

A boost for civil and military communications

Arianespace's fourth mission of the year will place two communications satellites into geostationary transfer orbit: Syracuse 3A for the French Ministry of Defense, and Galaxy 15 for the American satcom operator PanAmSat.

Syracuse 3A is the first satellite in France's new third-generation Syracuse III system, dedicated to secure military communications.

French defense procurement agency DGA (Délégation Générale pour l'Armement), part of the MoD, is in charge of this program, with management provided by the Observation, Telecommunications and Information Programs Department (SPOTI).

Alcatel Alenia Space and Thales Communications are joint prime contractors. The Syracuse 3A satellite is designed by Alcatel Alenia Space, while Thales Communications is in charge of the ground segment, comprising some 600 networked ground stations. The satellite will weigh about 3,700 kg at launch.

NATO has chosen the Syracuse III system as part of its NATO Satcom Post-2000 program. Led by France, in collaboration with the UK's Skynet system and Italy's Sicral system, this project is designed to pool satellite resources for subsequent sharing with other NATO members. It is the cornerstone in a European military satcom system.

Galaxy 15, weighing nearly 2,000 kg at liftoff, is the third next generation satellite that PanAmSat has ordered from Orbital Sciences Corporation to provide greater flexibility and availability to its customers.

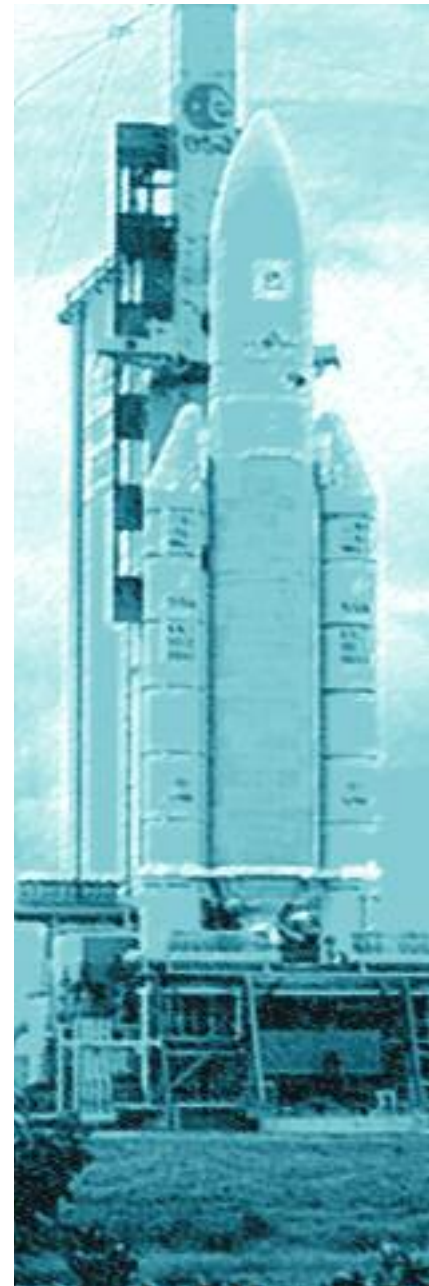
The launch of Galaxy 15 is a breakthrough for PanAmSat, carrying a dual C-band and L-band payload that will cement its leadership position in HDTV and video for cable as well as drive new government-related business. To be located at 133 degrees west longitude, the satellite is the third of PanAmSat's next-generation satellites from Orbital Sciences Corporation, providing coverage of all 50 U.S. states.

Since PAS 1, launched by the first Ariane 4 in June 1988, Galaxy 15 is the 20th PanAmSat satellite to be launched by Arianespace's family of launch vehicles.

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1. Arianespace Flight mission

Ariane's 167th launch will orbit the Syracuse 3A communications satellite for the French Ministry of Defense, and the Galaxy 15 communications satellite for the American operator PanAmSat.

It will be the 23rd Ariane 5 launch.

The launcher will have a total payload of 6, 478 kg, including 5, 758 kg for the two satellites to be released separately into their assigned orbits.

The mission will be carried out from Ariane Launch Complex No. 3 (ELA 3) in Kourou, French Guiana.

Injection orbit

<i>Perigee altitude</i>	565 km
<i>Apogee altitude</i>	35,863 km at injection
<i>Inclination</i>	7° degrees

The lift-off is scheduled on the night of October 13 to 14, 2005 as soon as possible within the following launch window:

Launch opportunity

	<i>Universal time (GMT)</i>	<i>Paris time</i>	<i>Washington time</i>	<i>Kourou time</i>
<i>Between</i>	10:32 pm	00:32 am	06:32 pm	07:32 pm
<i>and</i>	11:56 pm	01:56 am	07:56 pm	08:56 pm
<i>on</i>	October 13, 2005	October 14, 2005	October 13, 2005	October 13, 2005

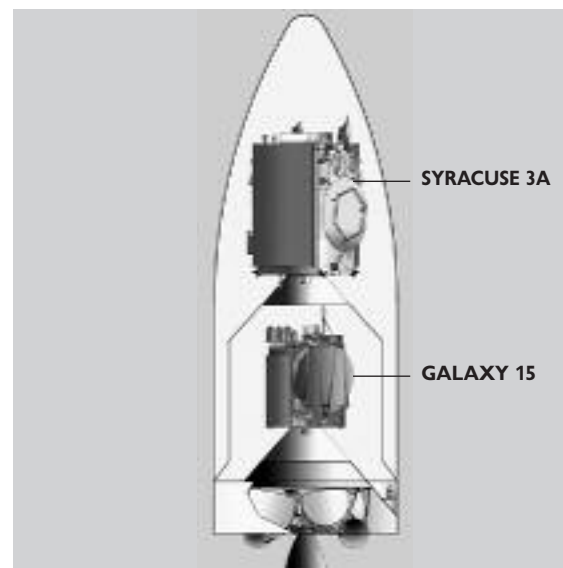
Ariane payload configuration

SYRACUSE 3A was built by Alcatel Alenia Space, which is in charge of the space segment, while Thales Communications is responsible for the ground segment.

Orbital position: 47 degrees East longitude

GALAXY 15 was built by Orbital Sciences Corporation in Dulles, Virginia, on behalf of the private U.S. operator PanAmSat.

Orbital position: 133 degrees West longitude



2. Range operations campaign: ARIANE 5 - SYRACUSE 3A - GALAXY 15

Satellites and launch vehicle campaign calendar

Ariane activities	Dates	Satellites activities
	May 3, 2005	Arrival in Kourou of SYRACUSE 3A
	August 17, 2005	Arrival in Kourou and beginning of GALAXY 15 preparation campaign in S5C building
	August 25, 2005	Transfer of GALAXY 15 from S5C to S5A building
Campaign start review	August 25, 2005	
EPC Erection	August 25, 2005	
EAP transfer and positioning	August 26, 2005	
Integration EPC/EAP	August 27, 2005	
EPS Erection	September 1st, 2005	
Integration equipment bay	September 1st, 2005	
	September 1st-3, 2005	GALAXY 15 filling operations in S5A building
	September 4, 2005	GALAXY 15 integration on adaptor
	September 5, 2005	Beginning of SYRACUSE 3A preparation campaign in S1B building
Roll-out from BIL to BAF	September 15, 2005	
	September 12, 2005	Transfer of SYRACUSE 3A into S5A building
	September 15-16, 2005	SYRACUSE 3A filling operations in S5A building

Satellites and launch vehicle campaign final calendar

J-9	Tuesday, Sept. 20	SYRACUSE 3A integration on adaptor and transfer to BAF
J-8	Wednesday, Sept. 21	SYRACUSE 3A integration on SYLDA
J-7	Wednesday, Oct. 5	GALAXY 15 transfer into BAF building
J-6	Thursday, Oct. 6	GALAXY 15 integration on the launcher
J-5	Friday, Oct. 7	Composite integration on the launcher
J-4	Saturday, Oct. 8	Filling of SCA with N ₂ H ₄
J-3	Monday, Oct. 10	Filling of EPS with N ₂ O ₄ - Launch rehearsal
J-2	Tuesday, Oct. 11	Launcher final preparation and arming of launch vehicle - Launch readiness review (RAL)
J-1	Wednesday, Oct. 12	Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC Helium sphere
J-0	Thursday, Oct. 13	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. If it proceeds as planned, the countdown leads to the ignition of the main stage engine, then the two boosters, for a liftoff 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 means that T-0 falls 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
- 11 h 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	Liftoff	0	0
+ 12,5 s	End of vertical climb and beginning of pitch rotation	0,09	40,0
+17 s	Beginning of roll manoeuvre	0,37	82,1
+ 2 mn 18 s	Jettisoning of solid boosters	68	2111
+ 3 mn 08 s	Jettisoning of fairing	105	2317
+ 8 mn 14 s	Acquisition by Natal tracking station	135	5668
+ 9 mn 39 s	Extinction of main cryogenic stage	142	7694
+ 9 mn 45 s	Separation of main cryogenic stage	145	7709
+ 9 mn 52 s	Ignition of the storable propellant stage (EPS)	148	7706
+ 12 mn 21 s	Acquisition by Ascension tracking station	224	7847
+ 21 mn 51 s	Acquisition by Malindi tracking station	871	8384
+ 26 mn 37 s	Extinction of EPS	1561	8633
+ 29 mn 28 s	Separation of SYRACUSE 3A satellite	2098	8281
+ 39 mn 49 s	Separation of GALAXY 15 satellite	3740	7370
+ 56 mn 17 s	End of Arianespace mission	8532	5767

4. Launch trajectory

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

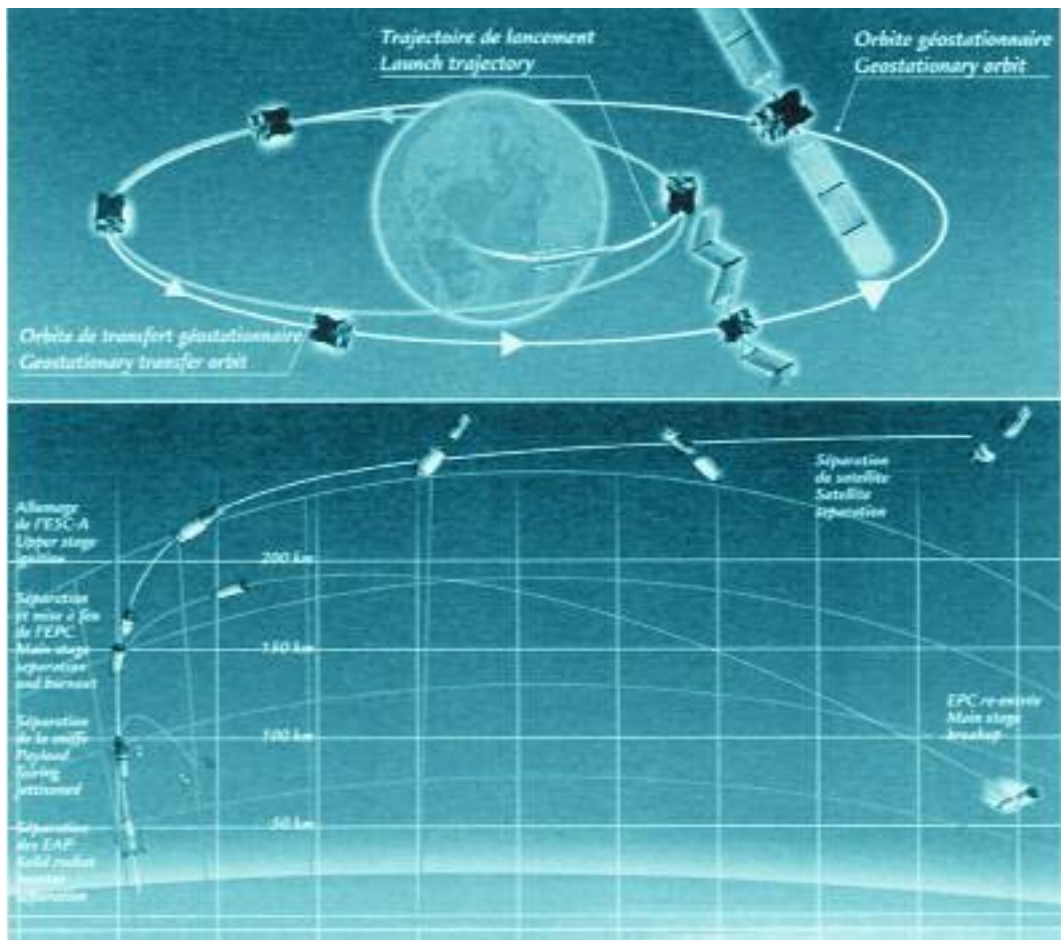
7.05 seconds after ignition of the main stage cryogenic engine at T-0, the two solid-propellant boosters are ignited, enabling liftoff. The launcher first climbs vertically for 6 seconds, then rotates towards the East. It maintains an attitude that ensures the axis of the launcher remains parallel to 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 computers optimize 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 cryogenic stage.

The main stage falls back off the coast of Africa in the Atlantic Ocean (in the Gulf of Guinea).

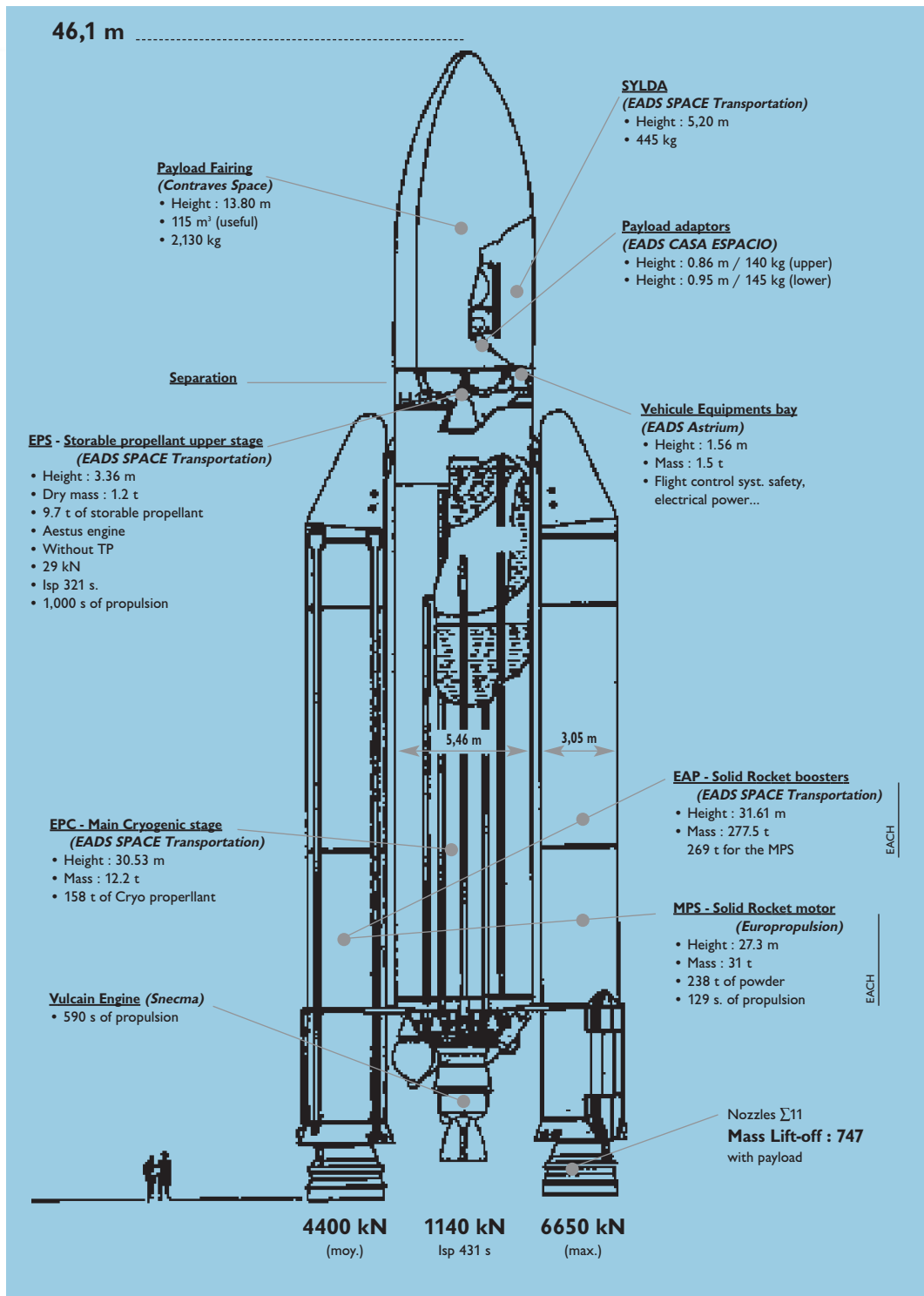
On orbital injection, the launcher will have attained a velocity of approximately 8,633 meters/second, and will be at an altitude of about 1,561 kilometers.

The fairing protecting the SYRACUSE 3A and GALAXY 15 spacecraft is jettisoned shortly after the boosters are jettisoned at about T+188 seconds.

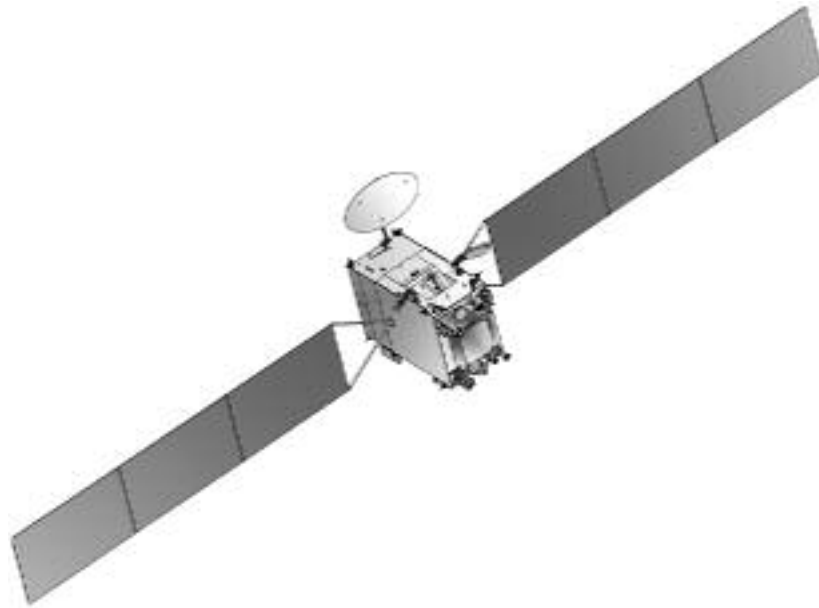
Standard Ariane 5 trajectory for geostationary transfer orbit



5. The Ariane 5G (Industrial architect: EADS SPACE Transportation)



6. The SYRACUSE 3A satellite



Customer	Alcatel Alenia Space for Ministère français de la Défense	
<i>Prime contractor</i>	Alcatel Alenia Space	
<i>Mission</i>	Military communications	
<i>Mass</i>	<i>Total mass at lift-off</i>	3.725 kg
<i>Stabilization</i>	3 axis	
<i>Dimensions</i>	<i>at launch</i>	3,9 x 2,3 x 2,3 m
	<i>span in orbit</i>	30 m
<i>Platform</i>	Spacebus 4000 B3	
<i>Payload</i>	15 channels: 9 SHF and 6 EHF	
<i>On-board power</i>	5.640 W (end of life)	
<i>Life time</i>	12 years	
<i>Orbital position</i>	47° East	

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7. The GALAXY 15 satellite



Customer	PanAmSat	
Prime contractor	Orbital Sciences Corporation (Dulles, Virginia)	
Mission	Video programming, high-definition (HDTV), VOD and IPTV service + 1 L-band payload for GPS navigation to in-flight aircraft	
Mass	Total mass at lift-off	2.033 kg
	Dry mass	885 kg
Stabilization	3 axis	
Dimensions	at launch	3,3 x 1,9 x 1,5 m
	span in orbit	12,6 m
Platform	Orbital Star 2	
Payload	28 C Band transponders:	
	Transmit frequency range:	3.7-4.2 Ghz
	Receive frequency range:	5.9-6.4 Ghz
On-board power	2.9 kW (beginning of life)	
Life time	15 years	
Orbital position	133° West longitude	
Coverage area	The 50 United States	

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Appendix 1. Arianespace SYRACUSE 3A/GALAXY 15 launch key personnel

In charge of the launch campaign

<i>Mission Director</i>	<i>(CM)</i>	<i>Dan MURE</i>	<i>ARIANESPACE</i>
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In charge of the launch service contract

<i>Ariane Payload Manager</i>	<i>(RCUA)</i>	<i>Christophe BARDOU</i>	<i>ARIANESPACE</i>
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<i>Ariane Deputy Mission Manager</i>	<i>(RCUA/A)</i>	<i>Caroline ARNOUX</i>	<i>ARIANESPACE</i>
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In charge of SYRACUSE 3A satellite

<i>Satellite Mission Director</i>	<i>(DMS)</i>	<i>Christian HERBERE</i>	<i>Alcatel Alenia Space</i>
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<i>Satellite Program Manager</i>	<i>(CPS)</i>	<i>Jacques ANSELME</i>	<i>Alcatel Alenia Space</i>
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<i>Technical Manager</i>	<i>(RT)</i>	<i>Didier RENE</i>	<i>Alcatel Alenia Space</i>
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In charge of GALAXY 15 satellite

<i>Satellite Mission Director</i>	<i>(DMS)</i>	<i>Brian SING</i>	<i>PanAmSat</i>
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<i>Satellite Program Manager</i>	<i>(CPS)</i>	<i>Doug CONNELLY</i>	<i>Orbital Sciences Corp</i>
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<i>Satellite Preparation Manager</i>	<i>(RPS)</i>	<i>Jim MOONEY</i>	<i>Orbital Sciences Corp</i>
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In charge of the launch vehicle

<i>Launch Site Operations Manager</i>	<i>(COEL)</i>	<i>Pierre-François BENAITEAU</i>	<i>ARIANESPACE</i>
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<i>Ariane Production Project Manager</i>	<i>(CPAP)</i>	<i>Denis SCHMITT</i>	<i>ARIANESPACE</i>
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In charge of the Guiana Space Center (CSG)

<i>Range Operations Manager</i>	<i>(DDO)</i>	<i>Thierry VALLEE</i>	<i>CNES/CSG</i>
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<i>Flight Safety Officer</i>	<i>(RSV)</i>	<i>Stéphane LOUVEL</i>	<i>CNES/CSG</i>
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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 395,010 €.

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 vehicle ;
- 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 updated 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 updated 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 bas operation, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (EPCU), 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 Spacial 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.