# A SATELLITE LAUNCH FOR THE BRITISH MOD AND MEXICO


**Arianespace will orbit two satellites on its seventh Ariane 5 launch of the year: the Skynet 5D military communications satellite for Astrium Services, on behalf of the British Ministry of Defence, and the Mexsat Bicentenario telecommunications satellite for the Mexican Secretariat of Communications and Transport.**

Arianespace's selection by the world's leading space telecommunications operators and manufacturers is clear international recognition of the company's excellence in launch services.

This launch also perfectly illustrates the strategic importance of Ariane, which guarantees independent access to space for European governments. Arianespace continues to confirm its position as the world's benchmark launch system for all telecommunications operators, whether civil or military.

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

The European launcher Ariane has already launched the Skynet 4B, 4C, 4E, 4F, 5A, 5B and 5C satellites for the British Ministry of Defence. Skynet 5D is the 38th military payload to be orbited by an Ariane launcher.

Skynet 5D will be launched on behalf of Astrium, which will deliver the satellite in orbit to Astrium Services. Astrium Services provides secure telecommunications services to the British Ministry of Defence, NATO and other countries which already use the Skynet family of military communications satellites.

Built by Astrium Satellites, Skynet 5D will weigh about 4,800 kg at launch. It is the 89th Astrium satellite to be launched by Arianespace.

Mexsat Bicentenario is the fifth Mexican satellite to be launched by Ariane, following Satmex 3, 4, 5 and 6 (previously known as the Morelos and Solidaridad satellites).

Built by Orbital Sciences Corporation in Dulles, Virginia, Mexsat Bicentenario is based on a GEOStar-2 platform. It will weigh about 3,000 kg at liftoff, and will be positioned in geostationary orbit at 114.9 degrees West. Equipped with eight C-band and eight Ku-band transponders, it will provide telecommunications services for Mexico and neighboring countries. Mexsat Bicentenario is the 23rd satellite built by Orbital Sciences Corp. to be launched by Arianespace.



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

# 1. Mission profile

The 211th Ariane mission will boost two telecommunications satellites into geostationary transfer orbit: Skynet 5D for the European operator Astrium Services, and Mexsat Bicentenario for the Mexico Secretary of Communications and Transportation (SCT).

This will be the 67th Ariane 5 launch.

The launcher will be carrying a total payload of 8,637 kg, including 7,735 kg for the Skynet 5D and Mexsat Bicentenario satellites, which will be released into their targeted orbits.

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

***Targeted orbit***

| | |
|---|---|
| *Perigee altitude* | ***249.7 km*** |
| *Apogee altitude* | ***35,977 km at injection*** |
| *Inclination* | ***2° degrees*** |

The lift-off is scheduled on the night of December 19 to 20, 2012 as soon as possible within the following launch window:

***Launch opportunity***

| | *Universal time (GMT)* | *Paris time* | *Kourou time* | *Washington time* | *Mexico time* |
|---|---|---|---|---|---|
| *Between* | *9:49 pm* | *10:49 pm* | *6:49 pm* | *4:49 pm* | *3:49 pm* |
| *and* | *11:08 pm* | *12:08 am* | *8:08 pm* | *6:08 pm* | *5:08 pm* |
| *on* | *December 19, 2012* | *December 19-20, 2012* | *December 19, 2012* | *December 19, 2012* | *December 19, 2012* |

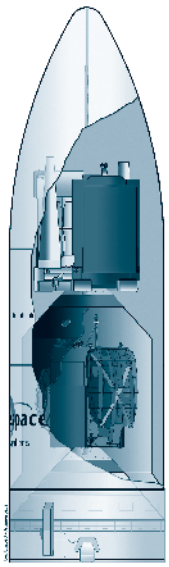
# Payload configuration

The Skynet 5D satellite was built by Astrium Satellites for the operator Astrium Services. Astrium in Stevenage is the prime-contractor for the satellite.

Orbital position: 25° East.

The Mexsat Bicentenario satellite was built by Orbital Sciences Corporation in Dulles, Virginia (United States) for the Mexico Secretary of Communications and Transportation (SCT).

Orbital position: 114.9° West.



# 2. Range operations campaign: ARIANE 5 - Skynet 5D & Mexsat Bicentenario

**Satellites and launch vehicle campaign calendar**

| *Ariane activities* | *Dates* | *Satellites activities* |
|---|---|---|
| *Campaign start review* | *October 24, 2012* | |
| *EPC Erection* | *October 24, 2012* | |
| *EAP transfer and positioning* | *October 25, 2012* | |
| *Integration EPC/EAP* | *October 26, 2012* | |
| *ESC-A and VEB Erection* | *October 30, 2012* | |
| | *November 14, 2012* | *Arrival in Kourou of Skynet 5D and beginning of preparation campaign in building S1B* |
| | *November 20, 2012* | *Arrival in Kourou of Mexsat Bicentenario and beginning of preparation campaign in building S1B* |
| *Roll-out from BIL to BAF* | *November 27 2012* | |
| | *November 26-29, 2012* | *Skynet 5D filling operations* |
| | *December 3-5, 2012* | *Mexsat Bicentenario filling operations* |

**Satellites and launch vehicle campaign final calendar**

| | | |
|---|---|---|
| *J-11* | *Tuesday December 4, 2012* | *Skynet 5D integration on adaptor (PAS)* |
| *J-10* | *Wednesday December 5, 2012* | *Skynet 5D transfer to Final Assembly Building (BAF)* |
| *J-9* | *Thursday December 6, 2012* | *Skynet 5D integration on Sylda and Mexsat Bicentenario integration on adaptor (PAS)* |
| *J-8* | *Friday December 7, 2012* | *Fairing integration on Sylda and transfer Mexsat Bicentenario to Final Assembly Building (BAF)* |
| *J-7* | *Monday December 10, 2012* | *Mexsat Bicentenario integration on launcher* |
| *J-6* | *Tuesday December 11, 2012* | *Upper composite integration with Skynet 5D on launcher and ESC-A final preparations* |
| *J-5* | *Wednesday December 12, 2012* | *ESC-A final preparations* |
| *J-4* | *Thursday December 13, 2012* | *Launch rehearsal* |
| *J-3* | *Friday December 14, 2012* | *Arming of launch vehicle* |
| *J-2* | *Monday December 17, 2012* | *Arming of launch vehicle*<br>*Launch readiness review (RAL) and final preparation of launcher* |
| *J-1* | *Tuesday December 18, 2012* | *Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC liquid helium sphere* |
| *J-0* | *Wednesday December 19, 2012* | *Launch countdown including EPC and ESC-A filling with liquid* |

# 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* |
| *- 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* |

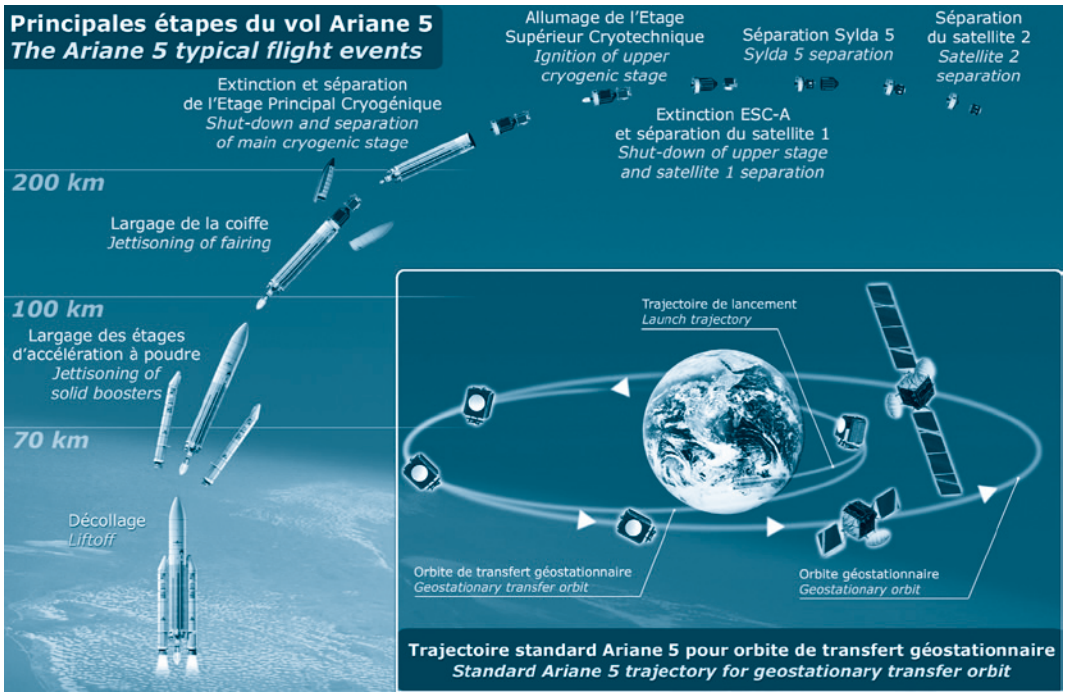
| *HO* | *Ignition of the cryogenic main stage engine (EPC)* | *ALT (km)* | *V. rel. (m/s)* |
|---|---|---|---|
| *+ 7.05 s* | *Ignition of solid boosters* | *0* | *0* |
| *+ 7.3 s* | *Liftoff* | *0* | *0* |
| *+ 12.7 s* | *End of vertical climb and beginning of pitch rotation (10 seconds duration)* | *0.1* | *35.0* |
| *+ 17 s* | *Beginning of roll manoeuvre* | *0.3* | *69.9* |
| *+ 2 mn 22 s* | *Jettisoning of solid boosters* | *66.4* | *2013* |
| *+ 3 mn 23 s* | *Jettisoning of fairing* | *111.6* | *2262* |
| *+ 7 mn 20 s* | *Acquisition by Natal tracking station* | *213.4* | *4602* |
| *+ 9 mn 0 s* | *Shut-down of main cryogenic stage* | *220.7* | *6809* |
| *+ 9 mn 06 s* | *Separation of main cryogenic stage* | *220.4* | *7313* |
| *+ 9 mn 10 s* | *Ignition of upper cryogenic stage (ESC-A)* | *220.2* | *7315* |
| *+ 13 mn 25 s* | *Acquisition by Ascension tracking station* | *183.6* | *7459* |
| *+ 18 mn 43 s* | *Acquisition by Libreville tracking station* | *184* | *8337* |
| *+ 23 mn 30 s* | *Acquisition by Malindi tracking station* | *415* | *9118* |
| *+ 25 mn 10 s* | *Injection* | *584.7* | *9411* |
| *+ 27 mn 09 s* | *Separation of **Skynet 5D** satellite* | *858.7* | *9182* |
| *+ 34 mn 39 s* | *Separation of Sylda 5* | *2362* | *8090* |
| *+ 36 mn 13 s* | *Separation of **Mexsat Bicentenario** satellite* | *2733.9* | *7859* |
| *+ 48 mn 12 s* | *End of Arianespace Flight mission* | *5772.3* | *6340* |

# 4. Flight trajectory of Skynet 5D & Mexsat Bicentenario

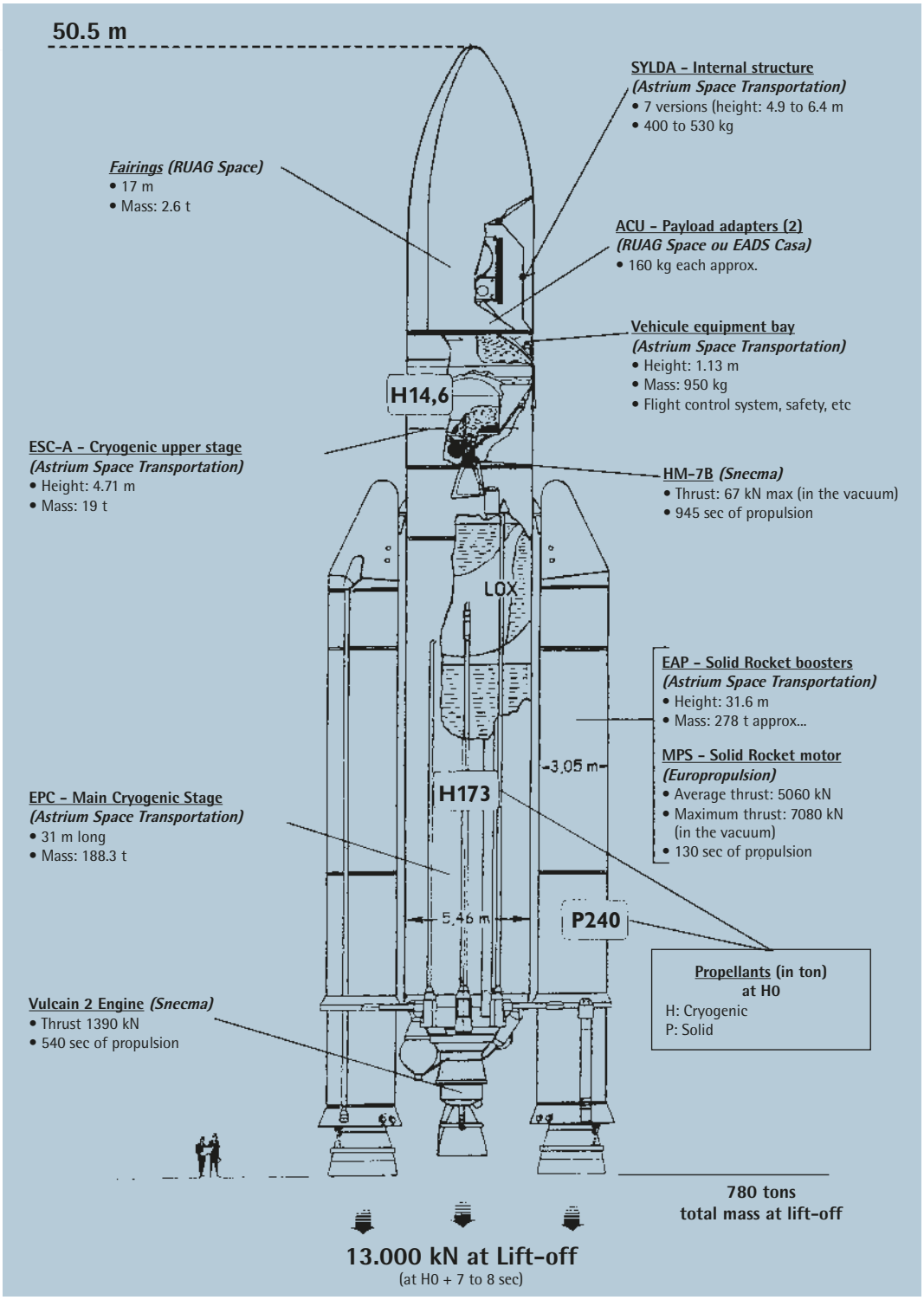
The launcher's attitude and trajectory are totally controlled by the two onboard computers, located in the Ariane 5 vehicle equipment bay (VEB).
7.05 seconds after ignition of the main stage cryogenic engine at T-0, the two solid-propellant boosters are ignited, enabling liftoff. The launcher first climbs 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 9411 meters/second, and will be at an altitude of about 584.7 kilometers.
The fairing protecting the Skynet 5D and Mexsat Bicentenario spacecraft is jettisoned shortly after the boosters are jettisoned at about T+203 seconds.

***Standard Ariane 5 trajectory for geostationary transfer orbit***



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



## 6. The Skynet 5D satellite

| Customer | *Astrium* |
|---|---|
| *Prime contractor* | *Astrium* |
| *Mission* | *Secure military communications* |
| *Mass* | *Total mass at lift-off approx. 4,800 kg* |
| *Stabilization* | *3 axis stabilized* |
| *Dimensions*<br>*Span in orbit* | *4.5 x 2.9 x 3.7 m*<br>*34 m* |
| *Platform* | *Eurostar E3000* |
| *On-board power* | *> 6 kW (end of life)* |
| *Life time* | *15 years* |
| *Orbital position* | *25° East* |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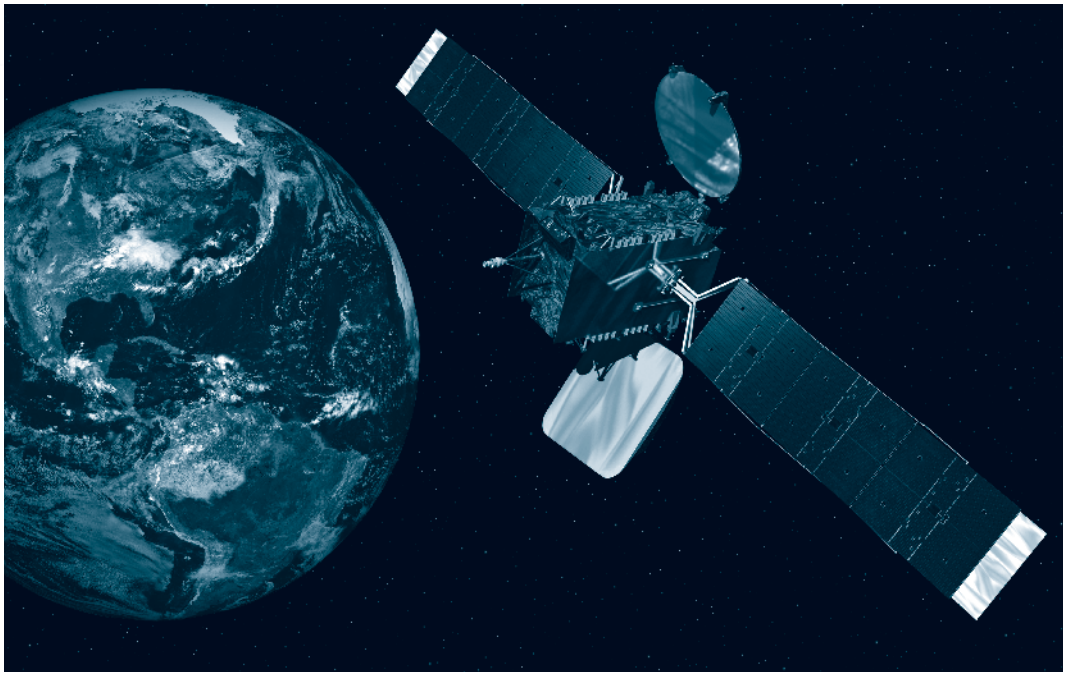
## 7. The Mexsat Bicentenario satellite



| Customer | *Mexico Secretary of Communications and Transportation (SCT)* | |
|---|---|---|
| *Prime contractor* | *Orbital Sciences Corporation* | |
| *Mission* | *Telecommunications* | |
| *Mass* | *Total mass at lift-off* | *2,935 kg* |
| *Stabilization* | *3 axis stabilized* | |
| *Dimensions* | *4.9 m x 2.5 m x 3.3 m* | |
| *Platform* | *GEOStar-2* | |
| *Payload* | *8 C-band transponders and 8 Ku-band transponders* | |
| *On-board power* | *6.750 kW (end of life)* | |
| *Life time* | *16 years* | |
| *Orbital position* | *114.9° West* | |
| *Coverage area* | *Mexico* | |

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## Appendix 1. Arianespace - Skynet 5D & Mexsat Bicentenario launch key personnel

| | | | |
|---|---|---|---|
| **In charge of the launch campaign** | | | |
| *Mission Director* | *(CM)* | *Didier SAID* | *ARIANESPACE* |
| **In charge of the launch service contract** | | | |
| *Program Director Skynet 5D* | *(CP)* | *Luca CHIECCHIO* | *ARIANESPACE* |
| *Program Director Mexsat Bicentenario* | *(CP)* | *Beatriz ROMERO* | *ARIANESPACE* |
| **In charge of Skynet 5D satellite** | | | |
| *Satellite Mission Director* | *(DMS)* | *Van ODEDRA* | *Astrium Satellites* |
| *Satellite Program Manager* | *(CPS)* | *Rick GREENWOOD* | *Astrium Services* |
| *Satellite Preparation Manager* | *(RPS)* | *Didier CARILLIER* | *Astrium Satellites* |
| **In charge of Mexsat Bicentenario satellite** | | | |
| *Satellite Mission Director* | *(DMS)* | *Omar CHARFEN* | *MEXSAT* |
| *Satellite Program Manager* | *(CPS)* | *Bill COOK* | *OSC* |
| *Satellite Preparation Manager* | *(RPS)* | *Tim WIEGAND* | *OSC* |
| **In charge of the launch vehicle** | | | |
| *Launch Site Operations Manager* | *(COEL)* | *Frédéric FACCHIN* | *ARIANESPACE* |
| *Ariane Production Project Manager* | *(CPAP)* | *Denis SCHMITT* | *ARIANESPACE* |
| *Launcher Production Quality Manager* | *(RQLP)* | *Isabelle LECLERE* | *ARIANESPACE* |
| *Launch Campaign Quality Manager* | *(CQCL)* | *Denis CORLAY* | *ARIANESPACE* |
| **In charge of the Guiana Space Center (CSG)** | | | |
| *Range Operations Manager* | *(DDO)* | *Joël EGALGI* | *CNES/CSG* |
| *Range Operations Deputy* | *(DDO/A)* | *Thierry VALLEE* | *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, they handle 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 21 shareholders from ten European countries (including French space agency CNES with 34%, Astrium with 30%, and all European companies participating in the construction of Ariane launchers).
Since the outset, Arianespace has signed more than 350 launch contracts and launched 309 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of 1013 million euros in 2011.

At January 1, 2012, Arianespace had 330 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 and the Guiana Space Center.
- The Vega light launcher, launched also from the Guiana Space Center.

With its family of launchers, 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 (ECPU), in particular the S5 facility.
- Ariane, Soyuz and Vega launch complexes, comprising the launch zones and launcher integration buildings.
- Various industrial facilities, including those operated by Regulus, Europropulsion, Air Liquide Spacial Guyane and Astrium, 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 is responsible for the development of the Ariane, Soyuz and Vega programs at the Guiana Space Center. Once these launch systems are qualified, ESA will transfer responsibility to the operator 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, Soyuz and Vega rockets throughout their trajectories.
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 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.