



*European launchers  
for the world*



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## Europe's independent vision

Since July 1973, when the Member States of ESA decided to start development of the Ariane launcher to give Europe independent access to space at an affordable cost, the Ariane programme has proved an outstanding example of successful European collaboration. With strong backing from its industrial partners and the political support of ESA Member States, the Ariane launchers will continue to symbolise the Europe of tomorrow.

## A strategy for success

An ambitious space programme needs an independent launch system. Europe realised this in the early 1970s and, along with ESA, the Ariane programme was born. Clear-sighted management and rapid transfer to private operation yielded almost instant success, giving ESA the impetus to develop the new Ariane-5 heavy-lift launcher and study new space transport systems for the future.

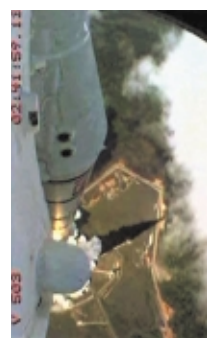
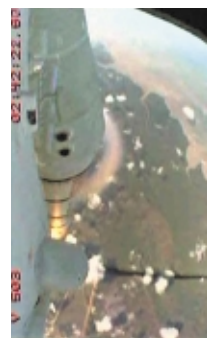
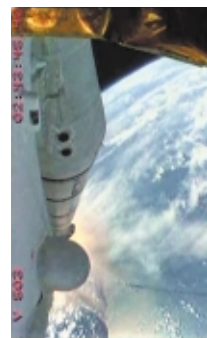


M. Ylieff, ESA Ministerial Council Chairman, and Mrs M. Wagner, Chairman of ESA's Ariane Programme Board, applaud the launch of Ariane-503



*"The successful third flight of Ariane-5 qualifies Europe's new heavy-lift launcher and vindicates the technological options chosen by ESA. This is another good example of what European cooperation can achieve. All of us who have consistently believed in Ariane have today witnessed the start of a new success story."*

**Fredrik Engström**  
Director of Launchers, ESA





1979

1984

### Evolution of a launcher

Ariane, which first flew in December 1979, was designed primarily for putting telecommunications satellites into orbit two at a time to reduce launch costs. As the size of satellites grew Ariane-1 gave way in 1984 to the more powerful Ariane-2 and Ariane-3, and these in turn were superseded by Ariane-4 in 1988.

Ariane-2, 3 and 4 all belonged to the same family but with certain differences. The first and third stages became longer and then liquid or solid propellant strap-on boosters were added for extra power and flexibility.



First Ariane-1 launch



First Ariane-3 launch

1986



First Ariane-2 launch

### Building an industry

Ariane development has spawned an expert European-wide industry and infrastructure, supporting both construction and launch. Under the overall direction of ESA, which delegated management of the development of Ariane launchers to CNES, more than 100 companies in Europe were involved in developing and manufacturing the Ariane launcher family.

Arianespace, the European company created to market, produce and operate the Ariane launchers, has secured more than half of the world launch market for launching commercial communications satellites into geostationary transfer orbit.

As well as in Europe, Arianespace has customers in the USA, Japan, Canada, India, Brazil and many other countries of the world.

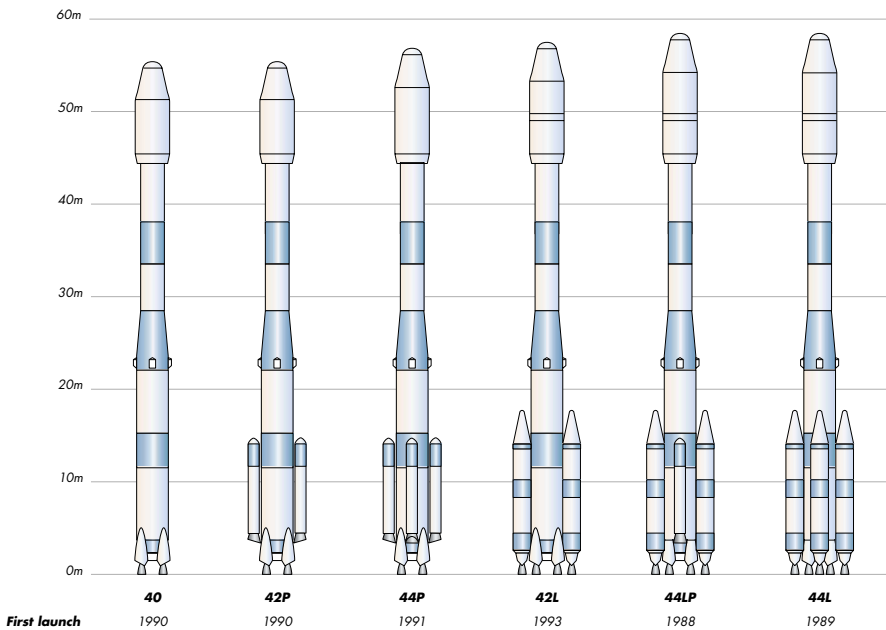
## 1988

### Power and reliability

The arrival of Ariane-4 in June 1988 increased the payload that could be placed in geostationary transfer orbit by almost three times, from 1700 to 4800 kg. To meet varying market demands it is available in six versions – one 'bare' and the others (depending on the mass to be put into orbit) fitted with two or four, solid or liquid strap-on boosters.

Ariane-4 also has a choice of widened fairings, designed to house larger and heavier satellites, and uses a special support structure (Spelda) for launching two satellites at a time.

Despite stiff competition, Ariane-4 continues to hold the number one position in the world for commercial satellite launches. It has one of the best reliability records in the market and is currently scheduled to remain in service until around 2003.



*A range of solid and/or liquid strap-on boosters add great flexibility to Ariane-4*

#### Facts & Figures

- 111 successful Ariane flights, out of 117 in total
- 45 consecutive Ariane-4 successes
- More than 200 satellites launched into GTO
- Studies show that for every Euro invested in the Ariane-1 to 4 programme in production and operations some four Euros have come back into the European economy



First Ariane-4 launch

1998

### **A new heavy-lift launcher for Europe...**

Ariane has never stopped evolving and the latest version Ariane-5 is no exception. It is shorter, squatter and developed with flexibility in mind.

- **Ariane-5 is very much a new-generation launcher for commercial geostationary transfer orbit (GTO) satellites**

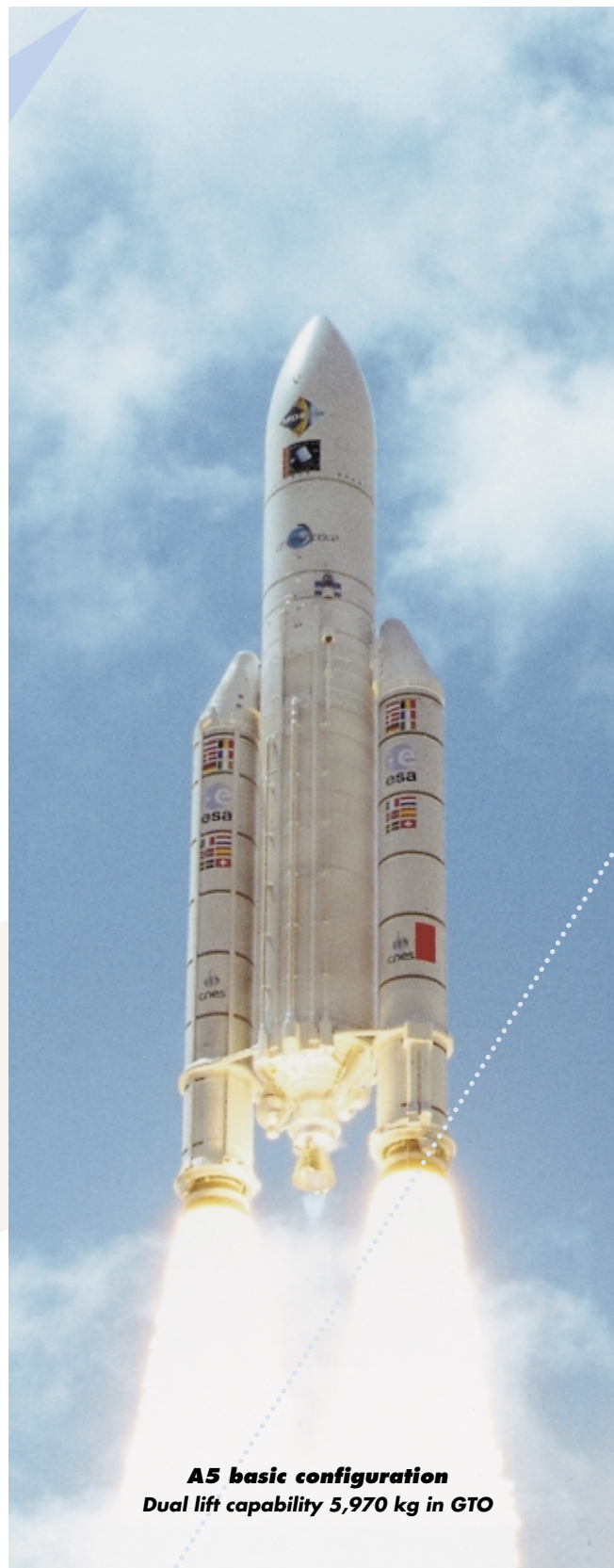
As a strategic launch vehicle for the new millennium, it is designed to maintain Europe's lead in the commercial GTO market.

Ariane-5's versatility allows it to be adapted both now and in the future to provide access to space for various other applications, such as:

- **deployment of satellite constellations**
- **positioning of satellites in polar and synchronous orbit**
- **exploration of planets in our solar system**
- **orbiting cargos for space stations**

Ariane-5 was developed so that it would be easy to adapt to future satellite trends. The flexibility and evolution potential built into the original design makes it a very powerful, reliable and economical launcher that is closely matched to typical commercial payloads of the early 2000s.

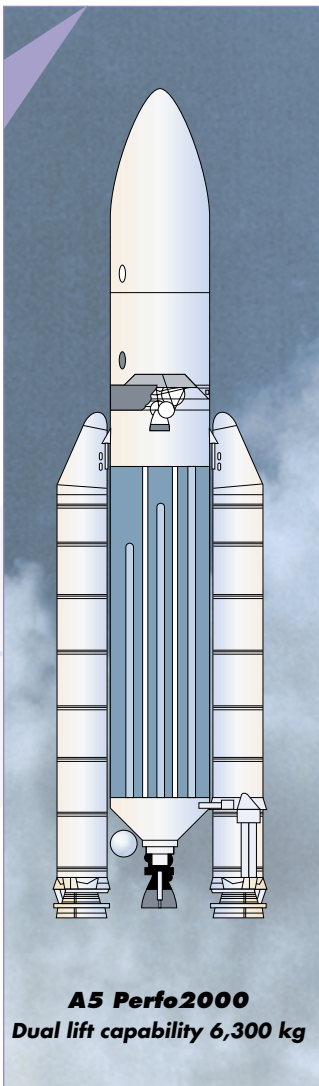
*The third Ariane-5 qualification flight (A503) in October 1998 from Kourou proved an outstanding success*



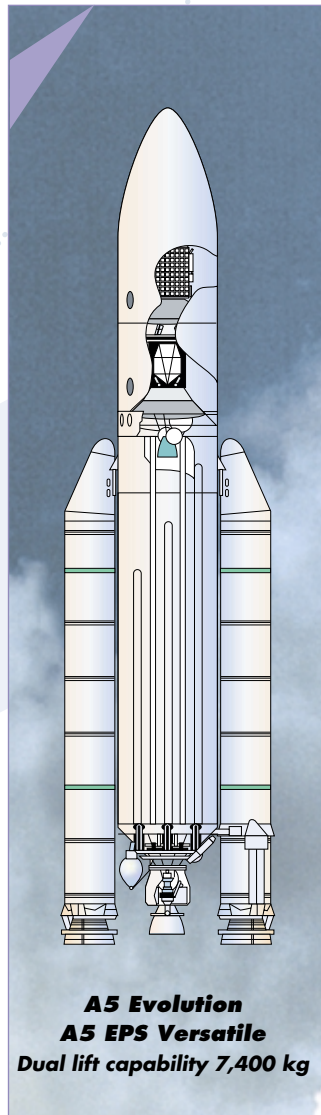
**A5 basic configuration**  
**Dual lift capability 5,970 kg in GTO**



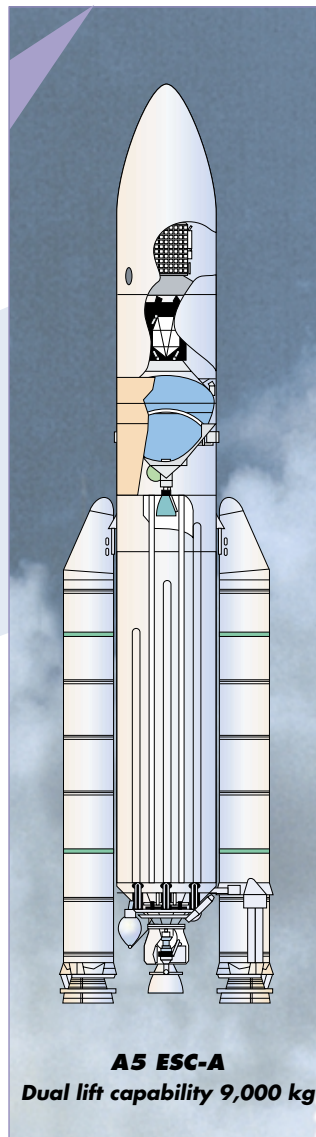
2001



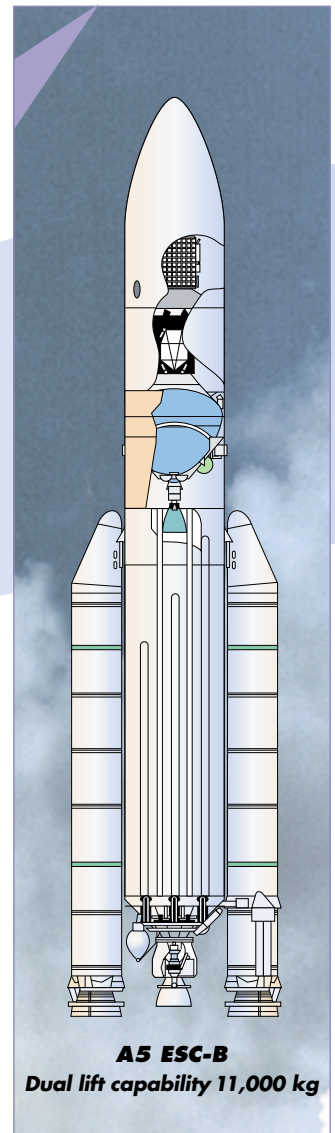
2002



2002



2005



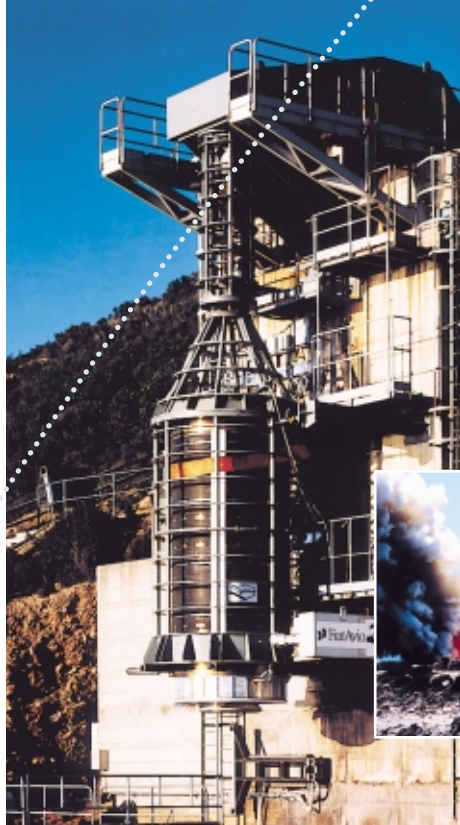
### ...more performance, greater versatility at lower cost

Launcher performance will be significantly increased by upgrade programmes already underway and the various stages in the growth of Ariane-5 to meet evolving market requirements are now clearly defined:

- The dual payload capability of 5,970 kg into geostationary orbit will rise to 6,300 kg in 2001 under the Ariane-5 "Perfo2000" initiative with Arianespace.
- Ariane-5 Evolution (an upgrading of the lower composite) and Ariane-5 Versatile (introducing a restartable upper stage) will further increase dual lift capability to 7,400 kg, as well as offering greater all round flexibility. First launches are scheduled in mid and late 2002, respectively.
- A further significant increase in performance and flexibility will be achieved in 2002 when Ariane-5 ESC-A will use an existing Ariane-4 cryogenic engine (achieving a dual lift capability of 9,000 kg).
- In 2005 this version will be superseded by ESC-B (11,000 kg dual lift capability), using a newly developed cryogenic restartable upper stage to allow compatibility with geostationary transfer orbit missions, demanding even higher performance, as well as all kinds of other missions.

# Completing the Ariane family

THE FUTURE for the world



## Small launcher spin-off

Vega is the Ariane family's new 'baby'. The small launcher – designed to make access to space easier, available quickly and more affordable for payloads of around 1,000 kg – will benefit from all the technologies, facilities and hardware developed in the Ariane programme. Vega will enhance Europe's flexibility and a reduction in launch prices will make it attractive to new categories of user.

Vega is designed as a single-body satellite launcher and is composed of three solid propulsion stages and a vernier liquid propulsion module. First launch is planned for 2002.

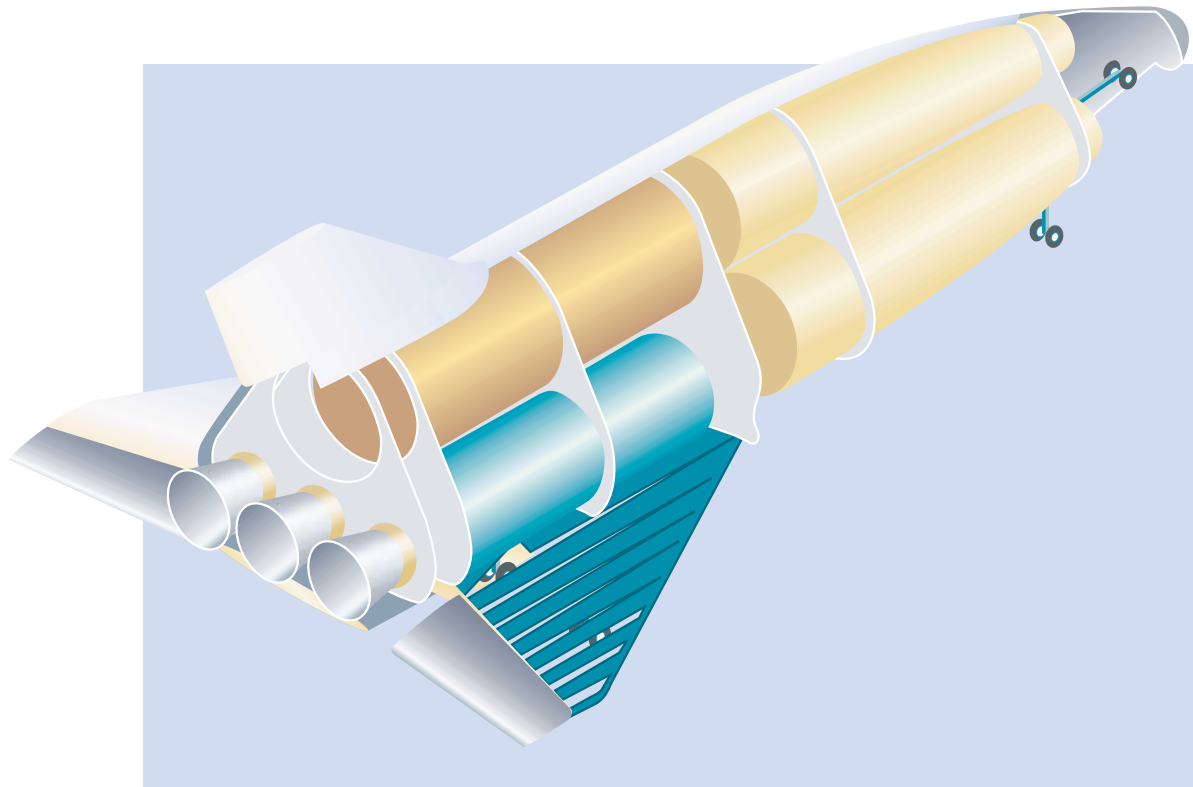


*The Vega second stage, Zefiro, was successfully tested in June 1998 in Italy*



*Artist's impression of the Vega small launcher. Development was started by ESA in 1998*





## Future launchers

A goal for the future is to significantly reduce launch costs and one way of doing this involves reusable launchers.

Plans for reusable launchers are concentrating on the development and validation of the advanced technologies that will be necessary to construct cost-effective reusable launchers.

ESA's Future Launchers Technology Programme (FLTP) will draw upon the full skills of the European launcher industry and ultimately includes a proposal to design, build and fly a European Experimental Test Vehicle.

## Key technologies

Taking into account work already done in Europe, and the proposed FLTP, a decision on developing a first generation reusable launcher could be made around 2007.

The FLTP concentrates on developing and demonstrating the enabling technologies required for future launchers, including



*Propulsion is one of the key technologies in developing future launch vehicles*

reusable elements such as advanced propulsion, low-mass structures, aerothermodynamics and health monitoring systems.

FLTP will be carried out in two successive phases, the first between 1999 and 2001. The need for a dedicated experimental vehicle, its definition, construction and flight testing would be the basis of phase two.



## Launcher operations

Europe's modern launch base at Kourou, French Guiana, now employs some 1400 people. It is just five degrees north of the equator and is one of the best operational launch sites in the world.

Kourou has evolved from a small launch operations base into a large area for different types of Ariane launch site capable of operating in parallel. It includes a dedicated industrial area involving many European companies, in production and assembly plants.

Since the beginning of the Ariane programme ESA has invested €1.2 billion in launch and production facilities in Kourou.



## Launcher production

The cycle of launcher production is a huge industry – more than 100 companies across Europe and in French Guiana are involved in the development and production of Ariane launchers.

Some 6,500 people are involved in Ariane production and another 6,000 in development.

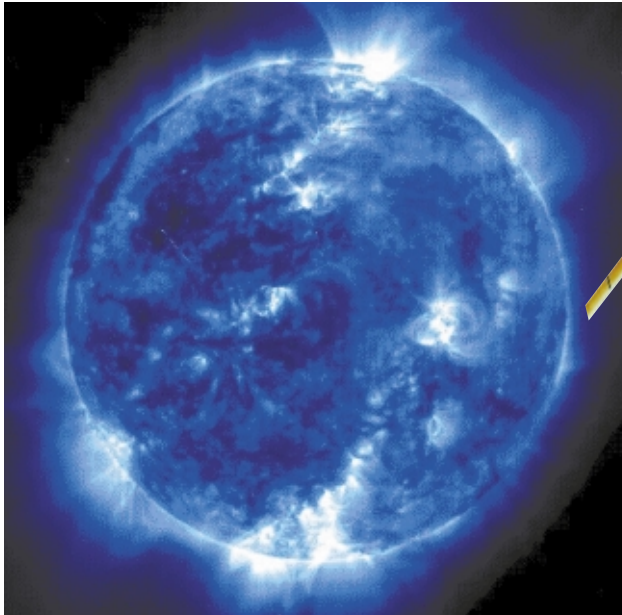
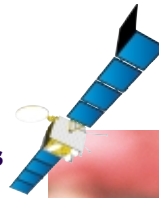
As well as increasing production rates, efficiencies brought about by cost reductions and economies of scale have lowered overall costs and increased reliability at the same time as improving performance.





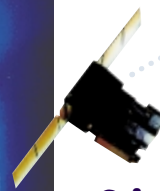
## Telecommunications

*Ariane is the world's leading launcher for commercial satellites operating from geostationary orbit which have transformed global communications. The proliferation of television would have been impossible without a fleet of direct broadcast satellites in geostationary orbit, many launched by Ariane.*



## Science

*Ariane has an important role to play in launching European science spacecraft. These have included Giotto, which encountered Halley's Comet in 1986, and SOHO, a solar observatory which has contributed a wealth of new information to help our understanding of the Sun.*



## Applications

*Meteosat, the series of satellites that watches the weather of Europe and Africa from a vantage point over the Equator, was started by ESA. Between 1977 and 1997, seven Meteosat spacecraft were put into orbit by Ariane. The launcher is also used for European observation satellites, such as ERS-1 and ERS-2, which use radar to monitor different aspects of the Earth.*



## Space Station

*Ariane-5 will be the launcher for ESA's Automated Transfer Vehicle that will make regular trips to deliver cargo and fuel to the International Space Station.*





*Photos © ESA, CNES, Arianespace*

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