



LAUNCH KIT

February 2017

VA235

SKY Brasil-1

Telkom 3S





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SKY Brasil-1  
Telkom 3S



## ARIANESPACE TO LAUNCH DIGITAL TV BROADCAST SATELLITES FOR BRAZIL AND INDONESIA

For its second flight of the year from the Guiana Space Center, and the first Ariane 5 launch in 2017, Arianespace will orbit two satellites: SKY Brasil-1 for the operator AT&T/DIRECTV; and Telkom 3S for Telkom Indonesia, within the scope of a turnkey contract with Thales Alenia Space.

### SKY Brasil-1 (SKYB-1)

SKY Brasil-1 (also known as SKYB-1) will be the 10th satellite launched by Arianespace for the operator AT&T/DIRECTV. The most recent launch was on May 27, 2015, lofting SKY México-1 and DIRECTV 15 on the same Ariane 5.

AT&T/DIRECTV, a world leading provider of digital television programs, will use the SKYB-1 satellite via its DIRECTV Latin America subsidiary - which offers services to 12,5 million subscribers in Latin America primarily Venezuela, Argentina, Chile, Colombia, and Brazil.

SKYB-1 is a high-definition television (HDTV) broadcast satellite. Weighing approximately 6,000 kg. at launch, it is fitted with 60 Ku-band transponders. SKYB-1 will be positioned at 43.1° West, and will cover Brazil.

The satellite was built by Airbus Defence and Space in Toulouse, France, using the Eurostar E3000 platform. It is the 116th spacecraft from this manufacturer and its predecessors to be launched by Arianespace.

Arianespace's order book includes 17 more Airbus Defence and Space satellites to be launched.

### Telkom 3S

Telkom 3S will be the third satellite entrusted to Arianespace by Telkom Indonesia within the scope of a turnkey contract with Thales Alenia Space.

Telkom Indonesia is an Indonesian state-owned company that supplies telecommunications, information, media and entertainment services (TIMES) to millions of customers throughout the Indonesian archipelago.

Telkom 3S will provide high-definition television services (HDTV), as well as mobile communications and internet applications. Positioned at 118° East, Telkom 3S will provide C-band coverage of Indonesia and Southeast Asia, while extended C-band beams will cover Indonesia and part of Malaysia. It also is fitted with Ku-band transponders dedicated to national coverage.

Telkom 3S will be the 146th satellite built by Thales Alenia Space and its predecessors to be launched by Arianespace. It was built in Toulouse and Cannes, France, using a Spacebus 4000B2 platform.

The Arianespace order book includes nine more Thales Alenia Space satellites to be launched.

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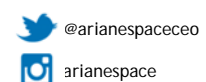
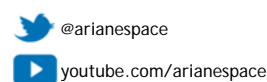
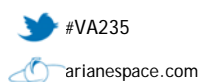
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## SKY Brasil-1 Telkom 3S



## MISSION DESCRIPTION

The first Arianespace Ariane 5 launch of the year will place both of its satellite passengers into geostationary transfer orbit.

The launcher will be carrying a total payload of approximately 10,482 kg.

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

### DATE AND TIME



Liftoff is planned on **Tuesday, February 14, 2017** as early as possible within the following launch window:

- > Between 4:39 p.m. and 6:05 p.m., Washington D.C. time
- > Between 6:39 p.m. and 8:05 p.m., Kourou time in French Guiana
- > Between 7:39 p.m. and 9:05 p.m., Brasilia time
- > Between 21:39 and 23:05, Universal Time (UTC)
- > Between 10:39 p.m. and 00:05 p.m., Paris time during the night of February 14 to 15
- > Between 4.39 a.m. and 6:05 a.m., Jakarta time, Indonesia, on February 15.

### MISSION DURATION



The nominal duration of the mission (from liftoff to separation of the satellites) is:

**39 minutes, 43 seconds.**

### TARGETED ORBIT



Perigee altitude  
**250 km.**



Apogee altitude  
**35,736 km.**



Inclination  
**4 degrees**

### THE LAUNCH AT A GLANCE

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

About seven seconds after start of the 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 13 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.

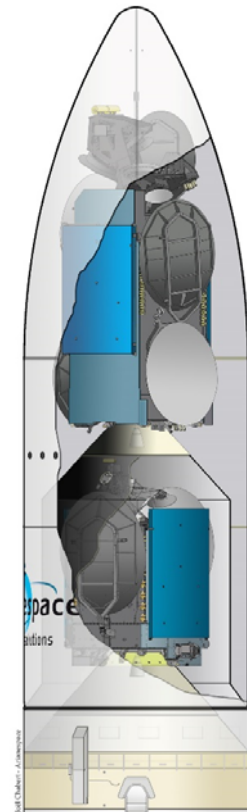
The fairing protecting the payload is jettisoned at T+202 seconds.

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 splashes down off the coast of Africa in the Atlantic Ocean (in the Gulf of Guinea). At orbital injection, the launcher will have attained a velocity of approximately 9,365 meters/second, and will be at an altitude of 640 kilometers.

### PAYLOAD CONFIGURATION

- > Upper payload (CUH): **SKY Brasil-1 (SKYB-1)**  
Mass at liftoff: 6,000 kg.
- > Lower payload (CUB): **Telkom 3S**  
Mass at liftoff: about 3,550 kg.
- > Long version of the payload fairing
- > SYLDA (SYstème de Lancement Double Ariane)





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Telkom 3S

## SKY Brasil-1 satellite (SKYB-1)



<b>CUSTOMER</b>	AT&T/DIRECTV via DIRECTV Latin America
<b>PRIME CONTRACTOR</b>	Airbus Defence and Space
<b>MISSION</b>	Broadcasting and communications services
<b>MASS</b>	Approximately 6,000 kg. at liftoff
<b>STABILIZATION</b>	3 axis
<b>DIMENSIONS</b>	7.5 m x 2.9 m x 2.3 m
<b>PLATFORM</b>	Eurostar E3000
<b>PAYLOAD</b>	60 Ku-band transponders
<b>ONBOARD POWER</b>	16 kW (end of life)
<b>DESIGN LIFE</b>	More than 19 years
<b>ORBITAL POSITION</b>	43.1° west
<b>COVERAGE AREA</b>	Brazil, North Atlantic Ocean

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## Telkom 3S satellite



<b>CUSTOMER</b>	Telkom Indonesia, in the scope of a turnkey contract with Thales Alenia Space
<b>PRIME CONTRACTOR</b>	Thales Alenia Space
<b>MISSION</b>	High-definition television (HDTV), mobile communications and Internet
<b>MASS</b>	3,550 kg. at liftoff
<b>STABILIZATION</b>	3 axis
<b>DIMENSIONS</b>	1.8 m x 2.95 m x 2.86 m
<b>PLATFORM</b>	Spacebus 4000B2
<b>PAYLOAD</b>	24 C-band transponders, 8 extended C-band transponders and 10 Ku-band transponders
<b>PAYLOAD POWER</b>	6.4 kW
<b>DESIGN LIFE</b>	More than 16 years
<b>ORBITAL POSITION</b>	118° East
<b>COVERAGE AREA</b>	Indonesia and south-east Asian in C-band Indonesia and part of Malaysia with additional C-band Indonesia in Ku-band

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## ARIANE 5-ECA LAUNCH VEHICLE

The launcher is delivered to Arianespace by Airbus Safran Launchers as production prime contractor.

54.8 m

### Fairing

(RUAG Space): 17 m.  
Mass: 2.4 t.

780 tons  
(total mass at liftoff)

### SKY Brasil-1 ou SKYB-1

(AT&T/DIRECTV via DIRECTV Latin America)  
Mass: 6,000 kg.

### ACU - Payload adaptor (2)

(RUAG Space or Airbus Safran Launchers)  
Mass: approx. 140 kg. each

### Telkom 3S

(Telkom Indonesia)  
Mass: 3,550 kg.

### SYLDA - Internal structure

7 versions (Height: 4.9 to 6.4 m)  
Mass: 400 to 530 kg.

### Vehicle Equipment Bay

Height: 1.13 m.  
Mass: 970 kg.

### ESC-A - Cryogenic upper stage

Height: 4.71 m.  
Mass: 19 t.

### HM-7B engine

Thrust: 67 kN (in vacuum)  
945 sec. of propulsion

H14.6

### EPC - Cryogenic main stage

Height: 31 m.  
Mass: 188 t.

H173

Propellants (in metric tons)  
at T-0  
H: Cryogenic  
P: Solid

### EAP - Solid rocket boosters

Height: 31.6 m.  
Mass: 277 t approx.

P240

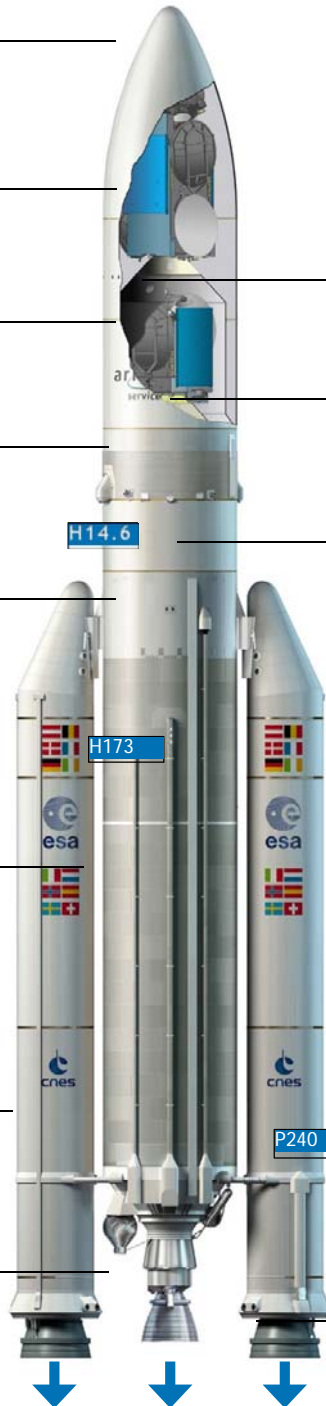
### Vulcain 2 engine

Thrust: 1,390 kN (in vacuum)  
540 sec. of propulsion

### MPS - Solid Rocket Motor (SRM)

Average thrust: 5,060 kN  
Maximum thrust: 7,080 kN (in vacuum)  
130 sec. of propulsion

13,000 kN at Liftoff  
(at T+7.3 sec.)





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## LAUNCH CAMPAIGN - ARIANE 5 SKY Brasil-1 (SKYB-1) / Telkom 3S

### SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
December 7, 2016		Campaign start review EPC unpacking
December 8, 2016		EPC erection - EAP 2 transfer
December 9, 2016		EAP1 transfer and EAP positioning
December 12, 2016		EPC/EAP integration
December 15, 2016		Erection of ESC-A with Vehicle Equipment Bay
January 10, 2017	Arrival in French Guiana of SKYB-1 and transportation to the S5C hall	
January 12, 2017	SKYB-1 fitcheck in the S5C hall	
January 13, 2017	Arrival in French Guiana of Telkom 3S and transportation to the S5C hall	
January 23, 2017	Telkom 3S fitcheck in the S5B hall	
January 23 to 27, 2017	SKYB-1 fueling operations	
January 25, 2017		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
January 25 to 28, 2017	Telkom 3S fueling operations	
January 30, 2017	SKYB-1 integration on ACUH in the S5B hall;	
January 31, 2017	SKYB-1 transfer to the Final Assembly Building (BAF)	
February 1, 2016	SKYB-1 integration on SYLDA Telkom 3S integration on ACHUB	
February 2, 2016	SKYB-1 encapsulation in the payload fairing Telkom 3S transfer to the Final Assembly Building (BAF)	

### SATELLITES AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Wednesday, February 3, 2017	Telkom 3S integration on launch vehicle	HM7B engine final inspection
Saturday, February 4, 2017	Completion of composite integration on launcher and payload checks	
Monday, February 6, 2017		Finalization of the composite/launcher integration, and payload checks
Wednesday, February 8, 2017		Launch rehearsal
Thursday, February 9, 2017		Arming of launch vehicle
Friday, February 10, 2017		Launch readiness review (RAL), final preparation of launcher and BAF for the chronology
Monday, February 13, 2017		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Tuesday, February 14, 2017		Start of launch countdown, EPC and ESC-A filling with liquid oxygen and liquid hydrogen



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## COUNTDOWN AND FLIGHT SEQUENCE

The countdown comprises all final preparation steps for the launcher, the satellites/spacecraft and the launch site. If it proceeds as planned, the countdown leads to ignition of the main stage engine, then the two boosters, for a liftoff at the targeted time.

The countdown culminates in a synchronized sequence, 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 shifts outside of 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	EVENT
- 11 h 23 min	Start of final countdown
- 10 h 33 min	Check of electrical systems
- 04 h 23 min	Start of filling of EPC with liquid oxygen and liquid hydrogen
- 03 h 18 min	Chilldown of Vulcain main stage engine
- 03 h 43 min	Start of filling of ESC-A with liquid oxygen and liquid hydrogen
- 01 h 15 min	Check of connections between launcher and the telemetry, tracking and command systems
- 7 min	"All systems go" report, allowing start of synchronized sequence
- 4 min	Tanks pressurized for flight
-1 min	Switch to onboard power mode
- 05 s	Opening command for the cryogenic arms
- 04 s	Onboard systems take over
<b>T-0</b>	<b>Ignition of the cryogenic main stage engine (EPC)</b>
+ 07 s	Ignition of solid boosters (EAP)
+ 07 s	Liftoff
+ 13 s	End of vertical climb, beginning of pitch motion
+ 17 s	Beginning of roll maneuver
+ 2 min 20 s	EAP separation
+ 3 min 21 s	Fairing jettisoned
+ 7 min 49 s	Acquisition by Natal tracking station
+ 8 min 55 s	End of EPC thrust phase
+ 9 min 01 s	EPC separation
+ 9 min 05 s	Ignition of ESC-A stage
+ 13 min 41 s	Acquisition by Ascension tracking station
+ 18 min 26 s	Data acquisition by Libreville tracking station
+ 23 min 10 s	Acquisition by Malindi tracking station
+ 25 min 16 s	Injection
+ 27 min 25 s	SKY Brasil-1 satellite separation
+ 29 min 16 s	SYLDA separation
+ 39 min 43 s	Telkom 3S satellite separation
+ 53 min 30 s	End of the Arianespace mission





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## ARIANE 5 ECA MISSION PROFILE

The launcher's attitude and trajectory are entirely controlled by the two onboard computers in the Ariane 5 Vehicle Equipment Bay (VEB).

The synchronized sequence starts seven minutes 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, the sequence 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:

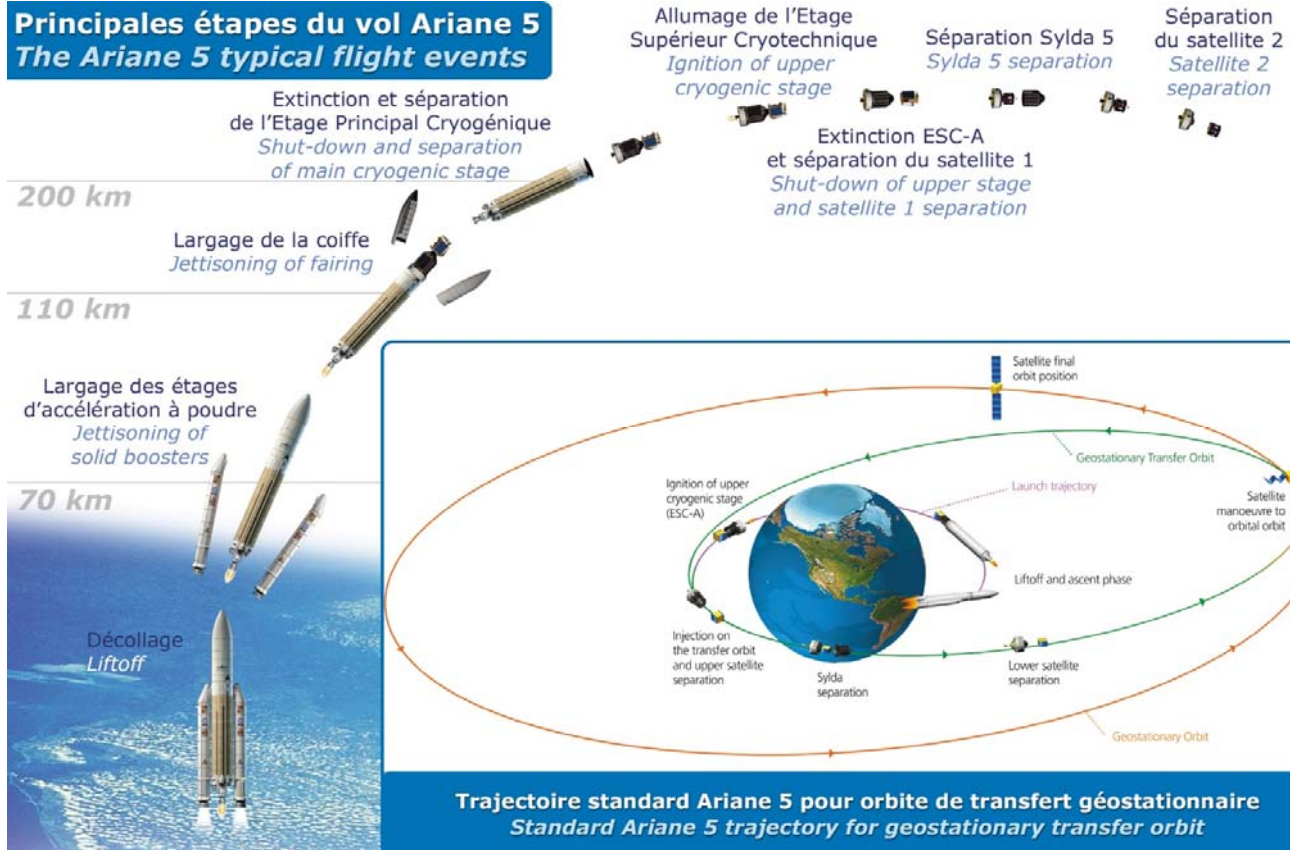
- > Startup of water injection in the flame trenches and exhaust guide (T-30 sec).
- > Hydrogen aspiration for chilldown of the Vulcain engine in the exhaust guide (T-18 sec).
- > Burnoff of hydrogen used for chilldown (T-5.5 sec).

At T-4 seconds, the onboard computer takes over control of final engine startup and liftoff operations. It:

- > Starts the ignition sequence for the Vulcain main stage engine (T-0).
- > Checks engine operation (from T+4.5 to T+6.9 sec).
- > Commands ignition for the solid boosters at T+7.05 sec for liftoff at T+7.3 seconds.

Any shutdown of the synchronized sequence after T-7 minutes automatically places the launcher back in its T-7 minute configuration.

### Principales étapes du vol Ariane 5 The Ariane 5 typical flight events





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## ARIANESPACE AND THE GUIANA SPACE CENTER

### ARIANESPACE, THE WORLD'S FIRST LAUNCH SERVICES COMPANY

Arianespace was founded in 1980 as the world's first launch Services & Solutions company. Arianespace is a subsidiary of Airbus Safran Launchers, which holds 74% of its share capital; the balance is held by 17 other shareholders from the European launcher industry.

Since the outset, Arianespace has signed over 530 launch contracts and launched 540-plus satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace. The company posted sales of more than 1.4 billion euros in 2016.

The company's activities are worldwide, with the headquarters in Evry, France (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 services to satellite operators from around the world, including private companies and government agencies. These services call on three launch vehicles:

- > The Ariane 5 heavy-lift launcher, operated from the Guiana Space Center in French Guiana.
- > The Soyuz medium-lift launcher, currently in operation at the Guiana Space Center and the Baikonur Cosmodrome in Kazakhstan.
- > The Vega light-lift launcher, also operated from the Guiana Space Center.

Building on its complete family of launchers, Arianespace has won over half of the commercial launch contracts up for bid worldwide in the past two years. Arianespace now has a backlog of more than 70 satellites to be launched.

### THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For more than 40 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches. It primarily comprises the following:

- > The 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, Soyuz and Vega launch complexes, comprising the launch zones and launcher integration buildings.
- > Various industrial facilities, including those operated by Regulux, Europropulsion, Air Liquide Spatial Guyane and Airbus Safran Launchers - all participating in the production of Ariane 5 components. A total of 40 European manufacturers and local companies are involved in the launcher operations.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), the French CNES space agency and Arianespace. ESA is responsible for the Ariane, Soyuz and Vega development programs. Once these launch systems are qualified, ESA transfers responsibility to Arianespace as the operator. 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 France's space program, the Guiana Space Center has evolved into 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 the CNES/CSG fixed expenses, and also helps finance the fixed costs for the ELA launch complexes.

The French CNES space agency has several main responsibilities at the Guiana Space Center. It designs all infrastructure and, on behalf of the French government, is responsible for safety and security. It provides the resources needed to prepare the satellites and launchers for missions. Whether during tests or actual launches, CNES is also responsible for overall coordination of operations and 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.

### ARIANESPACE IN FRENCH GUIANA

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 Airbus Safran Launchers 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), which is operated by the Guiana Space Center (CNES/CSG). Next, Arianespace oversees final assembly of the launcher and integration of satellites in the Final Assembly Building (BAF), followed by transfer of the Ariane launcher to Launch Zone No. 3 (ZL3), and then the final countdown and liftoff - which are managed from the Launch Control Center No. 3 (CDL3).

Arianespace deploys a top-flight team and technical facilities to ensure the launchers and their satellite payloads are 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.