

## A BOOST FOR SPACE COMMUNICATIONS SATELLITES

For its first launch of the year, Arianespace will orbit two communications satellites: **ASTRA 3B** for the Luxembourg-based operator **SES ASTRA**, and **COMSATBw-2** for **Astrium** as part of a contract with the German Ministry of Defense.

The choice of Arianespace by leading space communications operators and manufacturers is clear international recognition of the company's excellence in launch services. Because of its reliability and availability, the Arianespace launch system continues to set the global standard.

Ariane 5 is the only commercial satellite launcher now on the market capable of simultaneously launching two payloads.

Over the last two decades, Arianespace and SES have developed an exceptional relationship. ASTRA 3B will be the 33rd satellite from the SES group (Euronext Paris and Luxembourg Bourse: SESG) to have chosen the European launcher. SES ASTRA operates the leading direct-to-home TV broadcast system in Europe, serving more than 125 million households via DTH and cable networks.

ASTRA 3B was built by Astrium using a Eurostar E 3000 platform, and will weigh approximately 5,500 kg at launch. Fitted with 60 active Ku-band transponders and four Ka-band transponders, ASTRA 3B will be positioned at 23.5 degrees East. It will deliver high-power broadcast services across all of Europe, and offers a design life of 15 years.

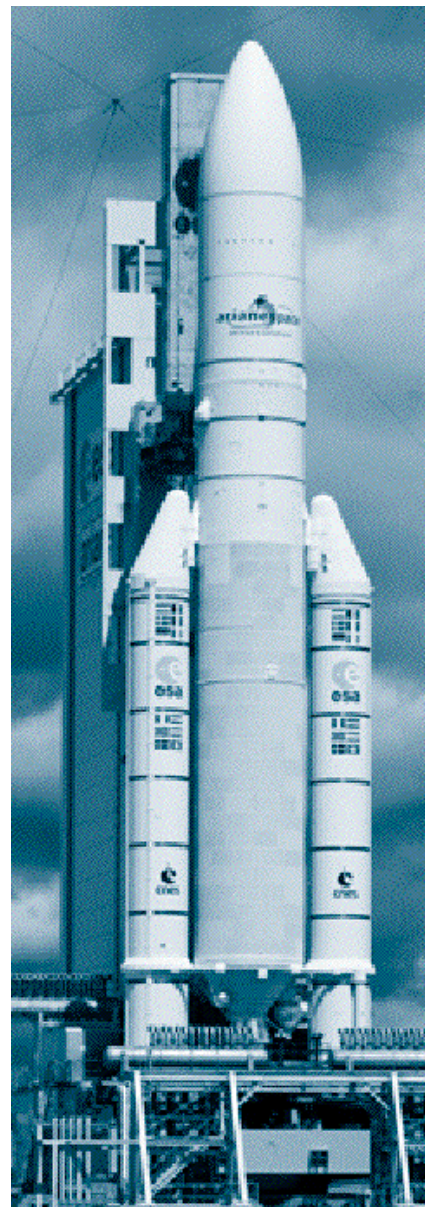
Astrium chose Arianespace for the launch of two military communications satellites, COMSATBw-1 and COMSATBw-2, as part of a satellite communications system supplied to the German Ministry of Defense. The first satellite in this family, COMSATBw-1, was launched by Arianespace in October 2009. COMSATBw-2 will be the 34th military payload lofted by Arianespace

For the first time, the German Ministry of Defense now deploys its own satellites in a secure network for voice, data, fax, video and multimedia transmissions. It chose the company MilSat Services GmbH, a joint venture of Astrium Services and ND Satcom, as prime contractor. Astrium, the European leader in civil and military communications satellites, is prime contractor for the space segment, comprising the two satellites supplied by Thales Alenia Space, based on the Spacebus platform and an Astrium payload. COMSATBw-2 will weigh about 2,500 kg at launch and has a design life of 15 years. Its footprint covers an area extending from the Americas to the Far East.

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## 1. Mission profile

The 194th Ariane mission will place two communications satellites into geostationary transfer orbit: ASTRA 3B for the Luxembourg-based operator SES ASTRA, and COMSATBw-2 for Astrium as part of a contract with the German Ministry of Defense.

This will be the 50th Ariane 5 launch

The launcher will be carrying a total payload of 9,116 kg, including 7,971 kg for the two satellites, which will be released into their targeted orbits.

The launch will take place from Ariane Launch Complex No. 3 (ELA 3) in Kourou, French Guiana.

<b>Injection orbit</b>	
<i>Perigee altitude</i>	<b>250 km</b>
<i>Apogee altitude</i>	<b>35,786 km at injection</b>
<i>Inclination</i>	<b>3° degrees</b>

Following additional checks, Arianespace has decided to restart the final countdown for its mission with the ASTRA 3B and COMSATBw-2 satellites.

Liftoff of the Ariane 5 launcher is now set for the night of Friday, May 21, as early as possible in the following launch window:

### **Launch opportunity**

	<i>Universal time (GMT)</i>	<i>Paris time</i>	<i>Kourou time</i>	<i>Washington time</i>
<i>Between</i>	10:01 pm	12:01 am	7:01 pm	6:01 pm
<i>and</i>	10:44 pm	12:44 am	7:44 pm	6:44 pm
<i>on</i>	May 21, 2010	May 22, 2010	May 21, 2010	May 21, 2010

## Configuration of Ariane payload

The ASTRA 3B satellite was built by Astrium in Toulouse, France for the operator SES ASTRA.

*Orbital position: 23.5° East*

The COMSATBw-2 satellite was built by Thales Alenia Space in Cannes, France, for Astrium, within the scope of a contract with the German Ministry of Defense.

*Orbital position : 13.2° East*



### 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.

<i>Time</i>	<i>Events</i>
- 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
- 05,5 s	Command issued for opening of cryogenic arms
- 04 s	Onboard systems take over
- 03 s	Unlocking of guidance systems to flight mode

<i>HO</i>	<i>Ignition of the cryogenic main stage engine (EPC)</i>	<i>ALT (km)</i>	<i>V. rel. (m/s)</i>
+ 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 (10 seconds duration)	0.085	36
+ 17 s	Beginning of roll manoeuvre	0.335	75
+ 2 mn 20 s	Jettisoning of solid boosters	67.0	1986
+ 3 mn 09 s	Jettisoning of fairing	106.5	2219
+ 7 mn 41 s	Acquisition by Natal tracking station	176.0	5500
+ 8 mn 55 s	Shut-down of main cryogenic stage	173.3	6916
+ 9 mn 01 s	Separation of main cryogenic stage	173.3	6943
+ 9 mn 05 s	Ignition of upper cryogenic stage (ESC-A)	173.3	6945
+ 13 mn 31 s	Acquisition by Ascension tracking station	153.0	7600
+ 18 mn 21 s	Acquisition by Libreville tracking station	182.0	8400
+ 23 mn 03 s	Acquisition by Malindi tracking station	450.0	9080
+ 24 mn 45 s	Shut-down of ESC-A / Injection	633.2	9372
+ 27 mn 40 s	Separation of ASTRA 3B satellite	981.5	9081
+ 31 mn 01 s	Separation of Sylva 5	1761.5	8494
+ 33 mn 21 s	Separation of COMSATBw-2 satellite	2248.9	8164
+ 49 mn 50 s	End of Arianespace Flight mission	6400	6088

## 4. Flight trajectory of ASTRA 3B & COMSATBw-2

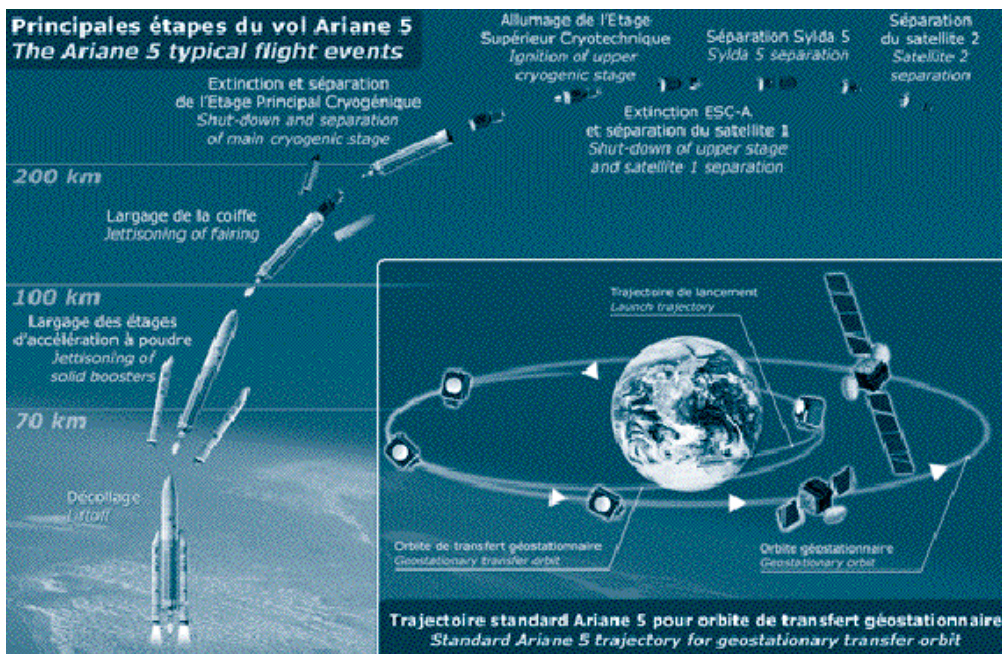
The launcher's attitude and trajectory are totally controlled by the two onboard computers, located in the Ariane 5 vehicle equipment bay (VEB).

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

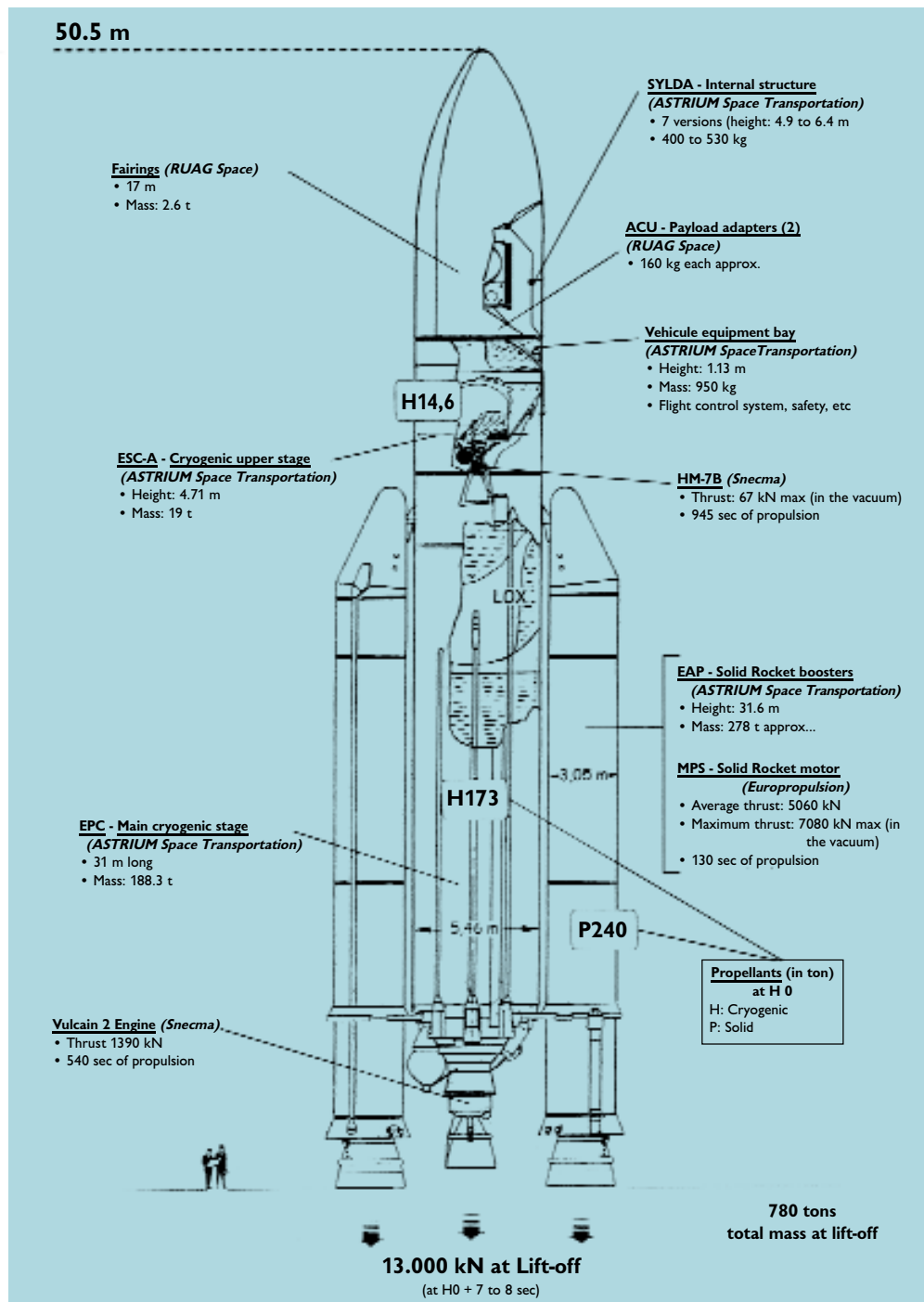
On orbital injection, the launcher will have attained a velocity of approximately 9372 meters/second, and will be at an altitude of about 633 kilometers.

The fairing protecting the ASTRA 3B et COMSATBw-2 spacecraft is jettisoned shortly after the boosters are jettisoned at about T+189 seconds.

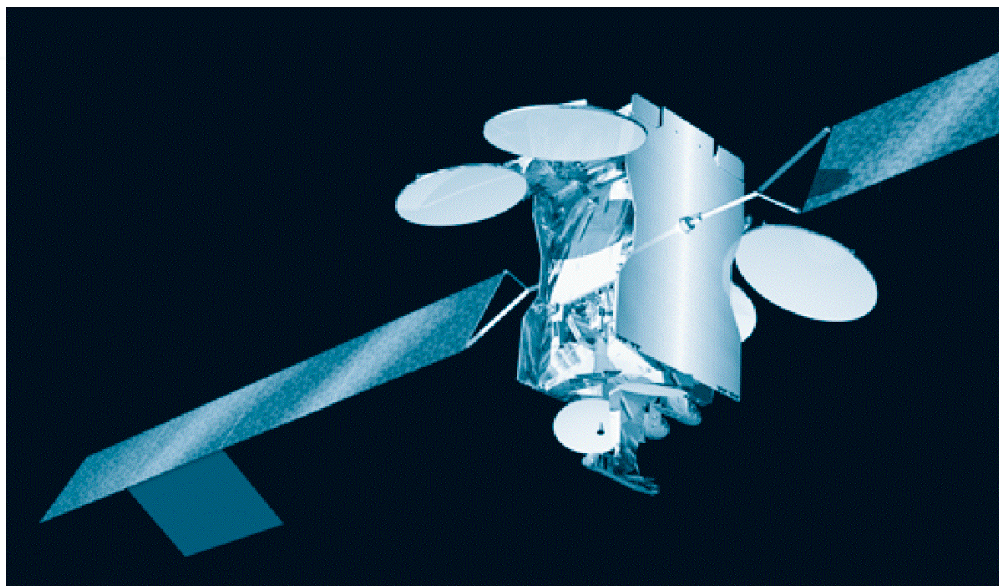
### Standard Ariane 5 trajectory for geostationary transfer orbit



## 5. The Ariane 5-ECA (Industrial prime contractor: ASTRIUM Space Transportation)



## 6. The ASTRA 3B satellite

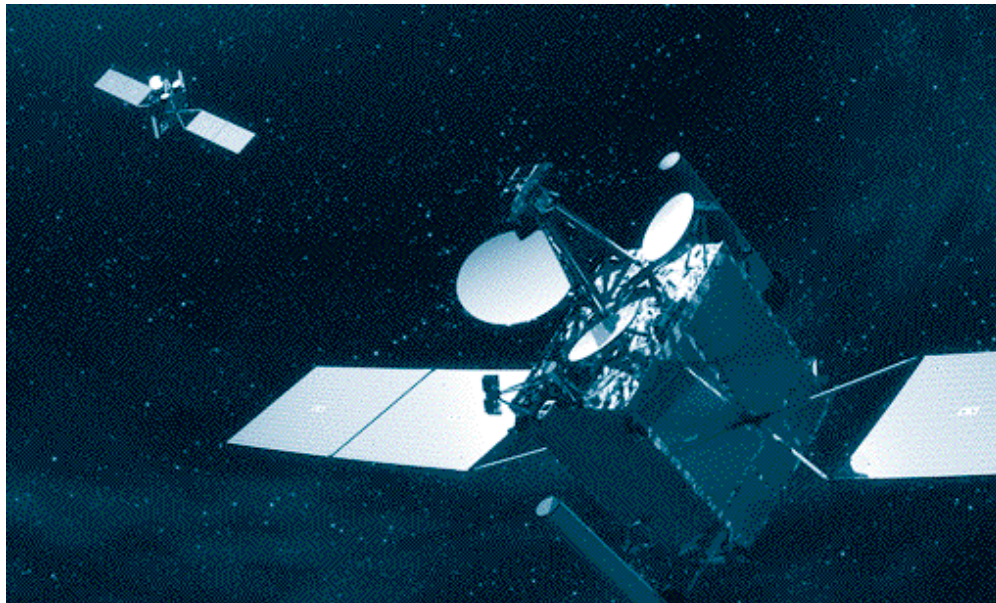


<i>Customer</i>	SES ASTRA
<i>Prime contractor</i>	Astrium
<i>Mission</i>	Telecommunications and Direct-to home (DTH) television services
<i>Mass</i>	Total mass at lift-off 5 471 kg
<i>Stabilization</i>	3 axis stabilized
<i>Dimensions</i>	4.5 x 3.2 x 2.8 m
<i>Span in orbit</i>	39.8 m
<i>Platform</i>	E 3000M
<i>Payload</i>	60 Ku-band transponders and 4 Ka-band transponders
<i>On-board power</i>	12 kW (end of life)
<i>Life time</i>	15 years
<i>Orbital position</i>	23.5° East
<i>Coverage area</i>	Europe.

### **Press Contact**

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## 7. The COMSATBw-2



<b>Customer</b>	German Ministry of Defense represented by IT-Amt	
<b>Prime contractor</b>	Astrium	
<b>Integrator</b>	Thales Alenia Space	
<b>Mission</b>	Secure military telecommunications	
<b>Mass</b>	Total mass at lift-off	2,440 kg
<b>Stabilization</b>	3 axis	
<b>Dimensions</b>	2,8 x 1,8 x 2,9 m	
<b>Span in orbit</b>	17.2 m	
<b>Platform</b>	Spacebus 3000 B2	
<b>Payload</b>	4 SHF-band transponders and 5 UHF-band transponders	
<b>On-board power</b>	3 205 W (end of life, Equinox)	
<b>Life time</b>	15 years	
<b>Orbital position</b>	13.2° East	

### **Press Contact**

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## Appendix 1. Arianespace ASTRA 3B & COMSATBw-2 launch key personnel

### *In charge of the launch campaign*

Mission Director	(CM)	Thierry WILMART	ARIANESPACE
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### *In charge of the launch service contract*

Program Director ASTRA 3B	(CP1)	Veronique LOISEL	ARIANESPACE
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Program Director COMSATBw-2	(CP2)	Jérôme RIVES	ARIANESPACE
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### *In charge of ASTRA 3B satellite*

Satellite Mission Director	(DMS)	Richard STARKOVIS	SES
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Satellite Program Manager	(CPS)	Pierre-François DELVAL	ASTRIUM
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Satellite Preparation Manager	(RPS)	Jean-François BADAQUI	ASTRIUM
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### *In charge of COMSATBw-2 satellite*

Satellite Mission Director	(DMS)	Anton LIBOSSEK	ASTRIUM
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Satellite Mission Deputy Director	(DMS/A)	Lionel IMBERT	ASTRIUM
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Satellite Program Manager	(CPS)	René NEYER	THALES
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Satellite Preparation Manager	(RPS)	Bernard ARTERO	THALES
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### *In charge of the launch vehicle*

Launch Site Operations Manager	(COEL)	Jean-Pierre BARLET	ARIANESPACE
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Ariane Production Project Manager	(CPAP)	Laurent JOURDAINNE	ARIANESPACE
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### *In charge of the Guiana Space Center (CSG)*

Range Operations Manager	(DDO)	Damien SIMON	CNES/CSG
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Range Operations Deputy	(DDO/A)	Thierry VALLEE	CNES/CSG
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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 and the Guiana Space Center

Arianespace was founded in 1980 as the world's first launch Service & Solutions company. Today, Arianespace has 24 shareholders from ten European countries (including French space agency CNES with 34%, EADS with 30%, and all European companies participating in the construction of Ariane launchers).

Since the outset, Arianespace has signed more than 300 launch contracts and launched 277 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace.

The company posted sales of 1046 million euros in 2009, and stayed in the black for the sixth year in a row.

At January 1, 2009, Arianespace had 309 employees, working at the company's headquarters in Evry (near Paris), the Guiana Space Center in French Guiana, where the Ariane, Soyuz and Vega launch pads are located, and offices in Washington, D.C., Tokyo and Singapore.

Arianespace offers launch Service & Solutions to satellite operators from around the world, including private companies and government agencies. These Service & Solutions call on three launch vehicles:

- The Ariane 5 heavy launcher, operated from the Guiana Space Center in Kourou, French Guiana.
- The Soyuz medium launcher. Currently in operation at the Baikonur Cosmodrome in Kazakhstan under the responsibility of Starsem, a Euro-Russian subsidiary of Arianespace, it will be launched from the Guiana Space Center in 2010.
- The Vega light launcher, to be launched from the Guiana Space Center starting in 2010.

Arianespace has also signed a mutual backup agreement with Boeing Launch Services and Mitsubishi Heavy Industries, through an entity called the Launch Services Alliance. This arrangement guarantees that customers' payloads will be launched in case the chosen launcher is unavailable for technical reasons.

With its family of launchers and this backup agreement, Arianespace won over half of the commercial launch contracts up for bid worldwide in the last two years. Arianespace now has a backlog of more than 40 satellites to be launched.

### 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 operations, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (EPCU), in particular the S5 facility.
- Ariane launch complexes (ELA), comprising the launch zone and launcher integration buildings.
- Various industrial facilities, including those operated by Regulux, 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.

The Guiana Space Center is preparing to welcome two new launch vehicles, Soyuz and Vega. The Soyuz launch complex (ELS) and the Vega launch complex (SLV) are now under construction.

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 the contracting authority in charge of operating the family of three launchers, Ariane, Soyuz and Vega.

Arianespace supervises the integration and functional checks of the Ariane launcher, built by EADS Astrium as production prime contractor, in the Launcher Integration Building (BIL). It then carries out acceptance tests of the launcher at the same time as satellite preparations in the Payload Preparation Complex (EPCU), operated by the Guiana Space Center (CSG). Arianespace next oversees final assembly of the launcher and integration of satellites in the Final Assembly Building (BAF), followed by transfer of the launcher to Launch Zone No. 3 (ZL3), and then final countdown and liftoff from Launch Complex No. 3 (CDL3).

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.