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LAUNCH KIT

March 2017

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ARIANESPACE TO LAUNCH TELECOM SATELLITES FOR BRAZIL AND SOUTH KOREA USING AN ARIANE 5

For its fourth launch of the year, and the second Ariane 5 mission in 2017 from the Guiana Space Center in French Guiana, Arianespace will orbit two satellites: SGDC for the Brazilian operator Visiona Tecnologia Espacial S.A., and KOREASAT-7 for ktsat of South Korea.

SGDC and KOREASAT-7 are the 555th and 556th satellites to be launched by Arianespace.

This will be the 287th mission by the Arianespace family of launchers, and the seventh all-Thales Alenia Space mission, as both satellites were built by this manufacturer.

CONTENTS

SGDC

SGDC (Geostationary Defence and Strategic Communications Satellite) is the first Brazilian government satellite, and the first for the operator Visiona Tecnologica Espacial S.A. to be launched by Arianespace, performed within the scope of a turnkey contract with Thales Alenia Space.

Visiona Tecnologia Espacial S.A. is a joint venture of Telebras Telecomunicações Brasileiras S.A. and Embraer Defense & Security. The SGDC satellite will be dedicated to strategic communications for the Brazilian Ministry of Defense, as well as the deployment of broadband services for the Ministry of Telecommunications. In particular, it will provide isolated populations with access to broadband services.

Positioned at 75° West, SGDC will offer X-band coverage over all of South America and neighboring maritime routes. Its Ka-band payload will cover Brazil, making broadband Internet access available for isolated villages.

SGDC was built by Thales Alenia Space in Cannes, France using a Spacebus 4000C4 platform.

KOREASAT-7

KOREASAT-7 is the third KOREASAT satellite to be launched by Arianespace for ktsat, following KOREASAT-3 and KOREASAT-6, launched in September 1999 and December 2010, respectively.

Ktsat, a wholly-owned subsidiary of KT Corp. – the largest telecom/media service provider in South Korea – is the country's sole satellite service provider. Since the establishment of the Kumsan Satellite Center (Teleport) in 1970, ktsat has been the national leader in telecommunications and broadcasting services. It currently operates three satellites.

KOREASAT-7 will provide a full range of video and data applications, including Internet access, direct-to-home broadcasting (DTH), government communications and connectivity for VSAT (Very Small Aperture Terminal) networks.

Positioned at 116° East, KOREASAT-7 is designed to provide higher throughput and extended coverage over Korea, the Philippines, the Indochinese Peninsula, India and Indonesia. Its added Ka-band capacity, with steerable beams, will enable it to meet increased demand.

KOREASAT-7 was built by Thales Alenia Space in Toulouse and Cannes, France, using a Spacebus 4000B2 platform.

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MISSION DESCRIPTION

Arianespace's second Ariane 5 ECA 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 10,322 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, March 21, 2017**
as early as possible within the following launch window:

> Between **4:31 p.m. and 7:20 p.m.**, Washington D.C. time
> Between **5:31 p.m. and 8:20 p.m.**, Kourou time in French Guiana
> Between **5:31 p.m. and 8:20 p.m.**, Brasilia time
> Between **20:31 and 23:20,** Universal Time (UTC)
> Between **21:31 p.m. and 00:20 p.m.**, Paris time during the night of March 21 to 22
> Between **5:31 a.m. and 8:20 a.m.**, Seoul Time, South Korea, on March 22

MISSION DURATION

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

36 minutes, 46 seconds.

TARGETED ORBIT

Perigee altitude	Apogee altitude	Inclination
250 km.	35,926 km.	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.

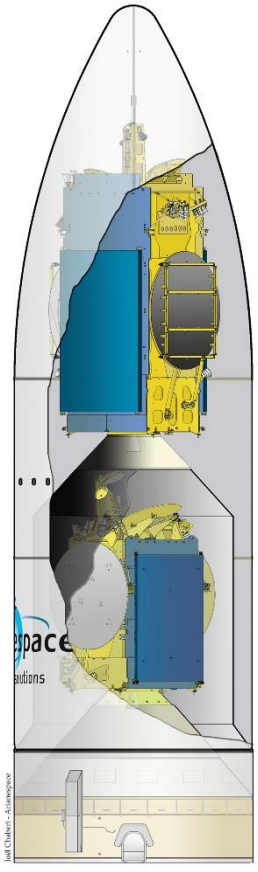
PAYLOAD CONFIGURATION

> **Upper payload (CUH):** SGDC
Mass at liftoff: 5,744 kg.

> **Lower payload (CUB):** KOREASAT-7
Mass at liftoff: approximately 3,680 kg.

> Long version of the payload fairing

> **SYLDA (SYstème de Lancement Double Ariane)**



SGDC SATELLITE

CUSTOMER	**Visiona Tecnologia Espacial S.A., within** the scope of a turnkey contract with **Thales Alenia Space**
PRIME CONTRACTOR	Thales Alenia Space
MISSION	Telecommunications: Internet broadband access, defense and strategic communications
MASS	Approximately 5,744 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	7.10 m x 2.20 m x 2.0 m (stowed configuration – for launch)
PLATFORM	Spacebus 4000C4
PAYLOAD	50 transponders in Ka band and 7 transponders in X-band
ONBOARD POWER	12 kW (end of life)
DESIGN LIFE	More than 18 years
ORBITAL POSITION	75° West
COVERAGE AREA	Brazil

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KOREASAT-7 SATELLITE

CUSTOMER	**ktsat**
PRIME CONTRACTOR	Thales Alenia Space
MISSION	Communications and broadcasting services
MASS	3,680 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	2.3 m x 1.75 m x 3.39 m
PLATFORM	Spacebus 4000B2
PAYLOAD	30 Ku-band transponders, 3 K0-band transponders
PAYLOAD POWER	Greater than 8 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	118° East
COVERAGE AREA	Korea, the Philippines, Indochina, India, Indonesia

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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.

SGDC

(Visiona Tecnologia Espacial S.A.)
Mass: 5,744 kg.

KOREASAT-7

(ktsat)
Mass: 3,680 kg.

Vehicle Equipment Bay

Height: 1.13 m.
Mass: 970 kg.

HM-7B engine

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

EPC - Cryogenic main stage

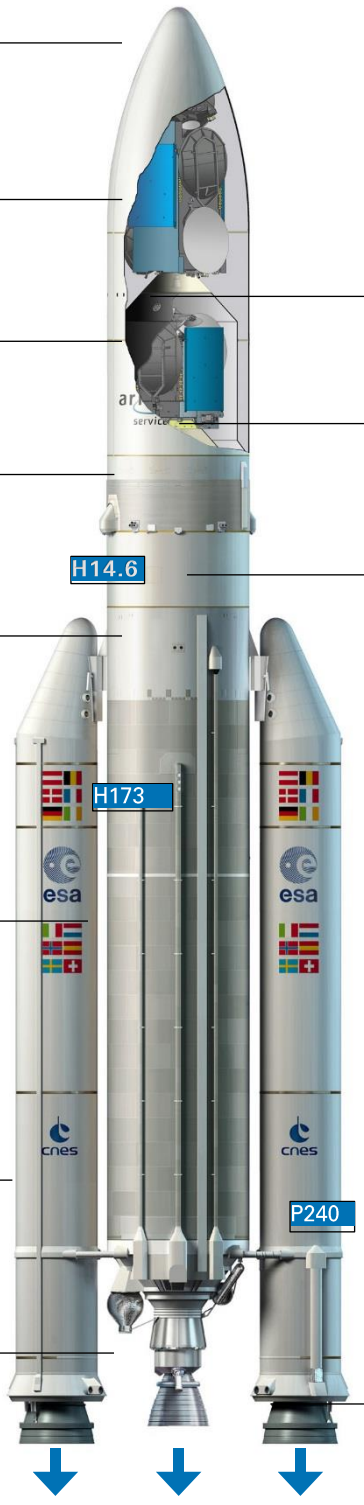
Height: 31 m.
Mass: 188 t.

EAP - Solid rocket boosters

Height: 31.6 m.
Mass: 277 t approx.

Vulcain 2 engine

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



780 tons
(total mass at liftoff)

ACU - Payload adaptor (2)

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

SYLDA - Internal structure

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

ESC-A - Cryogenic upper stage

Height: 4.71 m.
Mass: 19 t.

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

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.)

LAUNCH CAMPAIGN - ARIANE 5
SGDC / KOREASAT-7

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
January 30, 2017		Campaign start review EPC unpacking - EPC erection
January 31, 2017		EAP1 and EAP 2 transfer
February 1, 2017		EPC/EAP integration
February 6, 2017		Erection of ESC-A with Vehicle Equipment Bay
February 14, 2017	Arrival in French Guiana of SGDC and KOREASAT-7 and transportation to the S5	
February 23, 2017	KOREASAT-7 fitcheck	
February 24, 2017	SGDC fitcheck	
February 27 to March 3, 2017	SGDC fueling operations	
March 2 to 4, 2017	KOREASAT-7 fueling operations	
March 2, 2017		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
March 6, 2017	SGDC integration on ACUH in the S5B hall;	
March 7, 2017	SGDC transfer to the Final Assembly Building (BAF)	

SATELLITES AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Wednesday, March 8, 2017	SGDC integration on SYLDA KOREASAT-7 integration on ACHUB	
Thursday, March 9, 2017	SGDC encapsulation in the payload fairing KOREASAT-7 transfer to the Final Assembly Building (BAF)	
Friday, March 10, 2017	KOREASAT-7 integration on launch vehicle	HM7B engine final inspection
Saturday, March 11, 2017	Completion of composite integration on launcher and payload checks	
Monday, March 13, 2017		Finalization of the composite/launcher integration, and payload checks
Wednesday, March 15, 2017		Launch rehearsal
Thursday, March 16, 2017		Arming of launch vehicle
Friday, March 17, 2017		Launch readiness review (RAL), final preparation of launcher and BAF for the chronology
Monday, March 20, 2017		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Tuesday, March 21, 2017		Start of launch countdown, EPC and ESC-A filling with liquid oxygen and liquid hydrogen

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
T-O	**Ignition of the cryogenic main stage engine (EPC)**
+ 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 21 s	EAP separation
+ 3 min 22 s	Fairing jettisoned
+ 7 min 51 s	Acquisition by Natal tracking station
+ 8 min 53 s	End of EPC thrust phase
+ 8 min 59 s	EPC separation
+ 9 min 03 s	Ignition of ESC-A stage
+ 13 min 48 s	Acquisition by Ascension tracking station
+ 18 min 25 s	Data acquisition by Libreville tracking station
+ 23 min 06 s	Acquisition by Malindi tracking station
+ 24 min 57 s	Injection
+ 28 min 11 s	**SGDC satellite separation**
+ 29 min 52 s	SYLDA separation
+ 36 min 46 s	**KOREASAT-7 satellite separation**
+ 53 min 30 s	End of the Arianespace mission

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).

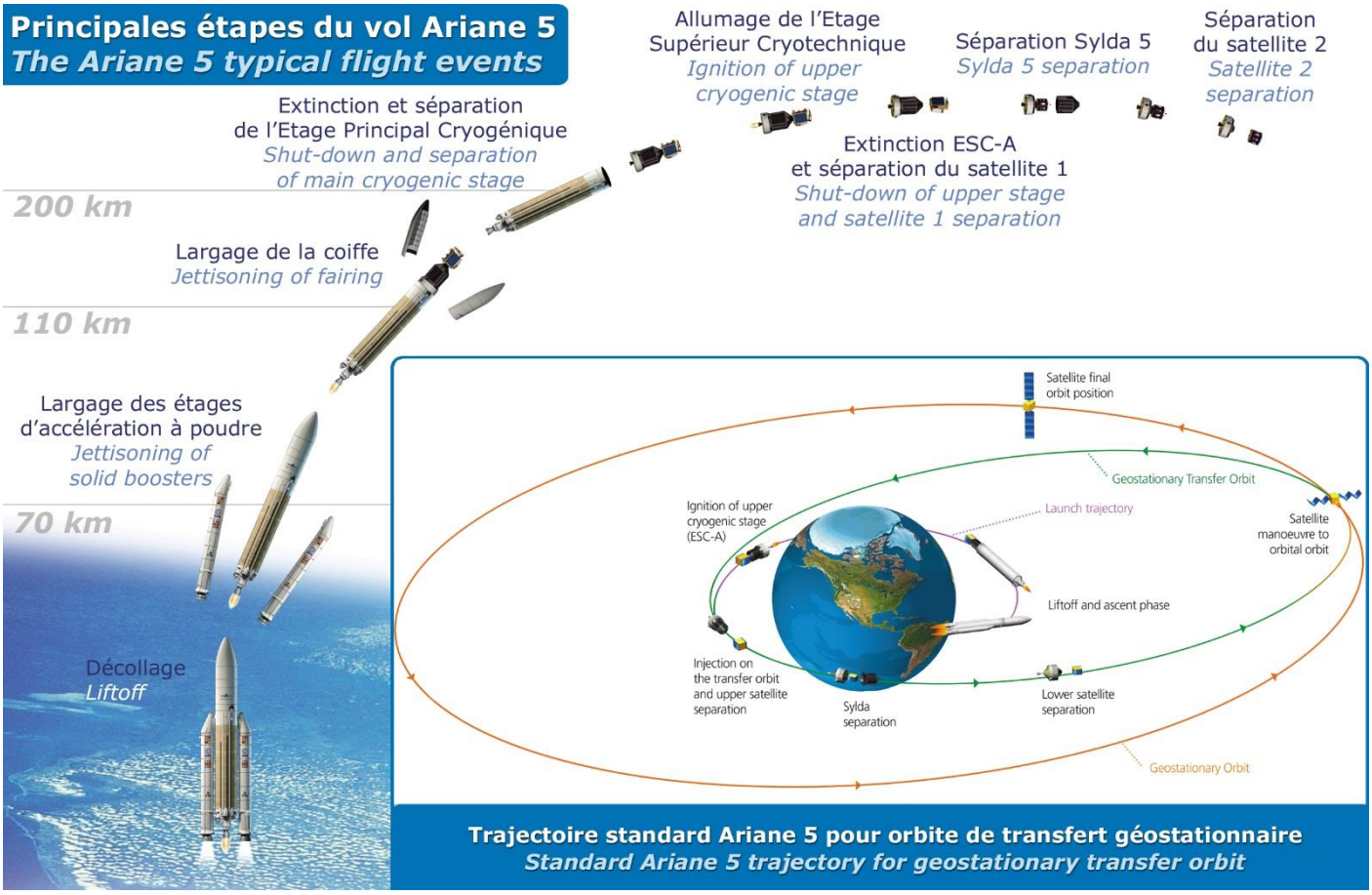
At T-4 seconds, the onboard computer takes over control of final engine startup and liftoff operations. It:

> 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.



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 550-plus satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace. The company posted sales of approximately 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 (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 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.