



LAUNCH KIT

December 2016

VA234

Star One D1

JCSAT-15





VA234

Star One D1
JCSAT-15



ARIANESPACE'S 11TH OF YEAR 2016 TO ORBIT SATELLITES FOR BRAZIL AND JAPAN

For its 11th launch of the year, and the seventh with an Ariane 5 from the Guiana Space Center in French Guiana during 2016, Arianespace will orbit two satellites: Star One D1 for the private operator Embratel/Star One, and JCSAT-15 for Sky Perfect JSAT Corporation.

For the second time this year, Arianespace will orbit two SSL-built satellites on the same Ariane 5 launcher.

CONTENTS

> THE LAUNCH

VA234 mission
Page 2-3

Star One D1 satellite
Page 4

JCSAT-15 satellite
Page 5

> FURTHER INFORMATION

Ariane 5-ECA launch vehicle
Page 6

VA234 launch campaign
Page 7

Countdown and flight sequence
Page 8

VA234 mission profile
Page 9

Arianespace and the Guiana Space Center
Page 10

Star One D1

Star One D1 will be the 11th satellite orbited by Arianespace for the private operator Embratel Star One. Its latest launch for this operator was with the Star One C4 satellite in July 2015.

Embratel Star One is the largest satellite operator in Latin America. Arianespace and Embratel Star One have been working together successfully for some 30 years, and Arianespace has launched all of Embratel Star One's satellites.

Star One D1 is the initial fourth-generation satellite to be deployed by this operator. It will handle different missions, including broadcasting, broadband, Internet access and other digital applications. Star One D1 also is the largest satellite built to date for Embratel Star One.

Fitted with 70 active transponders in Ka-, C- and Ku-band, Star One D1 will be positioned at 84 degrees West. It will cover Brazil, Latin America, Central America, Mexico and the Caribbean.

Star One D1 was built by SSL (Space Systems Loral) using an SSL 1300 platform, in Palo Alto, California. It will be the 60th SSL satellite launched by Arianespace.

JCSAT-15

JCSAT-15 will be the 18th Sky Perfect JSAT satellite assigned to Arianespace for launch. The most recent Arianespace launch for this operator was with JCSAT-13 in May 2012.

SKY Perfect JSAT Corporation is a leader in the converging fields of broadcasting and communications. It is Asia's largest satellite operator with a fleet of 17 satellites. Sky Perfect JSAT is a provider of both multi-channel pay TV broadcasting and satellite communications services.

SKY Perfect JSAT delivers a broad range of entertainment through the SKY PerfectTV! platform, the most extensive in Japan with a total of 3 million subscribers.

JCSAT-15 will offer a range of communications services for Japan, including broadcasting, data transfer, and maritime and aeronautical applications for the Oceania and Indian Ocean region.

Located at 110 degrees East longitude, it will replace the N-SAT-110 satellite launched in 2000 by Arianespace.

JCSAT-15 was built by SSL (Space Systems Loral) using an SSL 1300 platform, in Palo Alto, California. It will be the 61st SSL satellite to be launched by Arianespace.

CONTACT PRESSE

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

#VA234
arianespace.com

@arianespace
youtube.com/arianespace

@arianespaceceo
arianespace



VA234

Star One D1 JCSAT-15

MISSION DESCRIPTION

The seventh 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 10,722 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, December 21, 2016** as early as possible within the following launch window:

- > Between 3:30 p.m. and 4:45 p.m., Washington D.C. time
- > Between 5:30 p.m. and 6:45 p.m., Kourou time
- > Between 6:30 p.m. and 7:45 p.m., Brasilia time
- > Between 20:30. and 21:45, Universal Time (UTC)
- > Between 9:30 p.m. and 10:45 a.m., Paris time
- > Between 5.30 a.m. and 6:45 a.m., Tokyo, Japan time on December 22.

MISSION DURATION



The nominal duration of the mission (from liftoff to separation of the satellites) is: **43 minutes and 26 seconds.**

TARGETED ORBIT

Perigee altitude
250 km.

Apogee altitude
35,905 km.

Inclination
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 12 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.

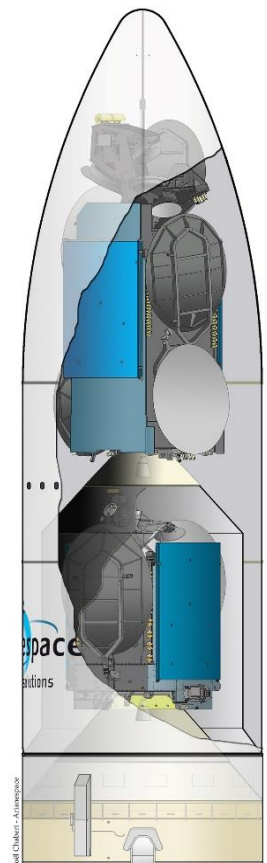
The fairing protecting the payload is jettisoned at T+195 seconds.

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): Star One D1**
Mass at liftoff: 6,433 kg.
- > **Lower payload (CUB): JCSAT-15**
Mass at liftoff: about 3,400 kg.
- > Long version of the payload fairing
- > SYLDA (Système de Lancement Double Ariane)

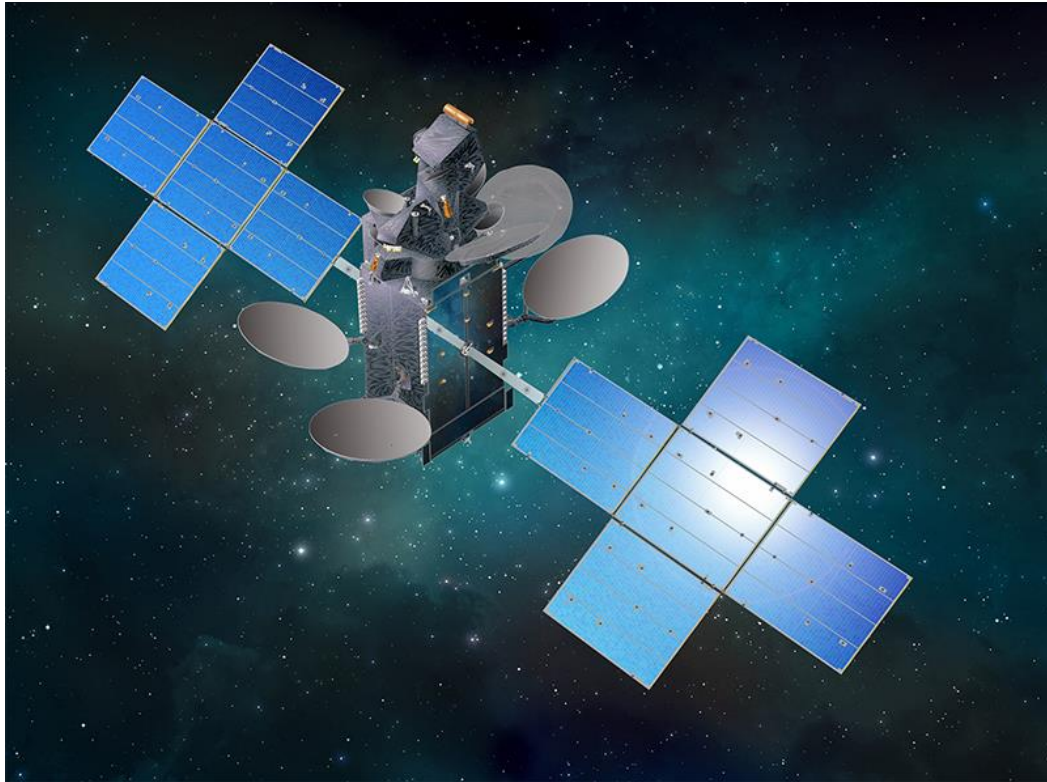




VA234

**Star One D1
JCSAT-15**

Star One D1 SATELLITE



CUSTOMER	Embratel Star One
PRIME CONTRACTOR	SSL
MISSION	Telecommunications: Broadcast, broadband, Internet access and other digital applications
MASS	6,433 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	5.10 m x 2.20 m x 2.35 m
PLATFORM	1300
PAYLOAD	70 transponders in Ka-, C- and Ku-band
ONBOARD POWER	17.1 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	84 to 75° West
COVERAGE AREA	Brazil, Mexico, Latin America (West), Central America and Caribbean

PRESS CONTACTS

Star One Satellite
Marcelo Lavrado
 LVI Manager, PMP
 T (55) (21) 21212542
www.starone.com.br/

SSL (Space Systems/Loral)
Joyce Wong
 Marketing Communications Manager
Joyce.Wong@sslmda.com
 Office : +1 650-852-6015
sslmda.com



VA234

**Star One D1
JCSAT-15**

JCSAT-15 SATELLITE



CUSTOMER	SKY Perfect JSAT
PRIME CONTRACTOR	SSL
MISSION	Broadcasting and communications services
MASS	About 3,400 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	5.2 m x 3.3 m x 3 m
PLATFORM	1300
ONBOARD POWER	10 kW (end of life)
DESIGN LIFE	More than 15 years
ORBITAL POSITION	110° East
COVERAGE AREA	Japan, the Oceania and Indian ocean region

CONTACT PRESSE

Ms. Etsumi SUZUKI
General Manager
Corporate Communications & Investor Relations Division
SKY Perfect JSAT Corporation
Phone : +81-3- 5571-7600
E-mail : pr@sptvjsat.com

SSL (Space Systems/Loral)
Joyce Wong
Marketing Communications Manager
Joyce.Wong@sslmda.com
Office : +1-650-852-6015
sslmda.com



VA234

Star One D1
JCSAT-15

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)

Star One D1

(EMBRATEL Star One)
Mass: 6,433 kg.

ACU - Payload adaptor (2)

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

JCSAT-15

(SKY Perfect JSAT)
Mass: 3,400 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

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

EPC - Cryogenic main stage

Height: 31 m
Mass: 188 t

EAP - Solid Rocket Boosters

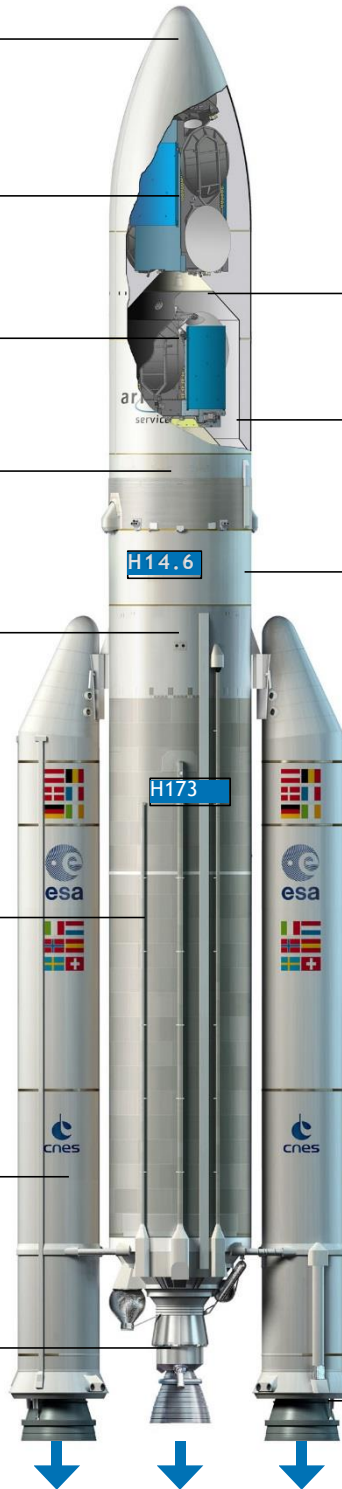
Height: 31.6 m
Mass: 277 t approx.

Vulcain 2 Engine

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

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.)



VA234

Star One D1 JCSAT-15



LAUNCH CAMPAIGN - ARIANE 5 – Star One D1 / JCSAT-15

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATES	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
October 28, 2016	Arrival in French Guiana of JCSAT-15; beginning of preparation in the S5C hall	
November 2, 2016		Campaign start review EPC unpacking EPC erection - EAP2 transfer
November 3, 2016		EAP1 transfer and EAP positioning
November 4, 2016		EPC/EAP integration
November 8, 2016		Erection of ESC-A with Vehicle Equipment Bay
November 10, 2016	JCSAT-15 fitcheck in the S5C hall	
November 14, 2016	Arrival in French Guiana of Star One D1; beginning of preparation in the S5C hall	
November 15, 2016	Star One D1 fitcheck in the S5C hall	
November 30, 2016		Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
December 10, 2016	Star One D1 integration on ACUH in the S5B hall; Star One D1 transfer to the Final Assembly Building (BAF)	
December 11, 2016	Star One D1 integration on SYLDA	
December 12, 2016	Star One D1 encapsulation in the payload fairing	
December 13, 2016	JCSAT-15 transfer to the Final Assembly Building (BAF)	
December 10, 2016	Star One D1 integration on ACUH in the S5B hall; Star One D1 transfer to the Final Assembly Building (BAF)	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATES	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Wednesday, December 14, 2016	JCSAT-15 integration on launcher	Final inspection of the HM-7B engine
Thursday, December 15, 2016		Completion of composite integration, including Star One D1, on launcher and payload checks
Friday, December 16, 2016		Finalization of the composite/launcher integration, and payload checks
Saturday, December 17, 2016		Launch rehearsal
Sunday, December 18, 2016		Arming of launch vehicle
Monday, December 19, 2016		Launch readiness review (RAL), final preparation of launcher and BAF for the chronology
Tuesday, December 20, 2016		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Wednesday, December 21, 2016		Start of launch countdown, EPC and ESC-A filling with liquid oxygen and liquid hydrogen



VA234

Star One D1
JCSAT-15

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 43 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 hydrogen
-03 h 43 min	Start of filling of ESC-A with liquid oxygen and hydrogen
- 03 h 33 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	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 15 s	Fairing jettisoned
+ 8 min 14 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 49 s	Acquisition by Ascension tracking station
+ 18 min 23 s	Data acquisition by Libreville tracking station
+ 23 min 05 s	Acquisition by Malindi tracking station
+ 25 min 23 s	Injection
+ 29 min 10 s	Star One D1 satellite separation
+ 31 min 58 s	SYLDA separation
+ 43 min 26 s	JCSAT-15 satellite separation
+ 59 min 02 s	End of the Arianespace commercial mission
+1 h 15 min 02 s	End of the Arianespace mission



VA234

Star One D1
JCSAT-15

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:

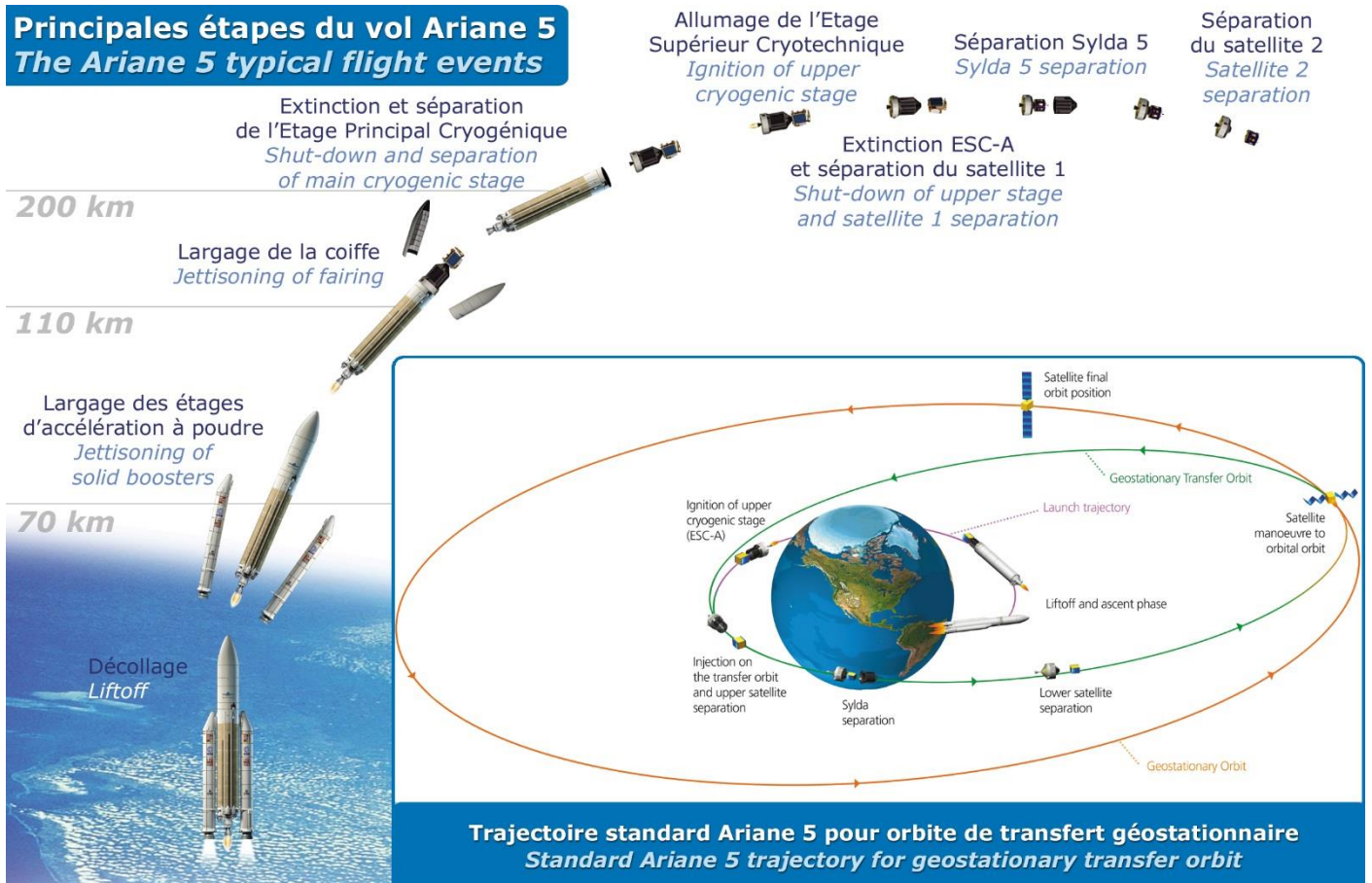
- > Startup of water injection in the flame trenches and exhaust guide (T-30 sec).
- > Hydrogen aspiration for chilldown of the Vulcain engine in the exhaust guide (T-18 sec).
- > Burnoff of hydrogen used for chilldown (T-5.5 sec).

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





VA234

Star One D1
JCSAT-15



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 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 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 (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 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.