

## Astrium and Ariane

The European leader of space transport and manned space flight, **Astrium** has been industrial prime contractor for the design, development and production of the Ariane family of launchers since the European Space Agency (ESA) Ministerial Council meeting on 27<sup>th</sup> May 2003. A new resolution was then adopted, defining a redistribution of responsibilities between the various players involved in the sector of space launchers. This resolution now structures all activities for the Ariane programme at an industrial level around Astrium.

Astrium is consequently the sole prime contractor for the production of the Ariane 5 system by managing all the contracts necessary for production with industrial partners from 12 countries in Europe.

The company supplies complete and validated launch vehicles to Arianespace, which then markets the Ariane launches. Astrium delivers all the Ariane 5 stages, as well as the vehicle equipment bay (VEB), the flight software and numerous subassemblies.

The company also supplies the main component elements of the Ariane 5 launcher including the launcher's stages, the flight programme and numerous sub-assemblies which are built at its Les Mureaux (France), Bremen (Germany), Madrid (Spain) and Kourou (French Guiana) facilities.



**Flight 198 Ariane 5 ECA/ Intelsat 17 & HYLAS 1**  
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Following on from the order for 30 launchers placed in 2004, Arianespace signed a new contract in January 2009, for production of a batch of 35 additional Ariane 5 launchers (PB batch).

Astrium possesses the multidisciplinary expertise required to control a programme of this complexity:

- **programme management:** customer relations, specification, overall coherence control, quality insurance, supplier management, configuration management, risk and RAMS management, documentation, main testing and validation
- **system engineering:** integrated system (aerodynamic, acoustic, thermal, structural, flight mechanics, guidance and attitude control and correction) studies, and testing (acoustic, thermal, dynamic and electrical models)
- **flight software:** design, qualification and development of real-time flight programmes and their adaptation to each mission

- **customer assistance:** this plays a major role in Ariane launch campaigns, providing support for Arianespace throughout launch operations
- **mission analysis** and flight data analysis after each launch

Astrium is prime contractor for all Ariane 5 launcher stages:

- the main cryogenic stage (**EPC**)
- the solid propellant boosters (**EAP**) and the various versions of the upper composite
- the cryogenic upper stage type A (**ESC-A**), the vehicle equipment bay (**VEB ECA**) and the cone 3936
- the storable propellant stage (**EPS**) and the vehicle equipment bay (**VEB ES**)

The EPC is integrated in the company's vast Les Mureaux complex near Paris. Cryospace, an Air Liquide - Astrium joint venture, which is located on the same site, manufactures the EPC and ESC-A cryogenic tanks. Also nearby is the functional simulation facility (ISF) where Astrium developed the launcher's electrical system and software, as well as its navigation and guidance-attitude control system.

The solid propellant boosters (EAP) are manufactured in French Guiana. Astrium integrates the booster stages in dedicated buildings at the Guiana Space Centre (CSG) with the MPS solid propellant motor supplied by Europropulsion, adding electrical, pyrotechnic, hydraulic, parachute recovery and other elements supplied from Europe. This is the first time that a major part of the launcher has been constructed in French Guiana. A new Ariane 5 "assembly line" and launch system was built in French Guiana between 1988 and 1996, including not only production facilities for the solid propellant boosters, but also assembly buildings for all the European elements of the launcher and all payload preparation facilities.

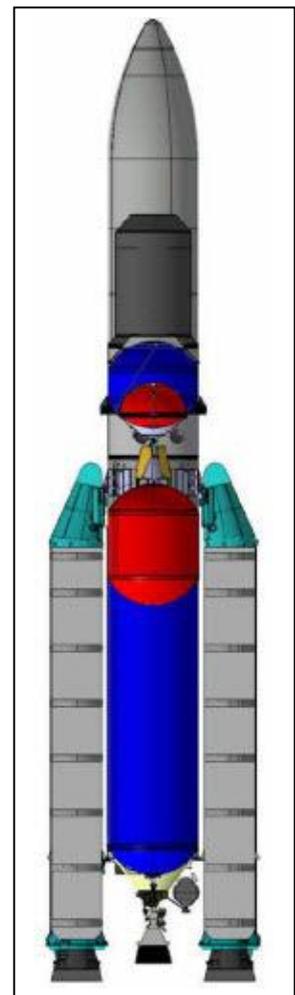
The different versions of the Ariane 5 launcher's upper composite are manufactured at the Astrium Bremen site in North Germany. Up to seven upper stages can now be assembled simultaneously. The company's other German sites at Ottobrunn near Munich and Lampoldshausen further to the west, supply the combustion chambers for the Ariane 5 Vulcain main engine and the HM7-B upper stage engine as well as the AESTUS motor of the storable propellant stage.

The largest space carbon fibre structure in one single piece manufactured in Europe is made at Astrium Barajas (Spain).

Astrium is also responsible for the Ariane 5 dual-launch system (SYLDA), which is built at its Les Mureaux site and enables the launch of two satellites at once.

Astrium is also now ESA's sole point of contact for future launcher development. As decided during the ESA Ministerial Council meeting in November 2008, Astrium will be responsible for the development of the Ariane 5 ME (Midlife Evolution) launcher. This new evolution will enable Ariane to better serve the markets and stay competitive in the face of increasing competition (Russia, Ukraine, USA, China, Japan etc.).

Astrium is also preparing, alongside ESA, the Next Generation Launcher (NGL), which will guarantee Europe's continued independent access to space.



*Ariane 5ME will be able to carry up to 12 tonnes to orbit and will have a re-ignitable engine*

## **Ariane launcher records**

**The highest Ariane:** The record is still held by an Ariane 4 equipped with a medium cone and a SPELDA short dual-launch external carrier structure. At 60.13 m high, it exceeded the highest version of the Ariane 5 (ECA + long cone) by about 4.23 m. This configuration was only used once, for Flight 61 in 1993, before the short cones and mini-SPELDA became the standard for dual launches on Ariane 4.

**Heavy weight category:** In over 200 flights, Ariane launchers have placed more than 800 tons of payload in orbit – or more than the launch weight of an Ariane 5 ECA.

The total weight of the Ariane vehicles launched from French Guiana is more than 90,000 tons, equivalent to the weight of the Eiffel Tower, or of two fully-equipped "Charles de Gaulle" aircraft carriers.

The largest payload ever placed in orbit by an Ariane launch vehicle was the "Johannes Kepler" ATV-2 vehicle (20.1 tons), on flight 200 (Ariane 5 ES).

**Reliability:** During its operating life, Ariane 4 made 74 successful launches. 116 missions achieved a reliability of 97.4%. With more than 40 successful consecutive launches, the Ariane 5 family can claim reliability of more than 97% (excluding qualification flights).

#### **Altitude and speed:**

The maximum speed reached by an Ariane launcher is 10,410 m/s (or 37,476 km/h), a record set by an Ariane 5G+, during Flight 158, when the Rosetta probe was injected into interplanetary orbit. At that speed, 50 seconds would be enough to travel the distance from Bremen to Munich (563 km).

The highest apogee (during a non-interplanetary flight) was achieved by the Herschel and Planck telescopes, on Flight 188 aboard an Ariane 5 ECA. The furthest point in their orbit from Earth was 1,193,622 km, or three times the distance from the Earth to the Moon.

Apart from the sub-orbital flight by the Atmospheric Re-Entry Demonstrator (ARD), the lowest perigee was achieved on Flight 137, with 180 km (record held by the last Ariane 44P).

The highest perigee is 1,322 km, or about the distance from Brussels to Barcelona, achieved on Flight 52, when an Ariane 4 placed the Franco-American Topex altimetry satellite into orbit.

#### **About Astrium**

Astrium is the number one company in Europe for space technologies and a wholly owned subsidiary of EADS, dedicated to providing civil and defence space systems and services.

In 2010, Astrium had a turnover of €5 billion and more than 15,000 employees worldwide, mainly in France, Germany, the United Kingdom, Spain and the Netherlands. Its three main areas of activity are Astrium Space Transportation for launchers and orbital infrastructure, Astrium Satellites for spacecraft and ground segment, and Astrium Services for comprehensive end-to-end solutions covering secure and commercial satcoms and networks, high security satellite communications equipment, bespoke geo-information and navigation services worldwide.

EADS is a global leader in aerospace, defence and related services. In 2010, the Group – comprising Airbus, Astrium, Cassidian and Eurocopter – generated revenues of € 45.8 billion and employed a workforce of nearly 122,000.

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## Figures – Data – Facts

### Ariane 5 ECA

Length	46 metres
Diameter	max. 12.2 metres
Payload	Max. 10 tons
Max. launch weight	approx. 710 tons
Propellant weight	633 tons

### **Solid propellant strap-on boosters**

Number	2
Length	31.9 metres
Diameter	3 metres
Propellant weight (each)	240 tons
Firing duration	141 seconds (or about 2.5 minutes)

### **Main cryogenic stage (EPC)**

Length	30.5 metres
Diameter	5.4 metres
Propellant weight	138 tons
Motor	Vulcain 2
Firing duration	530 seconds (or nearly 9 minutes)

### **Cryogenic upper stage (ESC-A)**

Length	4.7 metres
Diameter	5.4 metres
Propellant weight	14.6 tons
Firing duration	970 seconds (or nearly more than 16 minutes)

### **Vehicle Equipment Bay (VEB)**

Length	1.13 metres
Diameter	5.40 metres
Mass	950 kg
Main element	2 On-board computers