Flight 162

Serving faithful customers

For its fourth launch of the year, Arianespace will send two communications satellites into geostationary transfer orbit: INSAT 3E for the Indian Space Research Organization (ISRO), and e-BIRD™ for the operator Eutelsat.

ESA's scientific spacecraft, SMART-1, will join the two main payloads on the launcher.

INSAT 3E will be the eleventh Indian satellite orbited by an Ariane launch vehicle. Arianespace has teamed up with ISRO (Indian Space Research Organization) for 22 years, starting with the launch of the organization's first geostationary satellite, Apple, in June 1981.

INSAT 3E was designed, produced and integrated by ISRO in Bangalore, India. Positioned at 55 degrees East, it will be fitted with 36 C–band and extended C–band transponders.

The satellite will provide telecommunications and video transmission services for the Indian sub-continent.

e-BIRD™ will be positioned at 33 degrees East and will provide broadband services in Europe and Turkey. e-BIRD™ is a further step in Eutelsat's objective to be a key player in the broadband market, to serve businesses, consumers and regional public services and administrations.

e-BIRD™ was designed and built by Boeing Satellite Systems in El Segundo (California) and will be equipped with 20 ku–band transponders. This will be the 20th satellite launched by Arianespace for Eutelsat.

SMART-1, the auxiliary payload, will be the first European mission to the Moon. Its main objective is to test solar electric propulsion for future deep space missions.

The ESA's spacecraft was built by the Swedish Space Corporation, with contributions from international team of engineers and scientists.

For Flight 162, Arianespace will use a standard Ariane 5G launch vehicle.

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

1. Arianespace Flight 162 mission

The 161st Ariane launch (Flight 162/Ariane 516) will use an Ariane 5 to place 2 telecommunications satellites into geostationary transfer orbit: INSAT 3E for the Indian Space Research Organization (ISRO), and e-BIRD™ for the operator Eutelsat.
ESA's scientific spacecraft, SMART-1, will join the two main payloads on the launcher.
For Arianespace, this marks the fourteenth commercial mission of the Ariane 5 launcher.
The Ariane 516 launcher will carry a triple payload of 6,163 kg (13,558 lb), including 4,643 kg (10,214 lb) for the satellites.
The launch will be carried out from the ELA 3 launch complex in Kourou, French Guiana.

Injection orbit

Perigee altitude	***650 km***
Apogee altitude	***35,786 km at injection***
Inclination	***7° degrees***

The lift-off is scheduled on the night of September 27 to 28, 2003 as soon as possible within the following launch window :

Launch opportunity

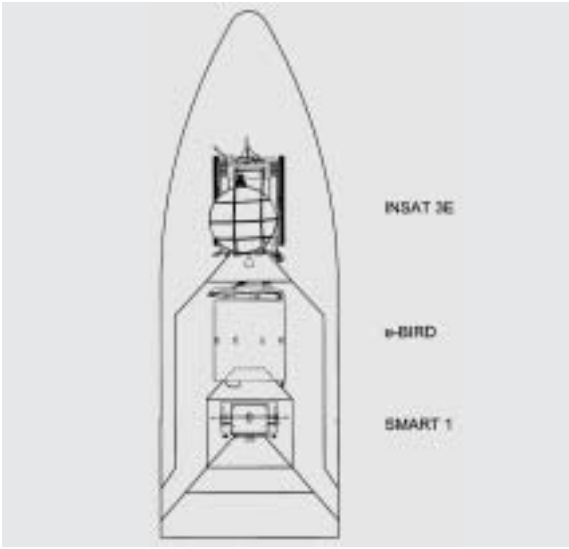
	Universal time (GMT)	*Paris time*	*Washington time*	*Kourou time*	*Bangalore time*
Between	*11:02 pm*	*01:02 am*	*07:02 pm*	*08:02 pm*	*04:32 am*
and	*11:21 pm*	*01:21 am*	*07:21 pm*	*08:21 pm*	*04:51 am*
on	*September 27, 2003*	*September 28, 2003*	*September 27, 2003*	*September 27, 2003*	*September 28, 2003*

Ariane V162 payload configuration

The INSAT 3E satellite was designed, assembled and integrated by ISRO in Bangalore (India).
Orbital position: : 55° East, above the Indian Ocean.

The e-BIRD™ satellite was built by Boeing Satellite Systems in El Segundo (California).
Orbital position: 33° East, above Central Africa.

The SMART-1 satellite was built by the Swedish Space Corporation for ESA.
Orbital position: polar elliptical, from 300 km to 10 000 km above the Moon's surface.



2. Range operations campaign : ARIANE 5 – INSAT 3E – e-BIRD™ – SMART-1

The actual work for satellite range operations lasts 27 working days for INSAT 3E from its arrival in Kourou (before beginning combined operations). Additional checks were carried on the INSAT 3E satellite from August 18 to September 12.
The actual work for satellite range operations lasts 14 working days for e-BIRD™ from its arrival in Kourou (before beginning combined operations).
The actual work for satellite range operations lasts 12 working days for SMART-1 from its arrival in Kourou (before beginning combined operations).

Satellites and launch vehicle campaign calendar

Ariane activities	*Dates*	*Satellites activities*
	July 15, 2003	*Arrival in Kourou and beginning of SMART-1 preparation campaign in S5B building*
	July 16, 2003	*Arrival in Kourou and beginning of INSAT 3E preparation campaign in S5C building*
Campaign start review	*July 17, 2003*	
EPC Erection	*July 17, 2003*	
EAP transfer and positioning	*July 21, 2003*	
Integration EPC/EAP	*July 22, 2003*	
EPS Erection	*July 23, 2003*	
Integration equipment bay	*July 23, 2003*	
	July 28, 2003	*SMART-1 filling operations in S5B building*
	August 1, 2003	*Arrival in Kourou and beginning of e-BIRD™ preparation campaign in S5C-South building*
	August 5, 2003	*Transfer of INSAT 3E into the S5A building*
	August 7, 2003	*INSAT 3E filling operations in S5A building*
	August 12, 2003	*e-BIRD™ filling operations in S3B building*
Roll-out from BIL to BAF	*August 12, 2003*	

Satellites and launch vehicle campaign final calendar

J-9	*Wednesday, September 17*	*SMART-1 integration on launcher*
J-8	*Thursday, September 18*	*e-BIRD™ integration on ACU*
J-7	*Friday, September 19*	*INSAT 3E integration on SYLDA*
J-6	*Saturday, September 20*	*e-BIRD™ integration on launcher*
J-5	*Monday, September 22*	*INSAT 3E integration on launcher*
J-4	*Tuesday, September 23*	*Filling of SCA with N_2H_4*
J-3	*Wednesday, September 24*	*Filling of EPS with N_2O_4 - Launch rehearsal.*
J-2	*Thursday, September 25*	*Launcher final preparation and arming of launch vehicle - Launch readiness review (RAL)*
J-1	*Friday, September 26*	*Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC Helium sphere*
J-0	*Saturday, September 27*	*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.

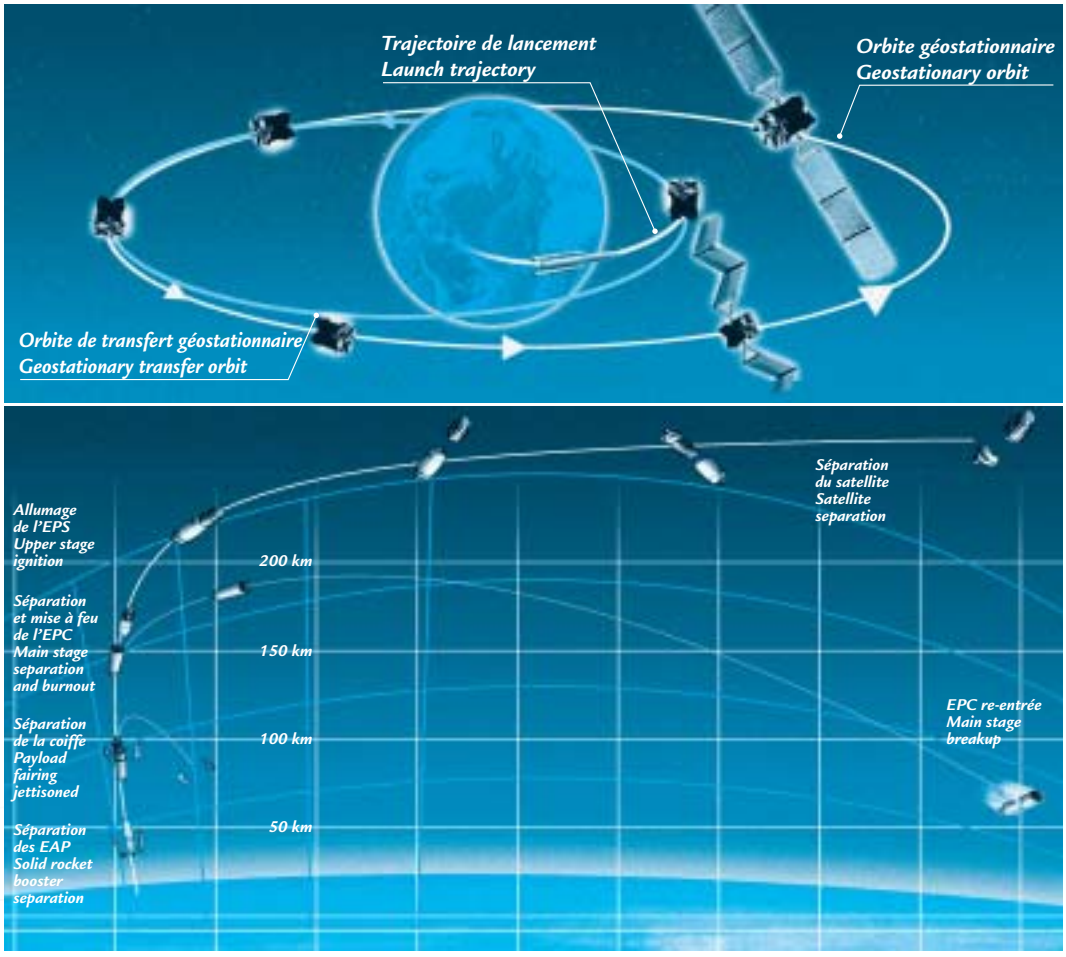
Time	Events
– 11h 30 mn	Start of final countdown
– 7 h 30 mn	Check of electrical systems
– 4 h 50 mn	Start of filling of main cryogenic stage with liquid oxygen and hydrogen
– 3 h 20 mn	Chilldown of Vulcain main stage engine
– 1 h 10 mn	Check of connections between launcher and telemetry, tracking and 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
+ 13 s	End of vertical climb and beginning of pitch rotation (10 seconds duration)	0.077	29.0
+ 17 s	Beginning of roll manoeuvre	0.314	67.0
+ 2 mn 21 s	Jettisoning of solid boosters	68.0	2070.6
+ 3 mn 10 s	Jettisoning of fairing	105.5	2268.8
+ 8 mn 13 s	Acquisition by Natal tracking station	136.3	5478.5
+ 9 mn 51 s	Extinction of main cryogenic stage	142.4	7667.4
+ 9 mn 57 s	Separation of main cryogenic stage	144.8	7686.8
+ 10 mn 04 s	Ignition of the storable propellant stage (EPS)	147.7	7683.3
+ 12 mn 30 s	Acquisition by Ascension tracking station	220.2	7838.3
+ 21 mn 48 s	Acquisition by Malindi tracking station	885.2	8324.1
+ 26 mn 56 s	Extinction of EPS	1619.0	8589.9
+ 29 mn 01 s	Separation of INSAT 3E satellite	2002.9	8323.5
+ 32 mn 43 s	Separation of Sylda 5	2777.7	7829.8
+ 34 mn 17 s	Separation of e-BIRD™ satellite	3126.4	7625.1
+ 39 mn 54 s	Separation of ACU + ACY	4463.0	6925.4
+ 41 mn 40 s	Separation of SMART-1 satellite	4894.6	6722.7
+ 57 mn 22 s	End of ARIANESPACE Flight 162 mission	8717.5	5275.6

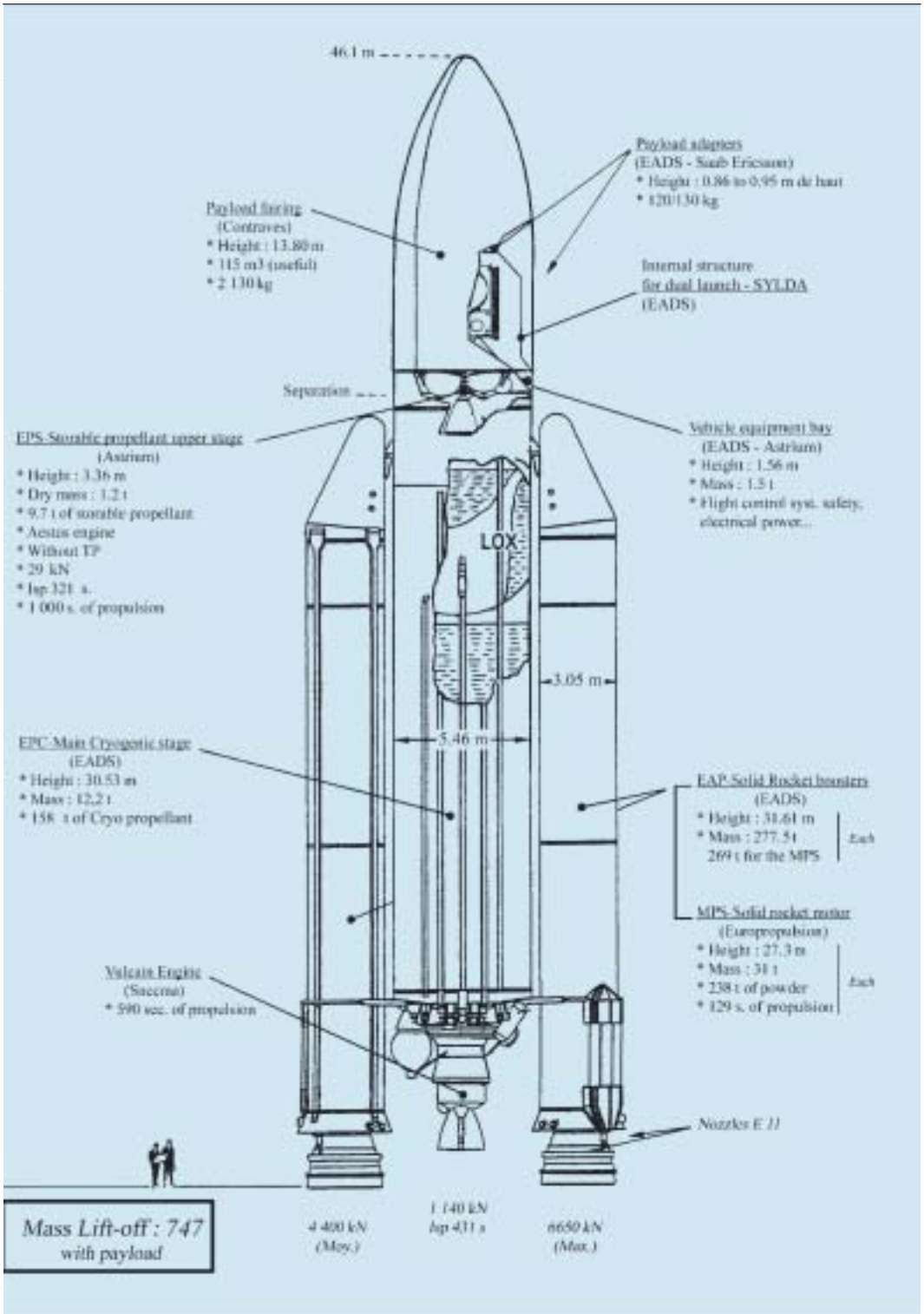
4 - Flight 162 trajectory

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 8,588 meters/second, and will be at an altitude of about 1625 kilometers.
The fairing protecting the INSAT 3E/e-BIRD™ and SMART-1 spacecrafts is jettisoned shortly after the boosters are jettisoned at about T+190 seconds.

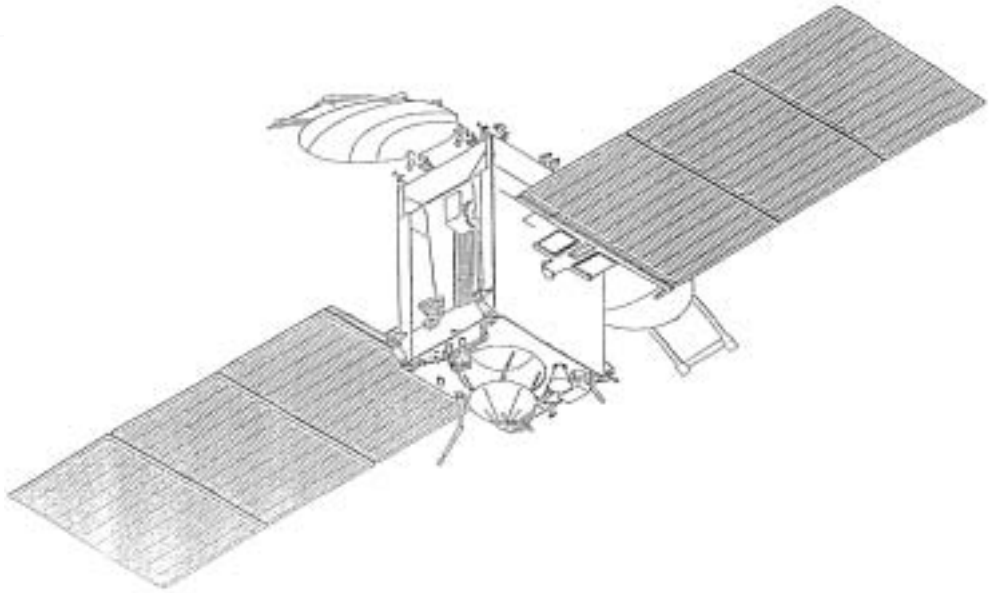
Standard Ariane 5 trajectory for geostationary transfer orbit



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



6 - The INSAT 3E satellite



Customer	***Indian Space Research Organisation (ISRO)***	
Prime contractor	*ISRO/ISAC*	
Mission	*Telecommunications and video broadcasting*	
Mass	*Total mass at lift-off*	*2,750 kg*
	Dry mass	*1,180 kg*
Stabilization	*3 axis stabilized*	
Dimensions		*2.8 x 1.77 x 2.0 m*
	Span in orbit	*15.4 m*
Payload	*24 C band transponders,* *12 extended C band transponders*	
On-board power	*2,400 W (at end of life)*	
Life time	*15 years (design)*	
Orbital position	*55° East (above the Indian Ocean)*	
Coverage area	*India*	

Press Contact :

Shri S. Krishnamurthy
Director, P and PR
ISRO Headquarters
New Bel Road, Bangalore 560 094
Tel.: (91 80) 3415275
Fax: (91 80) 3412253

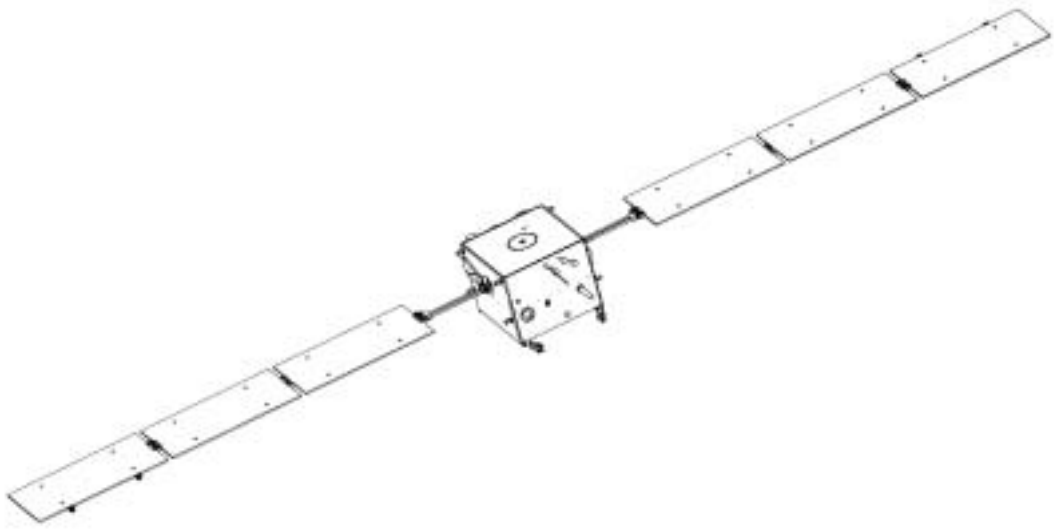
7 - The e-BIRD™ satellite

Customer	***EUTELSAT S.A.***	
Prime contractor	*Boeing Satellite Systems*	
Mission	*Two ways broadband services*	
Mass	*Total mass at lift-off* *Dry mass*	*1,525 kg (3,362 lb)* *1,300 kg (2,860 lb)*
Stabilization	*spinned*	
Dimensions ***Dimensions***	*at launch* *in orbit*	*3.16 x 2.16 x 2.17 m* *7.83 m high x 2.16 m*
Platform	*Boeing 376 HP*	
Payload	*20 Ku band transponders*	
On-board power	*1,641 W (at end of life)*	
Life time	*10 years*	
Orbital position	*33° East, above Central Africa*	
Coverage area	*Europe and Turkey*	

Press Contact:

Vanessa O'CONNOR / Frédérique GAUTIER
EUTELSAT
Tel.: + 33 (1) 53 98 47 57 - Fax: + 33 (1) 53 98 37 88
E-mail : voconnor@eutelsat.fr / fgautier@eutelsat.fr

8. The SMART-1 satellite



Customer	***European Space Agency (ESA)***	
Prime contractor	*Swedish Space Corporation*	
Mission	*Testing electric propulsion and other deep space technologies, performing scientific observation of the Moon*	
Mass	*Total mass at lift-off*	*370 kg*
	Dry mass	*255 kg*
Stabilization	*3 axis*	
Dimensions		*1,2 x 1,2 x 1,2 m*
	Span in orbit	*14 m*
On-board power	*1,900 W (beginning of life)*	
Life time	*24-30 months*	
Orbital position	*Polar elliptical around the Moon (300 x 10,000 km)*	

Press contact

Franco BONACINA
ESA, Spokesman and Head of Media Relations Division
Tel.: +33 (0) 1 53 69 77 13
E-mail : franco.bonacina@esa.int

Appendix 1 - Arianespace Flight 162 key personnel

In charge of the launch compaign			
Mission Director	*(CM)*	*Rémi KOCHER*	*ARIANESPACE*
In charge of the launch service contracts			
ARIANE Payload Manager	*(RCUA)*	*Jean-François LAUMONIER*	*ARIANESPACE*
ARIANE Deputy Mission Managers	*(RCUA/A)*	*Michael CALLARI/Christophe BARDOU*	*ARIANESPACE*
In charge of INSAT 3E satellite			
Satellite Mission Director	*(DMS)*	*V.R. PRATAB*	*ISRO*
Satellite Launch Director	*(CPS)*	*V.R. KATTI*	*ISRO*
Satellite Preparation Manager	*(RPS)*	*P.L. DANABALAN*	*ISRO*
In charge of e-BIRD™ satellite			
Satellite Mission Director	*(DMS)*	*Jean-Jacques DUMESNIL*	*EUTELSAT*
Satellite Project Director	*(CPS)*	*Philippe GINDRE*	*EUTELSAT*
Satellite Project Manager	*(RPS)*	*Jay STALRIT*	*BSS*
In charge of SMART-1 satellite			
Satellite Mission Director and Project Director	*(DMS/CPS)*	*Giuseppe RACCA*	*ESA*
Satellite Project Manager	*(RPS)*	*Luciano DI NAPOLI*	*ESA*
In charge of the launch vehicle			
Launch Site Operations Manager	*(COEL)*	*Daniel GROULT*	*ARIANESPACE*
ARIANE Production Project Manager	*(CPAP)*	*Jean-Marie CHOMMELOUX*	*ARIANESPACE*
In charge of the Guiana Space Center (CSG)			
Range Operations Manager	*(DDO)*	*Pierre RIBARDIERE*	*CNES/CSG*
Flight Safety Officer	*(RSV)*	*Franck CHATTON*	*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 guite (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 PRODUTION 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 350. 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.

The world's commercial satellite operators have contracted to launch with Arianespace. This record is the result of our company's realistic cost-effective approach to getting satllites 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 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 (BIL), 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.