soyuz at csg

→ EUROPE'S LAUNCH SITE FOR SOYUZ

European Space Agency

A dynamic new phase began at Europe's spaceport in French Guiana with the first launch of a Soyuz rocket from the Guiana Space Centre (CSG: Centre Spatial Guyanais) in October 2011. This historic event was the first time that a Soyuz launcher had lifted off from anywhere other than Kazakhstan or Russia.

ESA, Arianespace and the Russian space agency, Roscosmos, embarked on a bold project to construct and develop new launch facilities for the Russian Soyuz launcher at CSG.

'Soyuz at CSG' is an ESA programme with the participation of seven ESA Member States.

The programme, strongly supported by the French space agency, CNES, opened a new chapter for European launchers and consolidated European access to space for medium-sized satellites.

Soyuz fits neatly between the Ariane 5 and Vega launchers developed by ESA. Ariane 5 meets the requirement for larger satellites and Vega complements this for smaller payloads. Soyuz also introduced the exciting potential for upgrading the new launch facility to allow manned launches to the International Space Station from French Guiana.

From a European perspective, closer cooperation with Russia brings significant benefits, such as a reduction in the development and production costs of new launcher systems, as well as opening the door to other possible partnerships in the future.

Arianespace is the commercial operator and, although Soyuz cannot be considered a genuine European launcher, the exclusivity agreements between Arianespace/Starsem and Roscosmos, and the Launcher Agreement between ESA and Roscosmos secure a guaranteed and independent access to space for Europe.

Soyuz at CSG is a shrewd and prudent strategy for Europe: for a limited cost, it adds a new and significant dimension to Europe's launch capabilities.

THE SOYUZ LAUNCH SITE

A major construction project for a new launch pad and support facilities started in early 2004 following ground surveys the previous year. European industry is responsible for the ground infrastructure and Russian industry provided the launch table, mobile gantry structure, fixed and mobile filling systems, test benches and other equipment.

The Soyuz launch site is located 13 km northwest of the Ariane 5 launch complex. It comprises two main areas: the forward zone, with the launch pad, and the rear zone that includes the launcher preparation building.

The two zones are linked by a 600 m-long railway. The three-stage Soyuz is transferred in a horizontal position to the pad and erected into its vertical launch position. The 'upper composite', comprising the upper stage, payload and fairing, is then transferred to the pad and hoisted on top of the launcher.

The launch site is almost identical to the other Soyuz facilities in Kazakhstan and Russia, and has been adapted to conform to European safety regulations. The most visible difference is a mobile gantry, which allows payloads to be installed on the launcher vertically. Its total height is 53 m and its internal movable work platforms provide access to the launcher at various levels. The gantry provides a protected environment for the installation of payloads, as well as for the checkout of fully integrated vehicles.

The new launch control centre houses the ground equipment, monitoring and operations systems, and personnel for remote launch operations, which rely on combined European and Russian teams. The building can accommodate the workforce of 80 to 100 people required to launch Soyuz with a Fregat upper stage.

For safety reasons, it is situated in the rear zone, away from the launch pad, and is designed to withstand the impact of a three-tonne object falling from a height of 40 m.

THE SOYUZ LAUNCHER

The Soyuz launcher, in its various configurations, has been the workhorse of Russia's manned and unmanned programme since the 1960s — more than 1760 have been launched in its various guises.

Soyuz-2 is the most recent version of the renowned family of Russian vehicles that began the space race more than 50 years ago by launching Sputnik, the first satellite in orbit, and then sending the first human into space.

The vehicle used at Europe's Spaceport is the Soyuz-2 version known as Soyuz-ST. This four-stage launcher includes the Fregat upper stage and the ST fairing. With a launch location close to the equator, Soyuz has improved performance and is able to carry up to 3 tonnes into geostationary transfer orbit, compared to the 1.7 tonnes that can be launched from Baikonur in Kazakhstan.

ESA – D. Ducros

Similar first and second stages

The four boosters of the first stage cluster around the second stage central core. The boosters' RD-107A engines are powered by liquid oxygen and kerosene, the same propellants as on each of the three main stages.
The core's hammer-head shape accommodates the first-stage boosters. Its RD-108A engine includes four vernier thrusters, which provide three-axis flight control after the first stage has separated.

Third stage

The third stage is linked to the Soyuz second stage by a latticework structure. It uses an RD-0110 engine of four combustion chambers and nozzles, and four vernier nozzles to provide three-axis control. When the second stage shuts down, the third stage engine is ignited, causing separation.

Fregat fourth stage

The autonomous and flexible Fregat upper stage operates as an orbital vehicle. It consists of six spherical tanks (four propellant tanks, two avionics) arrayed in a circle. Fregat extends the launcher's capability to reach a wide range of orbits. It uses storable propellants and can be restarted up to 20 times in flight, enabling it to carry out complex missions.

ESA–S. Corvaja

ANCILLARY AREAS

The launcher propellant storage and filling zones are spread out over the launch site area at a safe distance from the pad. Special zones are reserved for kerosene, hydrogen peroxide, liquid oxygen, liquid nitrogen and compressed gases.

In addition, there are a number of service buildings in the preparation zone about a kilometre from the pad. These provide shelter for the ground service equipment and associated facilities, including nitrogen and helium compressors, launcher battery chargers, air conditioning and power production.

PAYLOAD PREPARATION COMPLEX

Payload preparation buildings accommodate satellite and control equipment unpacking, mechanical assembly work, electrical and mechanical inspections, and checkout of the various platform and payload subsystems. The building is equipped for fuelling the Fregat upper stage as well as for assembly of the complete upper composite, comprising the payload, Fregat and the payload fairing, before its journey to the launch pad for hoisting onto the top of the launcher.

TRAVEL

Before delivering its payload into orbit, the Soyuz launcher completes the journey from Russia to French Guiana by rail and sea. The first part carries various elements from Samara to St Petersburg on a 3-day rail journey. From there, they embark on a 15-day ocean voyage to the harbour of Kourou.

THE SOYUZ-2 FEATURES TWO MAJOR UPGRADES

Soyuz-2-1a: a modern digital control system increases atmospheric flight control and allows the use of the new, enlarged ST fairing for greater mission flexibility.

Soyuz-2-1b: adds an upgraded third stage engine to the digital control system, increasing the launcher's payload capability by 15%.

CONSTRUCTION COSTS

The total cost for the Soyuz at CSG programme amounted to €467.9 million. This cost was shared between ESA Participating States, providing €341.86 million, and Arianespace, providing €121 million. The European Union contributed the remaining part.

The cost covers:

- Ground segment infrastructure development by European companies;
- Soyuz launcher adaptation to CNES/CSG regulations;
- Development, manufacture and transport of Russian equipment;
- Industrial management and ESA internal costs.

Cover image: ESA–S. Corvaja

Soyuz in the launcher preparation building