SOYUZ TO LAUNCH GALILEO

This new Starsem's flight will boost the European Space Agency's Giove-B spacecraft (Galileo In Orbit Validation Element), the second European navigation satellite.

This prestigious mission constitutes the 21st Starsem flight. Started in 2000, Starsem's close cooperation with the European Space Agency was marked by the successful delivery of the 4 Cluster-II scientific satellites, Mars Express interplanetary probe to the Red Planet, Venus Express spacecraft to Earth's nearest planetary neighbor and Giove-A, first European navigation satellite. For all these missions Starsem was using similar versions of the Soyuz launch vehicle.

The purpose of this flight is to inject the 500 kg Giove-B spacecraft on the Middle Earth Orbit (MEO) of the final Galileo satellite constellation, to characterise the orbit environment and transmit the navigation signals at all the frequencies planned for the Galileo constellation for securing the frequency allocation and enable early experimentation on ground.

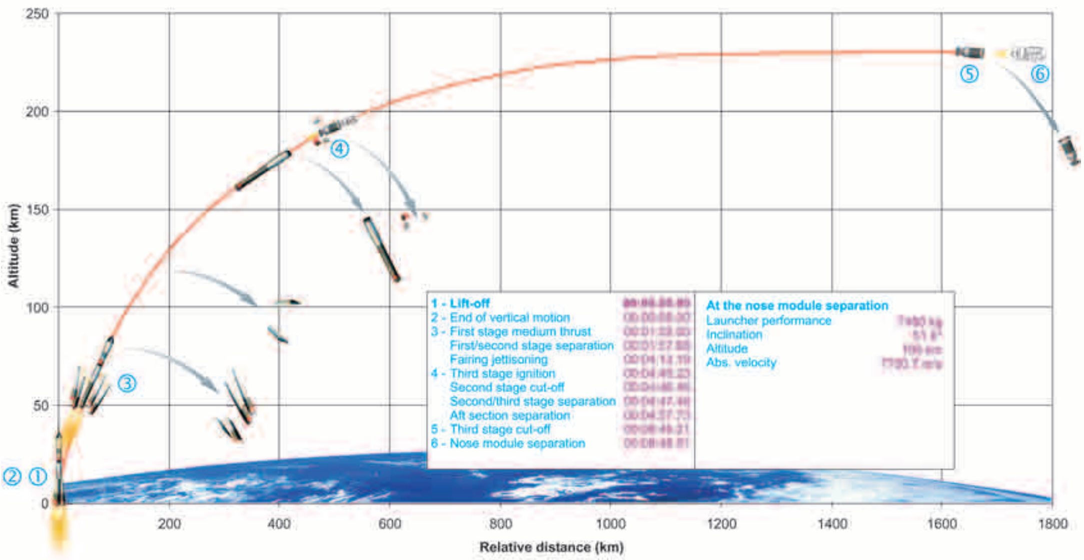
MISSION DESCRIPTION

The Giove-B launch will be performed from the Baikonur Cosmodrome, Launch Pad #6.

The launch will occur on Saturday, **April 26, 2008, at 10:16 p.m. UTC:**

04:16 a.m. Baikonur time on April 27, 2008
02:16 a.m. Moscow time on April 27, 2008
00:16 a.m. Paris time on April 27, 2008

The launch window : ±1sec



The Launch Vehicle Flight at a Glance

After lift-off from the Baikonur Cosmodrome, the flight of the three lower stages of the Soyuz launch vehicle will last for 8 minutes and 48 seconds. At this time, the Soyuz third stage will separate from the nose module, consisting of the Fregat upper stage and its Giove-B payload. The three lower Soyuz stages fall back down to Earth.

The Fregat upper stage will then fire its own engine, taking the nose module into a circular parking orbit above the Earth. After this first burn, the Fregat will perform a barbecue maneuver to maintain proper thermal conditions for the Giove-B spacecraft during the following coast phase, which lasts for about half an hour. At the correct point on this orbit, Fregat will fire again, to reach the intermediate elliptical transfer orbit.

After this second burn, a new coast phase will follow ending with Fregat third burn for transfer to required orbit and final change of inclination up to 56°. The Fregat upper stage will then turn the nose module to stabilize it and will release the Giove-B spacecraft. Separation will occur 3 hours 45 min. after lift-off.

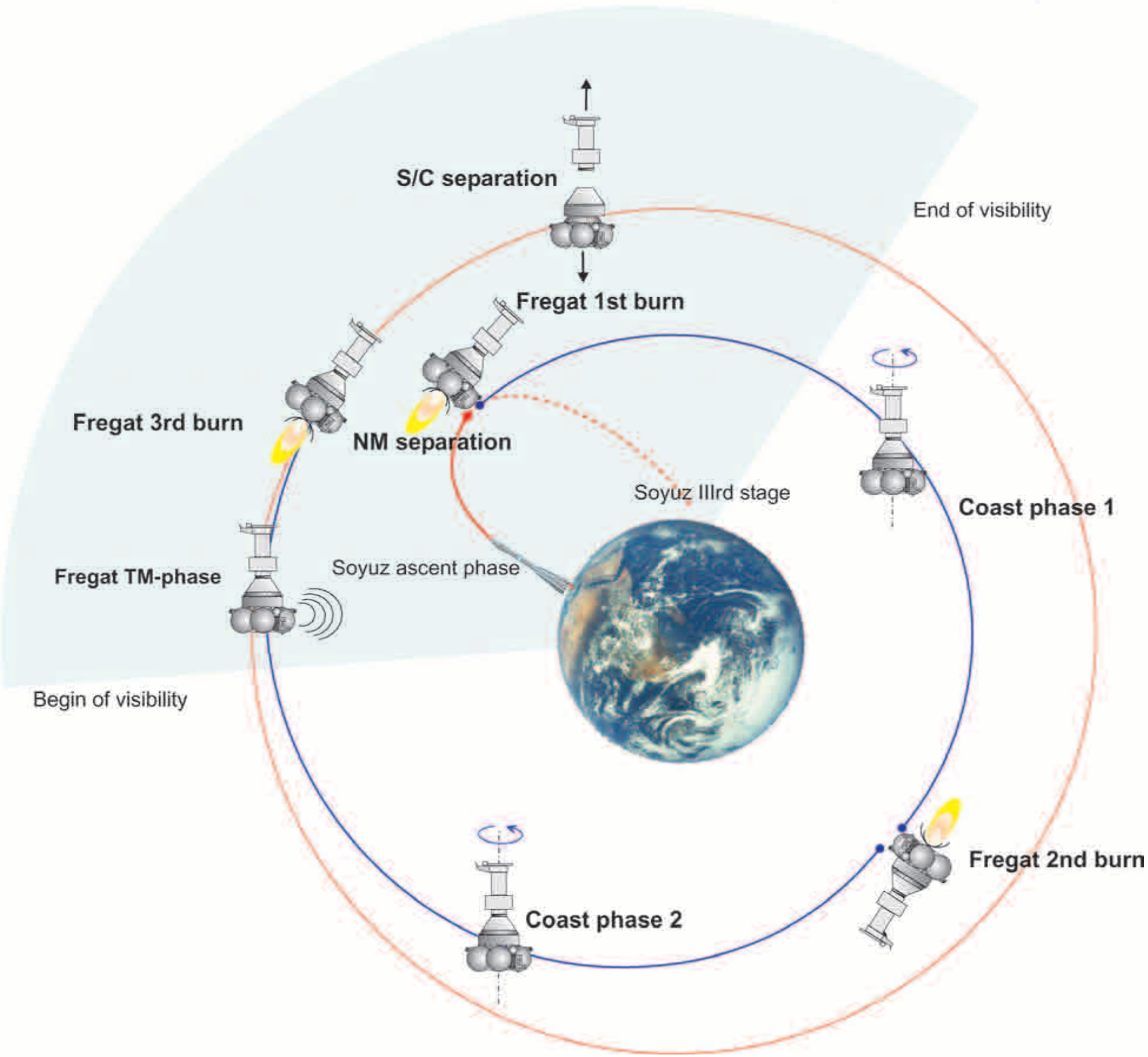
The orbital parameters at separation are the following:

Semi Major Axis: 29601.30 km
Orbit inclination: 56 °
Eccentricity: 0.00003

Mission Duration:

The nominal mission duration (from lift-off to spacecraft separation) is ~ 3 hours 45 minutes.

PROFILE OF THE GIOVE-B INJECTION 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 1731 launches to this date. Today, this vehicle is used for manned and unmanned flights to the International Space Station and commercial launches managed by Starsem.

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, the Soyuz benefits from very high standards in both reliability and robustness.

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

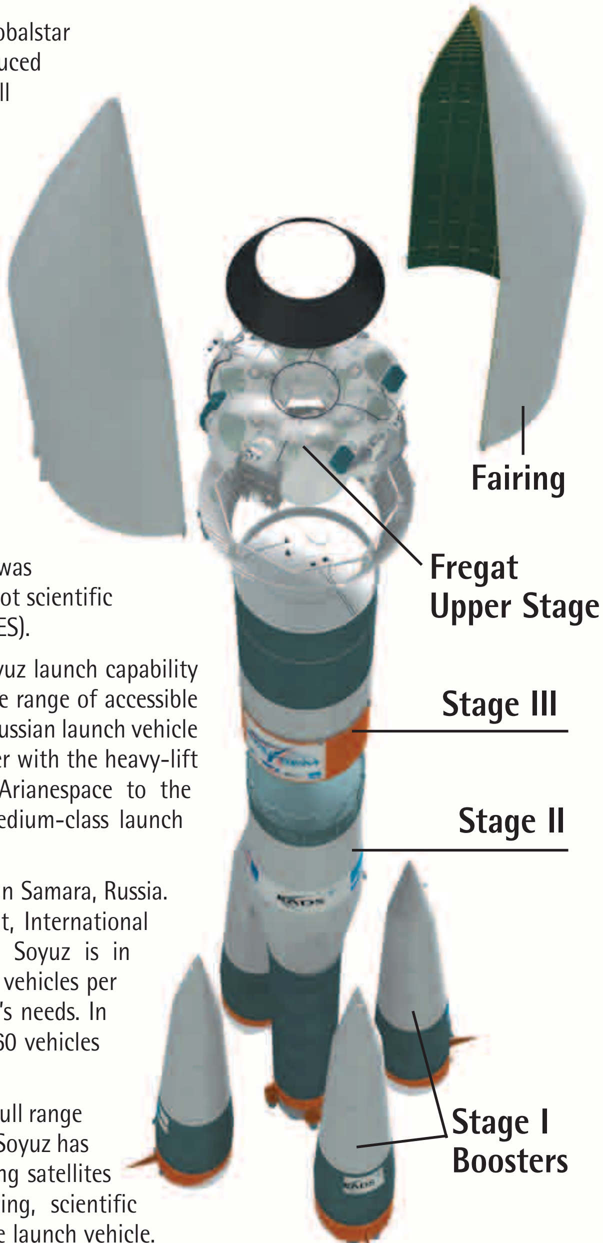
The inaugural flight of the Soyuz 2-1a launch vehicle performed on November 8, 2004 from the Plessetsk Cosmodrome represents a major step in the launch vehicle evolution program. This modernized version of Soyuz, which was also used to successfully launch MetOp-A on October 19, 2006, implements a digital 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 (CNES).

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 Starsem's commercial orders, the Soyuz is in uninterrupted production at an average rate of 10 to 15 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 Starsem 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.

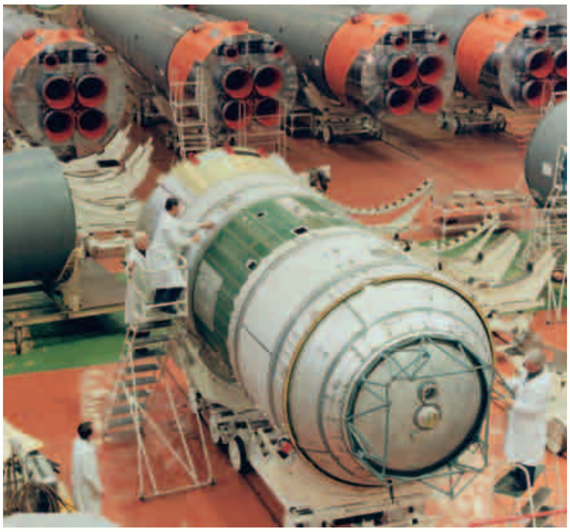
THE BOOSTERS (FIRST STAGE)

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.

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.

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. In between the oxidizer and fuel tanks is an intermediate bay where avionics systems are located. This stage uses a RD-0110 engine with four combustion chambers and nozzles. Four vernier nozzles provide three-axis flight control. The third stage engine nominally burns for 240 seconds. After engine cut-off and separation of the fourth stage, the third stage performs an avoidance maneuver by opening an outgassing valve in the liquid oxygen tank.

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 provide the Fregat with high initial reliability, several flight-proven subsystems and components from previous spacecraft and rockets are incorporated into the upper stage. The upper stage consists of 6 spherical tanks (4 for propellants, 2 for avionics) arrayed in a circle, with trusses passing through the tanks to provide structural support. 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 S-type fairing, with external diameter of 3.7 m and a length of 7.7 m. The Fregat upper stage is encapsulated in the fairing with the payload and a payload adapter/dispenser. Starsem has already developed a series of adapters and dispensers, which may be used directly by the customer.

THE GIOVE-B SPACECRAFT

Galileo, the European satellite navigation system, is named after the famous Italian scientist Galileo Galilei (1564–1642). GIOVE stands for 'Galileo In-Orbit Validation Element' and also refers to Jupiter. The giant planet's four main moons were discovered by Galileo and used as the 'clocks' in his navigation method. The first experimental satellite, Giove-A, was launched on Soyuz on 28 December 2005 and has been broadcasting Galileo signals from space since then.

Giove satellites are testing novel key technologies for the Galileo system, such as the high-precision passive maser atomic clock and the triple-channel transmission of navigation signals. Instruments will measure the radiation and spacecraft charging environments.

Giove-B will be able to transmit a signal adopting a specific standard (called MBOC), according to what was agreed only a few months ago by the European Union and the United States for their respective systems.

Giove-B Satellite

Mass	*500.6 kg*
Body size	*0.95 m x 0.95 m x 2.4 m*
Solar array	*1100 W; two wings each 4.34 m long*
Lifetime	*2 years*

Payload

The most important payload elements are the atomic clocks: two rubidium atomic clocks with a stability of 10 nanoseconds per day, and one hydrogen passive maser clock, with a stability of 1 nanosecond per day. As the first maser clock embarked on a satellite, it will become the most stable clock in space.

Orbit

Medium Earth orbit, at altitude 23 222 km.

Contractors

A consortium lead by Astrium GmbH (Germany) as satellite prime, with Thales Alenia Space Italy as sub-contractor for satellite AIT. Telespazio (Italy) will be in charge of the operations in orbit.

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LAUNCH CAMPAIGN

After the completion of the production activities in Europe, the Giove-B satellite arrived at the Baikonur airport and the launch campaign began. Activities in Baikonur during the first several weeks of the launch campaign included preparation of the satellite in the PPF followed by filling in the HPF. The satellite was then mated to the Fregat upper stage and together encapsulated under the fairing, comprising the Upper Composite.

The key events of the Giove-B Launch Campaign in the final days and moments prior to launch proceed as follows (L = lift-off):

L-7 days:
Upper composite (satellite + adapter + Fregat + fairing) is transferred to assembly facility near the launch pad where it is mated to the third stage of the launch vehicle

L-4 days:
The Transfer Readiness Review ensures the Soyuz and its payload are ready for final launch pad activity and launch

L-3 days:
The fully assembled launch vehicle is transferred to the pad and erected in the vertical position. Check out and countdown rehearsal for the lower 3 stages of the vehicle takes place

L-2 days:
Countdown rehearsal for the customer's spacecraft and the Fregat upper stage

L-10 hours:
Final countdown begins. Systems checks on Soyuz begin

L-5 hours:
Systems checks begin on Fregat upper stage

L-4 h20m:
Launch vehicle fueling authorization review

L-4 hours:
Launch vehicle fueling begins

L-30 minutes:
Removal of service platform

L-2m35s:
Pressurization of propellant tanks

L-45 seconds:
Transfer to on-board power supply

L-20 seconds:
Ignition of booster and core engines at intermediate thrust level

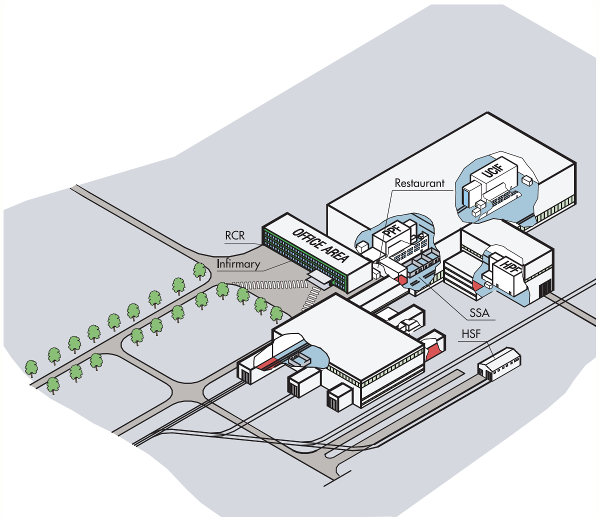
L:
Lift-off !

STARSEM BAIKONUR FACILITIES

Starsem has adapted, modified, developed, and built dedicated facilities at the Baikonur Cosmodrome which allow its customers to access to state-of-the-art facilities for their launch campaign. Central to these facilities are the three class 100,000 clean rooms used for the complete integration checkout, test, and fueling of customer's spacecraft.

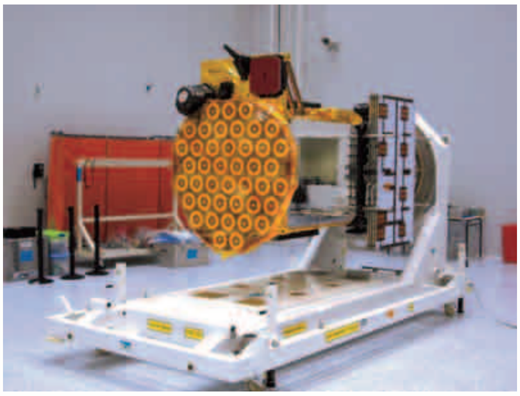
SITE 112

Starsem's facilities are located primarily in two areas of the Cosmodrome: Site 112 and Site 31. Site 112 is the location of the assembly and integration facility for the former Energia launch vehicle. This facility (MIK 112) houses Starsem's dedicated clean rooms and is the location where customer's spacecraft are prepared, fueled, and eventually mated to the Fregat upper stage and encapsulated in the fairing. Customer's offices are also located in this facility. Built in 1998, Starsem's 1158-m^2 of Class 100 000 clean rooms ensure customers with international standard facilities for the preparation of their spacecraft. This allows customers to have their spacecraft in a controlled environment from spacecraft unpacking through encapsulation. Portable and fixed ventilation systems ensure the thermal conditions of the spacecraft until launch. Failsafe backup power supplies are available in all clean rooms to protect sensitive hardware during processing activities. Dedicated networks allow voice and data exchange between the clean rooms and other facilities. An independent, redundant satellite communications system provides high data rate connections between customers and their home base.



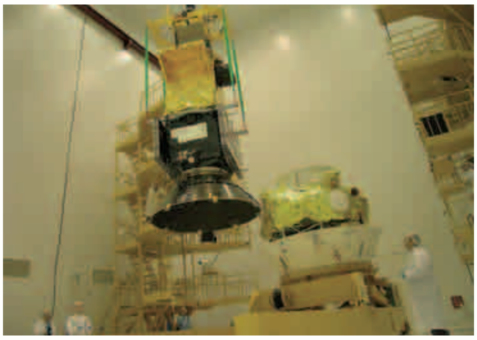
THE PAYLOAD PROCESSING FACILITY (PPF)

The PPF features a 286 m^2 high bay for the processing of customer's spacecraft. This facility has two independent 70 m^2 control rooms to permit parallel operations and personnel and equipment airlocks to ensure the integrity of conditions in the processing area.



THE HAZARDOUS PROCESSING FACILITY (HPF)

The HPF high bay covers a surface of 285 m^2, and is designed for spacecraft filling activities and pressurization of tanks. The HPF is designed to accommodate bipropellant spacecraft (e.g. MMH/N2O4). The facility has airlocks and an on-site control room. A remote control room in the customer office area with a dedicated data transmission system, intercoms, and video monitors ensures maximum safety for customer's launch teams. Spacecraft propellants are stored in the controlled and monitored Hazardous Storage Facility, located next to MIK 112.



THE UPPER COMPOSITE INTEGRATION FACILITY (UCIF)

Spacecraft mating with the Fregat upper stage is performed in this 587 m2 high bay, along with fairing encapsulation. The facility has equipment and personnel airlocks and a on-site control room. The remote control room in the customer office area can also be used to monitor activities in the UCIF. The data network allows the customer to carry out spacecraft testing via direct links with EGSE installed in the PPF control room.

SITE 31

Site 31 includes the launch pad, assembly and integration facility for the launch vehicle (MIK 40), and administrative buildings. After encapsulation, customer's spacecraft is transported to MIK 40 under a controlled environment to be mated to the rest of the launch vehicle in MIK 40. Following integration, the vehicle is rolled out to the launch pad.

STARSEM'S FOUNDING COMPANIES

As the Soyuz Company, Starsem brings together four of the world's leading space organizations

ASTRIUM

ASTRIUM, a wholly owned subsidiary of EADS is dedicated to providing civil and defense space systems. In 2006, ASTRIUM had a turnover of € 3.2 billion and 11,000 employees in France, Germany, the United Kingdom and Spain. Its activities are based on three main subsidiaries: ASTRIUM SAS - Space Transportation, for launchers and orbital infrastructure, ASTRIUM SAS for satellites and ground segment and ASTRIUM SAS - Services to develop and deliver satellite services. EADS is a global leader in aerospace, defense and related services. In 2006, EADS generated revenues of € 39.4 billion and employed a workforce of more than 113,000.

ARIANESPACE

Arianespace is the world's leading launch Service & Solutions company, delivering innovative services and solutions to its customers for more than 25 years. Backed by 23 shareholders, and by the European Space Agency, Arianespace offers an unrivalled launcher family, comprising Ariane 5, Soyuz and Vega, and an international workforce renowned for their culture of excellence. Arianespace has launched 254 satellites since being founded, including more than 60% of the commercial satellites now in service worldwide. It has a steady backlog of about 50 satellites to be launched, equal to more than three years of operations. www.arianespace.com

RUSSIAN FEDERAL SPACE AGENCY – ROSCOSMOS

The Russian Federal Space Agency - Roscosmos is the central body of the federal executive authority defining the Russian Federation's national policy in the field of space research and exploration. The agency also performs interdisciplinary coordination of national scientific and application space programs. It was created in February 1992 by a decree issued by the President of the Russian Federation. Agency's responsibilities include: development and implementation of Russian national space policy; acting in the capacity of government customer in the development of scientific and application space systems, facilities and equipment; establishing international cooperation and collaboration in space research, and organization/coordination of commercial space programs. Operations under Agency responsibility include several hundred space companies and organizations.

SAMARA SPACE CENTER

The Samara Space Center "TsSKB-Progress" was created by a Russian Presidential decree in 1996 by combining the TsSKB Central Samara Design Bureau and the Progress production plant. The Samara Space Center is one of the world leaders in the design of launchers, spacecraft and related systems. Its history goes back to the start of the space program in 1959 when a branch of the Moscow OKB-1 design bureau was established in the city of Kuibyshev (now known as Samara).