LAUNCH KIT

September 2017

VA239

Intelsat 37e

BSAT-4a

ARIANESPACE TO LAUNCH INTELSAT 37e AND BSAT-4a FOR INTELSAT AND JAPAN'S BROADCASTING SATELLITE SYSTEM CORPORATION (B-SAT)

For its ninth launch of the year, and the fifth Ariane 5 mission in 2017 from the Guiana Space Center in French Guiana, Arianespace will orbit Intelsat 37e for the global operator Intelsat and BSAT-4a for SSL (Space Systems Loral) in the framework of a turnkey contract for the Japanese operator B-SAT.

With this 292nd mission performed by its family of launchers, and the 239th utilizing an Ariane family launch vehicle - Arianespace is at the service of the latest innovation in space telecommunications.

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Intelsat 37e

Intelsat 37e is the fifth broadband infrastructure satellite in the Intelsat Epic^{NG} series. The satellite will be the fourth Epic^{NG} spacecraft orbited by Arianespace to date, after a successful dedicated Ariane 5 mission with Intelsat 29e, the 100% successful dual launch to orbit the Intelsat 33e and Intelsat 36 satellites, and less than six months after the successful orbiting of SKY Brasil 1/Intelsat 32e.

Intelsat 37e represents a significant evolution of the award-winning Epic^{NG} platform. Its enhanced, advanced digital payload features the highest throughput of the entire Intelsat Epic^{NG} fleet, with full beam interconnectivity in three commercial bands and significant upgrades on power and coverage flexibility.

Intelsat 37e incorporates enhanced power sharing technology, which enables the assignment of power between shaped, fixed and steerable spot Ku-band and Ka-band beams. This allows optimized services to meet the requirements of in-demand applications – by region – and deliver higher transmission efficiency for mobility and government customers in the Americas, Africa and Europe.

Intelsat 37e is the first satellite to offer interconnectivity between three different bands. The next-generation spacecraft delivers high-performance service in C-, Ku- and Ka-bands for use in wireless backhaul, enterprise VSAT and mobility networks. The C-band payload offers a unique mix of high-power spot and wide beams designed to deliver additional services and improved throughput. Intelsat 37e also features a Ku-band steerable beam that can be positioned anywhere to support government applications. In addition to the steerable beams and power-sharing technology, Intelsat 37e provides additional resiliency to the IntelsatOne® Flex managed service platform, for use in enterprise and mobility applications.

This satellite provides continuity for the Intelsat 901 satellite, which is used by enterprise network providers, wireless operators and mobility service providers. The beams on Intelsat 37e form part of the IntelsatOne Flex mobility and enterprise managed service infrastructure, which is used to support air and maritime services, as well as private data networks. It is designed to provide service for more than 15 years.

Built by Boeing based on its 702MP platform, Intelsat 37e will be the 55th satellite made by this manufacturer (or its predecessors) to be launched by Arianespace.

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BSAT-4a

The **BSAT-4a** satellite, designed and built for Broadcasting Satellite System Corporation (B-SAT), a leading broadcasting satellite operator in Japan, will be used for Direct-to-Home (DTH) television service in Japan.

BSAT-4a is the 9th satellite to be launched by Arianespace for B-SAT, and is being orbited as part of a turnkey contract between B-SAT and U.S.-based satellite manufacturer SSL.

Arianespace has launched all B-SAT satellites since the creation of this Japanese operator, reflecting the launch services company's exceptionally strong position in this market. BSAT-4a is the 30th launch contract for a geostationary commercial satellite won by Arianespace in Japan. This mission also underlines the exceptional quality of the partnership between Arianespace, SSL and the Japanese operator B-SAT.

The BSAT-4a satellite has 24 Ku-band transponders and will expand the availability of advanced television services such as high definition and 4K/8K ultra-high definition.

The satellite is based on the highly-reliable SSL 1300 platform, which provides the flexibility to support a broad range of applications and technology advances. It is designed to provide service for 15 years or longer.

BSAT-4a will be the 64nd SSL-built satellite to be launched by Arianespace.

MISSION DESCRIPTION

Arianespace's fifth 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 10,838 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, September 5, 2017**
as early as possible within the following launch window:

> Between 5:51 p.m. and 6:24 p.m., Washington, D.C. time
> Between 6:51 p.m. and 7:24 p.m., in Kourou, French Guiana
> Between 21:51 and 22:24, Universal Time (UTC)
> Between 11:51 p.m. and 00:24 a.m., Paris time during the night of September 5 to 6
> Between 6:51 a.m. and 7:24 a.m., Tokyo time on September 6.

MISSION DURATION

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

47 minutes, 15 seconds.

TARGETED ORBIT

Perigee altitude	Apogee altitude	Inclination
250 km.	35,706 km.	6 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.

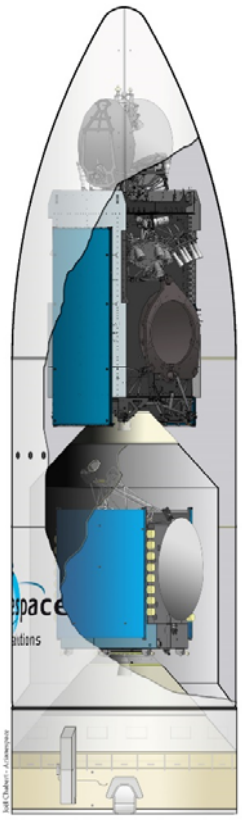
PAYLOAD CONFIGURATION

> **Upper payload (CUH): Intelsat 37e**
Mass at liftoff: 6,438 kg.

> **Lower payload (CUB): BSAT-4a**
Mass at liftoff: 3,520 kg.

> Long version of the payload fairing

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



Intelsat 37e SATELLITE

CUSTOMER	**Intelsat**
PRIME CONTRACTOR	Boeing
MISSION	New generation of fixed and mobile communications
MASS AT LAUNCH	6,438 kg.
STABILIZATION	3 axis
DIMENSIONS	7.9 m x 3.7 m x 3.2 m
PLATFORM	Boeing-702 MP
PAYLOAD	High throughput C-, Ku, and Ka-band transponders - 45 gigabits per second of bandwidth.
ONBOARD POWER	14 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	342° East
COVERAGE AREA	Americas, Africa and Europe

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BSAT- 4a SATELLITE

CUSTOMER	SSL (Space Systems Loral) on behalf of B-SAT.
PRIME CONTRACTOR	SSL
MISSION	DTH television services - advanced television services such as HD and 4K/8K ultra HD
MASS	3,520 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	5.1 m x 2.7 m x 3.1 m
PLATFORM	1300 bus
PAYLOAD	24 Ku-transponders
ONBOARD POWER	10.3 kW (end of life)
DESIGN LIFE	15 years
ORBITAL POSITION	110° East
COVERAGE AREA	Japan

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ARIANE 5 ECA LAUNCH VEHICLE

The launcher is delivered to Arianespace by ArianeGroup as production prime contractor.

54.8 m

Fairing

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

Intelsat 37e

(Intelsat)
Mass: 6,438 kg.

BSAT-4a

(SSL/ B-SAT)
Mass: 3,520 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

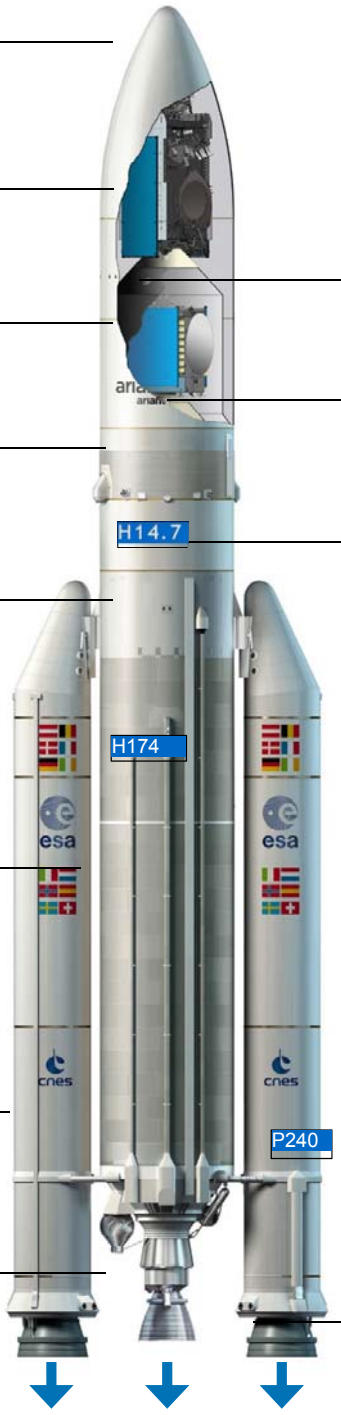
Height: 31 m.
Mass: 188 t.

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)

PA - 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
Intelsat 37e – BSAT-4a

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
July 18, 2017		Campaign start review EPC unpacking - EAP 2 transfer- EPC erection
July 19, 2017		EAP1 transfer - EPC/EAP integration
July 25, 2017		Erection of ESC-A with Vehicle Equipment Bay
August 2, 2017	Arrival in French Guiana of Intelsat 37e and transportation to the S5C	
August 4, 2017	Arrival in French Guiana of BSAT-4a and transportation to the S5C Intelsat 37e fit-check	
August 12, 2017	BSAT-4a fit-check	
August 14, 2017		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
August 16 to 18, 2017	BSAT-4a fueling operations	
August 16 to 19, 2017	Intelsat 37e fueling operations	
August 21, 2017	Intelsat 37e integration on payload adaptor in the S5B hall;	
August 22, 2017	Intelsat 37e transfer to the Final Assembly Building (BAF)	
August 23, 2017	BSAT-4a integration on payload adaptor Intelsat 37e integration on SYLDA	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Thursday, August 24, 2017	BSAT-4a transfer to the Final Assembly Building (BAF) Intelsat 37e encapsulation in the payload fairing	
Friday, August 25, 2017	BSAT-4a integration on launch vehicle	HM7B engine final inspection
Saturday, August 26, 2017	Completion of composite integration on launcher and payload checks	
Monday, August 28, 2017		Finalization of the composite/launcher integration, and payload checks
Tuesday, August 29, 2017		Final preparation of launcher
Wednesday, August 30, 2017		Launch rehearsal
Thursday, August 31, 2017		Arming of launch vehicle
Friday, September 1, 2017		Launch readiness review (RAL), final preparation of launcher and BAF for the chronology
Monday, September 4, 2017		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Tuesday, September 5, 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 38 min	Start of filling of EPC with liquid oxygen and liquid hydrogen
- 03 h 28 min	Start of filling of ESC-A with liquid oxygen and liquid hydrogen
- 03 h 18 min	Chilldown of Vulcain main stage engine
- 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-0	Reference time
+ 01 s	Ignition of the cyogenic main stage (EPC)
+ 07.05s	Ignition of solid boosters (EAP)
+ 07.3 s	Liftoff
+ 13 s	End of vertical climb, beginning of pitch motion
+ 17 s	Beginning of roll maneuver
+ 2 min 22 s	EAP separation
+ 3 min 23 s	Fairing jettisoned
+ 8 min 17 s	Acquisition by Natal tracking station
+ 8 min 56 s	End of EPC thrust phase
+ 9 min 02 s	EPC separation
+ 9 min 06 s	Ignition of ESC-A stage
+ 13 min 50 s	Acquisition by Ascension tracking station
+ 18 min 26 s	Data acquisition by Libreville tracking station
+ 23 min 09 s	Acquisition by Malindi tracking station
+ 25 min 31 s	Injection
+ 29 min 50 s	**Intelsat 37e satellite separation**
+ 31 min 56 s	SYLDA separation
+ 47 min 15 s	**BSAT -4a satellite separation**

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).

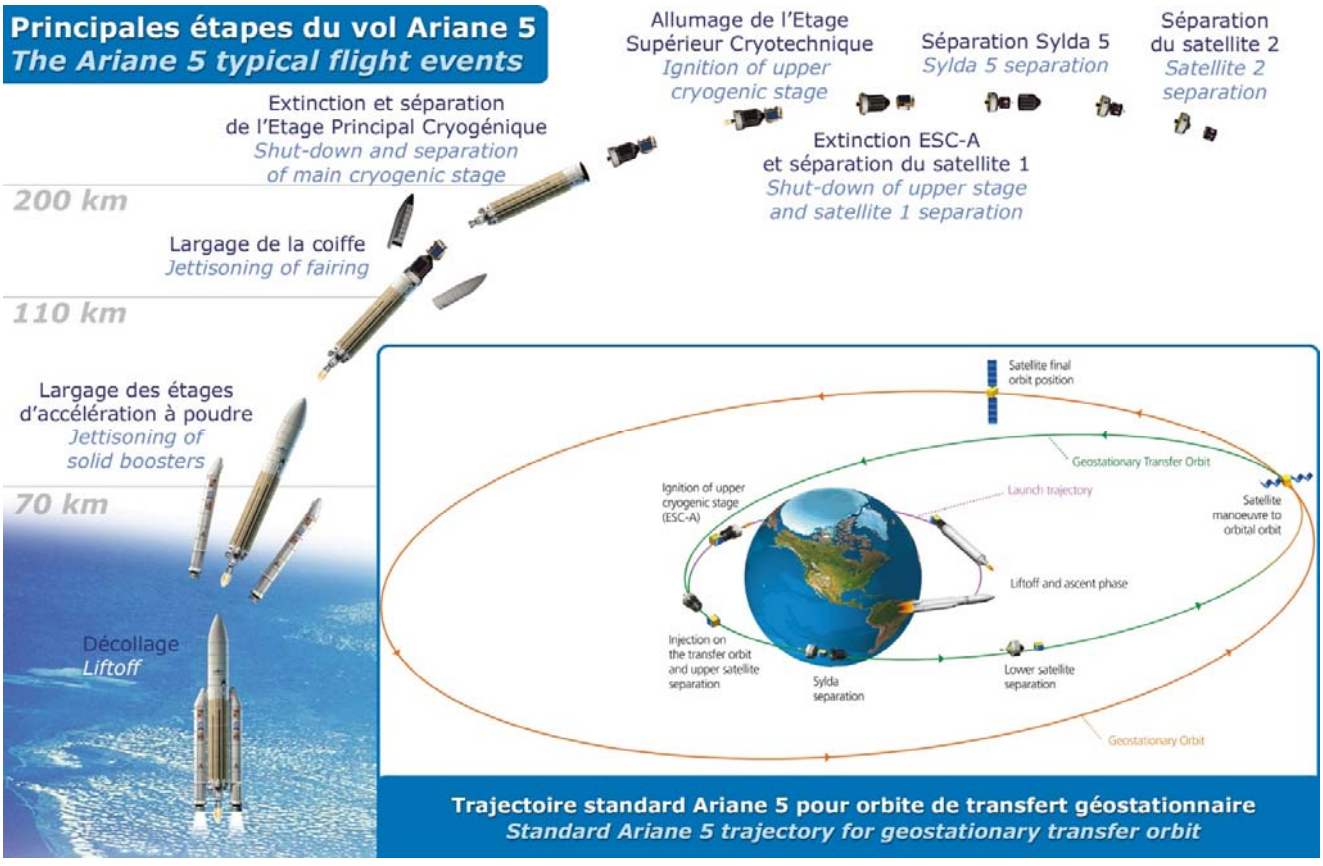
The synchronized sequence starts seven minutes before ignition (T-0). It is primarily designed to perform the final operations on the launcher prior to launch, along with the ultimate checks needed following switchover to flight configuration. As its name indicates, the sequence is fully automatic, and 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 ArianeGroup, 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 ArianeGroup - 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 ArianeGroup 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.