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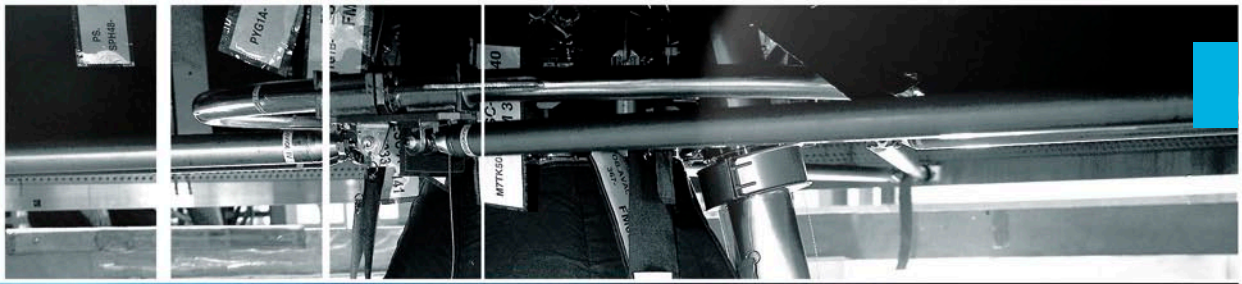
November
2015



VA 227

ARABSAT-6B (BADR-7)
GSAT-15

esa

BADR-7 26°E
ARABSAT

भारत INDIA

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GSAT-15

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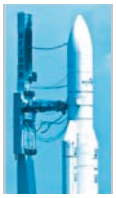

VA 227

ARABSAT-6B (BADR-7) - GSAT-15

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SATELLITE LAUNCHES TO SUPPORT TELECOM AND DTH SERVICES IN THE MIDDLE EAST, AFRICA AND INDIA

On its 10th launch of the year from the Guiana Space Center, and the sixth Ariane 5 mission, Arianespace will launch satellites for two long-standing customers, whose loyalty stretches back over 30 years: ARABSAT-6B (BADR-7) for the operator ARABSAT; and GSAT-15 for ISRO (Indian Space Research Organisation)

Through this mission, the 270th by launchers in the Arianespace family, the European launch service provider is proud to continue delivering adaptable and sustainable solutions to its customers.

ARABSAT-6B (BADR-7) and GSAT-15 are the 519th and 520th satellites to be launched by Arianespace.

ARABSAT-6B (BADR-7)

ARABSAT-6B (BADR-7) will be the ninth satellite orbited by Arianespace for the operator ARABSAT, based in Riyadh, Saudi Arabia.

Arianespace and ARABSAT, the leading regional satcom operator in the Middle East and Africa, have developed a very close, privileged relationship since the launch of ARABSAT 1A 30 years ago (February 8, 1985).

ARABSAT-6B (BADR-7), the first of this sixth generation of satellites in the Arabsat fleet, will provide broadcast, broadband and telecommunications services over Middle East, Africa and Central Asia.

Arianespace currently has one more ARABSAT satellite in its launch manifest, Hellasat-4.

ARABSAT-6B (BADR-7) was built by Airbus Defence and Space and TAS (Thales Alenia Space), with the former providing the Eurostar E3000 platform and handling satellite integration, while TAS supplied the payload. It will be the 113th satellite built by Airbus Defence and Space to be launched by Arianespace.

GSAT-15

GSAT-15 is the 18th satellite built by ISRO (Indian Space Research Organisation). Overall, it will be the 19th payload launched by Arianespace for ISRO. Since the launch of the experimental satellite Apple on Flight L03 in 1981, Arianespace has orbited 86% of the contracts for geostationary launches that India opened to bids by non-Indian launch systems.

GSAT-15 will provide telecommunications services, as well as dedicated navigation-aid and emergency services for India.

ISRO coordinates the use of space resources to support development in the Indian sub-continent. Its focus is on practical space applications, by developing satellites for Earth observation, telecommunications, the broadcasting of educational programs, science and navigation.

The strategic partnership between ISRO and Arianespace symbolizes the strong space sector relationship between France and India.

CONTENTS

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

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arianespace.tv
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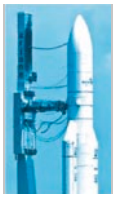
youtube.com/arianespace
@arianespaceceo
arianespace



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ARABSAT-6B (BADR-7) - GSAT-15

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MISSION DESCRIPTION

The sixth Arianespace Ariane 5 launch of the year will place the ARABSAT-6B (BADR-7) and GSAT-15 satellites into a geostationary transfer orbit.

The launcher will be carrying a total payload of 9,810 kg.

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

Targeted orbit
Perigee altitude **: 250 km**
Apogee altitude **: 35,786 km**
Inclination **: 4 degrees**

Liftoff is planned on **Tuesday, November 10, 2015**
as early as possible within the following launch window:

- Between 06:34 pm and 07:17 pm, Kourou time
- Between 04:34 pm and 05:17 pm, Washington DC time
- Between 09:34 pm and 10:17 pm, Universal Time (UTC)
- Between 10:34 pm and 11:17 pm, Paris time,
- Between 00:34 am and 01:17 am, Riyad time, on November 11, 2015
- Between 03:04 am and 03:47 am, Bangalore time, on November 11, 2015

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+220 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.

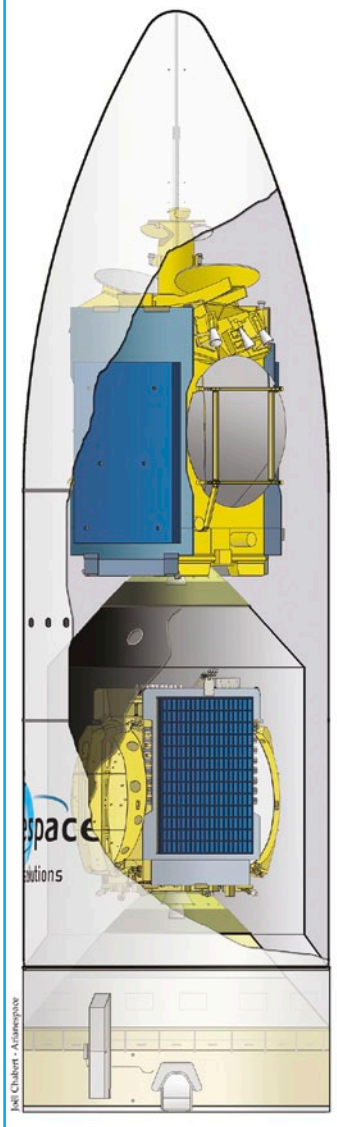
Payload configuration

Upper payload (CUH): ARABSAT-6B (BADR-7)
Mass at liftoff: 5,798 kg.

Lower payload (CUB): GSAT-15
Mass at liftoff: 3,164 kg.

Long version of the payload fairing

Long version of the SYLDA (SYstème de Lancement Double Ariane)



Mission duration

The nominal duration of the mission (from liftoff to separation of the satellites) is:
43 minutes
and 24 seconds.

ARABSAT-6B (BADR-7)

Customer	**ARABSAT**
Prime contractor	**Airbus Defence and Space – TAS (Thales Alenia Space)**
Mission	**Broadcast, broadband and telecommunications services**
Mass	**5,798 kg at liftoff**
Stabilization	**3 axis**
Dimensions	**8.5 m x 3 m x 3.5 m**
Platform	**Eurostar E3000**
Payload	**27 Ku-Band transponders, Multi-spot beams in Ka-band**
Onboard power	**11.5 kW (end of life)**
Design life	**More than 15 years**
Orbital position	**26° East**
Coverage area	**Middle East, Africa and Central Asia**

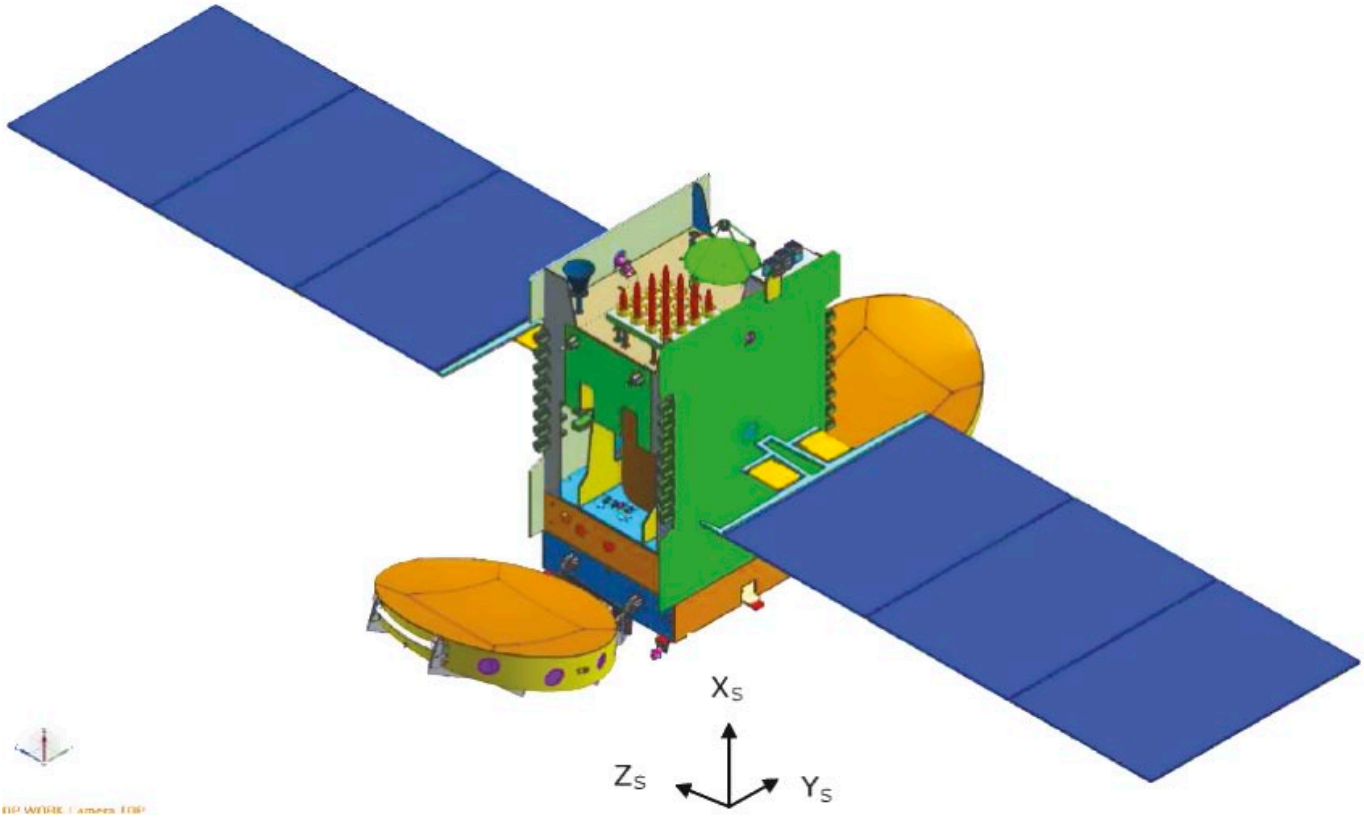
PRESS CONTACTS :

ARABSAT
Saad Al Tehaif
Director,Public Relations & Media
T:00966114820000 (Ext.) 9603 , (Direct)
M: F:00966114887999
SaadT@ARABSAT.com
www.arabsat.com

Airbus Defence and Space
Gregory Gavroy
Media Relations, Space Systems
Office: +33.139.06.89.42
Mobile: +33.629.48.12.72
gregory.gavroy@airbus.com
www.airbusdefenceandspace.com

Thales Alenia Space
Sandrine Bielecki
Media Relations, Space Systems
Tel : + 33 (0) 4 92 92 70 94
Sandrine.Bielecki@thalesaleniaspace.com

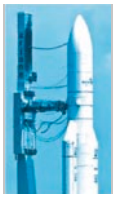
GSAT-15



Customer	**ISRO**
Prime contractor	**ISRO**
Mission	**Telecommunications services, emergency communications and navigation**
Mass	**3,164 kg at liftoff**
Stabilization	**3 axis**
Dimensions	**3 m x 1.7 m x 2 m**
Platform	**I3K**
Payload	**24 Ku-Band transponders and 2 GAGAN transponders for navigation**
Onboard power	**6.2 Kw equinox (End Of Life) & 5.8 Kw Summer Solstice (End Of Life)**
Design life	**12 years**
Orbital position	**93.5° East**
Coverage area	**India**

PRESS CONTACTS:

Deviprasad Karnik
Director, P and PR
ISRO Headquarters, Antariksh Bhavan,
New BEL Road, Bangalore 560 231
Tel: (91 80) 23415275
Fax: (91 80) 23412253
e-mail id: dpkarnik@isro.gov.in



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ARABSAT-6B (BADR-7) - GSAT-15

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ARIANE 5-ECA LAUNCH VEHICLE

54.8 m

780 tons
(total mass at liftoff)

Fairing
(RUAG Space)
- 17 m
- Mass: 2.4 t

ARABSAT-6B (BADR-7)
(ARABSAT)
- Mass: 5,798 Kg

GSAT-15
(ISRO)
- Mass: 3,164 Kg

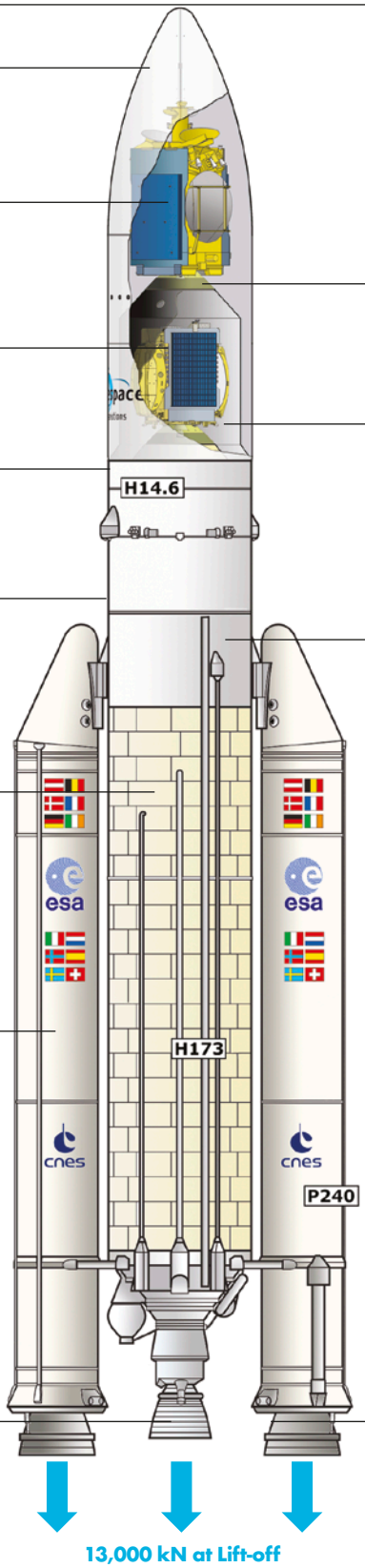
Vehicle Equipment Bay
(Airbus Defence and Space)
- Height: 1.13 m
- Mass: 970 kg.

ESC-A - Cryogenic upper stage
(Airbus Defence and Space)
- Height: 4.71 m
- Mass: 19 t

EPC - Cryogenic main stage
(Airbus Defence and Space)
- Height: 31 m
- Mass: 188 t

EAP - Solid Rocket Boosters
(Airbus Defence and Space)
- Height: 31.6 m
- Mass: 277 t approx.

Vulcain 2 Engine
(Snecma)
- Thrust: 1,390 kN (in vacuum)
- 540 sec of propulsion



ACU - Payload adaptor (2)
(RUAG Space or Airbus Defence and Space)
- Mass: approx. 140 kg each

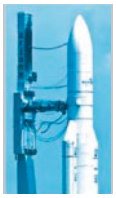
SYLDA - Internal structure
(Airbus Defence and Space)
- 7 versions (Height:4.9 to 6.4 m)
- Mass: 400 to 530 kg.

HM-7B engine
(Snecma)
- Thrust: 67 kN (in vacuum)
- 945 sec of propulsion

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

MPS - Solid Rocket Motor (SRM)
(Europropulsion)
- Average thrust: 5,060 kN
- Maximum thrust: 7,080 kN (in vacuum)
- 130 sec of propulsion

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



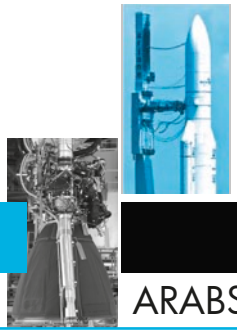
LAUNCH CAMPAIGN:
ARIANE 5 - ARABSAT-6B (BADR-7) - GSAT-15

ARABSAT-6B (BADR-7) - GSAT-15 and launch vehicle campaign calendar

Date	Satellite activities	Launch vehicle activities
September 21, 2015		Campaign start review EPC destocking - EPC erection - EAP2 transfer
September 22, 2015		EAP1 transfer and EAP positioning
September 23, 2015		EPC/EAP integration
September 25, 2015	Arrival in Kourou of GSAT-15; beginning of preparation in building S5B South	ESC-A erection and equipment bay integration
September 28, 2015	GSAT-15 fitcheck	
October 2, 2015	Arrival in Kourou of ARABSAT-6B (BADR-7); beginning of preparation in building S5C	
October 3, 2015	ARABSAT-6B (BADR-7) fitcheck	
October 9, 2015	GSAT-15 transfer to S5A	
October 12, 2015	ARABSAT-6B (BADR-7) transfer to S5B	
October 16, 2015	ARABSAT-6B (BADR-7) fueling operations	
October 20, 2015	ARABSAT-6B (BADR-7) integration on the ACUH adaptor	
October 21, 2015	ARABSAT-6B (BADR-7) transfer to Final Assembly Building (BAF)	
October 22, 2015	ARABSAT-6B (BADR-7) integration on SYLDA	Transfer from BIL (Launcher Integration Building) to BAF (Final Assembly Building)
October 22, 2015	GSAT-15 fueling operations	

ARABSAT-6B (BADR-7) - GSAT-15 launch vehicle campaign final calendar

Date	Satellite activities	Launch vehicle activities
Saturday, October 24, 2015	ARABSAT-6B (BADR-7)'s encapsulation in the payload fairing	
Wednesday, October 28, 2015	GSAT-15 integration on the ACUB	
Thursday, October 29, 2015	GSAT-15 transfer to Final Assembly Building (BAF)	
Friday, October 30, 2015	GSAT-15 integration on launcher	
Monday, November 2, 2015	Composite integration with ARABSAT-6B (BADR-7) on launcher	
Tuesday, November 3, 2015		Completion of composite integration on launcher and Payload check
Wednesday, November 4, 2015		Launch rehearsal
Thursday, November 5, 2015		Arming of launch vehicle
Friday, November 6, 2015		Launch readiness review (RAL), final preparation of launcher and BAF for chronology
Monday, November 9, 2015		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Tuesday, November 10, 2015		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 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 h 30 mn	Start of final countdown
- 07 h 30 mn	Check of electrical systems
- 04 h 50 mn	Start of filling of main cryogenic stage with liquid oxygen and hydrogen
- 03 h 20 mn	Chilldown of Vulcain main stage engine
- 01 h 10 mn	Check of connections between launcher and telemetry, tracking and command systems
- 7 mn	"All systems go" report, allowing start of synchronized sequence
- 4 mn	Tanks pressurized for flight
- 1 mn	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-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 mn 23 s	EAP separation
+ 3 mn 24 s	Fairing jettisoned
+ 7 mn 57 s	Acquisition by Natal tracking station
+ 8 mn 58 s	End of EPC thrust phase
+ 9 mn 04 s	EPC separation
+ 9 mn 08 s	Ignition of ESC-A stage
+ 13 mn 47 s	Acquisition by Ascension tracking station
+ 18 mn 26 s	Acquisition by Libreville tracking station
+ 23 mn 06 s	Acquisition by Malindi tracking station
+ 25 mn 02 s	End of ESC-A thrust phase / Injection
+ 27 mn 21 s	**ARABSAT-6B (BADR-7) satellite separation**
+ 30 mn 52 s	Sylda 5 separation
+ 43 mn 24 s	**GSAT-15 satellite separation**
1 h 08 mn 14 s	End of 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 7 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.

Ariane 5-ECA trajectory

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 450 launch contracts and launched 500-plus satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of 1.399 million euros in 2014.

As of March 1, 2015, Arianespace had 322 employees, working 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 70 satellites to be launched.

The Guiana Space Center: Europe's Spaceport

For 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 (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 Defence and Space - 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 Defence and Space 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.