SOYUZ TO LAUNCH METOP-B

This new Starsem's flight will launch the EUMETSAT's Metop-B meteorological spacecraft - Europe's latest polar-orbiting satellite dedicated to operational meteorology.

The purpose of flight ST 25 is to inject the 6.3 m high and 4 085 kg Metop-B spacecraft on a Sun-Synchronous Orbit (SSO), at an altitude between 800 and 850 km. Metop-B will provide more precise details about atmospheric temperature and moisture profiles, invaluable for weather forecasting and climate monitoring.

For this first flight of 2012, Starsem will utilize the Soyuz 2-1a version and ST-type payload fairing with an external diameter of 4.1 m and a length of 11.4 m.

The EUMETSAT Metop-A meteorological satellite was successfully orbited by Starsem on 19 October 2006 with the same launch vehicle.

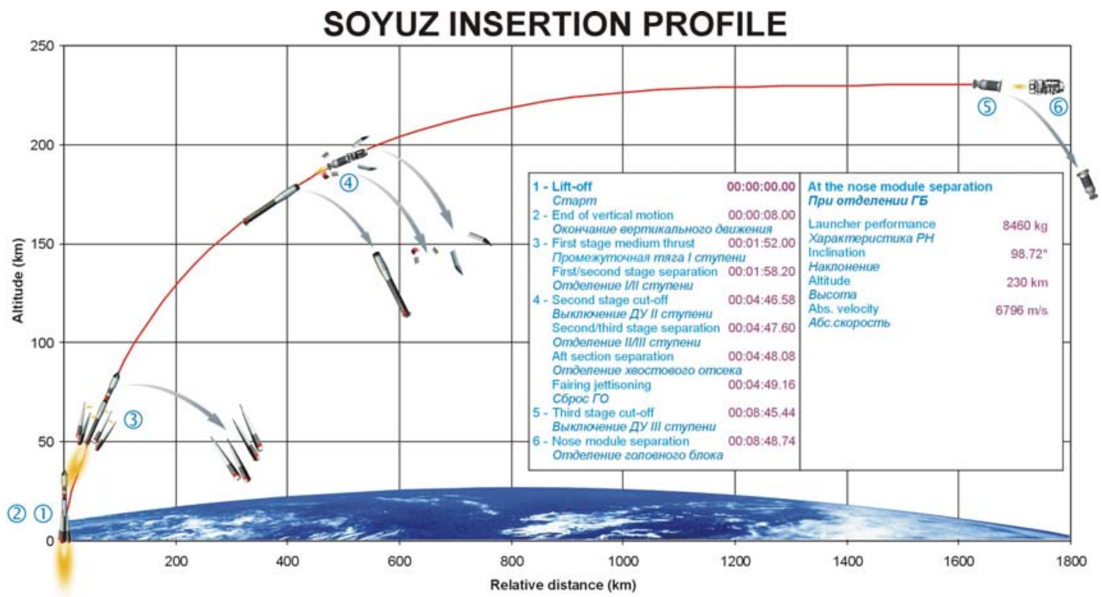
ABOUT STARSEM

Starsem is the Soyuz Company, bringing together all key players involved in the production, operation and international commercial marketing of the world's most versatile launch vehicle. Shareholders in Starsem are Arianespace, Astrium, the Russian Federal Space Agency and the Samara Space Center.

MISSION DESCRIPTION

The launch of Metop-B will be performed from the Baikonur Cosmodrome, Launch Pad #6. The Metop-B launch slot is fixed from 17 to 27 September 2012. The launch is possible at any day inside the above launch slot.

On **Monday, 17 September 2012,** the launch time will be **16:28 UTC:**
22:28 Baikonur time
20:28 Moscow time
18:28 Paris time



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 min. and 48 sec. At this time, the separation between the Soyuz third stage and the nose module consisting of the Fregat upper stage and its Metop-B payload will occur, putting the Fregat upper stage into orbit. The three lower Soyuz stages fall back down to Earth.

The Fregat upper stage (which carries the spacecraft) will then fire its own engine, taking the nose module into a transfer orbit above the Earth. After this first burn, the Fregat upper stage will control the nose module’s direction towards the Sun to maintain proper thermal conditions for the Metop-B spacecraft during the following coast phase, which lasts for about 45 minutes.

At the correct point on this orbit, Fregat will fire again, to reach the Sun-Synchronous Orbit. The upper stage will then turn the nose module to stabilize it and will release the Metop-B spacecraft. Separation will occur 1 hour 08 min. after lift-off.

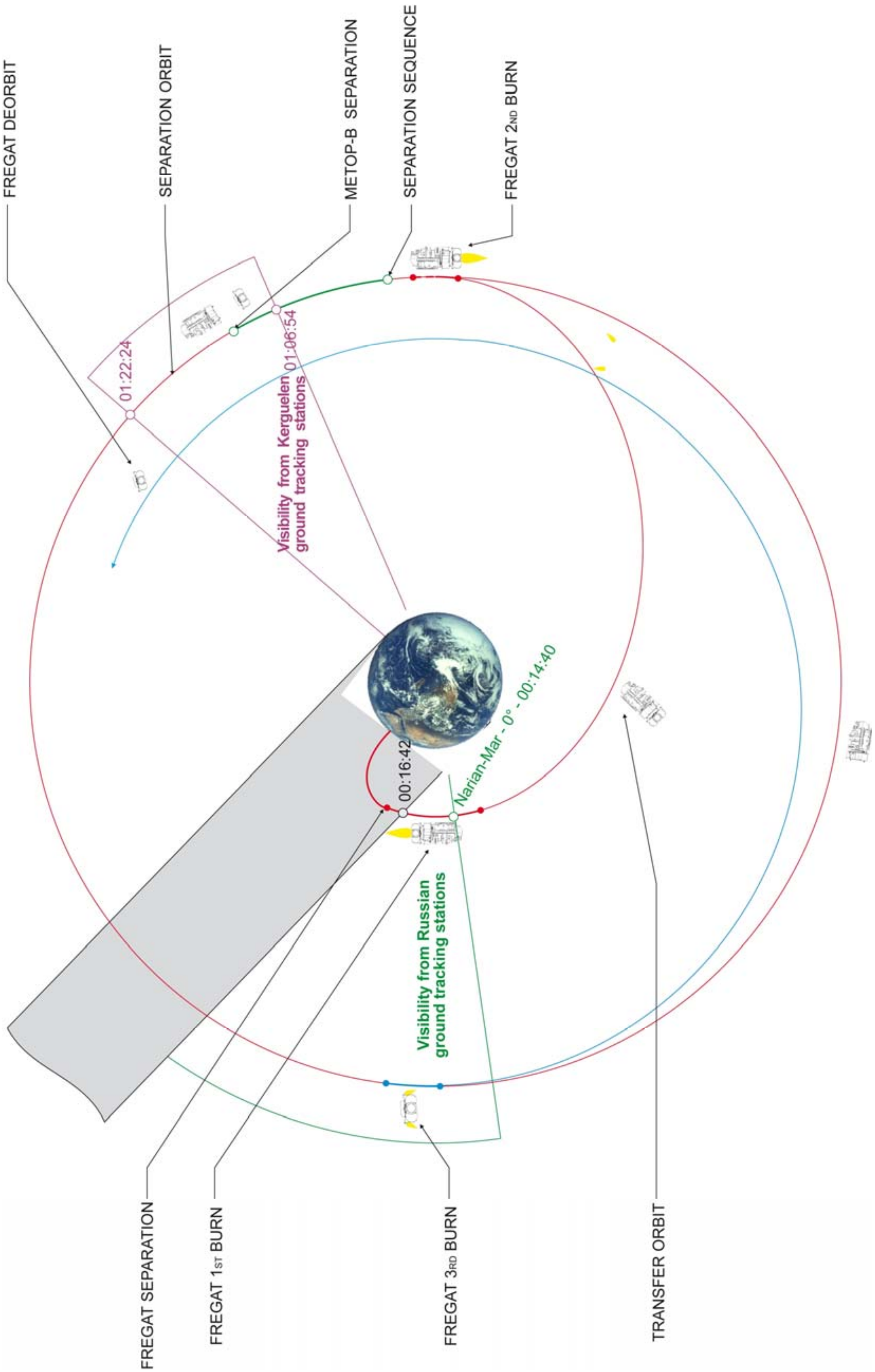
The planned orbital parameters at separation are the following:

Semi Major Axis: 7 172 km
Orbit inclination: 98.74 °
Eccentricity: 0.00286

Mission Duration

The nominal mission duration (from lift-off to the last spacecraft separation) is 1 hour, 09 minutes.

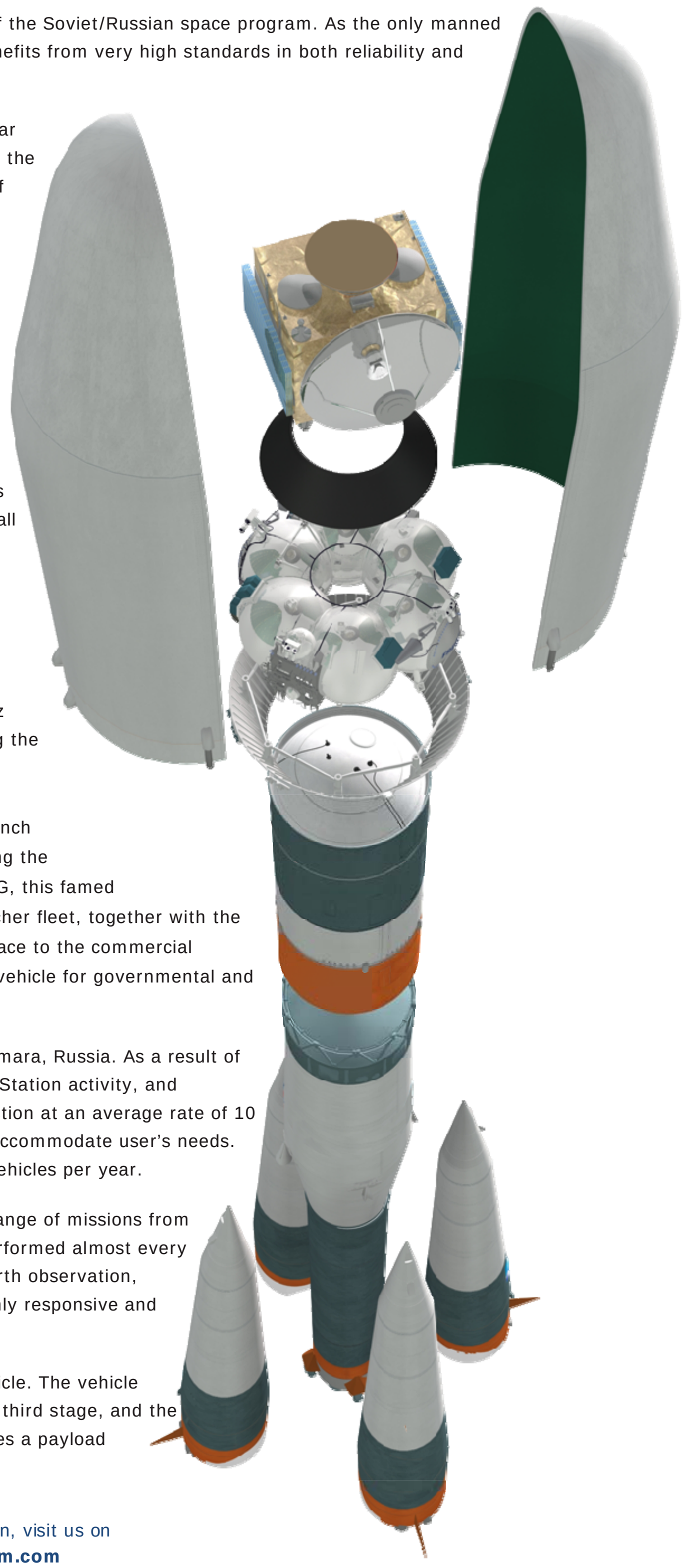
PROFILE OF THE METOP-B INJECTION MISSION



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 1791 launches to this date. Today, this vehicle is used for manned and unmanned flights to the International Space Station and commercial launches from Baikonur managed by Arianespace's affiliate 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 introduction in 2004 of the Soyuz 2-1a launch vehicle performed 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 19 October 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.

On 21 October 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 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. 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 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 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)

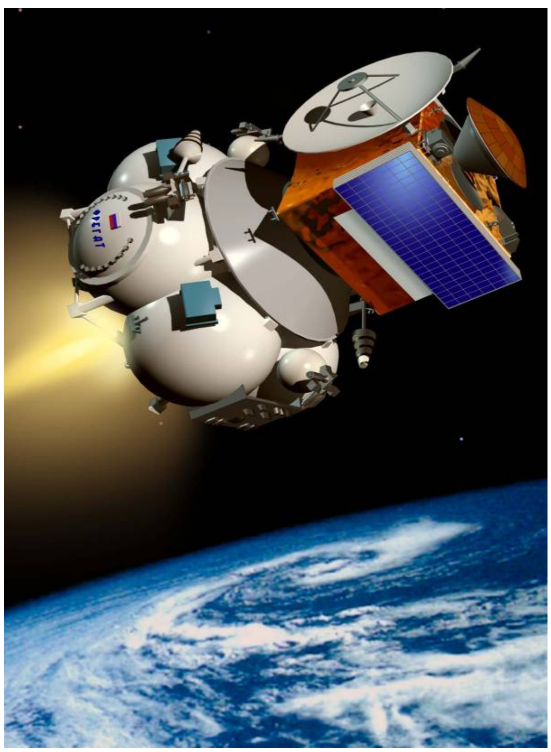
The four boosters are assembled around the central core and are tapered cylinders with the oxidizer tank in the tapered portion and the kerosene tank in the cylindrical portion. The booster's RD-107A engines are powered by liquid oxygen and kerosene, the same propellants which are used on each of the 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.

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 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. Starsem has already developed a series of adapters and dispensers, which may be used directly by the customer. Starsem can also carry out development of new adapter or dispenser tailored to the customer's spacecraft.

METOP-B SPACECRAFT

The Metop satellites are Europe's first operational meteorological satellites in polar orbit. They constitute the space segment of the EUMETSAT Polar System (EPS) delivering data for numerical weather prediction (NWP) – the basis of modern weather forecasting – and climate and environmental monitoring. Flying at an altitude of 817 km, each Metop satellite carries the same sophisticated suite of instruments providing fine-scale global data, which can only be gathered in the low Earth orbit, such as vertical profiles of atmospheric temperature and moisture, wind speed and direction at the ocean surface, and some atmospheric trace gases. Observations from Metop-A have significantly improved weather forecasts up to 10 days ahead. These forecasts are essential to protect life and limit damage to property, but they also benefit the weather-sensitive sectors of the European economy, especially energy, transportation, construction, agriculture and tourism. The three Metop satellites, launched sequentially, will provide continuous data until 2020. The first satellite, Metop-A, was launched in 2006, and the third and final satellite, Metop-C, is scheduled for launch at the end of 2017. ESA is responsible for the development of the three Metop satellites fulfilling EUMETSAT requirements, with major instruments provided by CNES and NOAA. ESA also carries out operations for the Launch and Early Orbit Phase to place the satellites in polar orbit, before handing them over to EUMETSAT for exploitation. The Metop satellites are built by EADS Astrium as the prime contractor. EUMETSAT develops all ground systems required to deliver products and services to users and to respond to their evolving needs, and operates the full system for the benefit of users. EUMETSAT also procures all Metop launch services. The EPS programme is Europe's contribution to the Initial Joint Polar System (IJPS), with the US National Oceanic and Atmospheric Administration (NOAA).

Customer	**European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)**
Type:	*Polar orbiting meteorological satellite*
Purpose:	*To ensure continuity, improvement and availability of operational meteorological observations from a morning polar orbit. To provide Europe with an enhanced capability for the routine observation of the Earth from space, in particular, to further increase Europe's capability for long-term climate monitoring.*
Dimensions:	*6.3 m high, 2.5 m by 2.5 m wide (in-Orbit configuration 17.6 m x 6.6 m x 5.0 m)*
Mass:	*4 085 kg*
Power:	*1 813 W power demand*
Orbit:	*Sun-synchronous at an altitude between 800 to 850 km. The satellite will not pass exactly over the geographic poles and is slightly inclined at an angle of 98.7° to the equator.*
Lifetime:	*Nominal life in orbit of five years*
Main contractors:	*EADS-Astrium (France): satellite prime contractor* *EADS-Astrium (Germany): Payload module, ASCAT and GRAS instruments* *50 sub-contractors from 12 European States*
Instruments:	*IASI - Infrared Atmospheric Sounding Interferometer* *GOME-2 - Global Ozone Monitoring Experiment–2* *MHS - Microwave Humidity Sounder* *ASCAT - Advanced Scatterometer* *GRAS - Global navigation satellite systems radio occultation GNSS Receiver for Atmospheric Sounding* *AMSU-A1 and A2 Advanced Microwave Sounding Units* *HIRS/4 High Resolution Infrared Sounder* *AVHRR Advanced Very High Resolution Radiometer* *A-DCS Advanced Data Collection System* *SEM-2 Space Environment Monitor* *SARP-3 Search And Rescue Processor* *SARR Search And Rescue Repeater*

Once the production and qualification activities have been completed, the spacecraft arrived at 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 in the HPF. The spacecraft was then mated to the Fregat upper stage and together encapsulated under the fairing, comprising the Upper Composite.

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

L-7 days:
Upper composite (spacecraft + 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

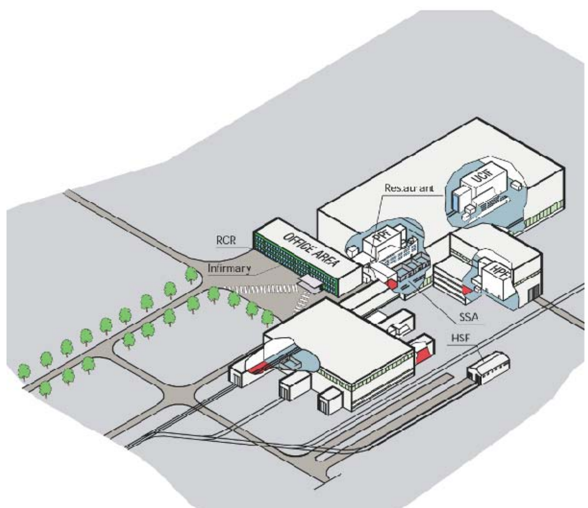
L:
Lift-off!

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-m2 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.

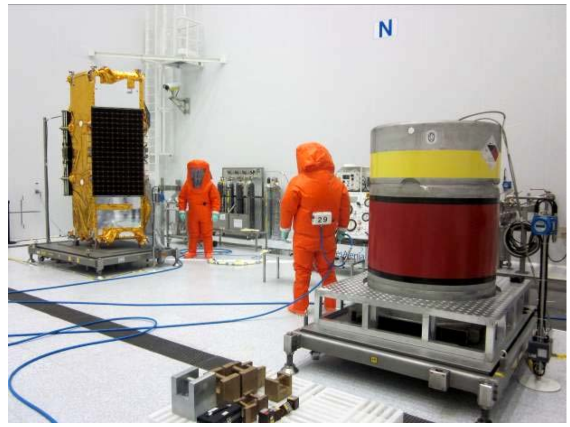


THE PAYLOAD PROCESSING FACILITY (PPF)

The PPF features a 286 m2 high bay for the processing of customer's spacecraft. This facility has two independent 70 m2 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 m2, 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.