Flight 159

23rd launch for Intelsat

Arianespace's first mission of the year will orbit the Intelsat 907 communications satellite for international operator Intelsat. This will be the 23rd Intelsat satellite to be launched by Ariane.

It is also the sixth IX series satellite to be orbited by Europe's launcher, confirming Intelsat's full confidence in Arianespace.

The Intelsat IX series plays a critical role in Intelsat's development strategy. By giving customers around the world two to three times more power than previous satellites, Intelsat can deliver higher quality services, and also support the installation of very competitively priced ground facilities.

Built by Space Systems/Loral in Palo Alto, California, the Intelsat 907 satellite will be positioned at 332.5 degrees East. It joins the Intelsat fleet of satellites that provides Internet, telephony, television and business network transmission services for North America, Latin America, Europe and Africa.

The first satellite in this series, Intelsat 901, was orbited by Arianespace in June 2001 (Flight 141), followed by Intelsat 902 in August 2001 (Flight 143), Intelsat 904 in February 2002 (Flight 148), Intelsat 905 in June 2002 (Flight 152) and Intelsat 906 in September 2002 (Flight 154).

Arianespace will use an Ariane 44L, the version of the launcher with four liquid-propellant strap-on boosters. With this mission, a total of 116 Ariane 4 launchers will have been launched between June 1988 and February 2003.

Follow the launch live on the internet broadband
at www.arianespace.com
(starting 20 minutes before lift-off)

1 - Arianespace Flight 159 mission

The 158th Ariane launch (Flight 159) is scheduled to place the Intelsat 907 satellite into a geostationary transfer orbit using an ARIANE 44L launch vehicle equipped with four liquid strap-on boosters (PAL). This will be the 116th Ariane 4 launch and the 40th in the ARIANE 44L configuration.
It will be launched from the Ariane launch complex n°2 (ELA2), in Kourou, French Guiana.
The launch vehicle performance requirement is 4,727 kg (10,399 lb) of which 4,685 kg (10,307 lb) represent the mass of the spacecraft to be separated on the injection orbit.

Injection orbit

Perigee	***200 km***
Altitude Apogee	***35 949 km at injection***
Inclination	***7° degrees***

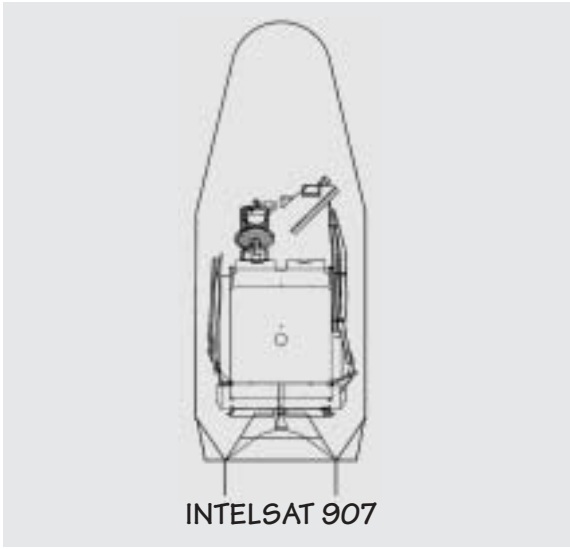
The ARIANE 44L launcher liftoff for Flight 159 is scheduled in the morning of February 12, 2003 as early as possible within the following launch window :

Launch opportunity

	GMT	*Paris time*	*Washington time*	*Kourou time*
From	*7:00 am*	*8:00 am*	*2:00 am*	*4:00 am*
to	*8:00 am*	*9:00 am*	*3:00 am*	*5:00 am*
on	*February 12, 2003*	*February 12, 2003*	*February 12, 2003*	*February 12, 2003*

Ariane payload configuration

The Intelsat 907 satellite was built by Space Systems/Loral in Palo Alto (California), for the international operator Intelsat.
Orbital position: 332.5° East, over the Atlantic Ocean.



2. Range operations campaign: ARIANE 44L – INTELSAT 907

The actual work for satellite range operations lasts 15 working days for Intelsat 907 from its arrival in Kourou (before start of combined operations).
The ARIANE 44L preparation campaign lasts 25 working days.

Satellite and launch vehicle campaign calendar

Ariane activities	*Dates*	*Satellite activities*
Campaign start review	*January 10, 2003*	
First stage erection	*January 10, 2003*	
Second stage erection	*January 11, 2003*	
	January 15, 2003	*Intelsat 907 arrival in Kourou and beginning of its preparation in S1 building*
Liquid strap-on boosters erection	*January 15-18, 2003*	
Third stage erection	*January 18, 2003*	
	January 25, 2003	*Intelsat 907 transfer from S1B to S3B building*
	January 28, 2003	*Beginning of Intelsat 907 filling operations*
Roll-out to launch pad	*January 30, 2003*	

D-7	*Friday, January 31*	*Start of combined operations*
D-6	*Monday, February 3*	*Satellite encapsulation operations*
D-5	*Tuesday, February 4*	*Satellite composite transfer to the launch pad*
D-4	*Wednesday, February 5*	*Satellite composite mating onto launcher and overall checks*
D-3	*Thursday, February 6*	*Launch Rehearsal*
D-2	*Friday, February 7*	*Launch Readiness Review (RAL) and launcher arming*
D-1	*Monday, February 10*	*Filling of 1st stage, and 2nd stage, and liquid boosters with UH 25 and N2O4*
D-0	*Tuesday, February 11*	*Launch Countdown including 3rd stage filling with liquid oxygen and liquid hydrogen*
H-0	*Wednesday, February 12*	

3. Launch countdown and flight events

The final launch countdown runs through all the final launcher and satellites related operations. It configures the vehicle and its payload for ignition of the first stage and PAL engines at the selected launch time, as soon as possible within the launch window authorized by the spacecraft.
A synchronized sequence (see Appendix 3), controlled by the Ariane ground check-out computers, starts at H0 - 6mn and concludes the countdown.
Should a hold in the countdown delay the H0 time beyond the launch window, the launch is postponed to (in days) : D + 1 or D + 2 (or later) depending on the source of the problem and the time to resolve it.

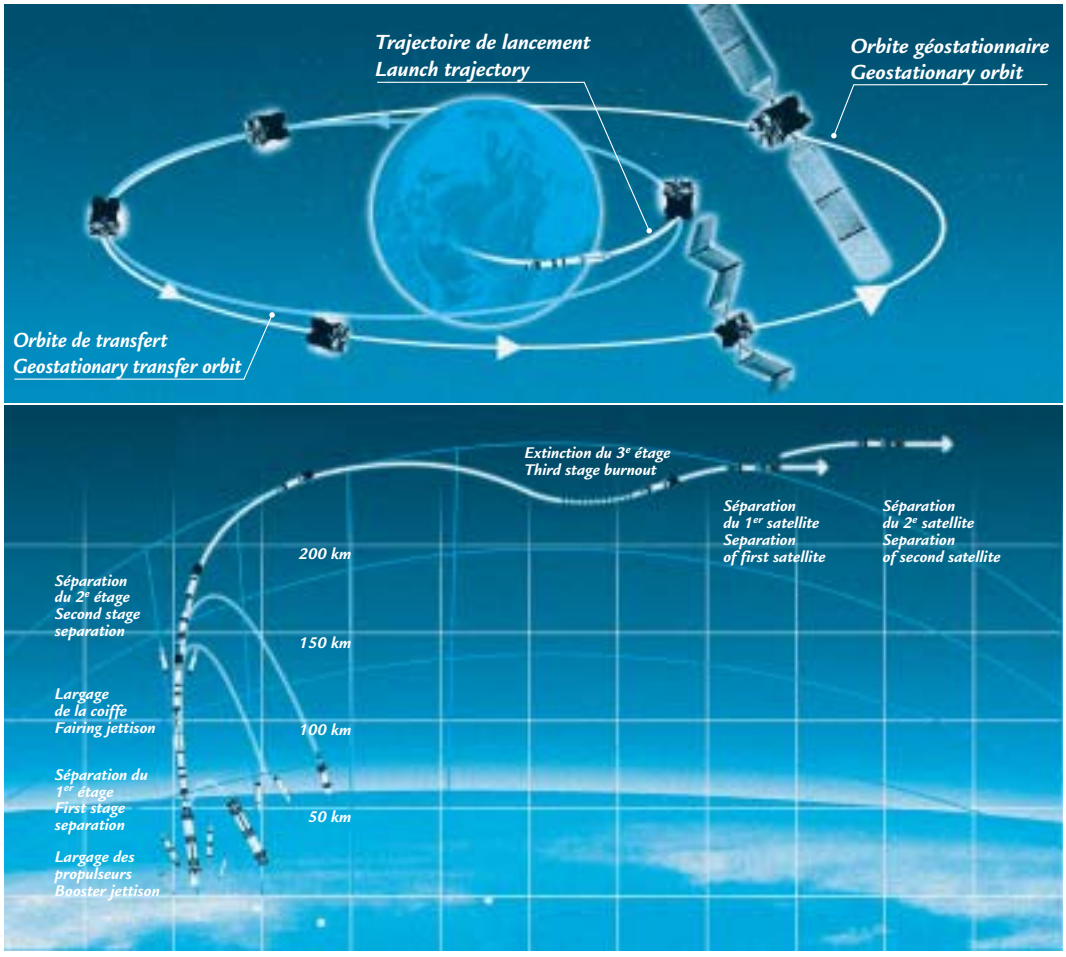
Time	*Events*
– 12h 30 mn 00 s	*Start of final countdown*
– 5 h 35 mn 00 s	*Start of gantry withdrawal*
– 3 h 35 mn 00 s	*Start of the 3rd stage filling operations with liquid hydrogen and liquid oxygen*
– 1 h 5 mn 00 s	*Activation of launcher telemetry, radar transponders, telecommand*
– 6 mn 00 s	*"Green status for all systems" to authorize : start of synchronized launch sequence*
– 3 mn 40 s	*Spacecraft switched to on-board power (latest time)*
– 1 mn 00 s	*Launcher equipment switched to on-board batteries*
– 09 s	*Inertial platform released*
– 05 s	*Release command to cryogenic arms retraction system*

Time/H_0 (s)	*Time/H_0 (mn/s)*	*Ignition of first stage and liquid strap-on boosters engines*	*Alt (km)*	*V. rel. (m/s)*
4.4	*0'04"*	*Lift-off*	*0*	*0*
16.0	*0'16"*	*End of vertical ascent phase of pitch motion*	*0.12*	*21*
78.0	*1'18"*	*Transonic*	*8.3*	*316*
94.0	*1'34"*	*Maximum dynamic pressure*	*14*	*469*
149.6	*2'29"*	*Liquid strap-on booster jettison 2 - 4*	*43*	*1581*
150.6	*2'30"*	*Liquid strap-on booster jettison 1 - 3*	*43*	*1598*
205.26	*3'25"*	*Burnout of 1st stage*	*81*	*2986*
210.41	*3'30"*	*First stage separation*	*85*	*2989*
210.41	*3'31"*	*Second stage ignition*	*85*	*2988*
258.2	*4'18"*	*Fairing jettison*	*117.1*	*3596*
336.7	*5'36"*	*Burnout of 2nd stage*	*164*	*5416*
342.2	*5'42"*	*Second stage separation*	*167*	*5439*
345.1	*5'45"*	*Third stage ignition*	*169*	*5438*
385.0	*6'25"*	*Launcher acquired by Natal station*	*189*	*5528*
535.0	*8'55"*	*End of tracking by Kourou and Galliot stations*	*233*	*6034*
750.0	*12'30"*	*Launcher acquired by Ascension Island station*	*217*	*7077*
785.0	*13'05"*	*End of tracking by Natal station*	*211*	*7245*
1065.0	*17'45"*	*Launcher acquired by Libreville station*	*206*	*9142*
1078.0	*17'58"*	*End of tracking by Ascension Island station*	*214*	*9289*
1127.3	*18'47"*	*Burnout of 3rd stage*	*244*	*9720*
1128.7	*18'48"*	*Start of ballistic phase, first maneuver*	*245*	*9724*
1255.3	*20'55"*	*Intelsat 907 separation*	*394*	*9587*
1349.3	*22'29"*	*End of Arianespace Flight 159 mission*	*586*	*9435*

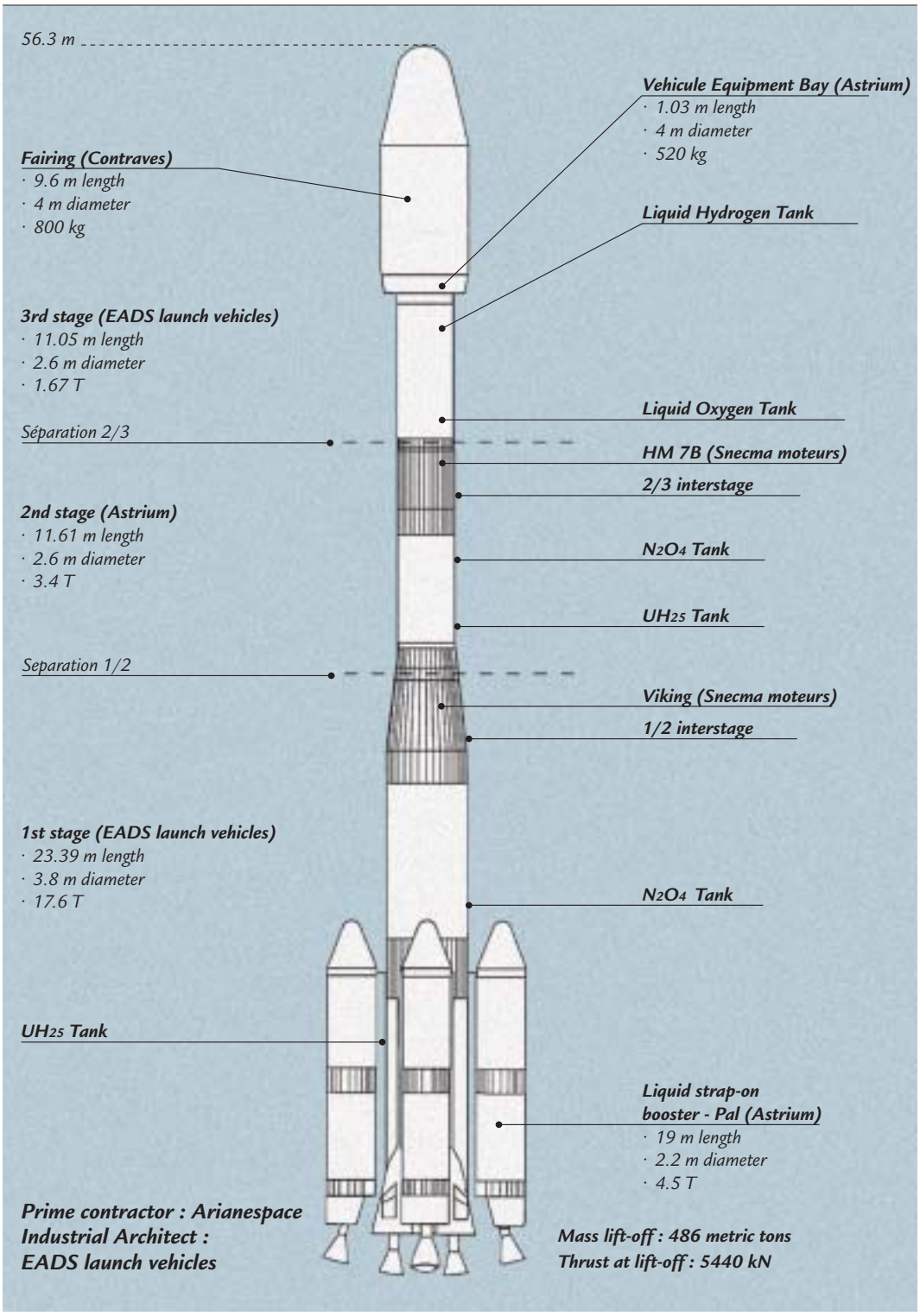
4. Flight 159 Trajectory

The launcher ascends vertically from lift-off to H0+16 sec. During a period of 10 sec. after this vertical ascent, the launch vehicle tilts in the pitch plane defined by the trajectory and pre-calculated by the on-board computer.
The vehicle's attitude is commanded by a predetermined law. The guidance phase is initiated 10 sec. after ignition of the 2nd stage. The attitude law in the pitch-and-yaw plane is optimized in order to minimize the 3rd stage propulsion time necessary to reach the target orbit with a performance margin of about 156 kg (343 lb).This ensures reaching this orbit with a probability of about 99% before the exhaustion of third stage propellant.
The roll law is applied so as to improve the launcher/ground station radio link budget.

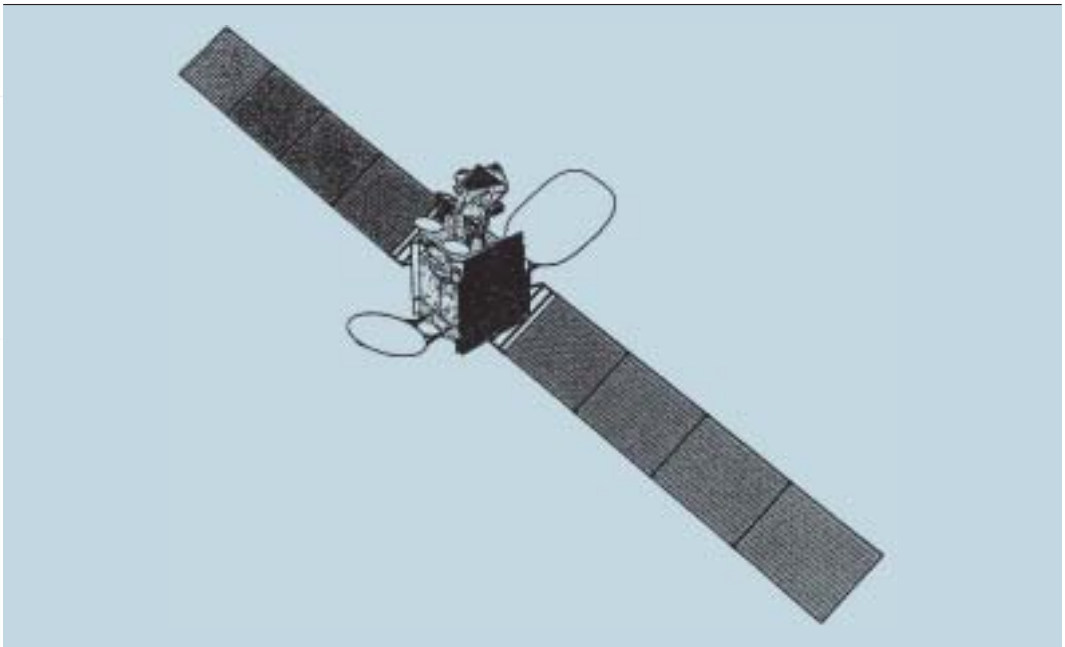
Typical trajectory for standard geostationary transfer orbit and ground station visibility



5. The launch vehicle



6. The Intelsat 907 satellite



Customer	***Intelsat***	
Prime contractor	*Space Systems / Loral in Palo Alto (California)*	
Mission	*Internet, broadcast, telephony and corporate network solutions*	
Mass	*Total mass (at lift-off)*	*4,685 kg (10,307 lb)*
Dry mass		*1,973 kg (4,350 lb)*
Stabilization	*3 axis*	
Dimensions		*2.80 m x 3.50 m x 5.56 m*
Spain in orbit	*31 m*	
Platform	*FS1300 Extended*	
Payload	*76 C Band transponders (in 36 MHz equivalent units)* *22 Ku Band transponders (in 36 MHz equivalent units)*	
On-board power	*10 kW (beginning of life)*	
Life time	*13 years*	
Orbital location	*332.5° East, over the Atlantic Ocean*	
Coverage area	*North America, Latin America, Europe and Africa*	

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Annex 1 - Arianespace flight 159 key personnel

In charge of the launch compaign			
Mission Director	*(CM)*	*Bernard PUYGRENIER*	*ARIANESPACE*
In charge of the launch service contracts			
Intelsat 907 Mission Manager and ARIANE Payload Manager	*(RCUA)*	*Steve HALL*	*ARIANESPACE*
Deputy Mission Manager	*(RCUA/A)*	*Michael CALLARI*	*ARIANESPACE*
In charge of Intelsat 907 satellite			
Satellite Mission Director	*(DMS)*	*Terry EDWARDS*	*INTELSAT*
Satellite Project Manager	*(CPS)*	*Erik LEVINE*	*SPACE SYSTEMS / LORAL*
Satellite Preparation Manager	*(RPS)*	*Thimothy COLE*	*SPACE SYSTEMS / LORAL*
In charge of the launch vehicle			
Launch Site Operations Manager	*(COEL)*	*Philippe HERS*	*ARIANESPACE*
Ariane Production Project Manager	*(CPAP)*	*Jean-Pierre DULOUT*	*ARIANESPACE*
In charge of the Guiana Space Center (CSG)			
Range Operations Manager	*(DDO)*	*Thierry VALLEE*	*CNES/CSG*
Flight Safety Officer	*(RSV)*	*Raymond BOYCE*	*CNES/CSG*

Annex 2 - Launch environment conditions

The allowable weather conditions for gantry withdrawal depend on the Ariane stage pressurization values.
Wind speed has to be below 17 m/s.
Acceptable wind speed limit at liftoff is 9,5 m/s for any wind direction. For safety reasons, the wind speed on the ground (at Kourou) and at a high altitude (between 10,000 and 20,000 m) also is taken into account.

Annex 3 - Synchronized sequence

The synchronized sequence starts at H0 – 6 min. This sequence is used for final preparation of the launcher, and for checkout operations related to switchover to flight configuration. The sequence is fully automatic, and is controlled in parallel, up to H0 – 5 sec., by two computers in the Ariane Launch Center (CDL). All resources used for launch are synchronized on a common countdown sequence.
One computer configures fluids and propellants for flight and performs associated checks. The other computer executes final preparation of the electrical systems (initiation of flight program, start-up of servomotors, switchover from ground power to flight batteries, etc.) and corresponding checkout operations.
After H0 – 5 s. and retraction of the cryogenic arms retraction from the launcher, a majority logic sequencer delivers the main timing pulses for :
- first stage & liquid booster engine ignition (H0) ;
- engine parameter checkout (conducted in parallel by the two computers, starting at H0 + 2.8 s.) ;
- opening of the launch table clamps (releasing the launch vehicle between H0 + 4. 1s. and H0 + 4.6 s.) as soon as engine parameters are judged as nominal by one of the computers.

Any hold in the synchronized sequence before H0 – 5 s. automatically resets the launcher to the H0 – 6 min. configuration

Annex 4 - Arianespace, its relations with ESA and CNES

From a production base in Europe, Arianespace, a private company, serves customers all over the world.
Arianespace is the world's first commercial space transportation company, created in 1980 by 36 leading European aerospace and electronics corporations, 13 major banks and the French space agency CNES (Centre National d'Etudes Spatiales).
Arianespace is a European venture, the direct result of the participating nation's commitment to bringing the Ariane family of launch vehicles from the drawing board to the launch pad. To do so, they turned to the European Space Agency (ESA) and mobilized the scientific and technological expertise of CNES.
The shareholder partners in Arianespace represent the scientific, technical, financial and political capabilities of 12 countries : Belgium, Denmark, Germany, France, Great Britain, Ireland, Italy, Netherlands, Norway, Spain, Switzerland and Sweden.
In order to meet the market needs, Arianespace is present throughout the world: in Europe, with its head office located near Paris, France at Evry, in North America with its subsidiary in Washington D.C. and in the Pacific Region, with its representative offices in Tokyo, Japan, and in Singapore.
Arianespace employs a staff of 380. Share capital totals 317 M€.
As a space transportation company, Arianespace:
- markets launch services to customers throughout the world;
- finances and supervises the construction of Ariane expendable launch vehicles;
- conducts launches from Europe's Spaceport in Kourou in French Guiana;
- insures customers for launch risks.

Personalized reliable service forms an integral part of Arianespace's launch package. It includes the assignment of a permanent team
of experts to each mission for the full launch campaign. Our customers appreciate the time and cost savings made possible by our
efficiency and flexibility.

Most of the world's commercial satellite operators have contracted to launch at least one payload with Arianespace. This record is the result of our company's realistic cost-effective approach to getting satellites into orbit.

Relations between ESA, CNES and Arianespace
Development of the Ariane launcher was undertaken by the European Space Agency in 1973. ESA assumed overall direction of the ARIANE 1 development program, delegating the technical direction and financial management to CNES. The ARIANE 1 launcher was declared qualified and operational in January 1982. At the end of the development phase which included four launchers, ESA started the production of five further ARIANE 1 launchers. This program, known as the "promotion series", was carried out with a management arrangement similar to that for the ARIANE 1 development program
In January 1980 ESA decided to entrust the commercialization, production and launch of operational launchers to a private-law industrial structure, in the form of ARIANESPACE, placing at its disposal the facilities, equipment and tooling needed to build and launch the ARIANE vehicles.
Ariane follow-on development programs have been undertaken by ESA since 1980. They include a program for developing uprated versions of the launcher : Ariane 2 and Ariane 3 (qualified in August 1984); the program for building a second ARIANE launch site (ELA 2) (validated in August 1985); the Ariane 4 launcher development program (qualified on June 15th, 1988); and the preparatory and development program of the Ariane 5 launcher (qualified in October 21st 1998) and its new ELA 3 launch facility. All these programs are run under the overall direction of ESA, which has appointed CNES as prime contractor.
In general, as soon as an uprated version of the launcher has been qualified, ESA makes the results of the development program together with the corresponding production and launch facilities available to ARIANESPACE.
ESA is responsible (as design authority) for development work on the Ariane launchers. The Agency owns all the assets produced under these development programs. It entrusts technical direction and financial management of the development work to CNES, which writes the program specifications and places the industrial contracts on its behalf. The Agency retains the role of monitoring the work and reporting to the participating States.
Since Flight 9 Arianespace has been responsible for building and launching the operational Ariane launchers (as production authority), and for industrial production management, for placing the launcher manufacturing contracts, initiating procurements, marketing and providing Ariane launch services, and directing launch operations.