

Arianespace: a **launcher** family for all seasons

Starting in 2011, the European launch services company will offer a family of launchers unrivaled in the global market: Ariane 5, Soyuz and Vega.

Arianespace will deploy these three launchers from its dedicated facilities in French Guiana. What this means is that the company can now offer satellite operators and space agencies from around the world tailored launch services for payloads from 1 to 20 tons, into all types of orbit: low Earth orbit (LEO) for the International Space Station; Sun-synchronous for Earth observation; special orbits for scientific missions; medium orbit for navigation and telecommunications; geostationary transfer orbit for communications and weather satellites, and translunar and interplanetary orbits for space exploration missions.

No other launch operator today can make that claim. Even China's impressive lineup of launchers does not offer all these capabilities. Arianespace's offering is spearheaded by the Ariane 5 ECA heavy launcher. Now available in standard configuration, it can boost nearly 10 metric tons into geostationary transfer orbit (GTO). In fact, the Ariane 5 ECA holds the world record for the largest commercial payload placed into GTO, at 9,515 kilograms. This exceptional payload capacity enables Arianespace to orbit even the largest commercial satellites, as well as carrying out dual launches with one of the satellites weighing up to 6,000 kg. Dual launch capacity also means that Arianespace offers regular access to space for all satellites in the 3 to 5 ton class.

Soyuz and Vega join the family

Arianespace also plays a major role in supplying the International Space Station by launching Europe's ATV (Automated Transfer Vehicle) cargo spacecraft with the Ariane 5 ES version, designed to place more than 20,000 kg into low Earth orbit.

In slightly over seven years, Arianespace has carried out 38 successful Ariane 5 launches in a row, a record. Most of these missions took place at the beginning of the launch window, which clearly reflects the rocket's excellent availability. Out of the 30 launchers in the original PA batch ordered in 2004, there are still four to be launched. Along with the 35 launchers in the new PB batch, ordered in 2009, Arianespace has enough launchers on hand for the next six years at its current rate of six to seven launches per year.

Russia's Soyuz launcher, operated since 1999 by Starsem, a

joint subsidiary of Arianespace, EADS, Roskosmos and the Samara Space Center, will join Arianespace's family in French Guiana starting in 2011. Part of a line of launchers that has carried out more than 1,750 missions since 1957, including all Soviet then Russian manned space missions, the Soyuz rocket operated by Starsem is fitted with the Fregat orbital stage – making it a perfect vehicle for complex deployments, especially constellations or interplanetary missions.

Operated from French Guiana near the equator, Soyuz will be able to boost 3,200 kg into geostationary transfer orbit. This makes it a perfect fit with the Ariane 5 ECA heavy lifter, and also gives Arianespace greater flexibility in managing its launch manifest for satellites weighing less than 3,200 kg, a significant part of the market. For instance, these medium satellites can now be paired with satellites in the 4.5 to 6 ton class for dual launches by Ariane 5, or orbited alone by Soyuz.

Furthermore, with payload capacity increasing to 5,000 kg in Sun-synchronous orbit, and a fairing fully 4.1 meters in diameter, Soyuz is also capable of launching the full range of satellites for Earth observation or scientific missions.

Arianespace now has a backlog of 17 Soyuz launches from French Guiana, including recently signed contracts for the launch of In-Orbit Validation (IOV) and Full Operational Capability (FOC) satellites in the Galileo satnav constellation, as well as the Gaia astronomy satellite. The company has therefore ordered 24 Soyuz launchers from Russian industry to handle this workload.

Vega is the newest member of the Arianespace family. It is a small launcher designed to place Earth observation or scientific payloads up to 1,500 kg into Sun-synchronous orbit. Vega will give Arianespace a foothold in the last market segment where it was not present. This market is currently dominated by Russia's Rocket and Ukraine's Dniepr launchers, but offers numerous contract opportunities from European space agencies.

After a qualification launch in 2011, with support from Arianespace, Vega will carry out a series of five launches for the European Space Agency, within the scope of the Verta program. ESA and Arianespace signed a framework contract for these services at the end of 2009. ●

Revolutionizing access to space

With the Ariane rocket program, Europe not only ensured its independent access to space, but also won half of the worldwide market for commercial satellite launches.

Europe abandoned its original Europa launcher program in 1972, after ten years and four unsuccessful satellite launch attempts. Two French-German communications satellites, named *Symphonie*, were supposed to be launched by this rocket. At the time the United States held a monopoly on launch services in the West for payloads exceeding 100 kilos. Although the Nixon administration had promised to make its launch systems available to allies, when it came time to negotiate a launch contract for *Symphonie*, the Americans stipulated that the two satellites could only be used for national and experimental communications links, in order to protect Intelsat's monopoly on international commercial telecommunications. At the time, only Intelsat (International Telecommunications Satellite organization) and Canada owned civilian communications satellites, although they were soon to be joined by the United States and Indonesia, and virtually all of these satellites were built in the U.S., mainly by Hughes.

Largely instigated by France, the Ariane program was given the green light in 1973. An initial market study showed that in the 1980s the new launcher could only count on winning one or two government launch contracts per year – not enough to sustain an acceptable launch rate. Ariane would therefore have to win commercial launch contracts, although this market was just beginning to take shape at the time. In 1976, as the program was about to make the transition from development to the production of a first run of six launchers, European partners were dragging their feet. Doubts were emerging about the feasibility of a launcher such as Ariane, especially since NASA was promising to revolutionize the sector with its new Space Shuttle and a predicted launch rate of a mission a week!

A first launch manifest with 18 missions

French space agency CNES (Centre National d'Études Spatiales), which was developing Ariane on behalf of ESA, wasn't any better for this purpose. The head of launchers at CNES, Frédéric d'Allest, who had already started looking for possible clients, proposed the creation of a marketing company, dubbed Transpace, in December 1977. This proposal was approved by CNES management in May 1978, and then by the French government in August, allowing CNES to begin negotiations with its ESA partners.

On December 8, 1978, Intelsat announced that it had selected Ariane to launch one of seven Intelsat 5 satellites, and on February 15, 1979 it signed a firm contract, along with two options. It turned out that the name "Transpace" was already used by an American company, so partners changed the name to Arianespace, which was officially incorporated on March 26, 1980, just as the production of a second batch of six launchers was getting underway. In the meantime, the first Ariane rocket was successfully launched from

Kourou, French Guiana on Christmas Eve, 1979. Published in January 1981, the first official launch manifest counted 18 commercial flights up to 1985, with 12 of them already covered by firm contracts. After four qualification flights and four promotional launches, the ninth Ariane mission was the first under the Arianespace banner – and it lofted an American satellite, Spacenet 1. Ariane not only gave Europe independent access to space, but also allowed its space industries to meet ambitious market objectives, as France, Germany and Italy deployed their own satellites for instance. Furthermore, the new launcher opened access to new domestic or regional operators, forcing the United States to relax Intelsat's monopoly while fostering the development of a real commercial market. Brazil and Japan joined the fray, alongside Arabsat and Eutelsat. In 1988 they were followed by two commercial initiatives that were to become market leaders: PanAmSat in the United States and SES in Luxembourg.

To compete with Arianespace, NASA offered not only to launch a customer's satellite on the Space Shuttle, but also one of their country's astronauts at the same time. But the Challenger disaster in January 1986 marked a definitive end to the Space Shuttle's commercial career.

With America's remaining expendable launch vehicles now reserved for government missions, Arianespace began to rake in all the chips. Originally, the market accessible to Ariane rockets for the period 1980 to 1990 had been estimated at 40 to 50 satellites, with a target of winning half those launch contracts. But by the end of the decade Arianespace had launched a total of 62 satellites. Production also changed scale, as Arianespace placed an unprecedented order for 50 launchers in February 1989.

Despite strong competition from American, Chinese and ex-Soviet launchers during the next decade, Arianespace would launch over 130 satellites from 1990-2000, and maintain its predominant market position after the turn of the century. A seemingly endless string of new operators chose Arianespace to start their business, while legacy operators continued to consider the company as their benchmark launch services provider.

In fact, the market opening driven by Arianespace enabled the European space industry to stake out a position as a world-class competitor in just 15 years.

The market has diversified beyond all expectations. While several huge satellites weighing over 6,000 kg have been launched for specific broadband applications, most operators continue to deploy satellites in the 4 to 5 ton class for telecommunications and direct TV broadcasting. Lighter spacecraft in the 3 ton class give operators more fleet flexibility, and allow new players to enter the market. "We have never seen such a wide range of satellite weights," notes Jean-Yves Le Gall, Chairman and CEO of Arianespace. "With the performance and reliability of Ariane 5, plus the flexibility offered by Soyuz, Arianespace enjoys an enviable position in this market." ●●

Ariane 5: renaissance

Following the failure of Flight 517 in 2002 (the 14th launch of Ariane 5, and the first ECA model) Europe began to consolidate its space industry, especially for launcher production. Astrium would now deliver a standard, integrated launch vehicle to Arianespace in French Guiana, and Arianespace would be in charge of marketing, launcher preparation and launch operations.

When Ariane 5 started its career in 1996, its payload capacity of nearly 6,000 kg made it perfect for the dual launch of satellites ranging from 2,500 to 3,500 kg. These satellites, which often had to be boosted by Ariane 4 one at a time, were then the core of the commercial launch market. Unfortunately, the maiden flight of the new launcher was a failure, and its qualification took longer than expected, so it only entered commercial service at the end of 1999. In the meantime, satellites had continued to grow, and the average was closer to 3,500 kg. Ironically, whereas Ariane 5 had initially been criticized as too powerful because it was designed for Europe's Hermes spaceplane, it was now proving to be underpowered for its core market.

In May 1999, the European Space Agency Council held a ministerial-level meeting in Brussels. Four years earlier, in Toulouse, the space ministers of Europe had decided to develop the enhanced Ariane 5E (Evolution) version, boosting GTO payload capacity to 7,500 kg. But Germany, whose budgets were severely strained by the costs of reunification, had postponed the study of a cryogenic upper stage. By the meeting in Brussels, this issue was back on the front burners, and a two-phase program was being considered. It would start with the development of an interim upper stage, ESC-A, that would use the liquid oxygen tank and cryogenic rocket engine from Ariane 4's H10 upper stage to provide a payload capacity of 10 metric tons into GTO. The subsequent ESC-B version would incorporate a brand-new upper stage to boost payload capacity to 12 metric tons. It would be powered by the Vinci engine operating on the expander cycle, offering much higher thrust and capable of being restarted in flight to carry out complex deployments.

The development of the revamped launcher, Ariane 5 ECA, proceeded full steam ahead. The project was more complex than it first seemed, because the launcher was larger and heavier, and some parts of it were subject to twice the loads of its lighter predecessor. The first Ariane 5 ECA lifted off from French Guiana on December 12, 2002, but it was a failure because of a problem with the nozzle on the main-stage Vulcain 2 engine some 98 seconds after launch.

For Arianespace and the entire European launcher industry, this was a real disaster. And it was even worse because two competing American launchers, Atlas 5 and Delta 4, had just made successful service entries, not to mention that Arianespace had posted its first ever losses in the last two years. The inquiry into the failure spotlighted a wide difference in skills and a vague chain of command in the production system. In this specific case, the faulty nozzle was produced in Sweden by Volvo as a subcontractor to

Astrium-Ottobrunn, manufacturer of the combustion chamber for the Vulcain 2 engine on behalf of Snecma, propulsion prime contractor for the main stage, which was integrated by Astrium at Les Mureaux – also “industrial architect” for the launcher, while French space agency CNES was “design authority”.

This dispersal of resources, a legacy of the initial developments for Ariane 1 and the geographic fair return rules applying to ESA programs, was amplified because of the considerable investments made by the 12 countries participating in the development of Ariane 5. Furthermore, the qualification process for Ariane 5 ECA was called into doubt, even casting a shadow over the basic Ariane 5 G version.

Reinventing the Ariane system

Faced with this crisis, Arianespace would seize the opportunity to “reinvent” the entire Ariane production system, by reassigning industrial responsibilities, rationalizing production and revamping qualification procedures. The urgent nature of the situation allowed decision-makers to avoid most of the delays inherent in the approval of any new European space policy.

ESA's ministerial council met in May 2003 in Paris to approve the major objectives and associated budgets. One of the most important decisions was to take advantage of the consolidation of the European space industry, with the creation of EADS, and ask Astrium, as part of this group, to supply a standard, integrated Ariane 5 ECA launcher to Arianespace at the launch site in French Guiana. Arianespace was placed in charge of marketing launches, integrating the payload, preparing the launcher and conducting launch operations. At the same time, an order was placed for 30 launchers, the PA batch. While waiting for Ariane 5 ECA to resume flight, the main stages under production reverted to the Ariane 5 G standard, although the solid boosters from Ariane 5 ECA were retained, since they had performed very satisfactorily in flight. Dubbed Ariane 5 GS, this would be the standard model for the interim. The last Ariane 5 GS was launched in December 2009, carrying the Helios 2B observation satellite.

With the last Ariane 4 launch and only three Ariane 5 launches in 2003, followed by three more Ariane 5 launches in 2004, Arianespace experienced its worst-ever business years. However, in February 2004, ESA approved a program called EGAS (European Guaranteed Access to Space), providing a budget of 960 million euros over five years to cover fixed operating costs and enable Ariane 5 to compete with government-backed American and Russian launchers. This enabled Arianespace to swing back into the black.

Ariane 5 resumed its missions in 2005, marking the start of a string of successes for Arianespace: five launches/year in 2005 and 2006, six launches in 2007 and 2008, and seven launches in 2009. Today, with the 200th Ariane launch slated for early 2011, Arianespace can boast 38 successful Ariane 5 launches in a row, enabling it to retain its world leadership in the space transportation market. ●●

Jacques Breton (*) : “What the commercial market really **needs** is stability and visibility”

AeroDefenseNews: With two companies, Arianespace and ILS, launching most commercial satellites, operators have voiced their concerns about a lack of launch options, high launch prices, and a risk of monopoly in case of launch failure – how do you answer these concerns?

Jacques Breton: If I look at the most recent event that led to a reduction in the number of launch operators on the commercial market, I would say that we are not one failure away from a monopoly, but one bankruptcy away!

More seriously, both Ariane 5 and its competitor Proton are mature systems, relying on solid, proven production infrastructures and established business plans. A failure may always occur but would be more likely to be a result of a quality or workmanship problem; these are generally solved in a matter of weeks rather than months. To be frank, the reduction in the number of launch service providers over the past few years is mainly due to the price drop that was experienced on the market in the early 2000's, a drop reported by the recent study of the Tauri Group. As a first example, Boeing, in 2003, recognizing that “a meaningful recovery in pricing was unlikely in the future,” decided to focus the Delta 4 program on the government launch service market. For the same reason Atlas 5 remains on the fringe of the commercial market. Recently, both Boeing and Lockheed Martin commented that the commercial prices were too low to justify their return. Another indication is provided by the restructuring plan that Sea Launch has presented as part of their exit from Chapter 11; this plan calls for prices significantly higher than the ones the company charged three or four years ago. Prices were too low for a sustainable, viable industry. I think we are much closer now to a business which works for both customers buying launch services and the companies providing them. This is in everyone's interest.

ADN: How come?

J.B.: Reasonable pricing of our launch services allows us to maintain production facilities and launch installations at the high level of quality and reliability required by the market. It also allows Arianespace to continuously improve the performance of its launch vehicles: the GTO payload capacity of Ariane 5 has gone from 5.9 metric tons in 2000 to 9.1 metric tons in 2010, and we are currently working to go further. With our partners we invested 400 million dollars to bring Soyuz to French Guiana, providing the market with a new launch solution and doubling the performance of this vehicle to GTO. What the commercial market really needs is stability and visibility. Arianespace has been providing this to our customers around the world for 30 years. When you pay Arianespace for a service, you may pay a higher price than the one announced by some of our competitors, but you know that in two years time you can depend upon us to deliver the service, that it will be an excellent service and that you'll pay only once.

ADN: So how do you see the market evolving in terms of supply and demand?

J.B.: When you look at the published results, many satellite operators have performed very strongly over the past two or three years in terms of revenues, profitability and backlog, and have resisted extremely well to the challenges of the economic downturn. It is worth noting that 2009 was a record year for the number of new satellite orders. Nevertheless, we remain prudent as many indicators suggest that the current strong replacement and expansion cycle will experience a pause.

On the supply side, Arianespace, and competitor ILS provide a large part of the capacity with Ariane 5 and Proton; Sea Launch plans to exit Chapter 11 over the next year or so and Soyuz will initiate commercial operation from French Guiana in the coming months. It has been recently confirmed that H2 can now be launched any time of the year, and ISRO continues to progress with its PSLV and GSLV vehicles. We should not neglect Atlas 5 or Delta 4, which remain attentive to commercial possibilities. When you look at the likely size of the market in the coming years, I do not think there is a problem of capacity – except maybe overcapacity!

ADN: Sea Launch back in business, H2 more flexible in term of launch opportunities, is this bad news for Arianespace?

J.B.: No, it's not – we have always had competition, and this has never been a problem for us. Healthy competition is good for the market and ensures that equilibrium is maintained.

In addition, both Sea Launch and H2 are members of the Launch Services Alliance we initiated a number of years ago – having stronger members will mean stronger partners for us and better service for our customers. Buying launch services also implies securing financing and insurance. We have always been at the forefront here, providing the most attractive support services to our customers, whether with export-credit financing support or our Launch Risk Guarantee insurance package.

You can expect this customer-focus and service-orientation to continue. Over the last 30 years Arianespace has faced many competitors, a number of which are no longer there. This industry is not about one contract, one launch or even one year's results – it's about being dependable over the long-term, insisting on a business model that makes sense and focusing on quality at all levels, day-in, day-out.

Our leadership has not been easy to acquire and we are all too aware that it can be lost overnight. It is, however, recognition that the market values our services and how we deliver them. We intend to maintain this position, whatever the competition. ○●

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