845 kg
Dimensions	5 x 1.5 x 2.2 m

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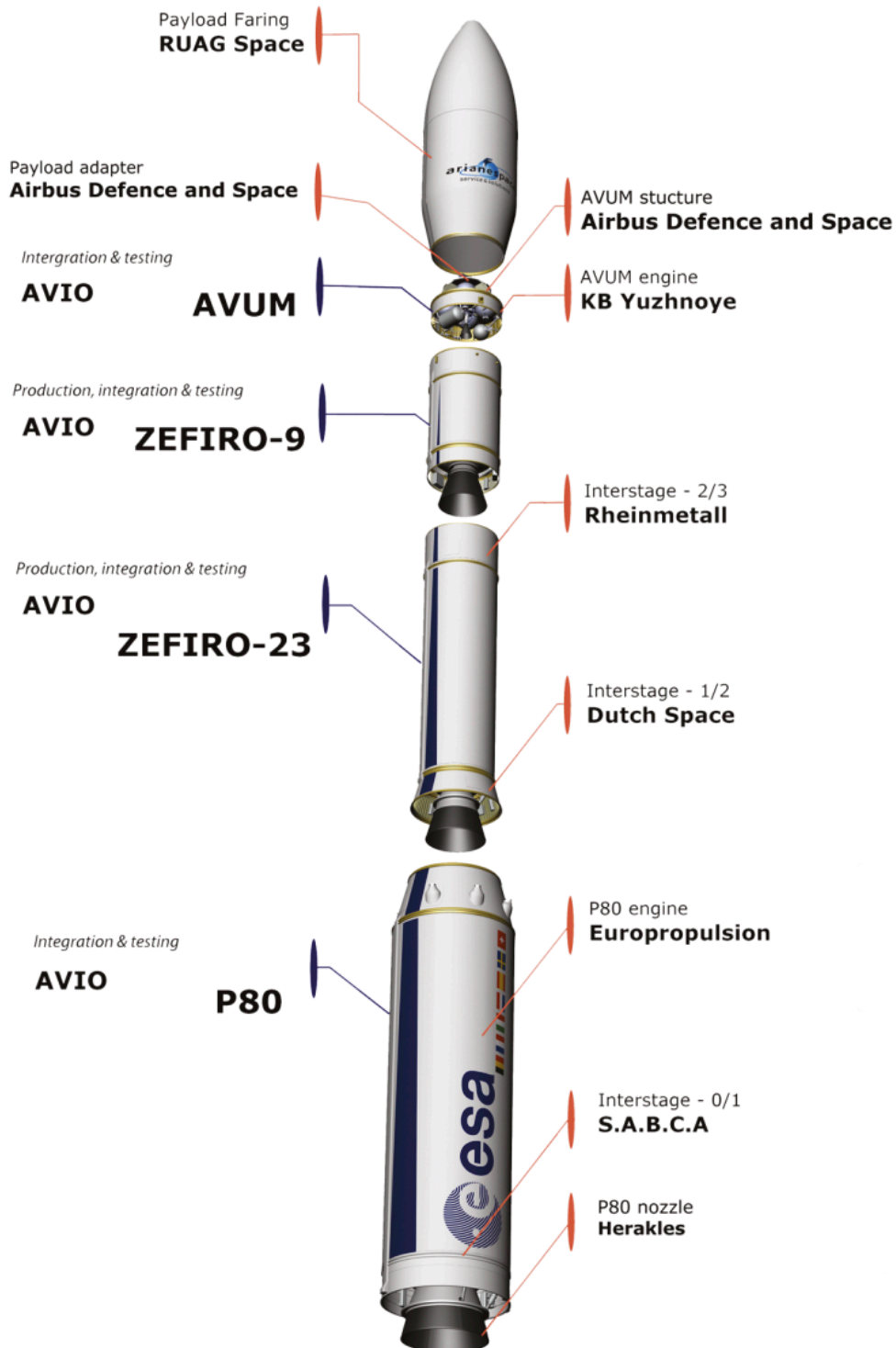
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THE VEGA LAUNCHER



Thrust vector control system
(P80, Zefiro-9, Zefiro-23 & AVUM)
S.A.B.C.A

Igniters (P80, Zefiro-9 & Zefiro-23)
APP

Avionics
**Thales, IN-SNEC, Selex Avionica,
CRISA, RUAG Space, SAFT**



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VEGA CHARACTERISTICS

Vega is a launch vehicle comprising three stages with solid rocket motors:

- P80 first stage
- Zefiro-Z23 second stage
- Zefiro-Z9 third stage

The fourth stage, AVUM, ensures mission versatility, injecting the payload(s) into precise orbits.

The fairing, 2.6 meters in diameter, can hold one or several payloads.

The total weight at liftoff is 139 metric tons. The launcher is 30 meter high and has a maximum diameter of 3 meters.

Launcher performance

The baseline performance set for Vega is to inject 1,500 kg into circular polar orbit at 700 km altitude, inclined 90° to the Equator, with injection accuracy of 5 km for altitude and 0.05° for inclination (1σ).

The diversity of launch elevations possible from Europe's Spaceport in Kourou, along with the flexibility provided by AVUM, will enable Vega to inject a wide range of payloads into different orbits, including 2,500 kg payloads into quasi-equatorial circular orbit at 200 km, 2,000 kg payloads for the International Space Station, or 1,300 kg payloads to be injected into Sun-synchronous orbit at an altitude of 800 km.

P80 first stage

Vega's first stage is powered by a large single-piece solid rocket motor containing 87,732 kg of the solid propellant HTPB 1912. This SRM delivers maximum vacuum thrust of 3,015 kN and burns for 110 seconds prior to being jettisoned at an altitude of about 55 km.

The P80 stage, a filament-wound carbon-epoxy case, has the same diameter (3 m) as the solid boosters used on Ariane 5 and its overall length (11.2 m) is similar to that of one of the longest segments of the solid booster.

Zefiro stages

The second and third stages of Vega use Zefiro solid rocket motors. These two stages, each 1.9 m in diameter, comprise a filament-wound carbon-epoxy case, with low-density EPDM insulation and a nozzle with flex-joints, equipped with electromechanical actuators to direct the thrust. The Zefiro-Z23 stage is 8.39 m long, and is loaded with 23,820 kg of solid propellant HTPB 1912, providing maximum vacuum thrust of 1,120 kN. It operates for 77 seconds.

The Zefiro-Z9 stage is 4.10 m long and is loaded with 10,570 kg of solid propellant HTPB 1912, providing maximum vacuum thrust of 317 kN. Although it is the smallest solid rocket motor on Vega, it offers the longest burn time, of 119 seconds.

AVUM

AVUM (Attitude & Vernier Upper Module) has a bipropellant propulsion system to provide orbital injection, and a monopropellant propulsion system for roll and attitude control.

It is designed to inject different payloads into different orbits, and ensures the fine pointing of satellites prior to separation.

At the end of the mission, it is deorbited under safe conditions to limit the amount of orbital debris.

AVUM contains about 577 kg of liquid propellant (UDMH/NTO), distributed in four tanks. It is powered by an engine derived from the reignitable RD-869, providing 2.45 kN of thrust. It has two also sets of three monopropellant thrusters to control roll and attitude. AVUM also contains Vega's avionics module, which handles flight control and mission management, telemetry and end-of-flight functions, along with the electrical power supply and distribution.

Fairing and payload adapters

The fairing, 2.6 m in diameter and with a volume of 20 m³, is made of two half-shells, each 7.90 m long.

The launch complex

The Vega launch pad ("Site de Lancement Vega" or SLV) was built on the former Ariane 1 launch pad (ELA-1). It is located about 1 km southwest of the ELA-3 launch pad, used for Ariane 5.

The concrete launch pad was modified to handle Vega and the new 50 meter mobile gantry, weighing about 1,000 metric tons, along with the umbilical mast, stretching 32 meters high. Four 60-meter masts protect the pad against lightning strikes.

The three solid propellant stages and the bipropellant module are assembled on the launch pad. The payload composite is integrated on Vega about a week prior to launch. The mobile gantry is displaced on its 80-meter long rails several hours before the launch.

The Vega launch center (CDL) is in the building that already houses its Ariane 5 counterpart, 1.3 km from the launch pad.

Mission control is handled from the Jupiter building, already used for Ariane and Soyuz launches.





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▼ COUNTDOWN AND FLIGHT

The countdown comprises all final preparation steps for the launcher, the satellites and the launch site, including the steps leading up to authorization of first-stage P80 ignition.

TIMES		EVENTS	
- 07 h	45 mn	Start of countdown	
- 05 h	40 mn	Activation of MFU (Multi Function Unit)	
- 05 h	30 mn	Activation of Inertial Reference System (IRS)	
- 05 h	30 mn	Activation of telemetry transmitters	
- 04 h	55 mn	Activation of onboard computer and loading of flight program	
- 04 h	50 mn	Activation of SMU (Safeguard Master Unit)	
- 04 h	25 mn	Synchronization of onboard clock with Universal Time (UTC)	
- 04 h	20 mn	IRS alignment and checks	
- 03 h	40 mn	Removal of safety devices	
- 02 h	40 mn	Mobile gantry withdrawal (45 min)	
- 01 h	55 mn	Activation of SRI after withdrawal of gantry	
- 01 h	20 mn	Activation of telemetry transmitters after withdrawal of gantry	
- 01 h	20 mn	Activation of transponders	
- 00 h	34 mn	Launcher system ready	
- 00 h	10 mn	Last weather report prior to launch	
- 00 h	04 mn	Start of synchronized sequence	
TO		LIFTOFF	
+ 00 h	01 mn	52 s	Separation of first stage (P80)
+ 00 h	03 mn	35 s	Separation of second stage (Zefiro-23)
+ 00 h	04 mn	02 s	Jettisoning of fairing
+ 00 h	06 mn	37 s	Separation of third stage (Zefiro-9)
+ 00 h	08 mn	00 s	AVUM first burn
+ 00 h	13 mn	49 s	AVUM shutdown
+ 00 h	17 mn	59 s	Séparation of IXV
+ 00 h	31 mn	14 s	AVUM second burn
+ 00 h	31 mn	30 s	AVUM shutdown
+ 01 h	49 mn	31 s	AVUM third burn
+ 01 h	50 mn	30 s	AVUM shutdown

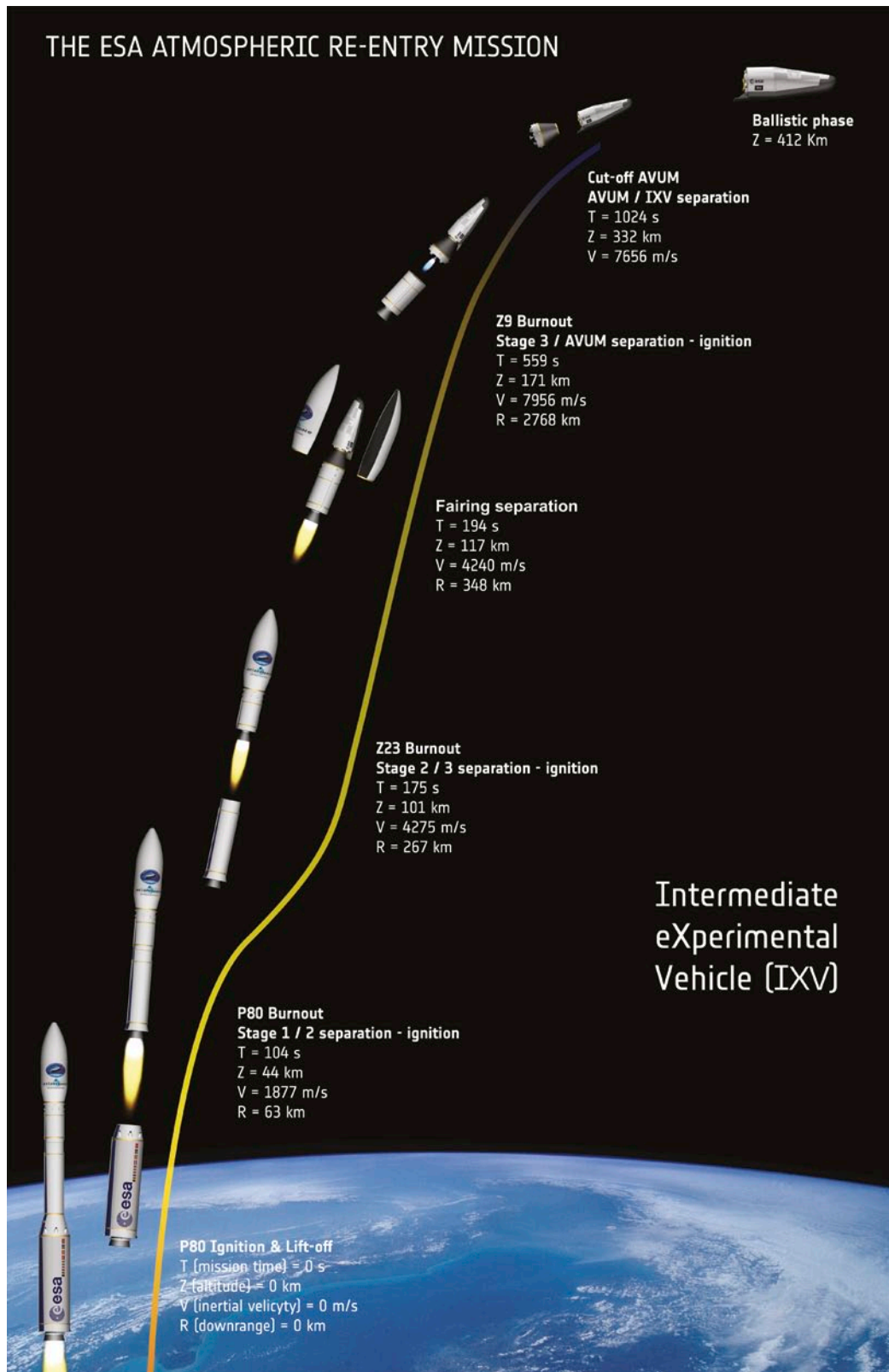


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▼ The IXV REENTRY DEMONSTRATOR MISSION PROFILE



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ARIANESPACE AND THE GUIANA SPACE CENTER

Arianespace, the first launch service company in the world

Arianespace was founded in 1980 as the world's first launch Service & Solutions company. Arianespace now has 21 shareholders from ten European countries (including Airbus Safran Launchers 40.99 % , CNES 34 % and all European companies participating in the construction of Ariane launchers). Since the outset, Arianespace has signed more than 400 launch contracts and launched 502 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of about 1367 million euros in 2014.

As of January 1, 2015, Arianespace had 329 employees, working at the company's headquarters in Evry (near Paris), the Guiana Space Center in French Guiana, where the Ariane, Soyuz and Vega launch pads are located, and offices in Washington, D.C., Tokyo and Singapore. Arianespace offers launch Services to satellite operators from around the world, including private companies and government agencies. These services call on three launch vehicles:

- The Ariane 5 heavy launcher, operated from the Guiana Space Center in Kourou, French Guiana.
- The Soyuz medium launcher, currently in operation at the Baikonur Cosmodrome in Kazakhstan and the Guiana Space Center.
- The Vega light launcher, also operated from the Guiana Space Center.

Building on its complete family of launchers, Arianespace has won over half of the commercial launch contracts up for bid worldwide in the last two years. Arianespace now has a backlog of more than 45 satellites to be launched.

The Guiana Space Center: Europe's Spaceport

For over 40 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches. It mainly comprises the following:

- CNES/CSG technical center, including various resources and facilities that are critical to launch base operations, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (EPCU), in particular the S5 facility.
- Ariane, Soyuz and Vega launch complexes, comprising the launch zones and launcher integration buildings.
- Various industrial facilities, including those operated by Regulux, Europropulsion, Air Liquide Spatial Guyane and Airbus Defence and Space, all involved in the production of Ariane 5 components. A total of 40 European manufacturers and local companies are involved in operations.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), French space agency CNES and Arianespace. ESA is responsible for the Ariane, Soyuz and Vega development programs. Once these launch systems are qualified, ESA transfers responsibility to the operator Arianespace. ESA has helped change the role of the Guiana Space Center, in particular by funding the construction of the launch Complexes, payload processing buildings and associated facilities. Initially used for the French space program, the Guiana Space Center has gradually become Europe's own Spaceport, according to the terms of an agreement between ESA and the French government. To ensure that the Spaceport is available for its programs, ESA takes charge of the lion's share of CNES/CSG fixed expenses, and also helps finance the fixed costs for the ELA launch Complexes.

French space agency CNES has several main responsibilities at the Guiana Space Center : It designs all infrastructures and, on behalf of the French government, is responsible for safety and security. It provides the resources needed to prepare the satellites and launcher for missions. Whether during tests or actual launches, CNES is also responsible for overall coordination of operations, collects and processes all data transmitted from the launcher via a network of receiving stations, to track Ariane, Soyuz and Vega rockets throughout their trajectories.

Arianespace in French Guiana

In French Guiana, Arianespace is the contracting authority in charge of operating the family of three launchers, Ariane, Soyuz and Vega.

For Vega, Arianespace supervises the integration and inspection of the launcher built by ELV, production prime contractor. Before taking official delivery of the launcher, it coordinates the preparation of satellites in the payload preparation facility (EPCU) operated by CSG, handles the final assembly of the launcher and integrates satellites on the launcher, and oversees the final countdown and launch from Launch Control Center 3 (CDL3).

Arianespace deploys a top-flight team and technical facilities to get launchers and satellites ready for their missions. Building on this unrivalled expertise and outstanding local facilities, Arianespace is now the undisputed benchmark in the global launch services market.



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