arianespace
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LAUNCH KIT

August 2016

VA232

Intelsat 33e

Intelsat 36

esa

INTELSAT 33e Epic NG

INTELSAT 36

cnes

SIXTH ARIANESPACE MISSION OF 2016: A DUAL LAUNCH FOR INTELSAT

For its sixth launch of the year, and the fourth by Ariane 5 in 2016, Arianespace will orbit the Intelsat 33e and Intelsat 36 satellites for operator Intelsat. Following the successful launch of Intelsat 29e on January 27, this is Arianespace's second Ariane 5 "all-Intelsat" launch, based on more than 30 years of partnership.

278th mission by the Arianespace launcher family

Intelsat 33e and Intelsat 36 will be the 57th and 58th Intelsat satellites to be lofted by Arianespace, continuing a relationship that started with Intelsat 507's launch in October 1983.

This also is the second launch of the year for Intelsat with Arianespace, following the successful launch of Intelsat 29e on January 27, using another Ariane 5 vehicle.

Arianespace has developed a very solid partnership over the last 30 years with Intelsat, the world leader in satellite services in terms of revenues and in-orbit capacity. Fully half of Intelsat's current fleet was orbited by Arianespace.

Deploying a fleet of about 50 satellites, Intelsat provides high-performance connectivity solutions for the media, fixed and mobile broadband communications, as well as business, government and military applications.

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Intelsat 33e

Intelsat 33e is the second satellite in Intelsat's next-generation high-throughput Intelsat Epic ^{NG} series.

It will meet broadband demand for carrier-grade telecom services, enterprise networks, aeronautical connectivity and certain media services.

Ku-band spot beams provide broadband services for Europe, Africa, the Middle East and Asia, while a Ku-band wide beam provides broadcast coverage of Europe, the Middle East and Asia.

C-band spot beams cover high traffic telecom centers in Europe, Central Africa, the Middle East, Asia and Australia; and a C-band wide beam provides coverage over sub-Saharan Africa for data and media services.

Intelsat 33e is the second in an order for seven Intelsat Epic ^{NG} satellites and will be located at 60° East.

Intelsat 33e was built by Boeing using a 702MP platform. It will be the 52nd satellite built by Boeing (or its predecessors) to be launched by Arianespace.

Intelsat 36

Intelsat 36 is designed to enhance Intelsat's media neighborhoods serving the South African and Indian Ocean region.

The Ku-band payload was built to support MultiChoice, the leading direct-to-home platform in South Africa. The C-band payload provides in-orbit resilience for the company's leading video content distribution neighborhood at 68.5° East. Intelsat 36 will be collocated with Intelsat 20.

Intelsat 36 was built by SSL (Space Systems/Loral) on a 1300 platform in Palo Alto, California. It will be the 56th satellite using an SSL platform (and 50th with the 1300 configuration) to be launched by Arianespace.

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MISSION DESCRIPTION

The fourth Arianespace Ariane 5 launch of the year will place both satellites into geostationary transfer orbit.

The launcher will be carrying a total payload of approximately 10,735 kg.

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

DATE AND TIME

Liftoff is planned on **Wednesday, August 24, 2016** as early as possible within the following launch window:

> Between **06:55 p.m. and 07:40 p.m.**, Kourou time
> Between **05:55 p.m. and 06:40 p.m.**, Washington D.C. time
> Between **09:55 p.m. and 10:40 p.m.**, Universal Time (UTC)
> Between **11:55 p.m. and 12:40 a.m.**, Paris time.

MISSION DURATION

The nominal duration of the mission (from liftoff to separation of the satellites) is:
41 minutes and 45 seconds.

TARGETED ORBIT

Perigee altitude	Apogee altitude	Inclination
250 km.	35,879 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 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.

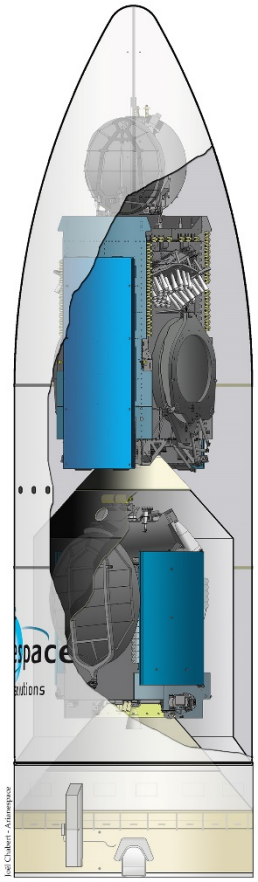
The fairing protecting the payload is jettisoned at T+200 seconds.

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 33e**
Mass at liftoff: 6,600 kg.
> **Lower payload (CUB): Intelsat 36**
Mass at liftoff: 3,253 kg.
> **Long version of the payload fairing**
> **SYLDA (Système de Lancement Double Ariane)**



INTELSAT 33e

CUSTOMER	Intelsat
PRIME CONTRACTOR	Boeing
MISSION	Next-generation fixed and mobile communications
MASS	6,600 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	7.9 m x 3.8 m x 3.2 m
PLATFORM	Boeing-702 MP
PAYLOAD	20 C-band + 249 Ku-band transponders (36 MHz equivalent) + 450 MHz Ka-band
ONBOARD POWER	13 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	60° East
COVERAGE AREA	Europe, Middle East, Africa, Asia Pacific

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INTELSAT 36

CUSTOMER	Intelsat
PRIME CONTRACTOR	SSL (Space Systems/Loral)
MISSION	Communications
MASS	3,253 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	5.2 m x 3.1 m x 3.4 m
PLATFORM	1300 bus
PAYLOAD	34 Ku-band transponders and 10 C-band transponders
ONBOARD POWER	15.8 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	68.5° East
COVERAGE AREA	Sub-Saharan Africa and South Asia

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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

Intelsat 33e
(Intelsat)
Mass: 6,600 kg.

Intelsat 36
(Intelsat)
Mass: 3,253 kg.

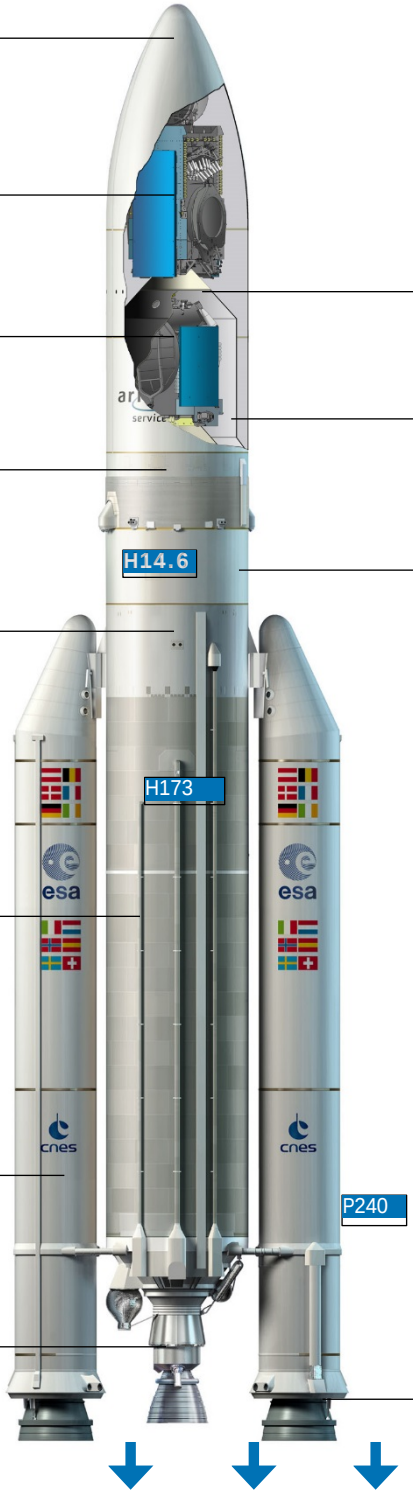
Vehicle Equipment Bay
Height: 1.13 m
Mass: 970 kg.

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



13,000 kN at Lify-off
(at T+7.3 sec.)

780 tons
(total mass at liftoff)

ACU - Payload adaptor (2)
(RUAG Space or Airbus Safran Launchers)
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

LAUNCH CAMPAIGN - ARIANE 5 - Intelsat 33e / Intelsat 36

SATELLITES AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATES	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
July 9, 2016		Campaign start review EPC destocking - EPC erection – EAP2 transfer
July 11, 2016		EAP1 transfer and EAP positioning
July 11, 2016		EPC/EAP integration
July 15, 2016		ESC-A erection +case
July 21, 2016	Arrival in French Guiana of Intelsat 33e; beginning of preparation in the S5B hall of the S5 facility	
July 23, 2016	Intelsat 33e fitcheck in the S5B hall	
July 25, 2016	Arrival in French Guiana of Intelsat 36; beginning of preparation in the S5C hall	
July 27, 2016	Intelsat 36 fitcheck in the S5C hall	
August 02 and 04, 2016	Intelsat 33e fueling operations in the S5B hall	
August 3, 2016		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
August 5, 2016	Intelsat 36 transfer to S5A	
August 6, 2016	Intelsat 33e integration on ACUH in the S5B	
August 8, 2016	Intelsat 33e transfer to the Final Assembly Building (BAF)	
August 9, 2016	Intelsat 33e integration on SYLDA	
August 9, 2016	Intelsat 36 fueling operations in the S5A hall	
August 10, 2016	Intelsat 33e encapsulation in the payload fairing	

SATELLITES AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATES	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Wednesday, August 10, 2016	Intelsat 36 integration on the ACUB in the S5B	
Thursday, August 11, 2016	Intelsat 36 transfer to Final Assembly Building (BAF)	
Friday, August 12, 2016	Intelsat 36 integration on launcher	
Saturday, August 13, 2016	Intelsat 36 encapsulation in the payload fairing and composite integration with Intelsat 33e on launcher	Final inspection of the HM-7B engine
Tuesday, August 16, 2016		Completion of composite integration on launcher and payload check
Thursday, August 18, 2016		Launch rehearsal
Friday, August 19, 2016		Arming of launch vehicle
Monday, August 22, 2016		Launch readiness review (RAL), final preparation of launcher and BAF for the chronology
Tuesday, August 23, 2016		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Wednesday, August 24, 2016		Start of launch countdown, EPC 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 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	EVENT
- 11 h 30 min	Start of final countdown
- 10 h 30 min	Check of electrical systems
- 04 h 20 min	Start of filling of EPC with liquid oxygen and hydrogen
-03 h 40 min	Start of filling of ESC-A with liquid oxygen and hydrogen
- 03 h 30 min	Chilldown of Vulcain main stage engine
- 01 h 10 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	Cryogenic arm opening command
- 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 22 s	EAP separation
+ 3 min 24 s	Fairing jettisoned
+ 7 min 41 s	Acquisition by Natal tracking station
+ 8 min 59 s	End of EPC thrust phase
+ 9 min 00 s	EPC separation
+ 9 min 04 s	Ignition of ESC-A stage
+ 13 min 28 s	Acquisition by Ascension tracking station
+ 18 min 13 s	Acquisition by Libreville tracking station
+ 23 min 11 s	Acquisition by Malindi tracking station
+ 25 min 13 s	Injection
+ 28 min 47 s	**Intelsat 33e satellite separation**
+ 30 min 21 s	SYLDA separation
+ 41 min 50 s	**Intelsat 36 satellite separation**
+1 h 00 min 06 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 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).

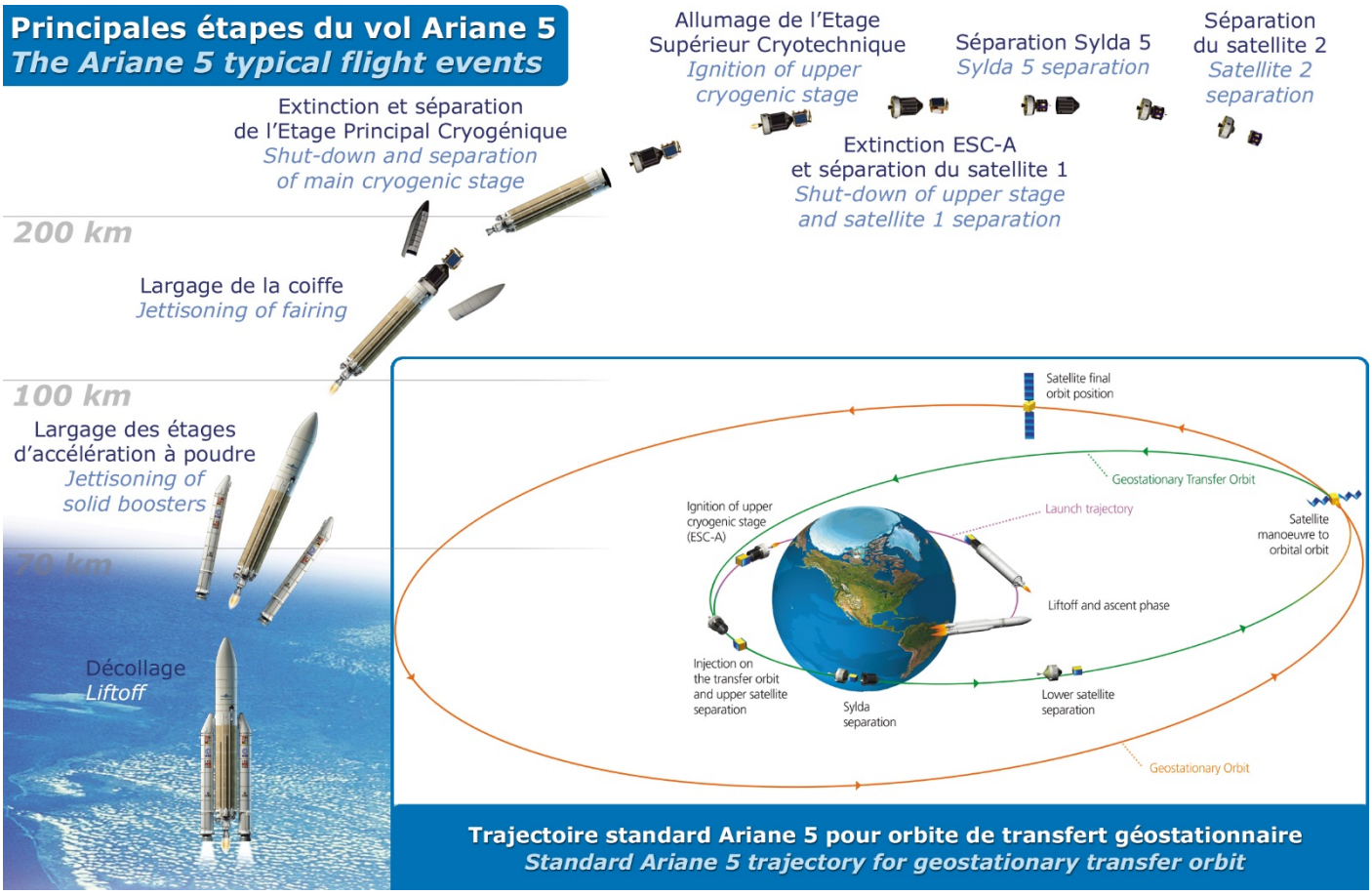
At T-4 seconds, the onboard computer takes over control of final engine startup and liftoff operations. It:

> 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 now has 20 shareholders from 10 European countries (including Airbus Safran Launchers, CNES and all European companies participating in the production of Ariane launchers). Since the outset, Arianespace has signed over 530 launch contracts and launched 520-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 2015.

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.