

TELESAT ANIK F2

Ariane to launch the world's largest communications satellite

Arianespace Flight 163 will place the Anik F2 communications satellite into geostationary transfer orbit for North American operator Telesat. Anik F2 is the fifth Canadian satellite to be lofted by the European launcher, following Anik E2 in April 1991, Anik E1 in September 1991, MSAT 1 in April 1996 and Anik F1 in November 2000.

Telesat is a pioneer in satellite communications and system management. It deploys a fleet of satellites that provide broadcast distribution and communications services across the Americas, and is a highly-respected consultant and partner in satellite ventures around the world. Telesat is a wholly-owned subsidiary of BCE Inc., one of the world's leading telecommunications companies.

Telesat's Anik F2 uses the new Boeing 702 platform built by Boeing Satellites Systems, Inc. (BSS) in El Segundo, California. The largest communications satellite ever, it will weigh over 5,950 kilograms (13,118 lb) at launch. Anik F2 is fitted with 38 Ka-band transponders, 32 Ku-band transponders and 24 C-band transponders.

Positioned at 111.1 degrees West, it will provide high-speed Internet access and digital communications services across all of North America. Anik F2 has a design life of 15 years.

- 1 - ARIANESPACE FLIGHT 163 MISSION.
- 2 - RANGE OPERATIONS CAMPAIGN:
ARIANE 163 - ANIK F2.
- 3 - LAUNCH COUNTDOWN AND FLIGHT EVENTS.
- 4 - FLIGHT 163 TRAJECTORY.
- 5 - THE ARIANE 5 LAUNCH VEHICLE.
- 6 - THE ANIK F2 SATELLITE.

APPENDICES

1. Flight 163 Key personnel.
2. Launch environment conditions.
3. Synchronized sequence.
4. ARIANESPACE, its relations with ESA and CNES.



1. Arianespace Flight 163 mission

The 163rd Ariane launch (Flight 163/Ariane 519) will use an Ariane 5 to place one telecommunications satellite into geostationary transfer orbit: ANIK F2 for North American operator, Telesat.

For Arianespace, this marks the sixteenth commercial mission of the Ariane 5 launcher.

The Ariane 516 launcher will carry a payload of 6,246 kg (13,744 lb), including 5,950 kg (13,118 lb) for the satellite.

The launch will be carried out from the ELA 3 launch complex in Kourou, French Guiana.

Injection orbit

Perigee altitude	580 km
Apogee altitude	35,810 km at injection
Inclination	6,8° degrees

The lift-off is scheduled on the night of July 12 to 13, 2004 as soon as possible within the following launch window :

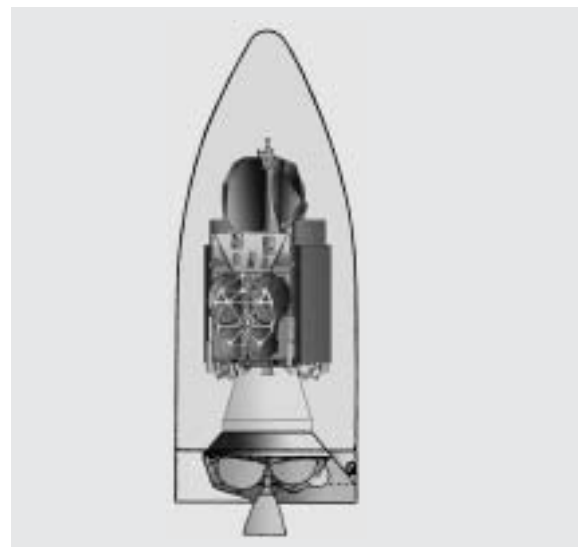
Launch opportunity

	Universal time (GMT)	Paris time	Washington and Ottawa time	Kourou time
Between	00:43 am	02:43 am	08:43 pm	09:43 pm
and	01:29 am	03:29 am	09:29 pm	10:29 pm
on	July 13, 2004	July 13, 2004	July 12, 2004	July 12, 2004

Ariane V163 payload configuration

The **ANIK F2 satellite** was built by Boeing Satellite Systems in El Segundo (California).

Orbital position: 111.1° West, above the Pacific Ocean.



2. Range operations campaign : ARIANE 5 – ANIK F2

The actual work for satellite range operations lasts 12 working days for Anik F2 from its arrival in Kourou (before beginning combined operations).
The Ariane 5 preparation campaign lasts 34 working days.

Satellites and launch vehicle campaign calendar

<i>Ariane activities</i>	<i>Dates</i>	<i>Satellites activities</i>
Campaign start review	May 27, 2004	
EPC Erection	May 27, 2004	
EAP transfer and positioning	May 28, 2004	
Integration EPC/EAP	June 1, 2004	
EPS Erection	June 3, 2004	
Integration equipment bay	June 3, 2004	
	June 8, 2004	Arrival in Kourou and beginning of ANIK F2 preparation campaign in SSC building
	June 17, 2004	Transfer of ANIK F2 into the SSA building
	June 18, 2004	ANIK F2 filling operations in SSA building
Roll-out from BIL to BAF	June 22, 2004	

Satellite and launch vehicle campaign final calendar

J-7	Thursday, July 1	ANIK F2 integration on adaptor and transfer into BAF building
J-6	Friday, July 2	ANIK F2 integration on launcher
J-5	Saturday, July 3	Fairing integration on launcher
J-4	Wednesday, July 7	Filling of SCA with N ₂ H ₄
J-3	Thursday, July 8	Filling of EPS with N ₂ O ₄ - Launch rehearsal.
J-2	Friday, July 9	Launcher final preparation and arming of launch vehicle - Launch readiness review (RAL)
J-1	Sunday, July 11	Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC Helium sphere
J-0	Monday, July 12	Launch countdown including EPC filling with liquid oxygen and liquid hydrogen

3 - Launch countdown and flight events

The countdown comprises all final preparation steps for the launcher, the satellites and the launch site. The nominal countdown leads to the ignition of the main stage engine, then the two solid boosters, for a lift-off at the targeted time, as early as possible in the satellites launch window.

The countdown culminates in a synchronized sequence (see appendix 3), which is managed by the control station and onboard computers starting at T-7 minutes.

If an interruption in the countdown results in T-0 falling outside the launch window, then the launch will be delayed by one, two or more days, depending on the problem involved, and the solution developed.

Time	Events
- 11h 30 mn	Start of final countdown
- 7 h 30 mn	Check of electrical systems
- 4 h 50 mn	Start of filling of main cryogenic stage with liquid oxygen and hydrogen
- 3 h 20 mn	Chilldown of Vulcain main stage engine
- 1 h 10 mn	Check of connections between launcher and telemetry, tracking and command systems
- 7 mn 00 s	"All systems go" report, allowing start of synchronized sequence
- 4 mn 00 s	Tanks pressurized for flight
- 1 mn 00 s	Switch to onboard power mode
- 04 s	Onboard systems take over
- 03 s	Unlocking of guidance systems to flight mode

HO	Ignition of the cryogenic main stage engine (EPC)	ALT (km)	V. rel. (m/s)
+ 7.0 s	Ignition of solid boosters	0	0
+ 7.3 s	Lift-off	0	0
+ 12.8 s	End of vertical climb and beginning of pitch rotation (10 seconds duration)	0.085	34.3
+ 17.0 s	Beginning of roll manoeuvre	0.296	66.5
+ 2 mn 21 s	Jettisoning of solid boosters	66.6	2079.9
+ 3 mn 16 s	Jettisoning of fairing	105.8	2312.6
+ 8 mn 14 s	Acquisition by Natal tracking station	134.2	5452.7
+ 9 mn 53 s	Extinction of main cryogenic stage	143.2	7675.3
+ 9 mn 59 s	Separation of main cryogenic stage	145.8	7694.2
+ 10 mn 06 s	Ignition of the storable propellant stage (EPS)	148.8	7691.0
+ 12 mn 38 s	Acquisition by Ascension tracking station	223.7	7848.1
+ 22 mn 02 s	Acquisition by Malindi tracking station	877.3	8380.4
+ 27 mn 02 s	Extinction of EPS	1604.4	8553.0
+ 28 mn 37 s	Separation of ANIK F2 satellite	1905.8	8444.1
+ 45 mn 52 s	End of ARIANESPACE Flight 163 mission	6023.3	6302.7

4 - Flight 163 trajectory

The launcher's attitude and trajectory are totally controlled by the two onboard computers, located in the Ariane 5 vehicle equipment bay (VEB).

7.0 seconds after ignition of the main stage cryogenic engine at T-0, the two solid-propellant boosters are ignited, enabling lift-off. The launcher first climbs vertically for 6 seconds, then rotates towards the East. It maintains an attitude that ensures the axis of the launcher remains parallel to its velocity vector, in order to minimize aerodynamic loads throughout the entire atmospheric phase, until the solid boosters are jettisoned.

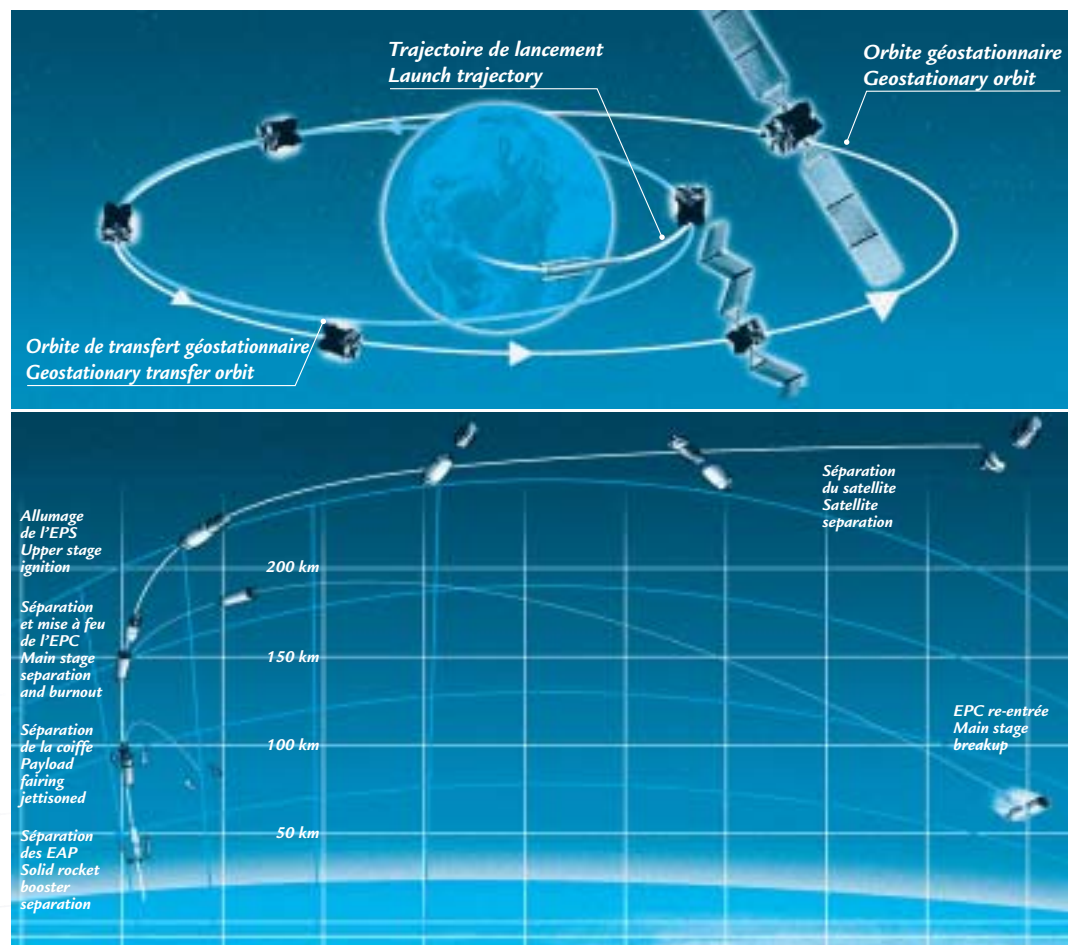
Once this first part of the flight is completed, the onboard computer optimizes the trajectory in real time, minimizing propellant consumption to bring the launcher first to the intermediate orbit targeted at the end of the main stage propulsion phase, and then the final orbit at the end of the flight of the upper stage.

The main stage falls back off the coast of South America in the middle of the Pacific Ocean.

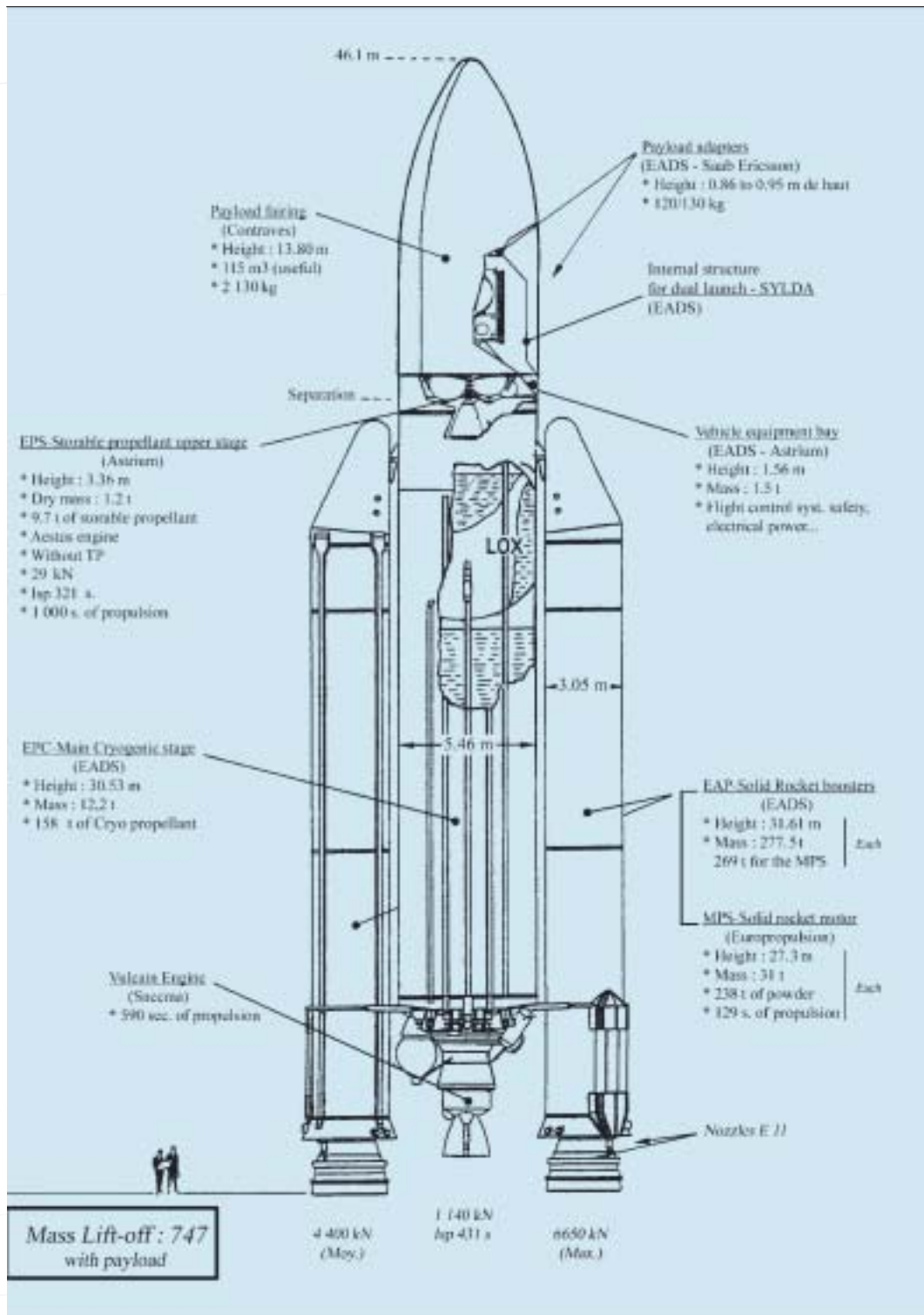
On orbital injection, the launcher will have attained a relative velocity of approximately 8,650 meters/second, and will be at an altitude of about 1,610 kilometers.

The fairing protecting the ANIK F2 spacecraft is jettisoned shortly after the boosters are jettisoned at about T+196 seconds.

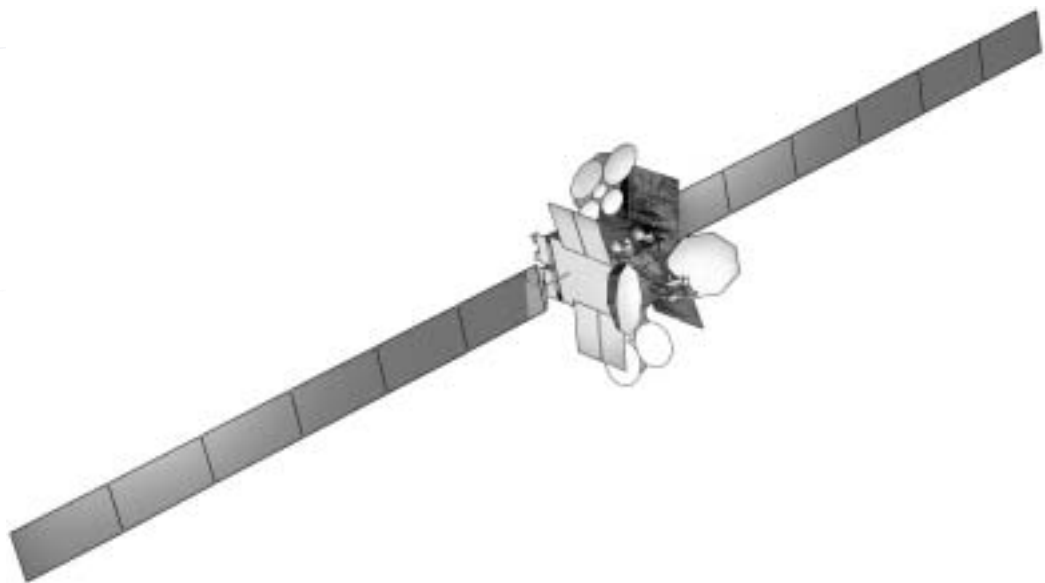
Standard Ariane 5 trajectory for geostationary transfer orbit



5 - ARIANE 5G LAUNCHER (Industrial architect: EADS Space Transportation)



6 - The ANIK F2 satellite



Customer	TELESAT	
Prime contractor	Boeing Satellite Systems	
Mission	High-speed Internet and digital communications	
Mass	Total mass at lift-off	5,950 kg (13,118 lb)
Stabilization	3 axis	
Dimensions	at launch	7.3 x 3.8 x 3.4 meters
Dimensions	in orbit	7.3 x 8.2 x 47.9 meters
Platform	Boeing 702	
Payload	32 Ku band transponders, 38 Ka band transponders and 24 C band transponders	
On-board power	15 kW (at end of life)	
Life time	15 years	
Orbital position	111.1° West, above the Pacific Ocean	
Coverage area	North America	

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Appendix 1 - Arianespace Flight 163 key personnel

In charge of the launch campaign

Mission Director	(CM)	Bernard PUYGRENIER	ARIANESPACE
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In charge of the launch service contract

ARIANE Payload Manager	(RCUA)	Alexandre MADEMBA-SY	ARIANESPACE
ARIANE Deputy Mission Manager	(RCUA/A)	Gilles TRIAY	ARIANESPACE

In charge of ANIK F2 satellite

Satellite Mission Director	(DMS)	Trevor LEWIS	TELESAT
Telesat F2 Program Manager	(Deputy DMS)	Mike MINHAS	TELESAT
Satellite Program Manager	(CPS)	Robert HLADEK	BOEING SATELLITE SYSTEMS
Satellite Preparation Manager	(RPS)	James FRANKLIN	BOEING SATELLITE SYSTEMS

In charge of the launch vehicle

Launch Site Operations Manager	(COEL)	Christel STURBOIS	ARIANESPACE
ARIANE Production Project Manager	(CPAP)	Denis SCHMITT	ARIANESPACE

In charge of the Guiana Space Center (CSG)

Range Operations Manager	(DDO)	Bruno GILLES	CNES/CSG
Flight Safety Officer	(RSV)	Isabelino DENIS / Fleur LEFEVRE	CNES/CSG

Appendix 2 - Launch environment conditions

Acceptable wind speed limits at lift-off range from between 7.5 m/s. to 9.5 m/s. according to the wind direction. The most critical is a northerly wind. For safety reasons, the wind's speed on the ground (Kourou) and at a high altitude (between 10,000 and 20,000 m) is also taken into account.

Appendix 3 - The synchronized sequence

The synchronized sequence starts 7 mn before ignition (T-0). It is primarily designed to perform the final operations on the launcher prior to launch, along with the ultimate checks needed following switchover to flight configuration. As its name indicates, it is fully automatic, and is performed concurrently by the onboard computer and by two redundant computers at the ELA 3 launch complex until T-4 seconds.

The computers command the final electrical operations (startup of the flight program, servocontrols, switching from ground power supply to onboard batteries, etc.) and associated checks. They also place the propellant and fluid systems in flight configuration and perform associated checks. In addition, it handles the final ground system configurations, namely :

- startup of water injection in the flame trenches and jet guide (T-30 sec);
- hydrogen aspiration for chilldown of the Vulcain engine in the jet guide (T-18 sec);
- burnoff of hydrogen used for chilldown (T-5.5 sec);

At T-4 seconds, the onboard computer takes over control of final engine startup and lift-off operations :

- It starts the ignition sequence for the Vulcain main stage engine (T-0);
- It checks engine operation (from T+4.5 to T+7.3 sec);
- It commands ignition of the solid boosters for immediate lift-off at T+7.3 seconds.

Any shutdown of the synchronized sequence after T - 7 mn automatically places the launcher back in its T-7 min configuration.

Appendix 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).

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 250. Share capital totals 317,362,320 €.

Arianespace is in charge of these main areas :

- markets launch services to customers throughout the world ;
- finances and supervises the construction of Ariane expendable launch vehicles ;
- conducts launches from Europe's Spaceport of Kourou in French Guiana ;
- insures customers for launch risks.

Personalized reliable service forms an integral part of Arianespace launch package. It includes the assignment of a permanent team of experts to each mission for the full launch campaign.

Today, Arianespace's offer is mainly based on Ariane 5. With its proven experience, demonstrated business model and unquestioned credibility, Arianespace has been committed for more than 24 years to providing its customers - satellite operators around the world - a technically and economically reliable means offer to place their satellites on the targeted orbit at the right moment. This offer is strengthened by the flexibility provided by the three launcher fleet - Ariane 5, Soyuz and Vega - and by the Launch Services Alliance, which gives customers mission back-up aboard alternative launch systems.

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 launching of operational launchers to a private-law industrial structure, in the form of ARIANESPACE company, placing at its disposal the facilities, equipment and tooling needed of producing and launching the ARIANE launchers.

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 and its new launch facilities : ELA 3 (qualified on November, 1997). 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 5 Oct, 1998, 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.

THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For over 30 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches.

It mainly comprises the following:

- CNES/CSG technical center, including various resources and facilities that are critical to launch base operation, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (ECPU), in particular the new S5 facility.
- Ariane launch complexes (ELA), comprising the launch zone and launcher integration buildings.
- Various industrial facilities, including those operated by Regulus, Europropulsion, Air Liquide Spatial Guyane and EADS, which contribute to the production of Ariane 5 elements. A total of 40 European manufacturers and local companies are involved in operations.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), French space agency CNES and Arianespace.

ESA has helped change the role of the Guiana Space Center, in particular by funding the construction of the launch complexes, payload processing buildings and associated facilities. Initially used for the French space program, the Guiana Space Center has gradually become Europe's own spaceport, according to the terms of an agreement between ESA and the French government.

To ensure that the Spaceport is available for its programs, ESA takes charge of the lion's share of CNES/CSG fixed expenses, and also helps finance the fixed costs for the ELA launch complexes.

French space agency CNES plays several roles at the Space Center:

- It designs all infrastructures and, on behalf of the French government, is responsible for safety and security.
- It provides the resources needed to prepare the satellites and launcher for missions.

Whether during tests or actual launches, CNES is also responsible for overall coordination of operations. It collects and processes all data transmitted from the launcher via a network of receiving stations, to track Ariane rockets throughout their trajectory.

In French Guiana, Arianespace is in charge of launcher integration in the Launcher Integration Building (BL), coordinates satellite preparation in the payload processing facility (EPCU), and integrates them on the launcher in the Final Assembly Building (BAF). It is also responsible for launch operations, from the CDL 3 Launch Center.

Arianespace has created a top-flight team and array of technical resources to get launchers and satellites ready for their missions. Building on this unrivalled expertise and outstanding local facilities, Arianespace is now the undisputed benchmark in the global launch services market.