

THIRD LAUNCH FOR DIRECTV

Arianespace's Flight 146 will orbit the DIRECTV-4S satellite for American company DIRECTV, Inc. This will be the third Ariane launch for the direct broadcast satellite company, following DIRECTV-1 in December 1993 (Flight 62) and DIRECTV-3 in June 1995 (Flight 74).

DIRECTV-4S features multi-beam coverage, giving DIRECTV a solution tailored to local TV broadcast needs and offering viewers throughout the United States a broad choice of programming. Its payload was designed to support carriage of additional local TV channels for DIRECTV customers.

DIRECTV-4S gives American viewers a wide range of broadcast services, while heralding tomorrow's multi-beam multimedia satellites.

Built by Boeing Satellite Systems in El Segundo, California, DIRECTV-4S will be positioned at 101 degrees West. It is equipped with 38 high-power Ku-band transponders to provide direct-to-home delivery of local channel programming using digital compression techniques and 10 transponders for national service coverage.

Arianespace's eighth launch of the year will use an Ariane 44LP, the version fitted with two solid-propellant and two liquid-propellant strap-on boosters.

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1 - Arianespace Flight 146 mission

The 145th Ariane launch (Flight 146) is scheduled to place the DIRECTV - 4S satellite into a geostationary transfer orbit using an ARIANE 44LP launch vehicle equipped with two solid strap-on boosters (PAP) and two liquid strap-on boosters (PAL). This will be the 107th Ariane 4 launch and the 26th in the ARIANE 44LP configuration. It will be launched from the Ariane launch complex n°2 (ELA2), in Kourou, French Guiana. The launch vehicle performance requirement is 4 371 kg (9 616 lb) of which 4 300 kg (9 460 lb) represent the mass of the spacecraft to be separated on the injection orbit.

Injection orbit

Perigee	200 km
Altitude Apogee	35 786 km at injection
Inclination	7 degrees

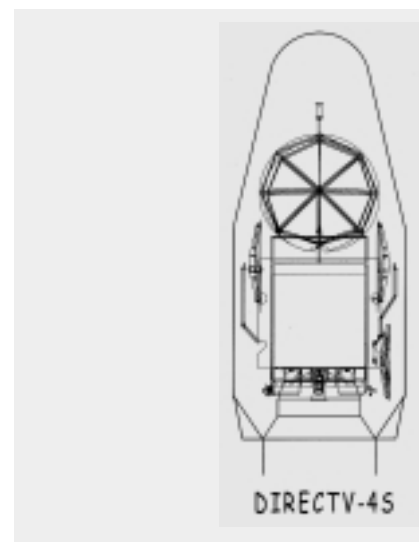
The ARIANE 44LP launcher lift-off for Flight 146 is scheduled on the night of November 26 to 27, 2001 as early as possible within the following launch window :

Launch opportunity

GMT	Paris time	Washington time	Kourou time
From 00:35 am	01:35 am	07:35 pm	09:35 pm
to 01:13 am	02:13 am	08:13 pm	10:13 pm
on November 27, 2001	November 27, 2001	November 26, 2001	November 26, 2001

Ariane payload configuration

The DIRECTV - 4S satellite was built by Boeing Satellite Systems in El Segundo (California) for the operator DIRECTV, Inc.
Orbital position: 101° West, over the Pacific Ocean.



2. Range operations campaign: ARIANE 44LP – DIRECTV - 4S

The actual work for satellite range operations lasts 9 working days for DIRECTV - 4S from its arrival in Kourou (before encapsulation).

The ARIANE 44LP preparation campaign lasts 23 working days.

Satellite and launch vehicle campaign calendar

<i>Ariane activities</i>	<i>Dates</i>	<i>Satellite activities</i>
Campaign start review	October 26, 2001	
First stage erection	October 26, 2001	
Second stage erection	October 29, 2001	
Liquid strap-on boosters erection	Oct. 31/Nov. 2, 2001	
Third stage erection	November 5, 2001	
	November 6, 2001	DIRECTV - 4S arrival in Kourou and beginning of its preparation in S3B building.
	November 12, 2001	Beginning of DIRECTV - 4S filling operations.
Roll-out to launch pad	November 14, 2001	
Solid strap-on boosters erection	November 15-16, 2001	
D-7 Friday, Nov. 16, 2001	Start of combined operations	
D-6 Monday, Nov. 19	Satellite encapsulation operations.	
D-5 Tuesday, Nov. 20	Satellite composite transfer to the launch pad.	
D-4 Wednesday, Nov. 21	Satellite composite mating onto launcher and overall checks.	
D-3 Thursday, Nov. 22	Launch Rehearsal	
D-2 Friday, Nov. 23	Launch Readiness Review (RAL) and launcher arming.	
D-1 Saturday, Nov. 24	Filling of 1st stage, 2nd stage and liquid boosters with UH 25 and N2O4.	
D-0 Monday, Nov. 26	Launch Countdown including 3rd stage filling with liquid oxygen and liquid hydrogen.	

3. Launch countdown and flight events

The final launch countdown runs through all the final launcher and satellite-related operations. It configures the vehicle and its payload for ignition of the first stage and PAL engines at the selected launch time or 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.

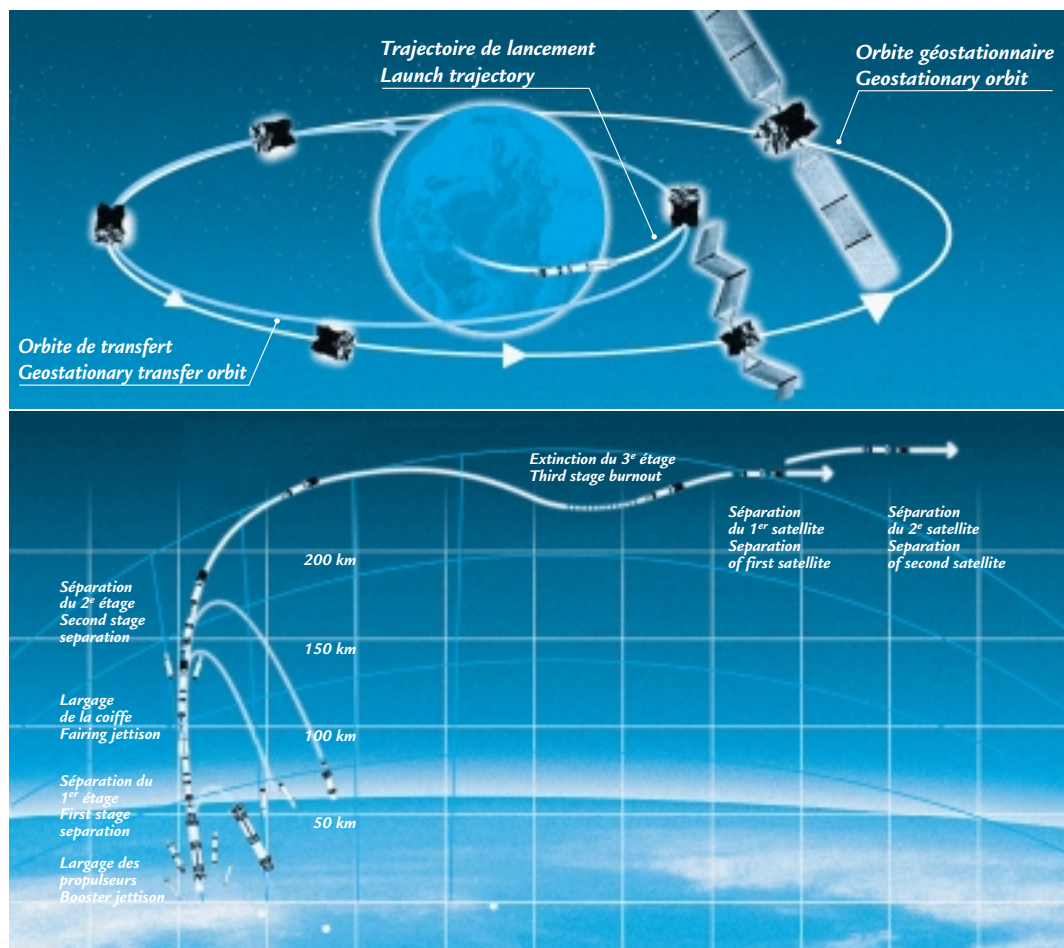
Time	Events
- 12h 30 mn 00 s	Start of final countdown.
- 5 h 35 mn 00 s	Start of gantry withdrawal.
- 3 h 35 mn 00 s	Start of the 3rd stage filling operations with liquid hydrogen and liquid oxygen.
- 1 h 5 mn 00 s	Activation of launcher telemetry, radar transponders, telecommand.
- 6 mn 00 s	"Green 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.
H0	Ignition of first stage and liquid strap-on boosters engines.
+ 4,2 s	Ignition of solid strap-on boosters.
+ 4,4 s	Lift-off.
+ 13 s	End of vertical ascent phase of pitch motion (10 s duration).
+ 1 mn 07 s	Solid strap-on boosters jettison.
+ 2 mn 27 s	Liquid strap-on boosters jettison.
+ 3 mn 31 s	First stage separation.
+ 3 mn 34 s	Second stage ignition.
+ 4 mn 40 s	Fairing jettison.
+ 5 mn 43 s	Second stage separation.
+ 5 mn 48 s	Third stage ignition.
+ 6 mn 50 s	Launcher acquired by Natal station.
+ 12 mn 50 s	Launcher acquired by Ascension Island station.
+ 17 mn 40 s	Launcher acquired by Libreville station.
+ 18 mn 19 s	Third stage shutdown sequence.
+ 21 mn 02 s	DIRECTV - 4S separation.
+ 21 mn 11 s	Start of the third stage avoidance maneuver.
+ 24 mn 45 s	End of Arianespace Flight 146 mission.

4. Flight 146 Trajectory

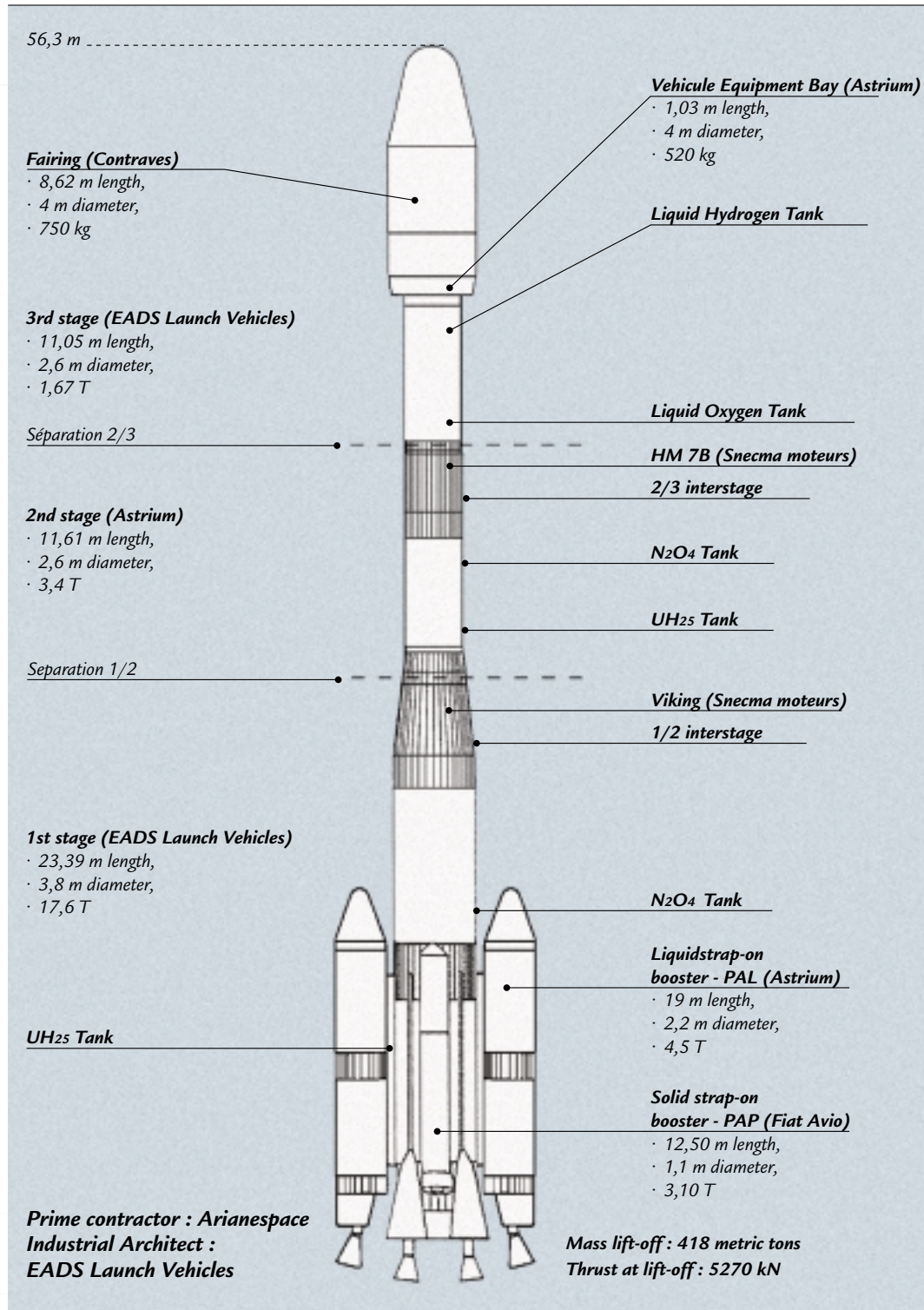
The launcher ascends vertically from lift-off to H0+16 sec. During a period of 10 sec. after this vertical ascent, the launch vehicle tilts in the pitch plane defined by the trajectory and pre-calculated by the on-board computer.

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 128 kg (268 lb). This ensures reaching this orbit with a probability of about 95% before the exhaustion of the third stage propellant. The roll law is applied so as to improve the launcher/ground station radio link budget.

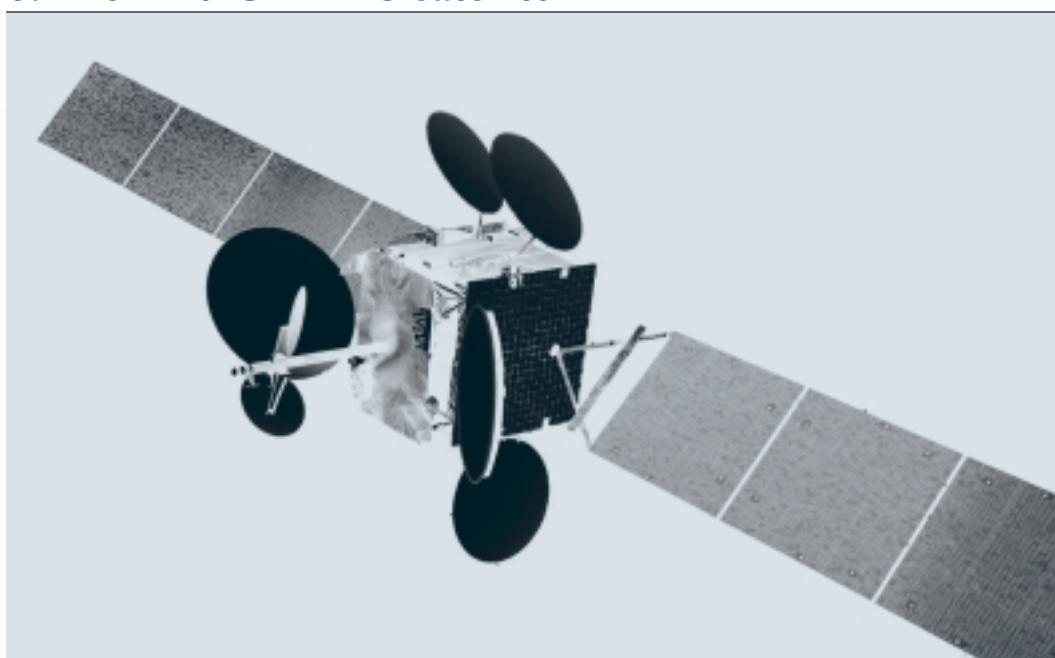
Typical trajectory for standard geostationary transfer orbit and ground station visibility



5. The 44LP launch vehicle



6. The DIRECTV - 4S satellite



Customer	DIRECTV, Inc.	
Prime contractor	Boeing Satellite Systems, El Segundo (California)	
Mission	DIRECTV	
Mass	Total mass (at lift-off)	4 300 kg (9 460 lb)
Dry mass		2 100 kg (4 620 lb)
Stabilization	3 axis	
Dimensions		2.7 m x 3.6 m x 4.0 m
Span in orbit	26.2 m	
Platform	601 HP Bus Block 1	
Payload	38 Ku band transponders for spot beam, 10 transponders for national beam	
On-board power	8.1 kW (end of life)	
Life time	15 years	
Orbital location	101° West, above the Pacific Ocean, west of the Galapagos Islands	
Coverage area	The Continental United States, Hawaii and Alaska.	

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Annex 1 - Arianespace Flight 146 key personnel

In charge of the launch campaign

Mission Director	(CM)	Gilles TRIAY	ARIANESPACE
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In charge of the launch service contracts

ARIANE Payload Manager			
DIRECTV - 4S Mission Manager	(RCUA)	Christophe BARDOU	ARIANESPACE
Deputy Mission Manager	(RCUA/A)	Stephen HALL	ARIANESPACE

In charge of DIRECTV - 4S satellite

Satellite Mission Director	(DMS)	Philip J. GOSWITZ	DIRECTV
Satellite Project Manager	(CPS)	Ronald E. DUKAT	BSS
Satellite Preparation Manager	(RPS)	Brad CROCKER/Stephen BLOSSFELD	BSS

In charge of the launch vehicle

Launch Site Operations Manager	(COEL)	Pierre-François BENAITEAU	ARIANESPACE
Ariane Production Project Manager	(CPAP)	Manuel SANCHEZ	ARIANESPACE

In charge of the Guiana Space Center (CSG)

Range Operations Manager	(DDO)	Thierry WILMART	CNES/CSG
Flight Safety Officer	(RSV)	Patrice BENARROCHE	CNES/CSG

Annex 2 - Launch environment conditions

The acceptable 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 engine ignition (H0) ;
- engine parameter checkout (conducted in parallel by the two computers, starting at H0 + 2.8 s.) ;
- solid boosters ignition (H0 + 4.2 s.) ;
- opening of the launch table clamps (releasing the launch vehicle between H0 + 4. 4s. 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 order book

To date 192 satellites and 38 auxiliary payloads have been launched by Arianespace.
Out of the 242 launch services contracted since 1981 by Arianespace and before Flight 146, 41 satellites and 9 ATV missions remain to be launched (2 confidential contracts at the request of customers).

Europe 12 satellites

Astra 1K, X, 3A
e-Bird
Envisat-1/PPF
Hot Bird 6
MSG-1 & 2
Rosetta
Spot 5
Stentor
Syracuse III
+ 9 ATV launches

International organizations 9 satellites

Ameristar (Worldspace)
Inmarsat 4
Intelsat 904, 905, 906, 907
New Skies Satellites 6 & 7
Stellat
Middle-East and Africa 1 satellite
Amos 2

Americas 9 satellites

Anik F2 (Canada)
DIRECTV-4S (USA)
Galaxy 12 (USA)
Galaxy VR & IRR (USA)
GE TBD (USA)
Loralsat 3 (USA)
Wild Blue 1 & 2 (USA)

Asia 8 satellites

Insat 3C, 3A & 3E (India)
JCSat 8 (Japan)
L-Star A & B (Thailand/Laos)
N-Star C (Japan)
Optus C1 (Australia)

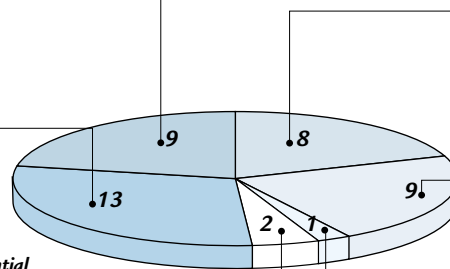
International

- Inmarsat
- Intelsat
- New Skies
- Stellat
- Worldspace

Europe

- ESA
- Eumetsat
- Eutelsat
- France
- Luxembourg

Confidential
at the request of customers



Asia

- Australia
- India
- Japan
- Thailand/Laos

Americas

- Canada
- USA

Middle East and Africa

- Israel

Appendix 5 - Arianespace, its relations with ESA et 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.

Use of the Guiana Space Center

The "Centre Spatial Guyanais" (CSG), CNES's launch base near Kourou, has all the equipment needed for launching spacecraft: radar tracking stations, telemetry receiving stations, a meteorology station, a telecommand station, safety facilities, etc.

It became operational in 1968 for the purpose of the French National Space Program.

ESA built its own launch facilities, the ELA 1 and ELA 2 complexes (for Ariane 4) and ELA 3 (for Ariane 5) and the EPCU payload preparation complex. These facilities comprise Europe's Spaceport. The use of these facilities requires CSG's technical and operational resources, especially during launch operations. The French Government has granted ESA the right to use the CSG for its space programs. In return, ESA shares in the costs of operating the CSG.

Arianespace directly covers the costs of use, maintenance and upgrading of the Ariane launch sites and the payload preparation complex.