A LAUNCH FOR EUROPE'S GALILEO CONSTELLATION

Arianespace's third launch of the Soyuz rocket from the Guiana Space Center (CSG) in French Guiana will orbit two new satellites in Europe's Galileo satellite navigation system.

With Soyuz, Ariane 5 and Vega all operating out of the Guiana Space Center in French Guiana, Arianespace is the only launch service 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.

The Soyuz at CSG program carries on the long-standing partnership between France and Russia which kicked off in 1996 with the creation of the joint venture Starsem to operate the Soyuz launcher at Baikonur. This strategic partnership gives Europe a medium launch vehicle, while allowing Russia to increase the number of Soyuz launches. A total of 25 successful Soyuz commercial launches have already been performed at the Baikonur cosmodrome. All versions of the Soyuz launcher have carried out 1,792 missions to date, from both Russia and Kazakhstan.

The European Space Agency (ESA) first began studying the possibility of Soyuz launches from the Guiana Space Center in early 1998 and officially started this program in 2004. Construction work in French Guiana kicked off in 2005 and the first Russian components started arriving in 2008.

ESA named French space agency CNES prime contractor for this project, overseeing the development and qualification of the Soyuz launch complex (ELS) at the Guiana Space Center.

Russian space agency Roscosmos was in charge of the Russian segment of the program and also coordinated the work of all Russian companies involved.

Arianespace managed the supply of Russian systems and coordinated the work by Russian companies during the development phase.

The "Soyuz at CSG" program is already a business success, with Arianespace having signed 14 launch contracts.

The two Galileo satellites, IOV-2 FM3 and FM4 (In Orbit Validation), nicknamed David and Tif, will be placed into circular orbit at an altitude of 23,000 kilometers. The satellites were built by a consortium led by Astrium GmbH.

Arianespace and its subsidiary Starsem earlier orbited the experimental satellites Giove-A and Giove-B, enabling Galileo to secure its allocated frequencies with the first two satellites in the Galileo constellation.

MISSION PROFILE

The third Soyuz launch from the Guiana Space Center (CSG) will place two satellites in the Galileo constellation into circular orbit at 23,000 km, as part of the IOV (In Orbit Validation) program.

The launcher will be carrying a total payload of 1 580 kg, including 1 400 kg for the IOV-2 FM3 and FM4 satellites, which will be released into their targeted orbits.

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

Targeted orbit : circular medium Earth orbit
Altitude : 23 222 km
Inclination : 55.345 degrés

Liftoff is scheduled for **Friday, October 12** at exactly:

03:15:01 pm local time
18:15:01 UTC
08:15:01 pm in Paris
02:15:01 pm in Washington, D.C.
10:15:01 pm in Moscow

The Launch Vehicle Flight at a Glance

After lift-off from the Guiana Space Center, the flight of the three lower stages of the Soyuz launch vehicle will last for 9 minutes and 20 seconds. At this time, the Soyuz third stage will separate from the nose module, consisting of the Fregat upper stage, the satellite dispenser and two Galileo IOV-2 FM3 and FM4 satellites. The three lower Soyuz stages will fall back to Earth.

The Fregat upper stage will then ignite its own engine, taking the nose module into a transfer orbit above the Earth. After this first burn, the Fregat will perform a barbecue manoeuvre (slow spin) which lasts for about 3 hours and 12 minutes.

At the correct point on this orbit, Fregat will fire again, to reach the circular separation orbit. After stabilization the two satellites will be released from the dispenser. At the end of the mission, the Fregat stage will raise its orbit to free the operational zones for Galileo satellites and it will be passivated.

Mission Duration

The nominal mission duration (from lift-off to the last spacecraft separation) is 3 hours 44minutes and 57 seconds.

Soyuz payload Configurtion

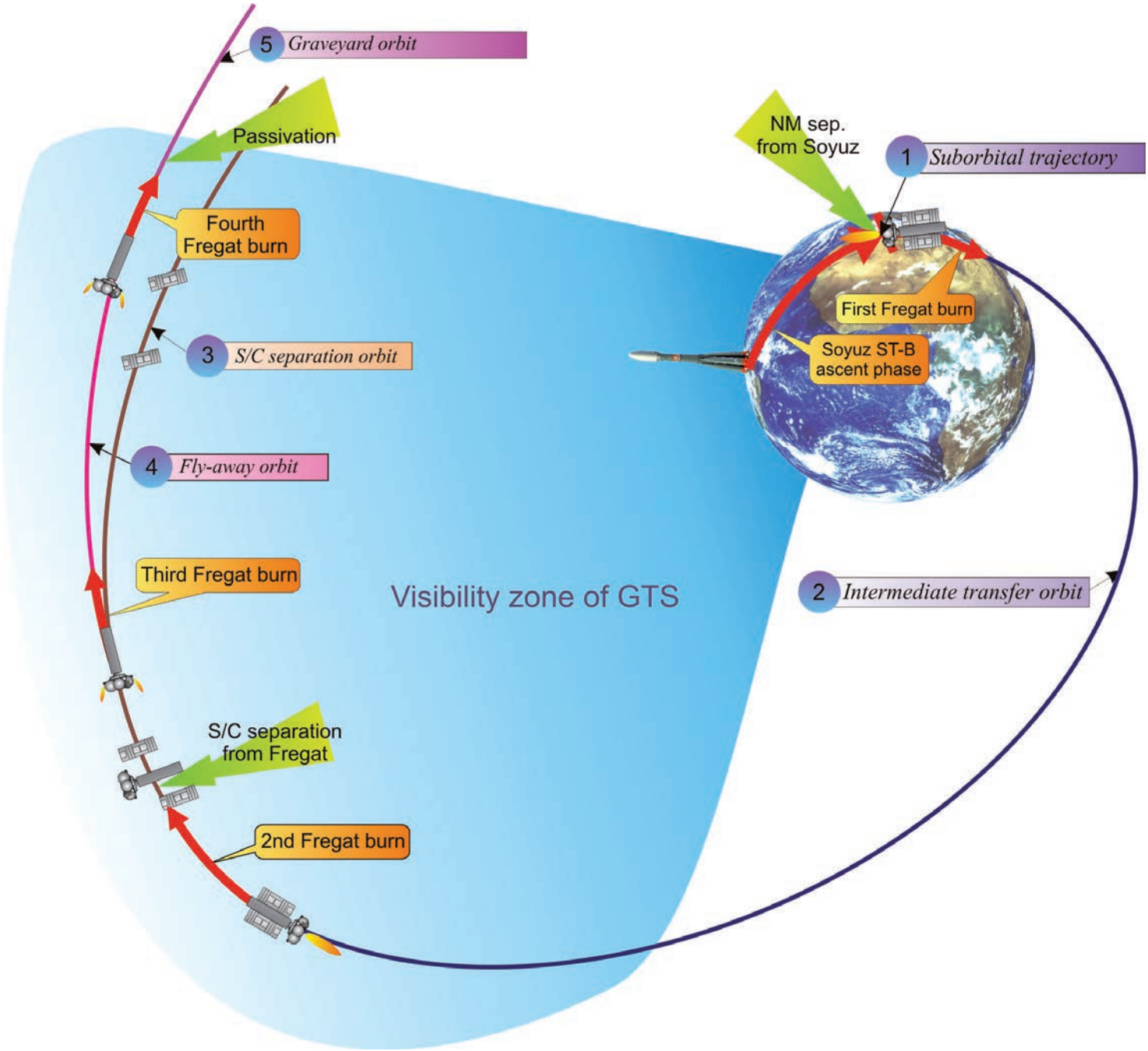
The Galileo IOV-2 FM3 and FM4 satellites were built by a consortium led by Astrium GmbH of Germany, on behalf of the European Space Agency (ESA).

LAUNCH COUNTDOWN AND FLIGHT EVENTS

The countdown comprises all final preparation steps for the launcher, the satellites and the launch site. If it proceeds as planned, the countdown leads to the ignition of the main stage engine and of the four boosters, for a liftoff at the targeted time.

Events	Time (s)
Beginning of the State Commission meeting for launcher fueling authorization	-04:20:00
Beginning of Launch Vehicle fuelling with propellant components.	-04:00:00
Launch Vehicle is fuelled with all propellant components	-01:45:00
Mobile gantry withdrawal	-01:00:00
Key on start (beginning of Soyuz synchronised sequence)	-00:06:10
Fregat transfer to onboard power supply	-00:05:00
Upper Composite umbilical drop off command.	-00:02:25
Ground-board	-00:00:40
Lower stage mast retraction	-00:00:20
Ignition	-00:00:17
Preliminary thrust level	-00:00:15
Full thrust level	-00:00:03
Lift-off	**00:00:00**
Jettisoning of boosters	+00:01:58
Jettisoning of fairing	+00:03:38
Separation of main stage	+00:04:48
Separation of 3rd stage	+00:09:24
Fregat 1st burn	+00:10:24
Fregat shut-down et beginning of ballistic phase	+00:23:31
Fregat 2nd burn	+03:34:40
Fregat shut-down	+03:39:57
Separation of IOV-2 FM3 and FM4	**+03:44:57**

PROFIL OF THE GALILEO MISSION

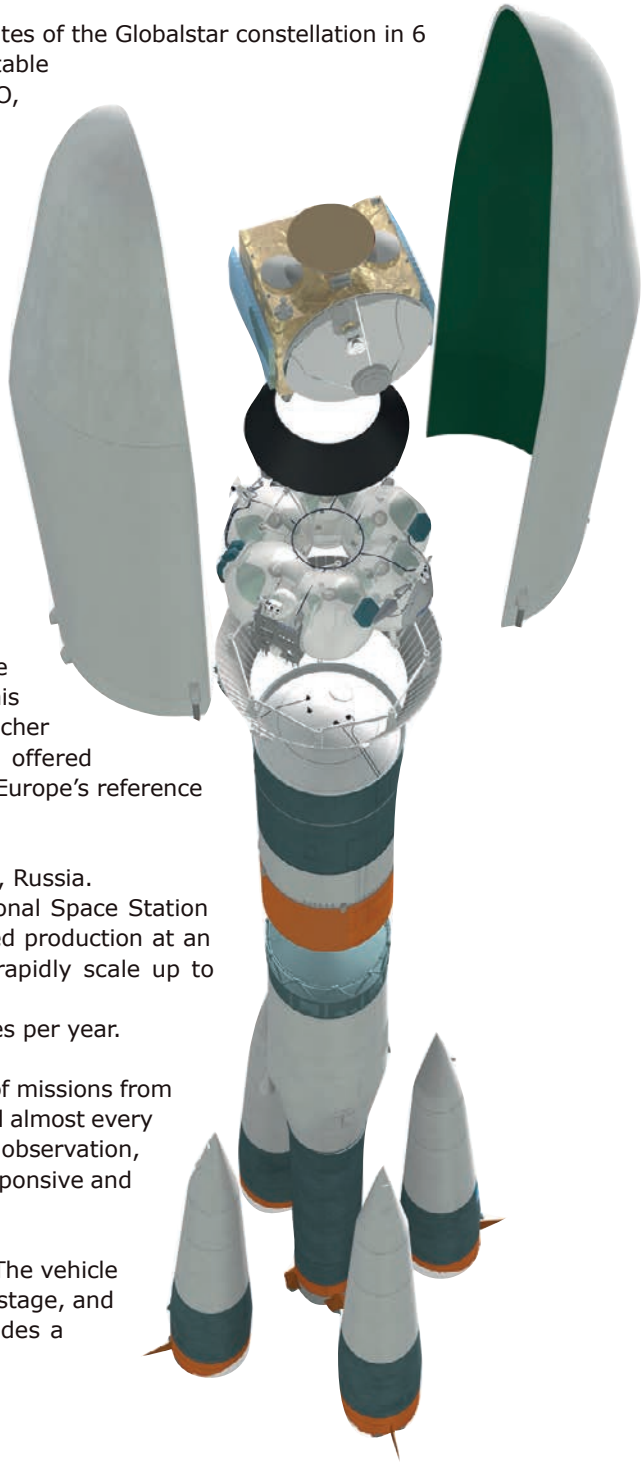


SOYUZ LAUNCH VEHICLE

The Soyuz launch vehicle family has provided reliable and efficient launch services since the birth of the space program. Vehicles in this family, which launched both the first satellite and first man into space, have been credited with more than 1792 launches to this date. Today, this vehicle is used for manned and unmanned flights to the International Space Station and commercial launches managed by Arianespace.

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 in the former Soviet Union and currently in the world, the Soyuz benefits from very high standards in both reliability and robustness.

In 1999, Soyuz allowed Starsem, Arianespace's affiliate, to launch 24 satellites of the Globalstar constellation in 6 launches. Following this success, Starsem introduced the flexible, re-startable Fregat upper stage, thus opening up a full range of missions (LEO, SSO, MEO, GTO, GEO and escape).



The introduction in 2004 of the Soyuz 2-1a launch vehicle represented a major step in the launch vehicle evolution program. This modernized version of Soyuz, which was also used to successfully launch MetOp-A on October 19, 2006, implements a digital control system providing additional mission flexibility and will enable control of the launch vehicle with the 4.1 m ST fairing. It represents a necessary milestone towards the next generation evolved Soyuz 2-1b launcher as the latest step in a cooperative European/Russian evolution program. In addition to the 2-1a version's features, it utilizes the more powerful third stage engine, significantly increasing the overall launch vehicle performance.

The inaugural flight of the upgraded Soyuz 2-1b launch vehicle was successfully performed on December 27, 2006, launching the Corot scientific spacecraft for the French Centre National d'Etudes Spatiales.

The decision of the European Space Agency to introduce the Soyuz launch capability at the Guiana Space Center (CSG) is a major step in widening the range of accessible missions. With the introduction of the Soyuz at CSG, this famed Russian launch vehicle becomes an integral part of the European launcher fleet, together with the heavy-lift Ariane 5 and the light Vega. To be offered exclusively by Arianespace to the commercial market, the Soyuz at CSG is Europe's reference medium-class launch vehicle for governmental and commercial missions.

The Samara Space Center continues to mass-produce the Soyuz in Samara, Russia.
As a result of continued demand from the Russian government, International Space Station activity, and Arianespace's commercial orders, the Soyuz is in uninterrupted production at an average rate of 15 to 20 launch vehicles per year with a capability to rapidly scale up to accommodate user's needs.
In fact, peak production of the Soyuz in the early 1980's reached 60 vehicles per year.

The Soyuz is a reliable, efficient, and cost effective solution for a full range of missions from LEO to Mars. In its unequalled flight history, the Soyuz has already performed almost every mission profile, including orbiting satellites for telecommunications, Earth observation, weather monitoring, scientific missions and manned flights. It is a highly responsive and flexible launch vehicle.

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

THE BOOSTERS (FIRST STAGE)

The four boosters are assembled around the central core and are tapered cylinders with the oxidizer tank in the tapered portion and the kerosene tank in the cylindrical portion. The booster's RD-107A engines are powered by liquid oxygen and kerosene, the same propellants which are used on each of the lower three stages. Each engine has four combustion chambers and nozzles. Three-axis flight control is carried out by aerofins (one per booster) and movable vernier thrusters (two per booster). Following lift-off, the boosters burn for 118 seconds and are then discarded. The separation time is determined by comparing the velocity with a predefined value. Thrust is transferred through a ball joint located at the top of the cone-shaped structure of the booster, which is attached to the central core by two rear struts.

THE CENTRAL CORE (SECOND STAGE)

The central core is similar in construction to the four boosters, with a hammer-head shape to accommodate the boosters. A stiffening ring is located at the interface between the boosters and the core. This stage has a RD-108A engine with four combustion chambers and nozzles and four vernier thrusters. The verniers are used for three-axis flight control once the boosters have separated. The core stage nominally burns for 286 seconds. Ignition of the central core and boosters occurs at an intermediate level of thrust on the launch pad 20 seconds before lift-off in order to monitor engine health parameters before the engines are throttled up and the vehicle leaves the pad.

THE THIRD STAGE

The third stage is linked to the central core by a lattice-work structure. Ignition of the third stage's main engine occurs approximately 2 seconds before shutdown of the central core. The third stage engine's thrust directly separates the stage from the central core. Located between the oxidizer and fuel tanks is a dry section housing the launcher's avionics systems. This stage uses the RD-0124 engine with four combustion chambers and nozzles. The RD-0124 engine is a staged combustion engine powered by a multi-stage turbopump driven by gas from combustion of the main propellants in a gas generator. These oxygen-rich combustion gases are recovered to feed the four main combustion chambers where kerosene, coming from the regenerative cooling circuit, is injected. Attitude control is provided by activating the four main engine combustion chambers along an axis in two planes. The LOX and kerosene tanks are pressurized by the heating and evaporation of helium from storage reservoirs located in the LOX tank. The RD-0124 engine adds an additional 34 seconds of Isp compared with the RD-0110 version, significantly increasing the launcher's overall performance.

THE FREGAT UPPER STAGE (FOURTH STAGE)

Flight qualified in 2000, the Fregat upper stage is an autonomous and flexible upper stage that is designed to operate as an orbital vehicle. It extends the capability of the lower three stages of the Soyuz vehicle to provide access to a full range of orbits (LEO, SSO, MEO, GTO, GEO and escape). In order to ensure high reliability for the Fregat stage, it integrates various flight-proven subsystems and components from previous launchers and satellites. The upper stage consists of 6 spherical tanks (4 for propellants, 2 for avionics) welded together in a circle. Eight trusses passing through the tanks are used to attach the payload and to transfer loads to the launcher. The stage is independent from the lower three stages, having its own guidance, navigation, control, tracking, and telemetry systems. The stage uses storable propellants (UDMH/NTO) and can be restarted up to 20 times in flight, thus enabling it to carry out complex mission profiles. It can provide the customer with 3-axis stabilization or spin-up of their spacecraft.

PAYLOAD ACCOMMODATION

The current Soyuz flies the ST-type fairing, with external diameter of 4.1 m and a length of 11.4 m.
The Fregat upper stage is encapsulated in the fairing with the payload and a payload adapter/dispenser.

THE GALILEO SATELLITES IOV-1 PFM AND FM2

Customer	**ESA (European Space Agency)**
Contractors	**Astrium GmbH (prime) with Thales Alenia Space Italy**
Mass	**Total mass at lift-off : 700 kg each**
Dimensions	**2.74 x 1.59 x 14.5 m (span in orbit)**
Life time	**More than 12 years**
On-board power	**1420 W**
Orbit	**Circular medium Earth orbit**

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ARIANESPACE AND THE GUIANA SPACE CENTER

Arianespace was founded in 1980 as the world's first launch service & solutions company. Today, Arianespace has 21 shareholders from ten European countries (including French space agency CNES with 34%, Astrium with 30%, and all European companies participating in the construction of Ariane launchers).

Since the outset, Arianespace has signed more than 300 launch contracts and launched more than 300 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace.

The company posted sales exceeding 1 013 million Euros in 2011

Arianespace offers launch Service & Solutions to satellite operators from around the world, including private companies and government agencies. These Service & Solutions call on three launch vehicles:
- The Ariane 5 heavy launcher, operated from the Guiana Space Center in Kourou, French Guiana.
- The Soyuz medium launcher
- The Vega light launcher in operations at the Guiana Space Center since February 2012.

With its family of launchers Arianespace 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 over 30 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), the French space agency CNES and 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 plays several roles at the 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. It collects and processes all data transmitted from the launcher via a network of receiving stations, to track Ariane and Soyuz rockets throughout their trajectory.

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

Roscosmos and the Russian companies

ROSCOSMOS (Russian Federal Space Agency) is responsible for the oversight for licensing and intergovernmental relations, launch range operations and launch authority.

TsSKB Progress (Samara Space Center) is responsible for the design, development, and manufacture of space launch vehicles including the Soyuz launch vehicle's first, second, third stages and fairing, integrates vehicle stages and performs flight operations.

NPO Lavochkin is responsible for the Fregat upper stage manufacture, integration and launch operations.

TsENKI, is responsible for launch planning and provision of launch services comprised of systems engineering, launch range operations and launch authority; and for the design, technical and operation management of the launch pad and associated facilities dedicated to the Soyuz Launch Vehicle.