SATELLITE LAUNCHES FOR ASIA AND INDIA

Arianespace will orbit two communications satellites on its third launch of the year: ST-2 for the operator ST-2 Satellite Ventures Pte Ltd., a joint venture of Singapore Telecommunications Limited (SingTel) and Chunghwa Telecom Company Limited (Chunghwa), and GSAT-8 for the Indian Space Research Organization (ISRO).

The choice of Arianespace by leading space communications operators and manufacturers is clear international recognition of the company's excellence in launch services. Based on its proven reliability and availability, Arianespace continues to confirm its position as the world's benchmark launch system.

Ariane 5 is the only commercial satellite launcher now on the market capable of simultaneously launching two payloads and handling a complete range of missions, from launches of commercial satellites into geostationary orbit, to dedicated launches into special orbits.

ST-2 will be the second satellite launched by Arianespace for SingTel and Chunghwa, following the launch of ST-1 in 1998.

The ST-2 satellite was built by Mitsubishi Electric Company (MELCO) of Japan, using a DS2000 platform. It will weigh about 5,090 kg at launch, and is equipped with Ku-band and C-band transponders. ST-2 will provide IP-based fixed and mobile, voice and data transmission satellite services to businesses, especially direct broadcast TV operators and maritime companies in Asia and the Middle East. It has a design life of 15 years.

GSAT-8 will be the 14th ISRO satellite to be launched by Ariane. Since the launch of the Apple experimental satellite on Flight L03 in 1981, Arianespace has orbited 13 Indian satellites.

Designed, assembled and integrated by the Indian Space Research Organization (ISRO) in Bangalore, southern India, GSAT-8 will weigh about 3,100 kg at launch, and offers a design life exceeding 12 years. It is fitted with 24 Ku-band transponders, and will mainly provide direct-to-home TV broadcast and radio-navigation services. Its coverage zone includes the entire Indian subcontinent.

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

1. Mission profile

The 202nd Ariane mission will place two communications satellites into geostationary transfer orbit: ST-2 for the operator ST-2 Satellite Ventures Pte. Ltd., a joint venture of Singapore Telecommunications Limited (SingTel) and Chunghwa Telecom Company Limited (Chunghwa), and GSAT-8 for the Indian Space Research Organization (ISRO).

This will be the 58th Ariane 5 launch

The launcher will be carrying a total payload of 9,013 kg, including 8,190 kg for the ST-2 and GSAT-8 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	***249 km***
Apogee altitude	***35,947 km at injection***
Inclination	***2,5° degrees***

The lift-off is scheduled on the night of May 19 to 20, 2011 as soon as possible within the following launch window:

Launch opportunity

	Universal time	*Paris time*	*Kourou time*	*Taipei time*	*Singapore time*	*Bangalore time*
Between	*8:37 pm*	*10:37 pm*	*5:37 pm*	*4:37 am*	*4:37 am*	*2:07 am*
and	*10:09 pm*	*12:09 am*	*7:09 pm*	*6:09 am*	*6:09 am*	*4:39 am*
on	*May 19, 2011*	*May 19-20, 2011*	*May 19, 2011*	*May 20, 2011*	*May 20, 2011*	*May 20, 2011*

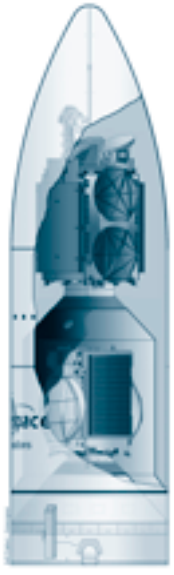
Configuration of Ariane payload

The ST-2 satellite was built by Mitsubishi Electric Corporation (MELCO) of Japan, for the operator ST-2 Satellite Ventures Pte. Ltd.

Orbital position: 88° *East*

The GSAT-8 satellite was built by the operator, the Indian Space Research Organization, in Bangalore.

Orbital position: 55° *East*



2. Range operations campaign: ARIANE 5 - ST-2 & GSAT-8

Satellites and launch vehicle campaign calendar

Ariane activities	*Dates*	*Satellites activities*
Campaign start review	*March 17, 2011*	
EPC Erection	*March 17, 2011*	
EAP transfer and positionning	*March 18, 2011*	
Integration EPC/EAP	*March 21, 2011*	
ESC-A and VEB Erection	*March 23, 2011*	
	April 4, 2011	*Arrival in Kourou of GSAT-8 and beginning of preparation campaign in building S5 C*
	April 5, 2011	*Arrival in Kourou of ST-2 and beginning of preparation campaign in building S5 C*
	April 26-30, 2011	*ST-2 filling operations*
	April 29-2 May, 2011	*GSAT-8 filling operations*
Roll-out from BIL to BAF	*May 3, 2011*	

Satellites and launch vehicle campaign final calendar

J-12	*Wednesday, May 4*	*ST-2 integration on adaptor (ACU)*
J-11	*Thursday, May 5*	*GSAT-8 integration on adaptor (ACU)*
J-10	*Friday, May 6*	*ST-2 transfer to Final Assembly Building (BAF)*
J-9	*Saturday, May 7*	*ST-2 integration on Sylda*
J-8	*Monday, May 9*	*Fairing integration on Sylda - GSAT-8 transfer to Final Assembly Building (BAF)*
J-7	*Tuesday, May 10*	*GSAT-8 integration on launcher*
J-6	*Wednesday, May 11*	*ESC-A final preparations and payloads control* *Upper composite integration with ST-2 on launcher*
J-5	*Thursday, May 12*	*Satellite functional tests on launcher*
J-4	*Friday, May 13*	*Launch rehearsal*
J-3	*Monday, May 16*	*Arming of launch vehicle*
J-2	*Tuesday, May17*	*Launch readiness review (RAL) and final preparation of launcher*
J-1	*Wednesday, May 18*	*Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC liquid Helium sphere*
J-0	*Thursday, May 19*	*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*

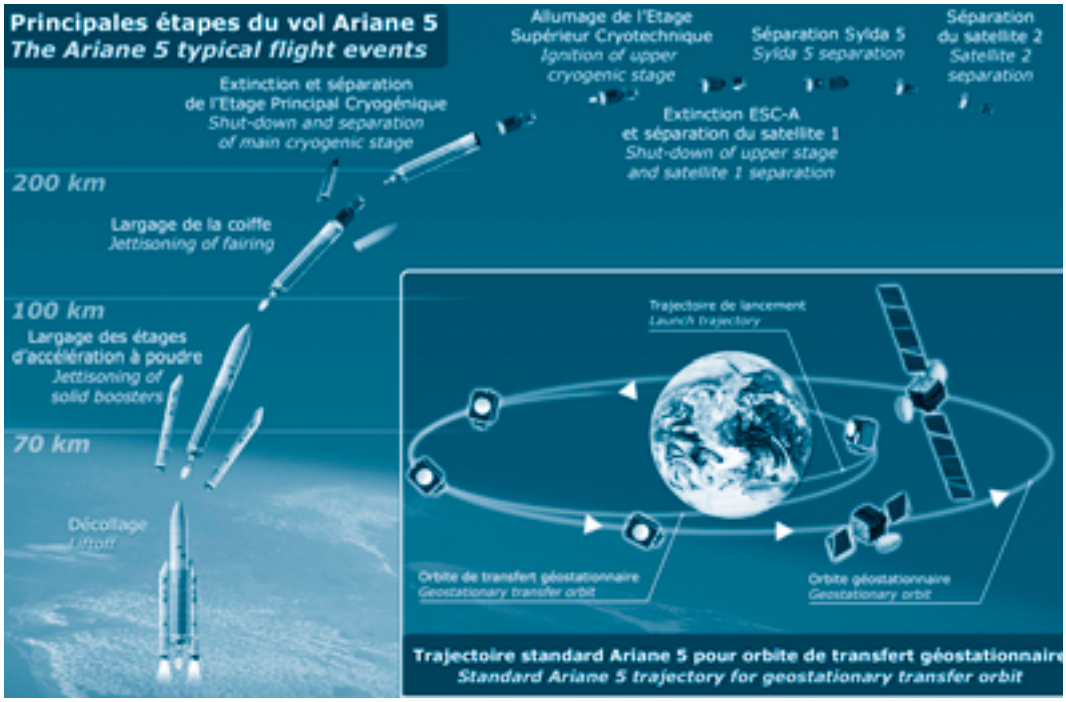
HO	*Ignition of the cryogenic main stage engine (EPC)*		*ALT (km)*	*V. rel. (m/s)*
	+ 7,05 s	*Ignition of solid boosters*	*0*	*0*
	+ 7,3 s	*Liftoff*	*0*	*0*
	+ 12,5 s	*End of vertical climb and beginning of pitch rotation (10 seconds duration)*	*0.089*	*37.3*
	+ 17,1 s	*Beginning of roll manoeuvre*	*0.343*	*76.2*
+ 2 mn	*21 s*	*Jettisoning of solid boosters*	*68.2*	*1995*
+ 3 mn	*09 s*	*Jettisoning of fairing*	*107.0*	*2196*
+ 7 mn	*33 s*	*Acquisition by Natal tracking station*	*190.0*	*5038*
+ 8 mn	*54 s*	*Shut-down of main cryogenic stage*	*186.8*	*6895*
+ 9 mn	*00 s*	*Separation of main cryogenic stage*	*186.6*	*6922*
+ 9 mn	*04 s*	*Ignition of upper cryogenic stage (ESC-A)*	*186.4*	*6924*
+ 13 mn	*30 s*	*Acquisition by Ascension tracking station*	*161.0*	*7586*
+ 18 mn	*22 s*	*Acquisition by Libreville tracking station*	*197.0*	*8355*
+ 23 mn	*04 s*	*Acquisition by Malindi tracking station*	*458.8*	*9073*
+ 24 mn	*51 s*	*Injection*	*658.4*	*9350*
+ 27 mn	*08 s*	*Separation of ST-2 satellite*	*1000.9*	*9066*
+ 29 mn	*00 s*	*Separation of Sylda 5*	*1337.3*	*8803*
+ 31 mn	*17 s*	*Separation of GSAT-8 satellite*	*1803.0*	*8465*
+ 46 mn	*08 s*	*End of Arianespace Flight mission*	*5471.7*	*6468*

4. Flight trajectory of ST-2 & GSAT-8

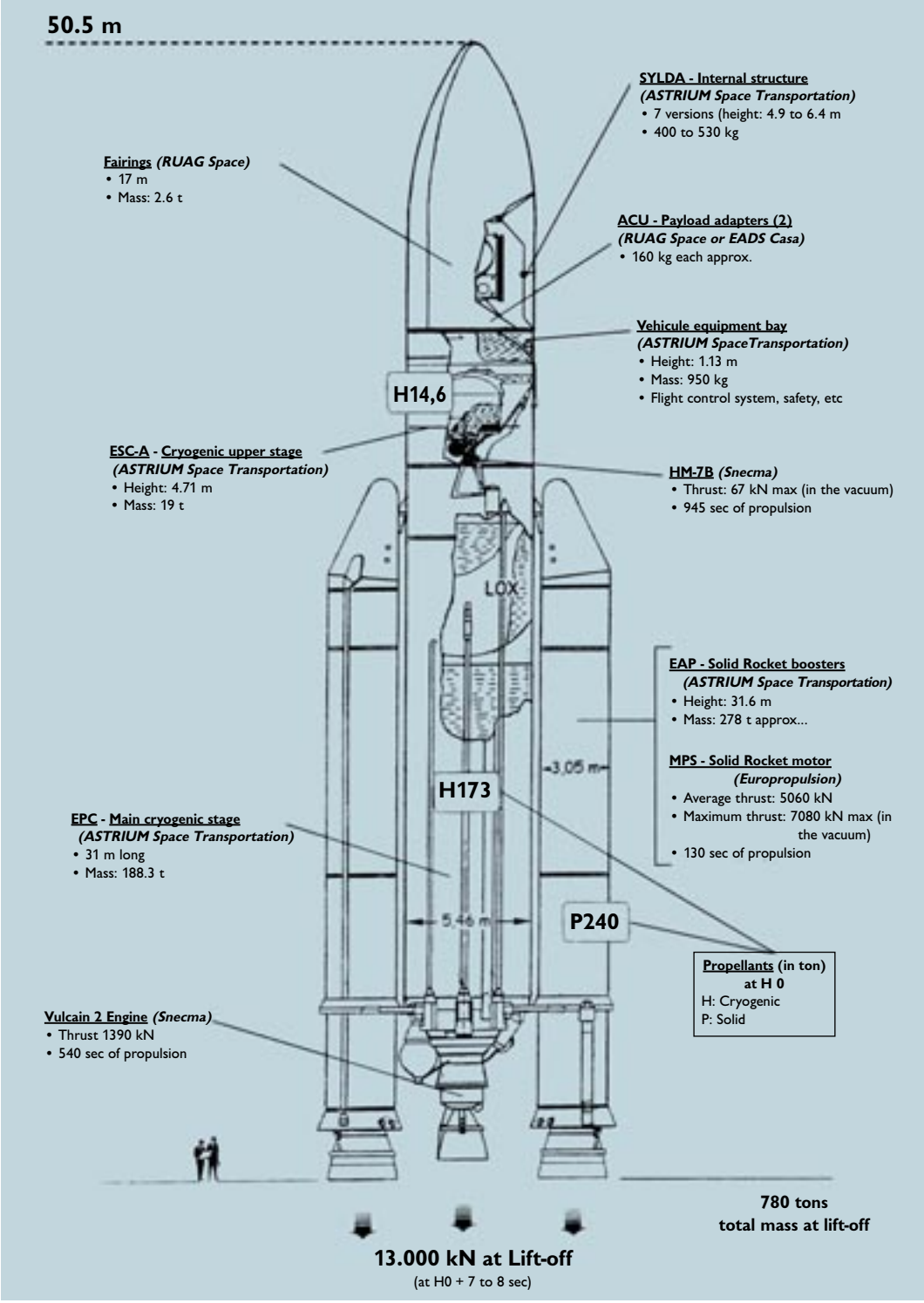
The launcher's attitude and trajectory are totally controlled by the two onboard computers, located in the Ariane 5 vehicle equipment bay (VEB).
7.05 seconds after ignition of the main stage cryogenic engine at T-0, the two solid-propellant boosters are ignited, enabling liftoff. The launcher first climbs 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 9350 meters/second, and will be at an altitude of about 658 kilometers.
The fairing protecting the ST-2 and GSAT-8 spacecraft is jettisoned shortly after the boosters are jettisoned at about T+189 seconds.

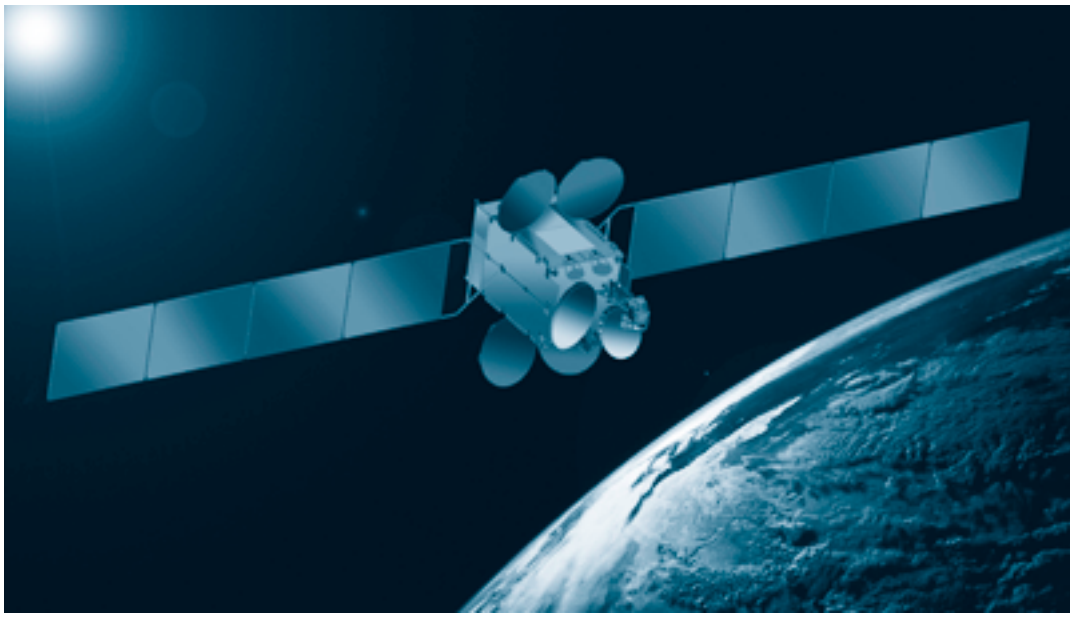
Standard Ariane 5 trajectory for geostationary transfer orbit



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



6. The ST-2 satellite

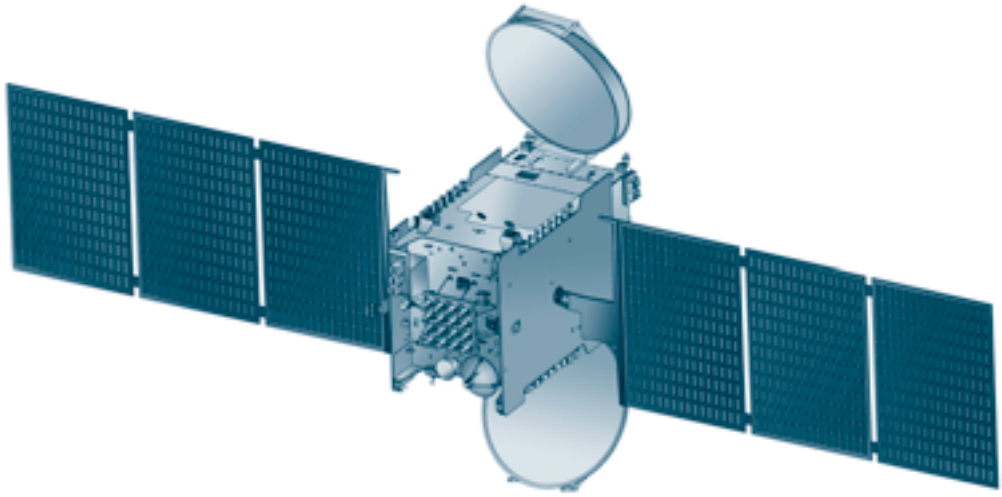


Customer	**ST-2 Satellite Ventures Pte Ltd**
Prime contractor	*MELCO*
Mission	*Telecommunications*
Mass	*Total mass at lift-off 5 090 kg*
Stabilization	*3 axis stabilized*
Dimensions	*6.21 x ø 3.75 m*
Span in orbit	*31.6 m*
Platform	*DS 2000*
Payload	*Ku-band and C-band transponders*
On-board power	*11.8 kW (end of life)*
Life time	*15 years*
Orbital position	*88° East*
Coverage area	*Asia and The Middle East*

Press Contact

Tricia Lee
Corporate Communications Manager
SingTel
Tél : + 65 6838 3065
Fax : + 65 9150 7199
Email : tricialee@singtel.com

7. The GSAT-8 satellite



Customer	*Indian Space Research Organisation (ISRO)*	
Prime contractor	*ISRO / ISAC*	
Mission	*Direct television (DTH) and Radio Navigation*	
Mass	*Total mass at lift-off*	*3 100 kg*
	Dry mass	*1 425 kg*
Stabilization	*3 axis stabilized*	
Dimensions	*4.1 x 2.3 x 3.4 m*	
Span in orbit	*37.40 m*	
Platform	*I-3K*	
Payload	*24 Ku-band transponders*	
On-board power	*6000 W (end of life)*	
Life time	*12 years minimum*	
Orbital position	*55° East*	
Coverage area	*Indian sub-continent*	

Press Contact

S. Satish
Director, P and PR
ISRO Headquarters
New Bel Road, Bangalore 560 095
Tel. : (91 80) 23415275
Fax : (91 80) 23412253

Appendix 1. Arianespace ST-2 & GSAT-8 launch key personnel

In charge of the launch campaign			
Mission Director	*(CM)*	*Thierry WILMART*	*ARIANESPACE*
In charge of the launch service contract			
Program Director ST-2	*(CP)*	*Jérôme RIVES*	*ARIANESPACE*
Program Director GSAT-8	*(CP)*	*Christophe BARDOU*	*ARIANESPACE*
In charge of ST-2 satellite			
Satellite Mission Director	*(DMS)*	*Mark BLAIR*	*ST2 Sat Ventures*
Satellite Program Manager	*(CPS)*	*Toshihiko HAYASHI*	*MELCO*
Satellite Preparation Manager	*(RPS)*	*Hiromi SEKO*	*MELCO*
In charge of GSAT-8 satellite			
Program Manager	*(PDI)*	*N. PRAHLAD RAO*	*ISRO*
Satellite Mission Director	*(DMS)*	*B. VENKATARAO*	*ISRO*
Satellite Program Manager	*(CPS)*	*V. RAMANATHAN*	*ISRO*
Satellite Preparation Manager	*(RPS)*	*V. HARIHARAN*	*ISRO*
In charge of the launch vehicle			
Launch Site Operations Manager	*(COEL)*	*Christian LARDOT*	*ARIANESPACE*
Ariane Production Project Manager	*(CPAP)*	*Marc ROY*	*ARIANESPACE*
Launcher Production Quality Manager	*(RQLP)*	*Damien GILLE*	*ARIANESPACE*
Launch Campaign Quality Manager	*(CQCL)*	*Fabrice DALTROFF*	*ARIANESPACE*
In charge of the Guiana Space Center (CSG)			
Range Operations Manager	*(DDO)*	*Thierry VALLEE*	*CNES/CSG*
Range Operations Deputy	*(DDO/A)*	*Bruno GILLES*	*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 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 300 launch contracts and launched 292 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.
At January 1, 2011, Arianespace had 331 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 in 2011.
- The Vega light launcher, to be launched from the Guiana Space Center starting in 2011.

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 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 Astrium, 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 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.