# Satellite launches for Japan and Australia

**For its fourth launch of the year, Arianespace will orbit two communications satellites: JCSAT-12, built by Lockheed Martin Commercial Space Systems for the Japanese operator SKY Perfect JSAT Corporation, and Optus D3, built by Orbital Sciences Corporation for the Australian operator Optus.**


The choice of Arianespace by leading space communications operators and manufacturers is clear international recognition of the company's excellence in launch services.

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

Arianespace has established a relationship of mutual trust with SKY Perfect JSAT Corporation, the leading private satellite operator in Japan, that reaches back to 1989. Since the launch of JCSAT-1, the Japanese operator has chosen Arianespace to launch 17 of its satellites.

Weighing about 4,000 kg at launch, JCSAT-12 will provide communications services for Japan, the Asia-Pacific region in general, Oceania and Hawaii. It was built by Lockheed Martin Commercial Space Systems in Newtown, Pennsylvania. JCSAT-12 has a design life of 15 years and will be used as an in-orbit spare in the SKY Perfect JSAT fleet.

Arianespace has won 27 of the 36 satellite launch contracts open to competition in the Japanese commercial market.

Optus D3 will be the fifth satellite orbited by Arianespace for the Australian operator, following Optus D2 in 2007, Optus D1 in 2006, Optus & Defence C1 in 2003 and Aussat A3 in 1987. SingTel, the parent company of Optus and Chunghwa also chose Arianespace to launch their satellite ST-1, orbited in 1998. In June 2009, SingTel and Chunghwa have selected Arianespace to launch ST-2.

Orbital Sciences Corporation integrated the Optus D3 satellite in Dulles, Virginia, using a Star-2 platform. Weighing about 2,500 kg at launch, Optus D3 will be positioned at 156 degrees East and have a design life of 15 years. It will provide direct TV and broadcasting services for Australia and New Zealand.



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

# 1. Mission profile

The 190th Ariane mission will place two communications satellites into geostationary transfer orbit: JCSAT-12 for the Japanese operator SKY Perfect JSAT Corporation, and Optus D3 for the Australian operator Optus.

This will be the 46th Ariane 5 launch

The launcher will be carrying a total payload of 7,654 kg, including 6,543 kg for the two 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.

***Injection orbit***

| | |
|---|---|
| *Perigee altitude* | ***250 km*** |
| *Apogee altitude* | ***35 786 km at injection*** |
| *Inclination* | ***2° degrees*** |

The lift-off is scheduled on the night of August 21, 2009 as soon as possible within the following launch window:

***Launch opportunity***

| | *Universel time (GMT)* | *Paris time* | *Kourou time* | *Washington time* | *Tokyo time* | *Sydney time* |
|---|---|---|---|---|---|---|
| *Between* | *22 : 09 pm* | *00 : 09 am* | *07 : 09 pm* | *06 : 09 pm* | *07 : 09 am* | *08 : 09* |
| *and* | *23 : 09 pm* | *01 : 09 am* | *08 : 09 pm* | *07 : 09 pm* | *08 : 09 am* | *09 : 09* |
| *on* | *August 21, 2009* | *August 22, 2009* | *August 21, 2009* | *August 21, 2009* | *August 22, 2009* | *August 22, 2009* |

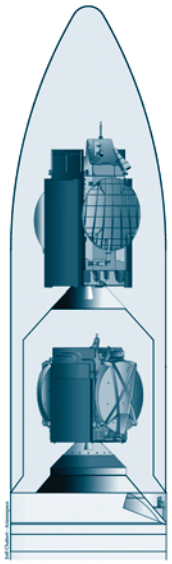
# Configuration of Ariane payload

JCSAT-12 was built by Lockheed Martin Commercial Space Systems in Newtown, Pennsylvania for the Japanese operator SKY Perfect JSAT Corporation,

*Orbital position : an in-orbit backup satellite*

Optus D3 was built by Orbital Sciences Corporation in Dulles, Virginia, for the Australian operator Optus.

*Orbital position : 156° East*



# 2. Range operations campaign: ARIANE 5 - JCSAT-12 & OPTUS D3

***Satellites and launch vehicle campaign calendar***

| *Ariane activities* | *Dates* | *Satellites activities* |
|---|---|---|
| *Campaign start review* | *June 11, 2009* | |
| *EPC Erection* | *June 11, 2009* | |
| *EAP transfer and positionning* | *June 12, 2009* | |
| *Integration EPC/EAP* | *June 12, 2009* | |
| *ESC-A and VEB Erection* | *June 17, 2009* | |
| *Roll-out from BIL to BAF* | *July 17, 2009* | |
| | *July 18, 2009* | *Arrival in Kourou of JCSAT-12 and beginning of preparation campaign in building S5 C* |
| | *July 21, 2009* | *Arrival in Kourou of OPTUS D3 and beginning of preparation campaign in building S5 C* |
| | *July 31 - August 3, 2009* | *JCSAT-12 filling operations in S5 A building* |
| | *August 1-4, 2009* | *OPTUS D3 operations in S5 B building* |
| | *August 5, 2009* | *JCSAT-12 integration on adaptor (ACU)* |

***Satellites and launch vehicle campaign final calendar***

| | | |
|---|---|---|
| *J-10* | *Saturday, August 8* | *JCSAT-12 transfer to Final Assembly Building (BAF)* |
| *J-9* | *Monday, August 10* | *JCSAT-12 integration on Sylda and OPTUS D3 integration on adaptor* |
| *J-8* | *Tuesday, August 11* | *Fairing integration on Sylda - OPTUS D3 transfer to Final Assembly Building (BAF)* |
| *J-7* | *Wednesday, August 12* | *OPTUS D3 integration on launcher* |
| *J-6* | *Thursday, August 13* | *Upper composite integration with JCSAT-12 on launcher* |
| *J-5* | *Friday, August 14* | *ESC-A final preparations and payloads control* |
| *J-4* | *Monday, August 17* | *Launch rehearsal* |
| *J-3* | *Tuesday, August 18* | *Arming of launch vehicle* |
| *J-2* | *Wednesday, August 19* | *Arming of launch vehicle*<br>*Launch readiness review (RAL) and final preparation of launcher* |
| *J-1* | *Thursday, August 20* | *Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC liquid Helium sphere* |
| *J-0* | *Friday, August 21* | *Launch countdown including EPC and ESC-A 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.

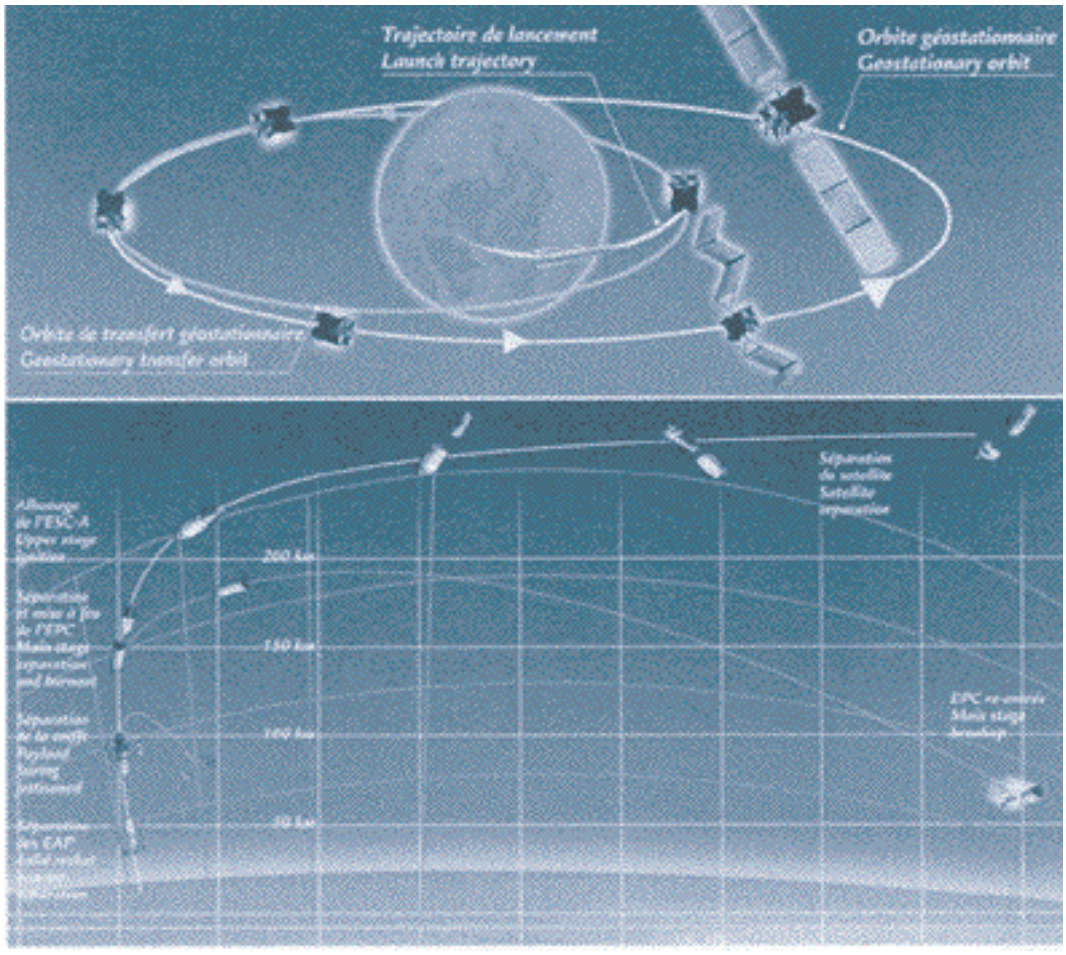
| *Time* | | *Events* |
|---|---|---|
| *– 11 h* | *30 mn* | *Start of final countdown* |
| *– 7 h* | *30 mn* | *Check of electrical systems* |
| *– 4 h* | *50 mn* | *Start of filling of main cryogenic stage with liquid oxygen and hydrogen* |
| *– 3 h* | *20 mn* | *Chilldown of Vulcain main stage engine* |
| *– 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* |
| | *- 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)* |
|---|---|---|---|---|
| | *+ 7,0 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* | *74* |
| *+ 2 mn* | *20 s* | *Jettisoning of solid boosters* | *67.9* | *1995* |
| *+ 3 mn* | *28 s* | *Jettisoning of fairing* | *121* | *2270* |
| *+ 7 mn* | *31 s* | *Acquisition by Natal tracking station* | *210* | *5300* |
| *+ 8 mn* | *52 s* | *Shut-down of main cryogenic stage* | *219.7* | *6760* |
| *+ 9 mn* | *01 s* | *Separation of main cryogenic stage* | *219.5* | *6788* |
| *+ 9 mn* | *05 s* | *Ignition of upper cryogenic stage (ESC-A)* | *219.4* | *6790* |
| *+ 13 mn* | *16 s* | *Acquisition by Ascension tracking station* | *220* | *7500* |
| *+ 18 mn* | *16 s* | *Acquisition by Libreville tracking station* | *222* | *8290* |
| *+ 23 mn* | *37 s* | *Acquisition by Malindi tracking station* | *450* | *9300* |
| *+ 24 mn* | *39 s* | *Shut-down of ESC-A / Injection* | *537.8* | *9455* |
| *+ 26 mn* | *52 s* | *Separation of JCSAT-12 satellite* | *819.5* | *9214* |
| *+ 32 mn* | *51 s* | *Separation of Sylda 5* | *1958.4* | *8357* |
| *+ 34 mn* | *17 s* | *Separation of OPTUS D3 satellite* | *2283* | *8141* |
| *+ 48 mn* | *57 s* | *End of Arianespace Flight mission* | *5974* | *4706* |

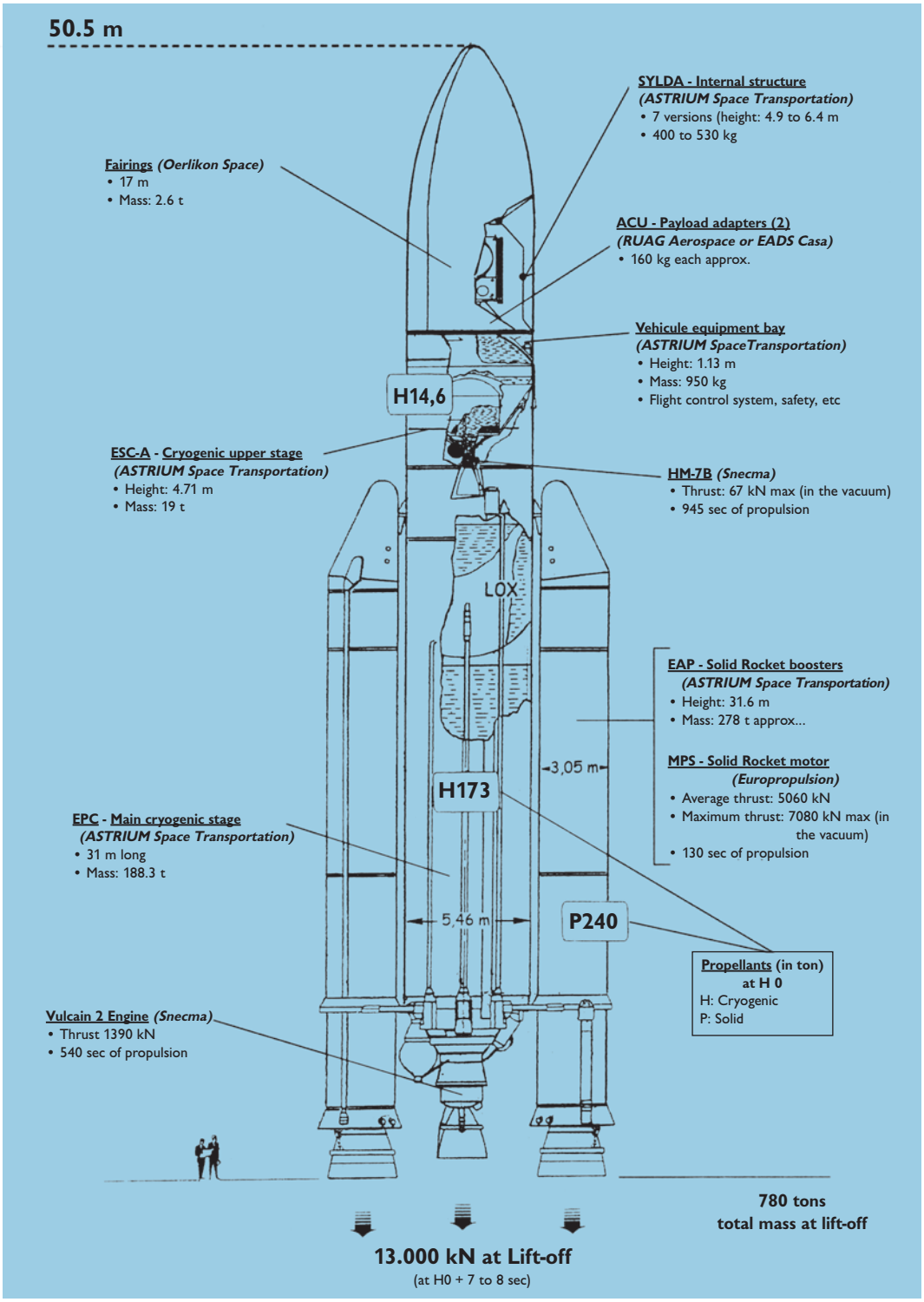
# 4. Flight trajectory of JCSAT-12 & OPTUS D3

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 9455 meters/second, and will be at an altitude of about 537 kilometers.
The fairing protecting the JCSAT-12 & OPTUS D3 spacecraft is jettisoned shortly after the boosters are jettisoned at about T+208 seconds.

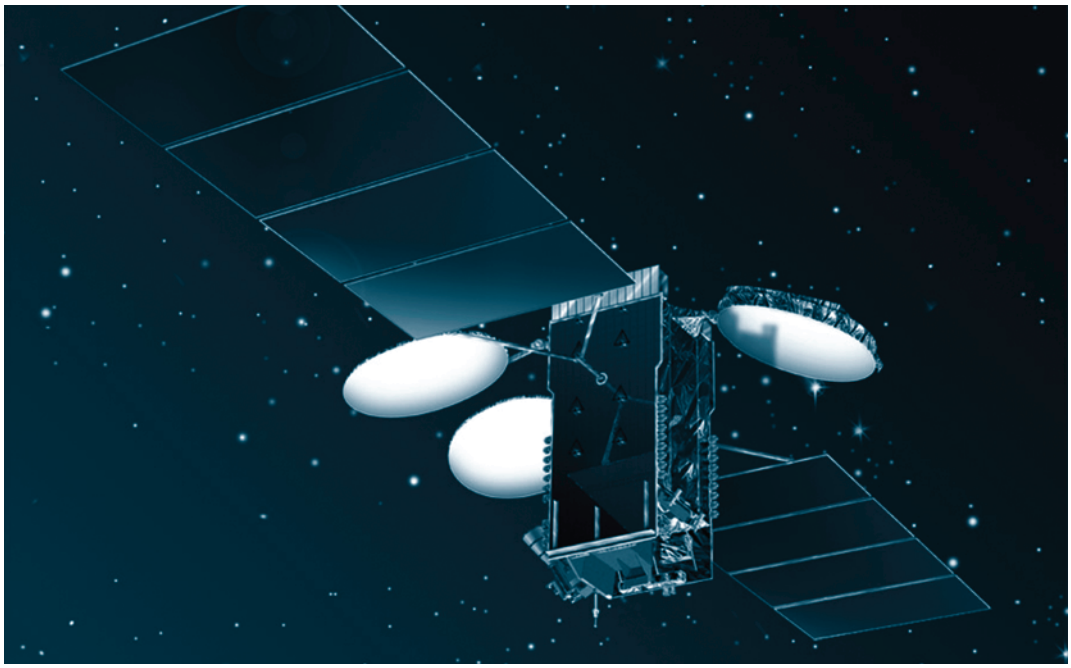
***Standard Ariane 5 trajectory for geostationary transfer orbit***



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



# 6. The JCSAT-12 satellite



| | |
|---|---|
| Customer | **SKY Perfect JSAT Corporation** |
| *Prime contractor* | *Lockheed Martin Commercial Space Systems* |
| *Mission* | *Backup Satellite* |
| *Mass* | *Total mass at lift-off 4 000 kg* |
| *Stabilization* | *3 axis stabilized* |
| *Dimensions* | *5.5 x 2.2 x 2.2 m* |
| *Span in orbit* | *23 m* |
| *Platform* | *A 2100 AX* |
| *Payload* | *30 Ku-band transponders, 12 C-band transponders* |
| *On-board power* | *8.4 kW (end of life)* |
| *Life time* | *15 years* |
| *Orbital position* | *An in-orbit backup satellite* |
| *Coverage area* | *Japan, Asia Pacific Region, Oceania and Hawaï* |

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# 7. The OPTUS D3 satellite

| *Customer* | **OPTUS** |
|---|---|
| *Prime contractor* | *Orbital Sciences Corporation* |
| *Mission* | *DTH TV & Broadcasting Services* |
| *Mass* | *Total mass at lift-off 2,501 kg* |
| *Stabilization* | *3 axis* |
| *Dimensions* | *4.0 x 3.2 x 2.4 m* |
| *Span in orbit* | *22.4 m* |
| *Platform* | *STAR 2* |
| *Payload* | *32 Ku-band transponders* |
| *On-board power* | *6 280 W (end of life)* |
| *Life time* | *15 years* |
| *Orbital position* | *156° East* |
| *Coverage area* | *Australia and New Zealand* |

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## Appendix 1. Arianespace JCSAT-12 & OPTUS D3 launch key personnel

| | | | |
|---|---|---|---|
| ***In charge of the launch campaign*** | | | |
| *Mission Director* | *(CM)* | *Thierry WILMART* | *ARIANESPACE* |
| **In charge of the launch service contract** | | | |
| *Ariane Payload Manager* | *(RCUA)* | *Thomas PANOZZO* | *ARIANESPACE* |
| *Ariane Deputy Mission Manager* | *(RCUA/A)* | *Michael CALLARI* | *ARIANESPACE* |
| **In charge of JCSAT-12 satellite** | | | |
| *Satellite Mission Director* | *(DMS)* | *Noriko MASUDA* | *SPJSAT* |
| *Satellite Program Manager* | *(CPS)* | *George BUSACCA* | *LMCSS* |
| *Satellite Preparation Manager* | *(RPS)* | *Roy WELLER* | *LMCSS* |
| **In charge of OPTUS D3 satellite** | | | |
| *Satellite Mission Director* | *(DMS)* | *Mark BLAIR* | *OPTUS* |
| *Satellite Program Manager* | *(CPS)* | *Nagesh KRISHNAMURTHY* | *OSC* |
| *Satellite Preparation Manager* | *(RPS)* | *Neilan HAGGARD* | *OSC* |
| **In charge of the launch vehicle** | | | |
| *Launch Site Operations Manager* | *(COEL)* | *Daniel GROULT* | *ARIANESPACE* |
| *Ariane Production Project Manager* | *(CPAP)* | *Olivier RICOUART* | *ARIANESPACE* |
| **In charge of the Guiana Space Center (CSG)** | | | |
| *Range Operations Manager* | *(DDO)* | *Bruno GILLES* | *CNES/CSG* |
| *Range Operations Deputy* | *(DDO/A)* | *Antoine GUILLAUME* | *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 beforre 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 reduntant 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 23 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 270 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace.
The company posted sales of 955,7 million euros in 2008, 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 starting at the beginning of 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 bas operation, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (ECPU), in particular the 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.

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.