SHAPING THE FUTURE OF ACCESS TO SPACE

#spaceenablers
ENABLING EUROPE TO ACCESS SPACE, FOR THE BENEFIT OF ALL ITS CITIZENS, IS WHAT WE DO EVERY DAY.

Alain Charmeau, CEO of ArianeGroup.
ARIA NE GROUP

A world leader in access to space, serving institutional and commercial customers and supporting Europe’s strategic independence.

The perfect innovative, highly competitive solution for civil and military launch systems and space applications – that’s what we give our institutional, commercial, and industrial customers. We are experts in the most cutting-edge technologies, from all aspects of complete propulsion systems right down to the items of equipment and materials.

We leverage all of this expertise, the unique knowledge of our teams, into benefiting the space, defense, energy, and other industrial sectors, with high value-added products, equipment and services.

Guarantor of Europe’s autonomous, reliable access to space, we are the lead contractor for the Ariane family of European launchers and for the missiles in the French oceanic deterrent force. Our activities cover the entire life-cycle of a launcher: design, development, production, exploitation and commercial service, the latter through our subsidiary Arianespace.

We build and operate Ariane 5, the most reliable launcher on the commercial market today, and we are developing the next-generation Ariane 6 launcher, for which we are the design authority.

ArianeGroup springs from the shared ambition of Airbus and Safran to take the European space industry to the highest possible level. Equally owned by the two groups, ArianeGroup houses the entire scope of their civil and military launcher activities and competences in a single, coherent company, with a workforce of over 9,000 highly skilled people in France and Germany.

The network includes 11 subsidiaries and affiliates in which ArianeGroup has a significant shareholding. Finalized in 2016, ArianeGroup’s roots reach back more than 70 years into the history of space activity in Europe.

To find out more, visit www.ariane.group
A BRIDGE BETWEEN MAN AND SPACE

Access to space is our business. Making it possible for everybody to benefit from space technologies is our ambition.

From time immemorial, Man has always been fascinated by the stars above. Modern man has unlocked the gateway to space. Space probes, telescopes and manned space activities enable us to explore ever deeper into the mysteries of space. We are continually making astounding new discoveries, building up our knowledge of our universe, but also adding importantly to our appreciation of our precious home planet and opening the way to an infinite range of new technologies and applications. For us at ArianeGroup, the most crucial aspect of space is the potential it offers to develop and deliver long-term benefits for the lives of people everywhere on Earth.

For more than 40 years, the European Ariane launchers have played a role in improving the lives of millions of people by ensuring that satellites which provide services every day get safely into orbit. Today, space-based technologies are omnipresent – for communication, navigation, positioning, business, education and learning, Earth observation for better understanding, weather forecasting, monitoring climate change, catastrophes and pollution for augmenting environmental protection, generating new methods for fishing and agriculture, improving natural resource management.

Without launch vehicles, access to space would not be possible. They are indispensable to enable humanity to benefit from the advantages of space technologies. Every rocket we produce, every launch mission we perform delivers a further improvement in the lives of our fellow citizens. We are making space available and useful for everyone – this is what drives us in our pursuit of this tremendous technological and human adventure. And improving life on Earth also entails strengthening security and peacekeeping, which we do in our work supporting the French oceanic deterrent force. We build a bridge between people and space. We are #spaceenablers.
COMING IN 2020: ARIANE 6

A perfect marriage of innovation and reliability, Ariane 6 will provide the best launch solution for commercial and institutional customers.

The highly modular design of Ariane 6 will offer institutional and commercial customers unprecedented flexibility, a critical attribute in the context of today’s rapidly changing market. With a very spacious fairing, it can loft any type of payload into an optimized energy-saving orbit, whether it be destined for low Earth orbit (LEO), geostationary transfer orbit (GTO) or sun-synchronous orbit (SSO).

The new launcher is perfectly suited not only to ‘conventional’ single or dual missions, but also, with an upper stage powered by the re-ignitable Vinci® engine, to complex missions addressing new market requirements, such as all-electric propulsion satellites, or batches of satellites for constellations. Ariane 6 will be available in two different versions, so as to provide the ideal solution for any mission:

- **The four-booster Ariane 64** can launch up to 12 metric tons into GTO, in a dual launch.
- **The two-booster Ariane 62** can carry over 4.5 metric tons into GTO, or seven metric tons into SSO.

Ariane 6 is a European Space Agency (ESA) program to ensure that Europe maintains independent space access capability. The maiden flight of the new launcher is scheduled for 2020, with full operations from 2023, delivering a level of reliability equal to that of the current Ariane 5.

Capitalizing on expertise built up with Ariane 5 and based on years of operating feedback from customers, ArianeGroup is coordinating development and production of Ariane 6 by combining innovative technologies with proven solutions, backed by the most efficient industrial organization approaches and cutting-edge digital tools.

We have set up European ‘clusters of excellence’, working with partners as an ‘extended enterprise’. We are implementing new processes and manufacturing technologies (such as 3D printing, friction stir welding, laser surface treatment, etc.) to support our objectives of maximum industrial efficiency, reduction of production costs, and boosting competitiveness to meet new market requirements.
Ariane 5 is the epitome of European space expertise. It has won the trust of institutional and commercial customers alike because it offers them extraordinary reliability.

The absolute benchmark in access to space, it holds the all-time record for the most successful commercial launches in a row. Moreover, Ariane 5 is also a highly flexible, adaptive system. Lead contractor ArianeGroup is ceaselessly attentive to customer requirements and feedback, constantly upgrading Ariane 5: boosting payload capacity, increasing the number of satellites that can be placed in orbit in a single mission, and extending mission length, for example.

Two variants of the Ariane 5 launcher provide the flexibility to respond to the complete range of missions: > **Ariane 5 ECA,** which can loft up to 10.5 metric tons into geostationary transfer orbit (GTO), addresses the needs of both communications satellites and space exploration missions. > **Ariane 5 ES** is specifically designed for launches into low or medium orbit, as well as more complex orbits.

Ariane 5 can with equal ease heavy payloads into low Earth orbit, several satellites together into medium orbit, or one or two satellites into GTO, in all cases optimizing the service life of the satellites. It can also be fitted with a special dispenser to orbit multiple satellites at the same time.

At the heart of Ariane 5’s success is a vast European industry network, headed by ArianeGroup as lead contractor, which oversees the entire chain, from managing production and performance enhancements right up to final adjustments with the supply of flight software for each mission.

ArianeGroup’s responsibility includes structures and equipment, propulsion systems, integrating the different stages, and also integrating the launcher at its launch site in French Guiana. More than 600 European companies, including some 350 SMEs, contribute to making the launcher, all under the coordination of ArianeGroup. Our constant focus is on ramping up Ariane 5 system competitiveness, and ensuring that it benefits to the maximum from advances in industrial processes being developed in the Ariane 6 program.

**ARIANE 5: THE BENCHMARK**
A crucial element in the French seagoing nuclear deterrent force, designed for deployment by France’s nuclear-powered ballistic missile submarines (SSBN). The embodiment of technical excellence, its role is to unfailingly deliver exceptional performance and the very utmost levels of reliability, security and safety at all times. As lead contractor for the M51 program, on behalf of France’s defense procurement agency DGA (Direction Générale de l’Armement) and serving the French Navy’s Strategic Oceanic Force, ArianeGroup brings together the skills of more than 900 French companies (including around 400 SMEs) to meet two objectives: consistently maintaining the missile’s outstanding performance and national sovereignty.

In this critically demanding field, where the onus on reliability and operational excellence is higher than in any other, our responsibilities encompass upstream research, the design, development, and production of the missiles, the ground systems, and the control and command system on board the submarines. We also maintain the missiles’ operational condition throughout their service life, and deal with their end-of-life dismantling.

The ability to anticipate is fundamental for credible deterrence. Therefore, ArianeGroup permanently monitors developments in strategic weapon systems worldwide, and is working on technologies to help respond to future operational requirements, particularly by heading up or contributing to DGA studies.

All the technological expertise which enabled the generations of French ballistic missiles to be designed and produced since the 1960s has been channeled into ArianeGroup. Today, through our role as lead contractor, we are established as the strategic partner of the DGA and of France, for the country’s seagoing nuclear deterrent.
We have world-beating space expertise, with unparalleled rich and varied competence resident in our teams and subsidiaries. And we want to share it. So we place skills and technologies derived from our core business at the service of other sectors, both within the space domain, such as orbital space activities, and beyond: the automotive, aeronautic, energy, critical infrastructure, and security fields. Our mastery of high technologies and our capacity for innovation are the twin threads running throughout all the new, inventive, great value-adding ideas that we offer these customers.

For satellites and spacecraft, we can offer the whole scope of propulsion solutions, and equipment for platforms, spacecraft, and commercial and scientific payloads. We supply all the world’s top 20 satellite manufacturers. For orbital propulsion, we can provide complete, integrated chemical, electric or hybrid propulsion systems, right down to the supply of individual components.

For platforms and payloads, we offer composite structure elements, mechanisms, pyrotechnic systems, star trackers, antennas and reflectors, and a broad range of high-performance optical and optronic products.

For launchers, we can support other prime contractors in all or specific areas of their requirements for liquid or solid propulsion systems, equipment or related materials. Metal and composite structures, thermal protection, and upper composite multiple launch systems are also part of our offer portfolio.

We design and manufacture complex infrastructures for space and defense applications, which can be handed over as turnkey systems: control centers, assembly, integration and test facilities for satellites, launch bases, plants for destruction, dismantling or safe storage of hazardous products, etc.

We also have expertise in missile defense systems, space surveillance, laser systems, robotic systems for major scientific or nuclear installations, and infrastructure hardening studies.

The aeronautic, automotive and energy industries are also beneficiaries, through our work with them, of the most highly advanced technologies that have their origin in space.
INNOVATION IS OUR STRENGTH

ArianeGroup draws its inspiration for constant innovation from the technical excellence, expertise and enthusiasm of its workforce.

For us at ArianeGroup, innovation is a natural consequence of the mix of technical excellence, individual creativity and our passion for space and technology. The instinct for innovation is in our DNA: from the extraordinary performance of our cryogenic engines to the astonishing resistance levels of our thermostructural materials; from immensely powerful solid propellants to the minute precision in orbital trajectories which they deliver; and in the extreme finesse of pioneering optical instruments and lasers. We understand and control every aspect and every stage of every product we design and make, from the molecular structure right through to the complete system.

Ariane 6 is an absolute concentrate of innovation. We are simplifying and streamlining our technical processes, applying the results of years of R&T investment, and implementing cutting-edge design tools and methods, such as a digital modeling facility for concurrent engineering. But innovation also means creating new, more efficient, value-adding organizational approaches, and changing our ways of working. This is why we are focusing on production and digitalization technologies: virtual reality techniques to make our production facilities even more efficient, 3D printing to speed up design and ultimately to be used in manufacture, and digitalization of all operations and data throughout the life-cycle.

We are actively preparing tomorrow’s space transportation, through our involvement in research programs supported by the European Space Agency (ESA) in partnership with major space agencies and national research bodies such as the national space agency CNES and the aeronautic, space, and defense research institution ONERA in France, and the national space research center DLR in Germany. One example is the Prometheus future engine project, which we have been working on together with CNES since 2015: this is a demonstrator for a reusable liquid oxygen and methane-fueled rocket engine which aims to be cheaper to produce by a factor of 10 than a Vulcain® 2-class engine, the Ariane 5 main stage motor, and provide reusability at least five times. First tests of Prometheus are slated for 2020.

Today, ArianeGroup’s prowess in civil and military space access technologies is among the most advanced in the world, but it is our aspiration to be an innovation trailblazer, by making our expertise in the space domain widely available to other sectors. We are therefore leveraging our expertise and disruptive, ground-breaking technologies into a high value-added, R&T-backed propositions aimed at customers both within and outside the space sector.
A GROUP WITH AN INCOMPARABLE PORTFOLIO OF COMPLEMENTARY EXPERTISE

11 subsidiaries and main affiliates.

APPLE - AEROSPACE PROPULSION PRODUCTS

European leader in igniters and starters for launcher propulsion systems, APP (Aerospace Propulsion Products) designs, develops and makes products and equipment for Ariane 5, Ariane 6, Vega, the European Future Launcher Preparatory Program (FLPP), and ExoMars. APP is also a specialist in gas generators and fire extinguishers for security applications.

ARIANESPACE

World-leading commercial launch services provider, Arianespace offers operators all over the world a complete range of services and solutions for all types of satellites, commercial and institutional, and into all orbits. To address customers’ different mission requirements, Arianespace’s family of launchers comprises the Ariane heavy launcher, the Soyuz medium launcher, and the Vega small launcher.

Shareholding of over 1% in Arianespace Participations

CILAS

Cilas is a world leader in optroonic systems, civil and military laser systems, and high-precision space optics. The company develops and manufactures a wide range of equipment for defense, industrial, astronomy, and space applications.

EUROCKOT

Eurockot markets launches using the Rockot launch vehicle produced by Khrunichev in Russia for observation satellites, science satellites, and communications satellites into low Earth orbit.

EURO CRYOSPACE

Euro Cryospace develops and produces hydrogen and liquid oxygen tanks for the cryogenic main and upper stages of the Ariane 5 launcher, as well as the cryogenic and non-cryogenic feedlines for Ariane 5.

EURO-PROPULSION

Europropulsion is prime contractor for the solid-propellant boosters for Ariane 5, Ariane 6, and Vega’s P80 first stage. The company is also developing the future P120C solid-propellant motor to be used on both the Ariane 6 and Vega C European launchers.

NUCLÉTUDES

Expert in protection of space and strategic systems. Nuclétudes is a specialist in hardening against radiation and electromagnetic aggressions for the space, defense, aeronautic, and nuclear sectors. The company also offers engineering services, and testing for radioactive and highly electromagnetic environments.

PYROALLIANCE

Pyroalliance designs, develops and produces high-reliability pyrotechnic and mechanical systems for the space, defense and industrial sectors. The company is involved in several major programs, notably the Ariane 5, Vega, and VLS launchers, and the M51, SCALP, and MdCN missiles.

REGULUS

Regulus is responsible for the production and loading of the propellant in the Ariane 5 and Vega first stage solid-propellant boosters made by Europropulsion.

SODERN

Sodern designs, develops and produces optical, optroonic and neutronic systems and equipment for the space, defense and industrial sectors, notably attitude sensors (star trackers), on-board scientific instruments, optical Earth observation equipment, and neutron analysis systems for the mining and cement industries.

STAREM

Starsem provides launch services using the Soyuz vehicle for missions from the Baikonur cosmodrome in Kazakhstan, including technical assistance and logistic support (the company also delivers these activities in relation to Soyuz launches from the European Space Center in Kourou, French Guiana).