



With a total land area of 91,000 km<sup>2</sup>, French Guiana is only slightly smaller than Portugal. Situated in the northeast of South America, it has the Atlantic Ocean to the east, Surinam to the west and Brazil to the south and southeast. The capital is Cayenne.

French Guiana has a hot and humid equatorial climate with an average temperature of between 25 to 27C. The rainy seasons stretch from December to February and from April to July, with a dry season between August and November.

Altogether 95 percent of the land is covered by equatorial forest and most of the 158,000 inhabitants live along the coast. The two main rivers are the Maroni, that forms a natural boundary with Surinam to the west, and the Oyapock, that marks the border with Brazil to the east.

Europe's Spaceport has helped to bring jobs and wealth to French Guiana. Industry is centred around the spaceport and an estimated 24 percent of the population work directly or indirectly in jobs connected with the space industry.

Fishing and forestry are also important economic activities. The large reserves of tropical hardwood support an expanding sawmill industry that provides cut logs for export. Agriculture is mainly carried out in the coastal area, the most important crops being rice and cassava.

*Aerial views of the Soyuz launch zone construction site in French Guiana.*



Starsem

## New Soyuz launch site takes shape

# Spaceport Europe

by Clive Simpson

From the air the scene is reminiscent of a giant scar stretching across miles of the lush tropical landscape. We are close to the equator on the picturesque coastline of French Guiana in South America and, far below, giant construction vehicles and workers are making steady progress in the hot and humid climate.

They are carving out a new launch site in an unprecedented phase of development at the European Spaceport that will lead to the launch of Russian Soyuz rockets from the equatorial base that has been the launch pad for Europe's space ambitions for more than two decades.

The European Space Agency (ESA), Arianespace and the Russian Space Agency (Roskosmos), embarked on the bold new project to construct and develop new launch facilities for Soyuz after reaching agreement three years ago.

From around the end of 2008 when the first Soyuz launch is expected, it will certainly bring a new perspective to the European launcher sector and consolidate European-controlled access to space for medium-sized spacecraft.

The Russian Soyuz will fit neatly between the ESA-developed launchers - Ariane 5 and Vega - and Arianespace will have exclusive rights for its commercial exploitation from French Guiana.

But as well as strengthening Europe's long-term cooperation in the launch sector with Russia, Soyuz will bring the exciting potential for upgrading the new facility to allow crewed launches to the International Space Station (ISS), and maybe even further afield.

According to Antonio Fabrizi, ESA's director of launchers, the introduction of Russia's Soyuz ST launcher to French Guiana is an exciting new opportunity for ESA.

"It means that however diverse future launch requirements are, Europe will be able to offer a solution in the form of either Vega, Ariane 5 or Soyuz," he said.

Fabrizi says the agreement, signed in the summer of 2003, for commercial launches of the revamped Soyuz 2 Fregat carrier rockets will benefit both sides.

"Russia's space programme will receive considerable additional income through the launch of space technology from one of the world's most attractive space centres. ESA,



ESA - D. Ducros



ESA/CNES - Service Optique CSG



*Artist's impression of Soyuz being prepared for launch on the new pad in French Guiana and (above) a Soyuz rocket lifting off from Kourou. ESA - D.Ducros*

meanwhile, will benefit from a dependable medium-class launch vehicle, which is the most popular in the world.”

He added that the development also introduces the possibility of launching crewed missions from French Guiana which will have tremendous significance for future near-Earth research and further raising the space profile of Europe.

It is now more than two decades since ESA first sent an Ariane launcher into space from French Guiana – a launcher designed, developed and manufactured by ESA and its prime partners the French space agency (CNES), Arianespace and European industry.

A site for Ariane 5 was inaugurated in 1977 and is now operated by Arianespace for launching commercial and scientific payloads into geostationary orbit, medium and low-Earth orbits and sun-synchronous orbits.

Although Soyuz ST cannot be considered a genuine European launcher, exclusivity

agreements between Arianespace/Starsem and Roskosmos, and the launcher agreement between ESA and Roskosmos – combined with the fact that Arianespace would be the commercial operator – provide adequate guarantees for it to be considered with the efficient implementation of the European Guaranteed Access to Space programme.

It represents a shrewd and prudent strategy for Europe – for a limited cost participating Member States it will add a new and very significant dimension to Europe's launch capabilities.

Europe's launch industry already benefits from the best placed and most efficient launch base in the world near Kourou, French Guiana.

The specially built Ariane 5 and Vega launch sites extend along a 15 km stretch of coast, the launch towers, assembly buildings and telemetry dishes bordered on one side by the Atlantic ocean and the other side by

the northern reaches of tropical rain forest.

ESA's Ariane launcher has become one of the biggest commercial success stories in the history of space. It began in 1973 after the nations of Europe decided that independent access to orbit and the development of a pioneering space programme go hand in hand.

The Arianespace-operated launcher family – based on Vega, Soyuz and Ariane 5 – will be able to launch any size of spacecraft, from 500 kg to 16 tons and more in low Earth orbits, and up to 12 tons to geostationary orbit.

Current estimates anticipate the demand for non-commercial missions would lead to an annual launch rate of one or two missions for Soyuz from French Guiana.

Commercially, Arianespace forecasts that the addition of a Soyuz launch capability from French Guiana could help it capture at least two thirds of the market for spacecraft

of less than three tons, compared to a maximum 50 percent market share expected with Ariane 5 alone.

The Soyuz launcher in various configurations has been the workhorse of Russia's manned and unmanned programme since the 1960s.

Soyuz ST, the latest variant, was introduced in 2005 and is based on modifications to the existing Soyuz launcher. It features two major upgrades – a four metre diameter fairing and a modern digitally controlled avionics system. The new guidance system has increased the rocket's load-carrying capacity by 15 percent.

Arianespace and Roskosmos signed a contract in February 2006 to kick off the Soyuz operations in French Guiana for the first four Soyuz launch vehicles to be launched starting in 2008 or 2009.



Antonio Fabrizi,  
ESA's director  
of launchers.

The European Space Agency and Arianespace are co-financing the launch site work, worth a total of 344 million euros, with French space agency CNES as prime contractor, assisted by Arianespace. Initial construction started in 2004.

European industry is responsible for the ground infrastructure and Russian industry will provide the launch table, fixed and mobile filling systems, test benches and other equipment.

The Soyuz launch site is being built some 10 km north of the Ariane 5 launch complex to avoid interference between the two installations.

A new launch control centre will house the offices, equipment and personnel necessary for launch operations. The offices will be large enough for the expected workforce of 180 people required to mount a Soyuz launch campaign and designed to survive the impact of a three ton object falling from a height of 40 metres.

Launch systems integration and testing will be carried out by combined European and Russian teams.

The launch pad itself is based on the existing Russian model used at Baikonur

## First test for Vega rocket motor



The P80 motor test firing.

ESA/CNES

The P80 motor that will power the first stage of ESA's new Vega launch vehicle came to life for the first time on 20 November 2006 when it was ignited for a static firing test at Europe's Spaceport in Kourou, French Guiana.

The largest European mono-segment filament-wound case solid propellant motor ever developed delivered a mean thrust of about 190 tonnes for over 100 seconds, representing roughly one third of the thrust delivered by each of Ariane 5's solid booster stages. A peak of 250 tonnes was reached seven seconds into the test.

"The first data we have at hand show that the firing closely followed the predicted pressure curve," said Antonio Fabrizi, ESA's director of launchers.

"This excellent result marks a milestone that contributes significantly to further increasing confidence in the Vega launcher. It concludes the first set of development tests conducted for the Vega launcher in 2006, a very intensive

and successful year for the programme."

Around 12 m high and 3 m in diameter, the P80 motor is loaded with 88 tons of solid propellant. Unlike previous motors of this size or larger developed in Europe or in the rest of the world, it is made of a single propellant segment instead of several segments cast separately before being assembled together.

This was the first of two firings for the P80. A second is planned for mid 2007.

Europe's three stage Vega 'light' launcher for small satellites of up to 2000 kg is designed to make cost-effective access to space available quickly and on a flexible basis. It is expected to fulfil the need for a small launcher that will place smaller satellites into the polar and low-Earth orbits used for many scientific and Earth observation missions.

Vega has been developed with the support of seven ESA member states - Italy, France, Belgium, Switzerland, Spain, the Netherlands and Sweden.

and adapted to conform with European safety regulations.

A 45 metre high launch tower, including platforms for access at different levels, will be built for placing of the upper payload unit on the launcher and this would be extendable to 53 metres for manned spacecraft. The pad itself will be protected by 80 m high lightning rods.

Before blasting its payload into orbit, each Soyuz launcher will have to complete the journey from Russia to French Guiana by rail and sea. The first stage by rail will carry various launcher elements from Samara or Moscow on a three day trip to St Petersburg, where they will be transferred to ship for a 15 day ocean voyage to the port of Kourou.

"The Soyuz launcher is currently one of the few systems in the world capable of

transporting humans into space so, in designing the Soyuz Launch facilities, it made sense to take into account the potential for a possible future upgrade," said Antonio Fabrizi.

"In the future it will be possible to do this by taking advantage of features common to both manned and unmanned missions, enabling us to use the same buildings, transportation systems and launch pad without major new work."

The total cost for the new Soyuz launch site in French Guiana is estimated to be €344 million, split between ESA participating States providing €223 million and Arianespace €121 million.

The cost for adapting the Soyuz ground infrastructure in French Guiana from unmanned to manned missions is anticipated at around €15-17 million.