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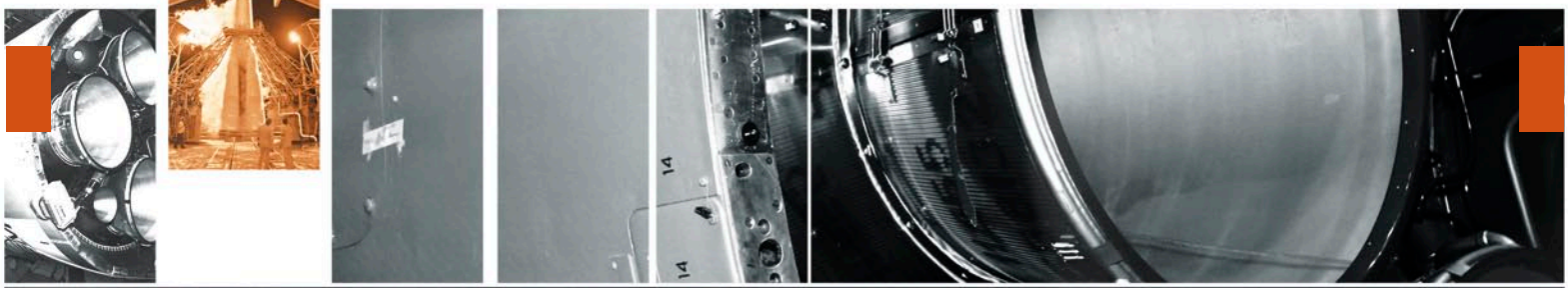
December
2014



VS 10
O3b

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3b Networks
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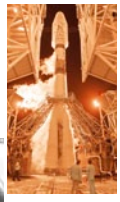

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O3b

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A THIRD LAUNCH FOR THE O3b CONSTELLATION

Arianespace's tenth Soyuz launch from the Guiana Space Center will be the third launch for O3b Networks, following the successful launch of the first eight satellites in the O3b constellation in June 2013 and July 2014. Arianespace continues developing long-term partnership with new operators, by providing services tailored to their specific needs. These four O3b satellites were built by Thales Alenia Space as prime contractor.

O3b, a new generation of satellites to provide high throughput,low latency connectivity, for telecommunications, ISPs, Enterprises and Governments.

Arianespace continues to deploy the O3b constellation (the "other 3 billion") into an equatorial orbit to provide high-speed, affordable Internet access for emerging markets in Asia, Africa, Latin America, Australia and the Middle East. That covers nearly 180 countries which do not yet enjoy broadband Internet.

O3b Networks provides telecom operators with trunking capacity and connectivity for mobile networks at rates and response times equal to fiber-optic networks.

These four Ka-band satellites will be placed in an equatorial orbit at an altitude of about 8,000 km, where they will join the first eight satellites. With this latest launch, the O3b constellation is now fully deployed and operational. O3b Networks started commercial service on September 1, 2014

Arianespace continues to build partnerships with new operators by offering comprehensive, long-term support.

Services tailored to customer requirements

Arianespace adapted its launch services to the specific requirements of its customer, O3b: mission analysis and proposed solutions for deployment in equatorial orbit, adaptation to a multiple launch configuration (dispenser) and optimized launch campaign to manage operations involving several satellites.

With this launch for O3b Networks, Arianespace has passed the mark of 500 satellites boosted into orbit, from the 499th to the 502nd.

Arianespace continues to set the standard in launch services for all operators, guaranteeing independent access to space.

This will be the 11th launch of the year for Arianespace, setting a new record for its family of launch vehicles at the Guiana Space Center, with six launches by Ariane 5, four by Soyuz and one by Vega.

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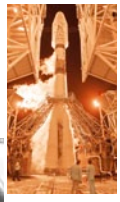
Press Contact
Claudia Euzet-Hoyau
c.hoyau@arianespace.com
01.60.87.55.11
06.74.07.90.28

#VS10
arianespace.tv
@arianespace
youtube.com/arianespace
@arianespaceceo
arianespace



VS 10

O3b

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MISSION DESCRIPTION

The tenth Soyuz launch from the Guiana Space Center (CSG) will place into circular orbit, at an altitude of about 8,000 km, the four satellites of the O3b constellation.

The launcher will be carrying a total payload of 3,184 kg, including about 2,800 kg for the four O3b satellites, to be released into its targeted orbit at an inclination of 0.04 degrees

The launch will be from the Soyuz Launch Complex (ELS) in Sinnamary, French Guiana.

Targeted orbit : circular orbit
Altitude : between 7,820 and 7,836 km
Inclinaison : 0,04 degrees

Liftoff is scheduled for **Thursday, December 18, 2014**, at :

- 15:37:00 (Local Time in French Guiana)
- 13:37:00 (in Washington, DC)
- 18:37:00 (UTC)
- 19:37:00 (in Paris)
- 21:37:00 (in Moscow)

The launch at a glance

Following liftoff from the Guiana Space Center, the powered phase of the lower three Soyuz stages will last about nine minutes. The third stage of the launcher will then be separated from the upper composite, comprising the Fregat upper stage and the four O3b satellites. The three lower stages will fall back into the sea.

Fregat will carry out three main powered phases:

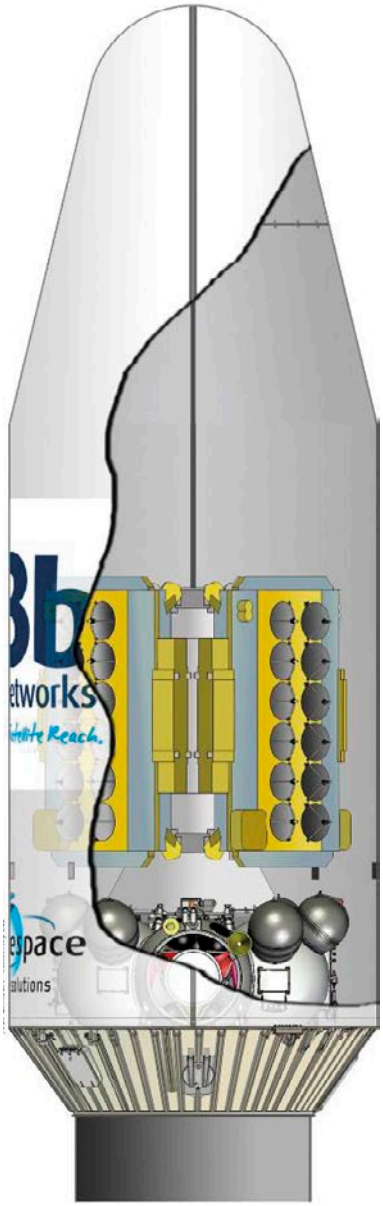
- 1st burn, lasting about 4 minutes, followed by a ballistic phase lasting about 7 minutes and 30 seconds.
- 2nd burn, lasting about 8 minutes and 30 seconds, followed by a second ballistic phase, lasting one hour and 21 minutes.
- 3rd burn, lasting about 5 minutes.

The satellites will be released two by two, with the first pair being released about two hours after liftoff. One additional burn will be carried out with Attitude Control System (ACS) to inject the second pair of satellites on the dedicated orbit, it will then be released about 22 minutes later.

Then, two successive firings of the Fregat engine will place Fregat into an security orbit above that of the O3b constellation.

Soyuz payload configuration

The O3b constellation satellites were built by Thales Alenia Space for the O3b Networks Limited satellite operator.



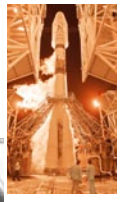
Mission length

The nominal length of the mission (from liftoff to separation of the satellites) is **2 hours 22 minutes and 27 seconds.**

O3b SATELLITES

Customer	**O3b Networks Limited**
Manufacturer	**Thales Alenia Space**
Mission	**Telecommunications and internet**
Orbit	**7820 at 7836 km altitude**
Payload	**12 steerable antennas, 12 Ka-band transponders**
Visibility time	**45 minutes (approximately)**
Période	**288 minutes**
Mass of one satellite	**700 kg at lift-off**
Life time	**Approximately 10 years**
On-board power	**1,500 W**
Coverage aera	**Asia, Africa, South America, Australia, Middle -East**

PRESS CONTACT:
Vicki Warker
VP, Marketing
O3b Networks Ltd
Mobile:+1 202 340 7120
vicki.warker@o3bnetworks.com



SOYUZ LAUNCH VEHICLE

The Soyuz launch vehicle family has provided reliable and efficient launch services since the start of space exploration. Soyuz rockets, which launched both the first artificial satellite and the first man into space, have been credited with more than 1,830 launches to date. Today, Soyuz is used for manned and unmanned flights to the International Space Station, as well as Russian government launches, and commercial launches with Arianespace as launch operator.

The Soyuz configuration introduced in 1966 has been the workhorse of the Soviet/Russian space program. As the only manned launch vehicle in Russia and the former Soviet Union, Soyuz meets very high standards of reliability and robustness.

The first launch of the Soyuz 2-1a version on November 8, 2004 from the Plessetsk Cosmodrome represented a major step in the launch vehicle development program. This modernized version of Soyuz, also used to successfully launch MetOp-A on October 19, 2006, features a digital control system providing additional mission flexibility; it also enables control of the launch vehicle fitted with the 4.1-meter ST fairing. This was a necessary step towards the next-generation Soyuz 2-1b launcher, the culmination of a joint European/Russian upgrade program. It adds a more powerful third-stage engine, significantly increasing the launcher's overall performance.

The inaugural flight of the upgraded Soyuz 2-1b launch vehicle was successfully performed on December 27, 2006, orbiting the Corot scientific spacecraft for French space agency CNES.

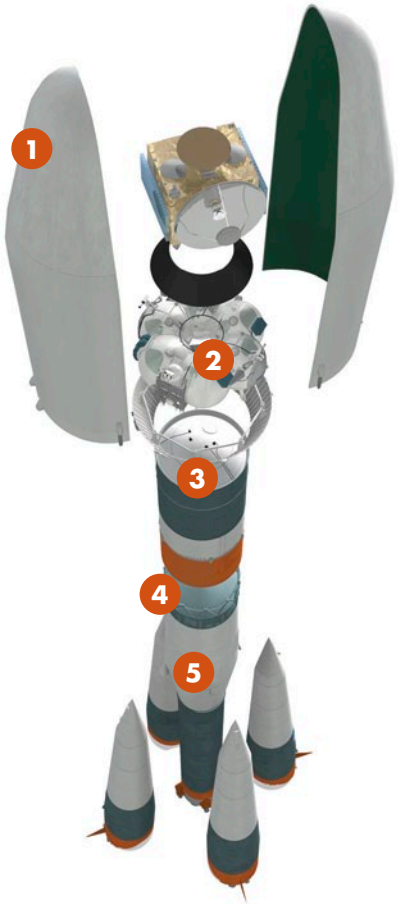
The decision of the European Space Agency to introduce Soyuz launch capability at the Guiana Space Center (CSG) marked a major step forward in expanding the range of missions. With the introduction of Soyuz at CSG, this famed Russian launch vehicle is now an integral part of the European launcher fleet,together with the heavy-lift Ariane 5 and the light Vega. Offered exclusively by Arianespace to the commercial market, for launches from CSG, Soyuz becomes Europe's standard medium launcher for both government and commercial missions.

On October 21, 2011 Arianespace successfully launched the first Soyuz rocket from the Guiana Space Center (CSG) in French Guiana, orbiting the first two satellites in the GALILEO constellation.

The Samara Space Center in Russia continues to produce Soyuz launchers. Because of sustained demand from the Russian government, International Space Station requirements and Arianespace's commercial orders, the Soyuz is being produced at an average rate of 15 to 20 launchers per year. The manufacturer can also rapidly scale up to accommodate market demand. In fact, annual Soyuz production peaked in the early 1980's at 60 vehicles per year.

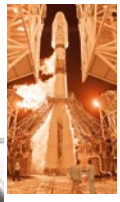
Soyuz is a reliable, efficient,and cost-effective solution for a full range of missions, from LEO to Mars or Venus. Offering an unrivaled heritage, Soyuz has already performed almost every type of mission, from telecommunications, Earth observation, weather and scientific satellites, to manned spacecraft. It is a very scalable and flexible launch vehicle.

The Soyuz version currently offered by Arianespace is a four-stage launch vehicle: four boosters (first stage), a central core (second stage), a third stage, and the restartable Fregat upper stage (fourth stage). It also includes a payload adapter/dispenser and fairing.



SOYUZ

1 - The fairing
2 - The Fregat upper stage
3 - The third stage
4 - The central core (2nd stage)
5 - The boosters (1st stage)



Boosters (first stage)

The four cylindrical-conical boosters are assembled around the central core. The booster's RD-107A engines are powered by liquid oxygen and kerosene, the same propellants used on each of the lower three stages. The kerosene tanks are located in the cylindrical part and the liquid oxygen tanks in the conical section. Each engine has four combustion chambers and four nozzles. Three-axis flight control is provided by aerofins (one per booster) and steerable vernier thrusters (two per booster). Following liftoff, the boosters burn for approximately 118 seconds and are then jettisoned. Thrust is transferred to the vehicle through a ball joint located at the top of the conical structure of the booster, which is attached to the central core by two rear struts.

Central core (second stage)

The central core is similar in construction to the four boosters, with a special shape to accommodate the boosters. A stiffening ring is located at the interface between the boosters and the core. This stage is fitted with an RD-108A engine, also comprising four combustion chambers and four nozzles. It also has four vernier thrusters, used for three-axis flight control once the boosters have separated. The core stage has a nominal burn time of 286 seconds. The core and boosters are ignited simultaneously on the launch pad, 20 seconds before liftoff. Thrust is first adjusted to an intermediate level to check engine readings. The engines are then gradually throttled up, until the launcher develops sufficient thrust for liftoff.

Third stage

The third stage is linked to the central core by a latticework structure. Ignition of the third stage's engine occurs approximately two seconds before shutdown of the central core engine. The third stage engine's thrust enables the stage to separate directly from the central core. Between the oxidizer and fuel tanks is a dry section where the launcher's avionics systems are located. The third stage uses either a RD-0110 engine in a ST-A version, or a RD-0124 engine in a ST-B version.

Fregat upper stage (fourth stage)

Flight qualified in 2000, the Fregat upper stage is an autonomous and flexible stage that is designed to operate as an orbital vehicle. It extends the capability of the Soyuz launcher, now covering a full range of orbits (LEO, SSO, MEO, GTO, GEO and escape). To ensure high reliability for the Fregat stage right from the outset, various flight-proven subsystems and components from previous spacecraft and rockets are used. The upper stage consists of six spherical tanks (four for propellants, two for avionics) arranged in a circle and welded together. A set of eight struts through the tanks provide an attachment point for the payload, and also transfer thrust loads to the launcher. The upper stage is independent from the lower three stages, since Fregat has its own guidance, navigation, attitude control, tracking, and telemetry systems. The stage's engine uses storable propellants – UDMH (unsymmetrical dimethyl hydrazine) and NTO (nitrogen tetroxide) – and can be restarted up to 20 times in flight, thus enabling it to carry out complex missions. It can provide the customer with 3-axis or spin stabilization of their spacecraft.

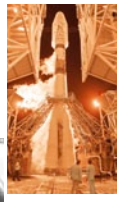
The Fregat upper stage is encapsulated in a fairing with the payload and a payload adapter/dispenser

The fairing

Soyuz launchers operated by Arianespace at CSGuse the ST fairing in standard configuration, with an external diameter of 4.1 meters and a length of 11.4 meters.

Roscosmos and the Russian launcher industry

Roscosmos, the Russian space agency, is responsible for license allocations and intergovernmental relations. it is the launch authority in charge of range operations. RKTs-Progress (Samara Space Center) is responsible for the design, development, and manufacture of launch vehicles, including the Soyuz launch vehicle's first, second and third stages and fairing. It also integrates vehicle stages and handles flight operations. NPO Lavochkin manufactures and integrates the Fregat upper stage, and is responsible for launch operations. TsENKI is in charge of launch planning and the provision of associated services, including systems engineering, and the design, and technical and operational management of the launch pad and associated facilities dedicated to the Soyuz launcher.



COUNTDOWN AND FLIGHT

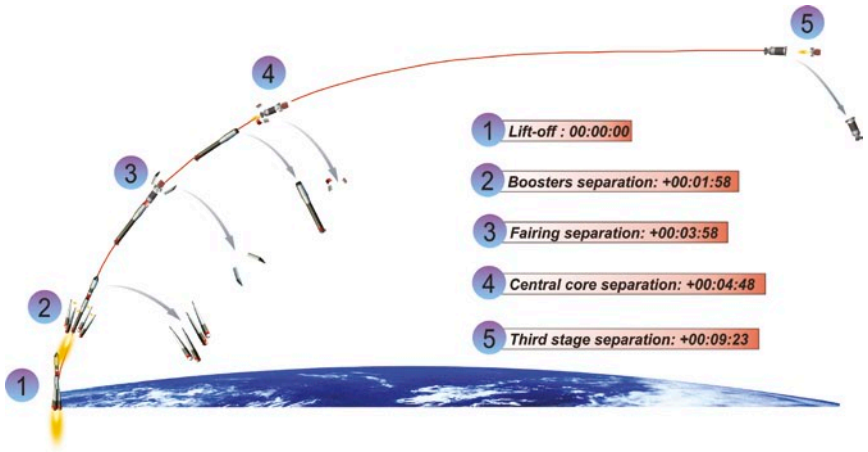
The countdown comprises all final preparation steps for the launcher, the satellite and the launch site. If it proceeds as planned, the countdown leads to the ignition of the core stage engine and the four boosters.

EVENTS	TIME (h:min:s)
Beginning of the State Commission meeting for launcher fueling authorization	-05:00:00
Beginning of Launch Vehicle fuelling	-04:30:00
End of fueling operation	-01:35:00
Mobile gantry withdrawal	-01:10:00
Key on start	-00:05:10
Fregat transfer to onboard power supply	-00:05:00
Upper Composite umbilical drop off command	-00:02:25
Ground-board power transfer	-00:00:40
Lower stage umbilical mast retraction	-00:00:30
Ignition	-00:00:17
Preliminary thrust level	-00:00:15
Full thrust level	-00:00:03

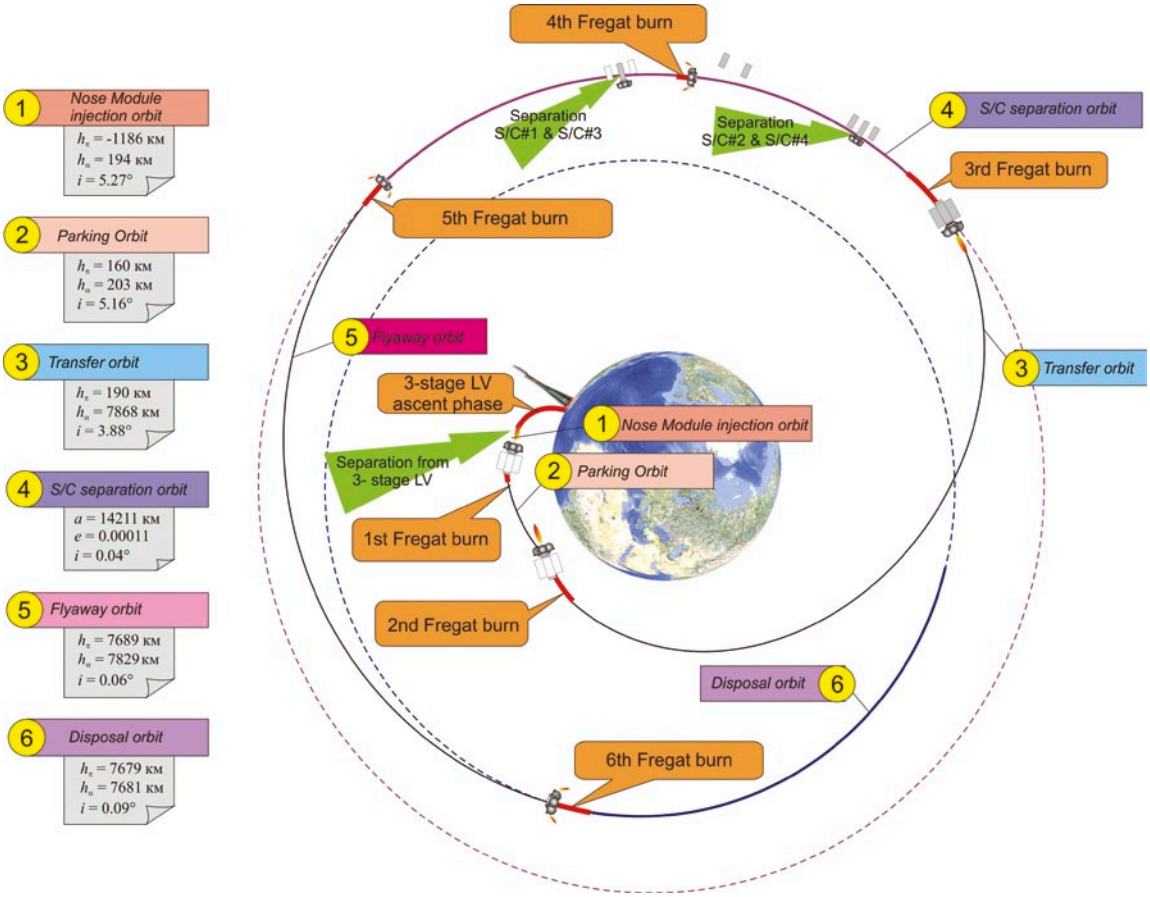
LIFTOFF	00:00:00
Jettisoning of boosters	+00:01:58
Jettisoning of fairing	+00:03:58
Separation of main stage	+00:04:48
Separation of 3rd stage	+00:09:23
Fregat 1st burn	+00:10:23
Fregat shut-down and beginning of ballistic phase	+00:14:19
Fregat 2nd burn	+00:22:50
Fregat shut-down and beginning of ballistic phase	+00:31:21
Fregat 3rd burn	+01:52:25
Fregat shut-down and beginning of ballistic phase	+01:57:27
SC2 and SC4 separation	**+02:00:46**
ACS ignition and injection SC1 and SC3 on separation orbit	+02:00:48 to +02:16:03
SC1 et SC3 separation	**+02:22:27**

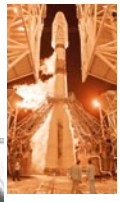
VS 10 MISSION PROFILE

THE SOYUZ THREE STAGES MISSION PROFILE



THE FREGAT MISSION PROFILE





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 20 shareholders from ten European countries: including Airbus Safran Launchers 40.99%, French space agency CNES with 34% and all European companies participating in the construction of Ariane launchers. Since the outset, Arianespace has signed more than 390 launch contracts and launched 490 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of about 989 million euros in 2013.

At January 1, 2014, Arianespace had 330 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 Service & Solutions 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 40 satellites to be launched.

The Guiana Space Center: Europe's Spaceport

For 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 (ECPU), 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 Regulus, 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 Guiana

In French Guiana, Arianespace is the contracting authority in charge of operating the family of three launchers, Ariane, Soyuz and Vega. On Soyuz, Arianespace supervises the integration and functional checks of the launcher in the MIK facility, carried out by RKTs-Progress for the three lower stages, and by NPO-Lavochkin for the Fregat upper stage. It also coordinates Fregat propellant loading operations in the S3B building, and satellite preparations in the EPCU payload preparation facility operated by CNES/CSG. Arianespace then integrates the satellite(s) on the Fregat stage in the S3B building, transfers the launcher and upper composite to the Soyuz Launch Zone and, along with the Russian entities in charge of the launcher, conducts the final countdown and liftoff operations from the Soyuz Launch Center (CDLS). 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.