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LAUNCH KIT

JANUARY 2016

VA228

Intelsat 29e

esa

INTELSAT 29e Epic NG

BOEING

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ARIANESPACE'S FIRST LAUNCH IN 2016 AT THE SERVICE OF INTELSAT, ARIANE 5'S LEADING COMMERCIAL CUSTOMER

Arianespace's first launch of 2016 will use an Ariane 5 rocket to orbit the Intelsat 29e satellite for Intelsat. This global international operator is a long-standing partner of Arianespace, in a relation spanning more than 30 years.

Intelsat 29e is the first satellite in the company's next-generation, high throughput Intelsat Epic^{NG} series.

With this mission - the 273rd by its family of launchers, Arianespace kicks off another busy year of mission activity, establishing an objective of 11 launches; including as many as eight by Ariane 5.

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Intelsat 29e

Intelsat 29e will be the 56th Intelsat satellite launched by Arianespace, starting with the Intelsat 507 spacecraft in October 1983.

Since then, Arianespace and Intelsat - the world's leading provider of satellite services in terms of sales and in-orbit capacity - have developed a very fruitful partnership. For example, half of Intelsat's satellites now in operation were launched by Arianespace.

With its fleet of about 50 satellites, Intelsat provides high-performance connectivity solutions for media, fixed and mobile broadband communications; along with business, government and military applications.

Intelsat 29e is the first satellite in the company's next-generation, high throughput Intelsat Epic^{NG} series and will deliver high throughput Ku- spot beams in the Americas to meet broadband demand for carrier-grade telecom and enterprise connectivity as well as Atlantic Ocean and Caribbean coverage for dense aeronautical and shipping routes.
A transatlantic Ku-band wide beam overlay provides efficient broadcast capabilities for in-flight entertainment and the C-band wide beam provides full South American continent coverage for media distribution. It will offer throughput of 25 gigabits per second.

Three more Intelsat satellites are currently in Arianespace's launch manifest: two from the new Intelsat Epic^{NG} series, and Intelsat 36. The second Intelsat Epic^{NG} satellite (Intelsat 33e) and Intelsat 36 are scheduled to launch in 2016.

Intelsat 29e was built by Boeing using a Boeing 702MP platform.
It will be the 51st Boeing-built satellite to be launched by Arianespace.
The Arianespace launch manifest includes four more Boeing satellites: the two Intelsat Epic^{NG} models, along with SES-15 and one "undisclosed" satellite.

PRESS CONTACT
Claudia Euzet-Hoyau
c.hoyau@arianespace.com
+33 (0)1.60.87.55.11

MISSION DESCRIPTION

The first Arianespace Ariane 5 launch of the year will place the Intelsat 29e satellite into geostationary transfer orbit.

The launcher will be carrying a total payload of 6,700 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, **January 27, 2016**
as early as possible within the following launch window:

> Between **08:20:41.pm and 09:40:24 pm**, Kourou time
> Between **06:20:41 pm and 07:40:24 pm**, Washington D.C. time
> Between **11:20:41 pm and 00:40:24 am**, Universal Time (UTC), on January 28
> Between **00:20:41 am and 01:40:24 am**, Paris time, on January 28,

MISSION DURATION

The mission's nominal duration (from liftoff to satellite separation) is:

29 minutes and 52 seconds.

TARGETED ORBIT

Perigee altitude	Apogee altitude	Inclination
250 km.	35,546 km.	0.5 degrees

THE LAUNCH AT A GLANCE

About seven seconds after start of the main stage cryogenic engine's ignition at T-0, the two solid-propellant boosters are ignited, enabling liftoff.

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

The launcher first climbs vertically for six seconds, then rotates towards the East. It maintains an attitude that ensures the axis of the launcher remains parallel to its velocity vector, minimizing aerodynamic loads throughout the entire atmospheric phase until the solid boosters are jettisoned.

The fairing that protects the payload is jettisoned at T+220 seconds.The main stage splashes down off the coast of Africa in the Atlantic Ocean (in the Gulf of Guinea).

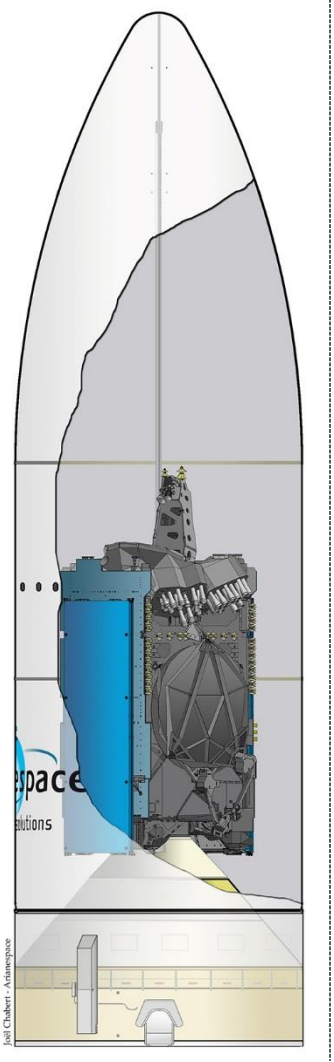
Once the first part of the flight is completed, the onboard computers optimize the trajectory in real time – thereby minimizing propellant consumption to bring the launcher first to the intermediate orbit targeted at the end of the main stage propulsion phase, and then to the final orbit at completion of the cryogenic upper stage's operation.

At orbital injection, the launcher will have attained a velocity of approximately 9,430 meters/second, and will be at an altitude of 560 kilometers.

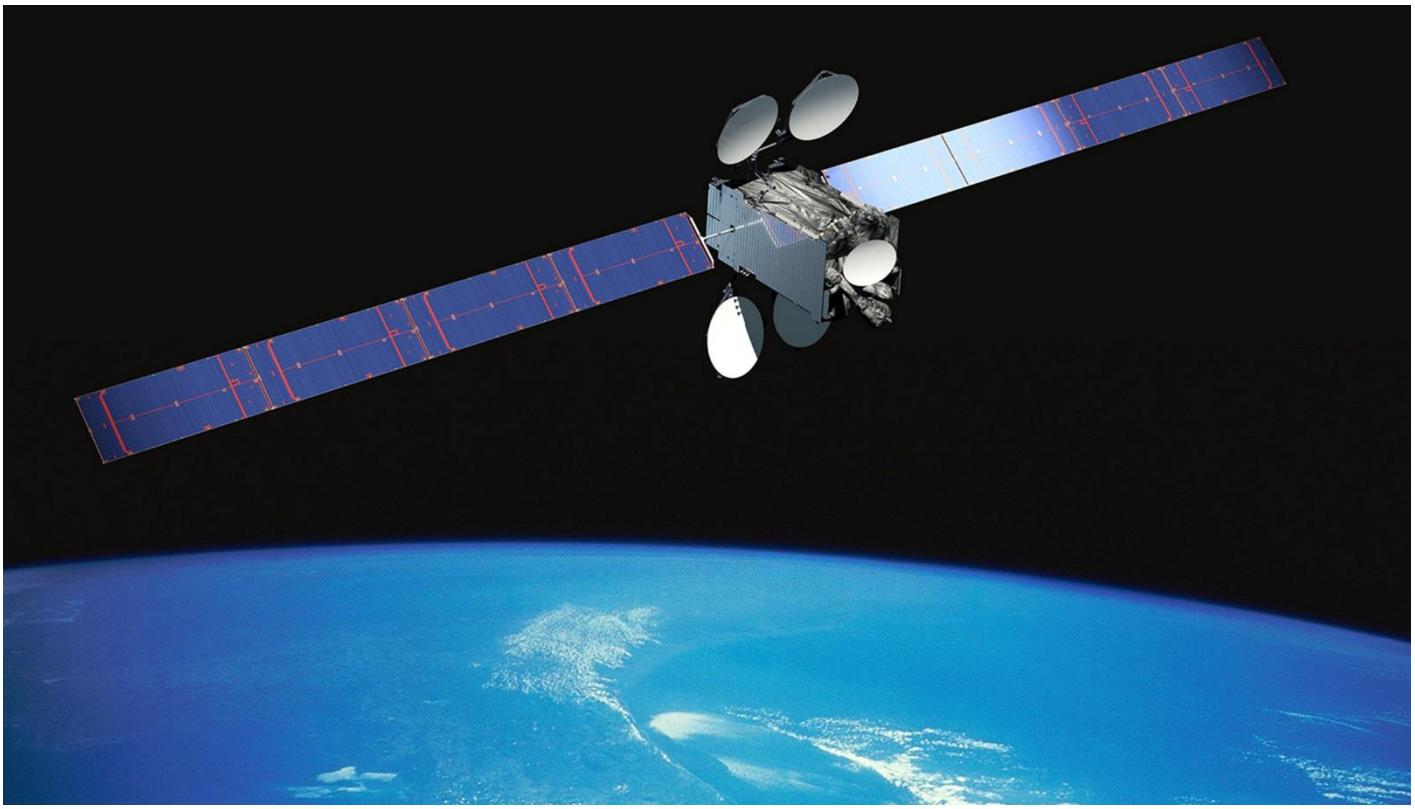
PAYLOAD CONFIGURATION

> **Payload (CU):** Intelsat 29e
Mass at liftoff: 6,552 kg.

> **Long version of the payload fairing**



Intelsat 29e



CUSTOMER	Intelsat
PRIME CONTRACTOR	BOEING
MISSION	Next generation fixed and mobile communications
MASS	6,552 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	6 m x 3 m x 2 m
PLATFORM	Boeing-702MP
PAYLOAD	20 C-band + 249 Ku-band transponders (36 MHz equivalent) + 450 MHz Ka-band
ONBOARD POWER	15.8 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	310° East
COVERAGE AREA	CONUS, Latin America and the North Atlantic region (for maritime and aviation routes)

PRESS CONTACT

Intelsat
Michele Loguidice
Director, Investor Relations & Corporate Communications
michele.loguidice@intelsat.com
Tel. : +1 703-559-7372
Mobile: +1 917-862-7261

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)

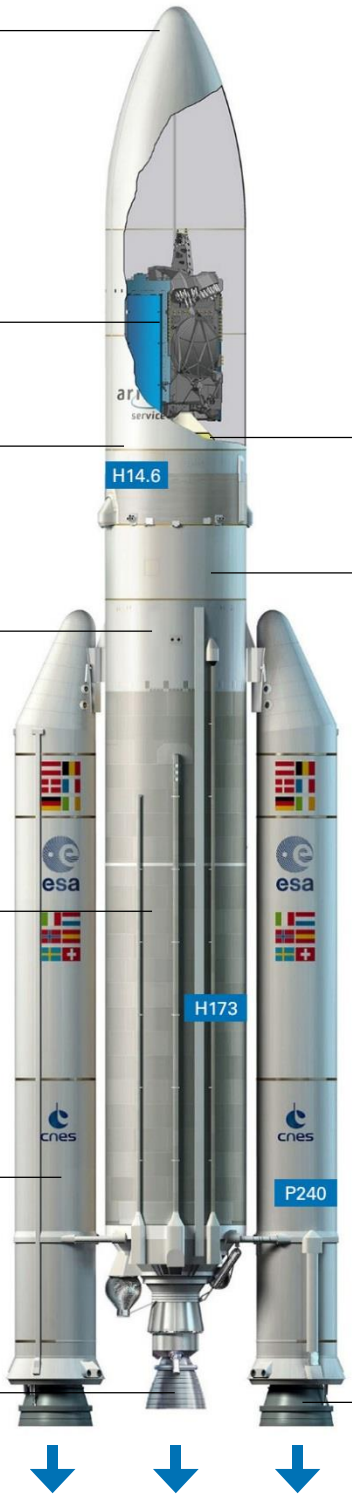
Intelsat 29e
(Intelsat)
Mass: 6,552 kg.

Vehicle Equipment Bay
Height: 1.13 m
Mass: 970 kg

ACU – Payload adaptor
(Airbus Defence and Space)
Mass: approx. 148 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



EPC - Cryogenic main stage
Height: 31 m
Mass: 188 t

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

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

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 29e

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
November 25, 2015		Campaign start review EPC destocking and erection
November 25 and 26, 2015		Transfer and EAP positioning
November 26 and 27, 2015		EPC/EAP integration
November 30, 2015		ESC-A erection and equipment bay integration
December 11, 2015	Arrival in Kourou of Intelsat 29e; beginning of payload preparation in the S5C facility	
December 12, 2015	Intelsat 29e fitcheck in the S5C hall	
January 7, 2016	Intelsat 29e transfer to S5A hall	
January 8, 2016		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
January 9 to 12, 2016	Intelsat 29e fueling operations in S5A hall	
January 14, 2016	Intelsat 29e integration on the payload adaptor	
January 15, 2016	Intelsat 29e transfer to Final Assembly Building (BAF)	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Monday, January 18, 2016	Intelsat 29e integration on launcher	
Tuesday, January 19, 2016	Intelsat 29e encapsulation in the payload fairing	
Wednesday, January 20, 2016	Completion of composite integration on launcher	
Thursday, January 21, 2016		Payload check - Launch rehearsal
Monday, January 25, 2016		Arming of launch vehicle - final preparation of launcher and BAF for countdown Launch readiness review (RAL)
Tuesday, January 26, 2016		Rollout from BAF to the ELA 3 Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Wednesday, January 27, 2016		Start of final 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 results in the T-0 falls outside of the nominal liftoff 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 hr 30 min	Start of final countdown
- 10 hr 30 min	Check of electrical systems
- 04 hr 20 min	Start of filling of main cryogenic stage with liquid oxygen and hydrogen
- 03 hr 40 min	Start of filling of the ESC-A stage with liquid oxygen and hydrogen
- 03 hr 30 min	Chilldown of Vulcain main stage engine
- 01 hr 10 min	Check of connections between launcher and 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
- 03 s	Two inertial reference systems switch to flight mode
T-O 00 s	**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 24 s	EAP separation
+ 3 min 38 s	Fairing jettison
+ 7 min 27 s	Acquisition by Natal tracking station
+ 8 min 46 s	End of EPC thrust phase
+ 8 min 52 s	EPC separation
+ 8 min 56 s	Ignition of ESC-A stage
+ 13 min 00 s	Acquisition by Ascension tracking station
+ 18 min 29 s	Acquisition by Libreville tracking station
+ 23 min 31 s	Acquisition by Malindi tracking station
+ 24 min 43 s	End of ESC-A thrust phase / injection
+ 29 min 52 s	**Intelsat 29e satellite separation**
+ 43 min 31 s	End of Arianespace mission

ARIANE 5 ECA MISSION PROFILE

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).

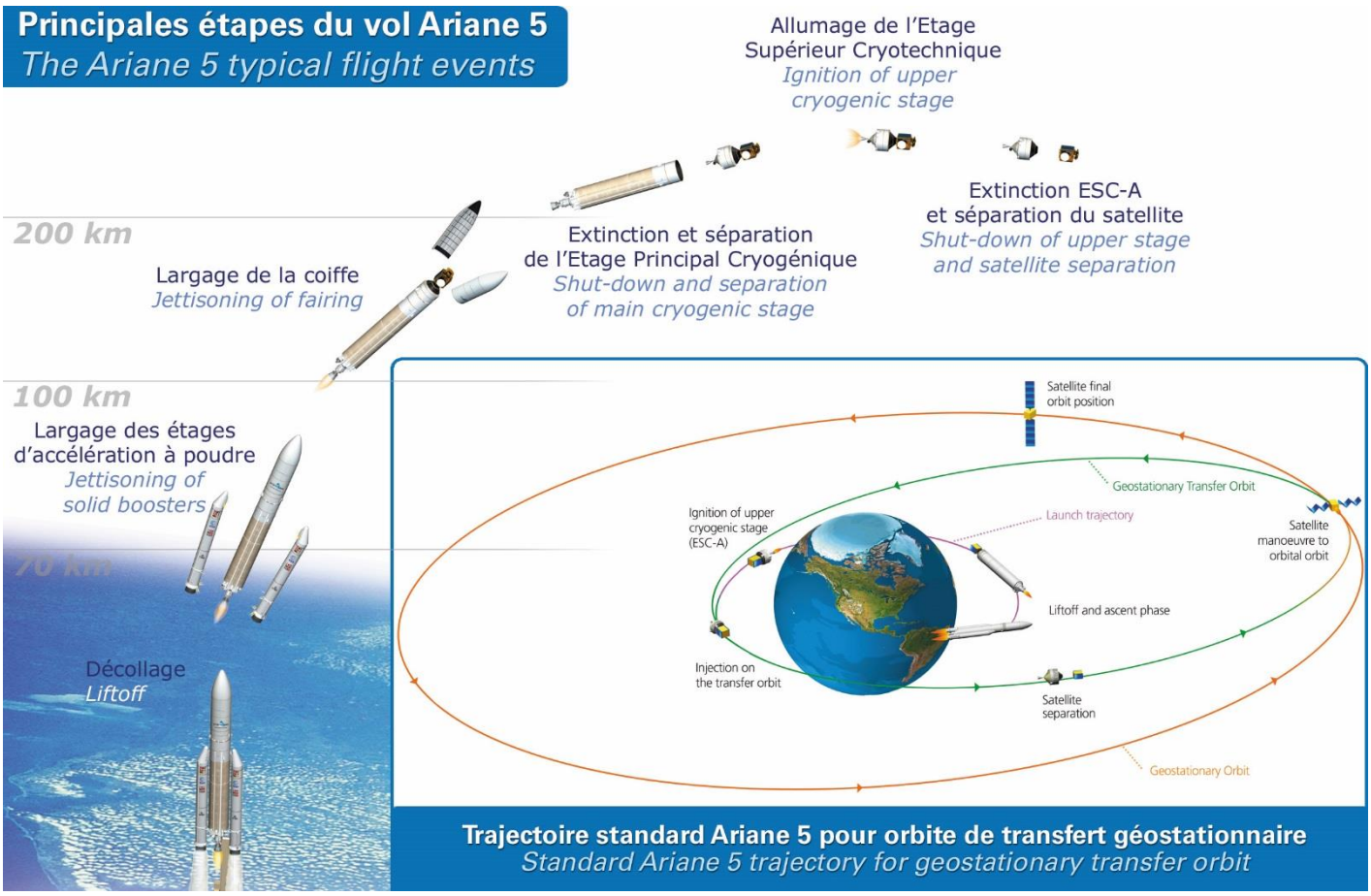
At T-4 seconds, the onboard computer takes over control of final engine startup and liftoff operations. It:

> Starts the ignition sequence for the Vulcain main stage engine (T-0).

> Checks engine operation (from T+4.5 to T+7.3 sec).

> Commands ignition of the solid boosters for immediate 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 worldwide were launched by Arianespace. The company posted sales of more than 1.4 billion euros in 2015.

As of January 1, 2016, Arianespace had 313 employees, who work 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 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 launcher, operated from the Guiana Space Center in French Guiana.

> The Soyuz medium launcher, currently in operation at the Guiana Space Center and the Baikonur Cosmodrome in Kazakhstan.

> The Vega light 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 700 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 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 (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 Regulus, Europropulsion, Air Liquide Spatial Guyane and Airbus Safran Launchers - all involved in the production of Ariane 5 components. A total of 40 European manufacturers and local companies are involved in 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 the operator 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.

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), operated by the Guiana Space Center (CNES/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 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.