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LAUNCH KIT

August 2020

VA253

Galaxy 30/MEV-2

BSAT-4b

esa

INTELSAT GALAXY 30

NORTHROP GRUMMAN
SpaceLogistics

BSAT

MAXAR

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

FLIGHT VA253: ARIANESPACE WILL ORBIT GALAXY 30 / MISSION EXTENSION VEHICLE-2 FOR INTELSAT; AND BSAT-4B FOR MAXAR AND BROADCASTING SATELLITE SYSTEM CORPORATION (B-SAT) AS A FINAL CUSTOMER

For its fifth launch of 2020, Arianespace will orbit two telecommunications satellites (Galaxy 30 and BSAT-4b) and one life extension vehicle (Mission Extension Vehicle-2 or MEV-2) using an Ariane 5 launch vehicle from the Guiana Space Center.

With this 253rd Ariane mission, Arianespace once again serves the ambitions of leading satellite operators by contributing to the improvement of life on Earth.

Galaxy 30 / Mission Extension Vehicle-2

The Galaxy 30/MEV-2 is a Northrop Grumman Corporation program combining two satellites stacked together: Intelsat's Galaxy 30 and Mission Extension Vehicle-2 for SpaceLogistics LLC, a satellite servicing vehicle which will dock initially with Intelsat 10-02 (IS-10-02).

Galaxy 30 (G-30) will be the first replacement satellite in Intelsat's North American Galaxy fleet refresh. It will provide high-performance broadcast distribution capabilities, including Ultra-High Definition (UHD) and over-the-top (OTT) streaming media, while also supporting broadband, mobility and enterprise network solutions.

The launch of G-30 demonstrates Intelsat's long-term commitment to its media customers and its media distribution neighborhoods, which have an unmatched penetration of cable headends in the United States.

- Galaxy 30 will be the 62nd satellite launched by Arianespace for Intelsat.
- Galaxy 30 will be the 29th Northrop Grumman satellite launched by Arianespace.

MEV-2 is supplied by Northrop Grumman for the company's wholly owned subsidiary, SpaceLogistics LLC. Intelsat 10-02 will be the first customer for the MEV-2. Once docked, it will control the satellite's orbit using its own thrusters. After its mission for IS-10-02, MEV-2 will undock and be available for another customer's vehicle.

The first MEV, MEV-1, was launched in October 2019. It docked with Intelsat-901 in February 2020.

After MEV-2, Northrop Grumman and SpaceLogistics are developing a new generation of satellite servicing vehicles that could attach propulsion jetpacks to multiple spacecraft in a single mission.

- MEV-2 will be the first satellite servicing vehicle launched by Arianespace.
- MEV-2 will be the 30th Northrop Grumman satellite launched by Arianespace.

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BSAT-4b

The BSAT-4b 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 above the Japan archipelago.

BSAT-4b satellite will serve as a backup system to BSAT-4a launched in September 2017. It will be the 10th Arianespace launch for B-SAT, and the satellite will provide Direct-To-Home (DTH) television to ensure exceptional 4K/8K ultra-high definition (UHD) video distribution across the Japan archipelago – like its BSAT-4a twin. BSAT-4b is designed to provide service for 15 years or longer.

B-SAT is a Japanese company created in April 1993 to manage satellite procurement, control and management of broadcast satellites, supply basic broadcasting stations and all related operations and businesses.

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. This mission also underlines the exceptional quality of the partnership between Arianespace, Maxar (the satellite manufacturer) and the Japanese operator B-SAT.

The Arianespace market share of launch services for geostationary orbit satellites in Japan is 74% since Japan's first commercial satellite launch JCSAT-1 on Ariane in 1989. In addition, Arianespace has launched a total of two auxiliary payloads in cooperation with Japan Aerospace Exploration Agency (JAXA).

Maxar is a major supplier of innovative satellite systems that already has built and integrated many of the most powerful and complete satellites in the world.

- BSAT-4b will be the 66th Maxar satellite launched by Arianespace.
- BSAT-4b will be the 68th satellite launched by Arianespace based on a Maxar platform.
- It will be the 58th satellite launched by Arianespace based on the 1300 platform.
- There currently are three Maxar satellites in Arianespace's backlog.

PRESS CONTACT
Claudia Hoyau
c.hoyau@arianespace.com
+33 (0) 1 60 87 55 11

MISSION DESCRIPTION

Arianespace's fifth launch of 2020 will place its satellite passengers into geostationary transfer orbit.

The launcher will be carrying a total payload of approximately 10,468 kg.

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

DATE AND TIME

Liftoff is planned on **Friday, August 14, 2020,** as early as possible within the following launch window:

- **Between 5:33 p.m. and 6:20 p.m.** Washington, D.C. time,
- **Between 6:33 p.m. and 7:20 p.m.** Kourou, French Guiana time,
- **Between 21:33 and 22:20** Universal time (UTC),
- **Between 11:33 p.m. and 12:20 a.m.** Paris time, in the night of August 14 to August 15,
- **Between 06:33 a.m. and 07:20 a.m.** Japan time, in the morning of August 15.

MISSION DURATION

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

47 minutes, 39 seconds.

TARGETED GEOSTATIONARY ORBIT

Perigee altitude	Apogee altitude	Inclination
250 km.	35,738 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 about 13 seconds, then rotates towards the East. It maintains an attitude that ensures the axis of the launcher remains parallel to its velocity vector to minimize aerodynamic loads throughout the entire atmospheric phase until the solid boosters are jettisoned.

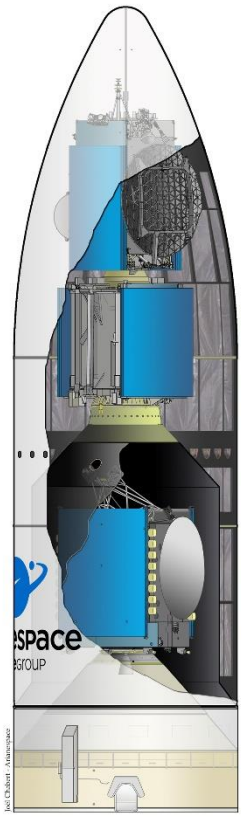
The fairing protecting the payloads is jettisoned at T+200 seconds.

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.

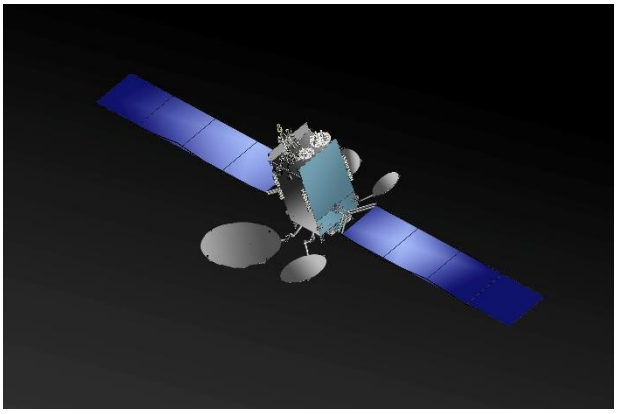
The main stage splashes down off the coast of Africa in the Atlantic Ocean (in the Gulf of Guinea).

PAYLOAD CONFIGURATION

- **Upper payload (CUH): Galaxy 30/MEV-2**
  Mass at liftoff: 3,298 kg. for Galaxy 30 and 2,875 kg. for MEV-2
- **Lower payload (CUB): BSAT-4b**
  Mass at liftoff: 3,530 kg.
- **Long version of the payload fairing**
- **SYLDA (Système de Lancement Double Ariane)**



Galaxy 30/MEV-2 SATELLITES



SATELLITE	Galaxy 30	MEV-2
CUSTOMER	**Intelsat**	**SpaceLogistics LLC**
MANUFACTURER	**Northrop Grumman**	**Northrop Grumman**
MISSION	Telecommunications	Life extension vehicle
MASS AT LAUNCH	3,298 kg.	2,875 kg.
PLATFORM	GEOStar-2.4E	GEOStar-3
PROPULSION	Chemical bipropellant	Chemical monopropellant and Xe Electric
BATTERIES	2 x Li-ion	2 x Li-ion
PAYLOAD	C-band, Ku-band and Ka-band	C-band and Ku-band
COVERAGE AREA	USA, Alaska, Hawaii and Caribbean Islands	
DESIGN LIFE	15 years	15 years

PRESS CONTACTS

Intelsat
Melissa Longo
Manager & Media Relations
Tel: +1 240 308-1881
E-mail: melissa.longo@intelsat.com
Website: www.intelsat.com

Northrop Grumman
Vicki Cox
Director Communications
Tel: +1 410 409-8723
E-mail: vicki.cox@ngc.com
Website: www.northropgrumman.com

BSAT-4b SATELLITE

CUSTOMER	**Maxar Technologies for B-SAT corporation**
MANUFACTURER	**Maxar Technologies**
MISSION	DTH television services - advanced television services, such as HD and 4K/8K ultra HD
ORBITAL POSITION	110° East
MASS AT LAUNCH	3,530 kg.
PLATFORM	1300-140”
BATTERIES	2 x 18 - cells Li-ion (102 Ah)
PROPULSION	Chemical bipropellant
PAYLOAD	Ku-band
COVERAGE AREA	Japan
DESIGN LIFE	15 years

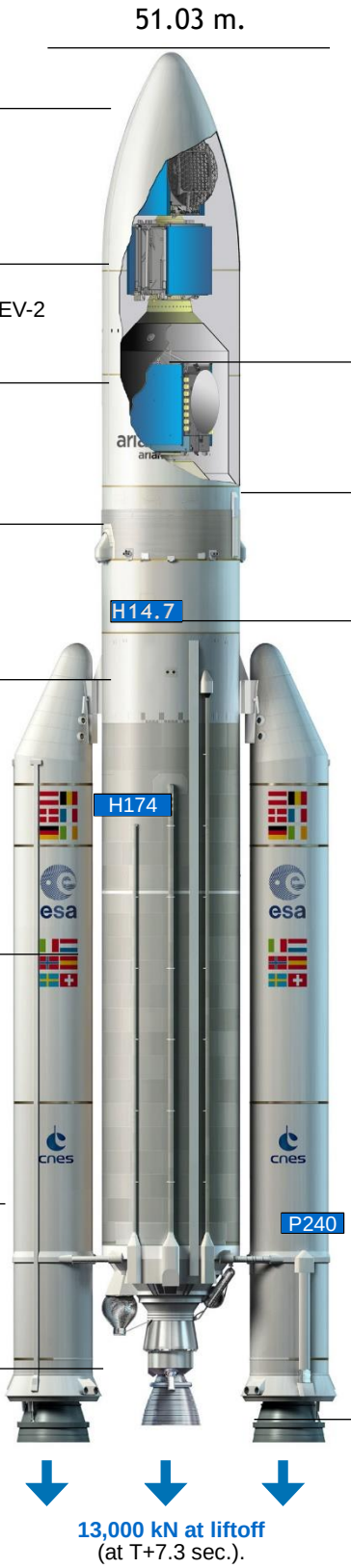
PRESS CONTACTS

B-SAT
Hirotake Hamasaki
Corporate Officer & Planning Division
Tel: +81 3 5453 5707
E-mail: h-hamasaki@b-sat.co.jp
Website: www.b-sat.co.jp

Maxar
Kristin Carringer
Media Relations
Tel: +1 303 684-4352
E-mail: kristin.carringer@maxar.com
Website: www.maxar.com

ARIANE 5 ECA LAUNCH VEHICLE

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



Fairing

(RUAG Schweiz AG):
Height: 17 m.
Mass: 2.4 t.

Galaxy 30/MEV-2

Northrop Grumman
Mass: 3,298 kg. for Galaxy 30 and 2,875 kg. for MEV-2

BSAT-4b

Maxar
Mass: 3,530 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: 1,410 kN (in vacuum).
540 sec. of propulsion.

780 metric tons
(total mass at liftoff)

PA - Payload adaptor (2)

(*Airbus Defence and Space - ASE*)
(RUAG Space AB)
Mass: approx. 235 kg.

SYLDA - Internal structure

Mass: 530 kg.

ESC-D - 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:
Galaxy 30/MEV-2
BSAT-4b

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATES	SATELLITES ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
June 4, 2020		Campaign start review EPC unpacking
June 5, 2020		EPC erection EAP 2 transfer to the BIL (Launcher Integration Building)
June 8, 2020		EAP 1 transfer to the BIL (Launcher Integration Building)
June 9, 2020		EPC/EAP integration
June 22, 2020		Erection of ESC-D and vehicle equipment bay installation
June 27, 2020	Arrival of Galaxy 30/MEV-2 in French Guiana and transfer by road to the Spaceport's S5C payload preparation facility	
July 1, 2020	Arrival of BSAT-4b in French Guiana and transfer by road to the Spaceport's S5C payload preparation facility	
July 6, 2020	Galaxy 30/MEV-2 transfer to the Spaceport's S5B payload fueling facility	
July 7, 2020	Galaxy 30/MEV-2 fueling operations	Transfer from BIL to BAF (Final Integration Building)
July 8, 2020	BSAT-4b transfer to the Spaceport's S5A payload fueling facility	
July 9, 2020	MEV-2 integration on payload adaptor in S5B BSAT-4b fueling operations	
July 10, 2020	MEV-2 transfer to the BAF	
July 11, 2020	MEV-2 hoisting onto SYLDA	
July 13, 2020	Galaxy 30 transfer to the BAF	
July 15, 2020	Galaxy 30 integration on payload adapter BSAT-4b integration on payload adapter in S5A	
July 16, 2020	Galaxy 30 hoisting onto MEV-2	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITES ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Friday, July 17, 2020	Payload fairing encapsulation on SYLDA BSAT-4b transfer to the BAF	
Saturday, July 18, 2020	BSAT-4b integration on launch vehicle	HM7B engine final inspection
Sunday, July 19, 2020	Composite (Galaxy 30/MEV-2 under fairing) integration on launch vehicle (BSAT-4b under SYLDA)	
Tuesday, July 21, 2020	Upper Composite flight configuration set-up	Finalization of the composite/launcher integration
Wednesday, July 22, 2020	General dress rehearsal	Dress rehearsal
Wednesday, July 29, 2020		Final preparation of launcher and BAF for chronology Launch readiness review (LRR) Arming of launch vehicle
Thursday, July 30, 2020	Functional checkout of the satellites after transfer on the launch pad	Roll-out from BAF to the launch pad, launch vehicle connections and filling of the EPC liquid helium tank

Friday, July 31, 2020		Start of launch countdown, EPC and ESC-D filling with liquid oxygen and liquid hydrogen Interruption of the countdown at H0 - 2'14. Launch delay
Monday, August 3, 2020	Both S/C project put satellites in stand-by mode under fairing waiting for the final chronology restart on D-1	Rollout from Launch Zone to the BAF
From Tuesday, August 4, 2020 to Wednesday, August 5, 2020		Additional maintenance operations on the launcher
Thursday, August 6, 2020		HM7B lubrication
From Friday, August 7, 2020 to Tuesday, August 11, 2020		Defective sensor replacement Additional maintenance operations on the launcher Resumption of the combined operations
Wednesday, August 12, 2020		Launch readiness review (LRR) n°2 Arming of launch vehicle
Thursday, August 13, 2020	Functional checkout of the satellites after transfer on the launch pad	Final preparation of launcher and BAF for chronology Roll-out from BAF to the launch pad, launch vehicle connections and filling of the EPC liquid helium tank
Friday, August 14, 2020		Start of launch countdown, EPC and ESC-D filling with liquid oxygen and liquid hydrogen

COUNTDOWN AND FLIGHT SEQUENCES

The countdown comprises all final preparation steps for the launcher, the satellites and the launch pad. 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 moving 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	EVENTS
- 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-D 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
+ 01.00 s	Ignition of the cryogenic main stage (EPC)
+ 07.01 s	Ignition of solid boosters (EAP)
+ 07.3 s	Liftoff
+ 12.7 s	End of vertical climb, beginning of pitch motion
+ 17.05 s	Beginning of roll maneuver
+ 32.05 s	End of roll maneuver
+ 2 min 22 s	EAP separation
+ 3 min 20 s	Fairing jettisoned
+ 7 min 43 s	Acquisition by Natal tracking station
+ 8 min 40 s	End of EPC thrust phase
+ 8 min 46 s	EPC separation
+ 8 min 50 s	Ignition of ESC-D stage
+ 13 min 19 s	Acquisition by Ascension tracking station
+ 18 min 12 s	Acquisition by Libreville tracking station
+ 23 min 05 s	Acquisition by Malindi tracking station
+ 25 min 32 s	Extinction of ESC-D stage
+ 25 min 34 s	Injection
+ 27 min 47 s	**Galaxy 30 satellite separation**
+ 34 min 22 s	**MEV-2 satellite separation**
+ 35 min 52 s	SYLDA separation
+ 47 min 39 s	**BSAT-4b 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).

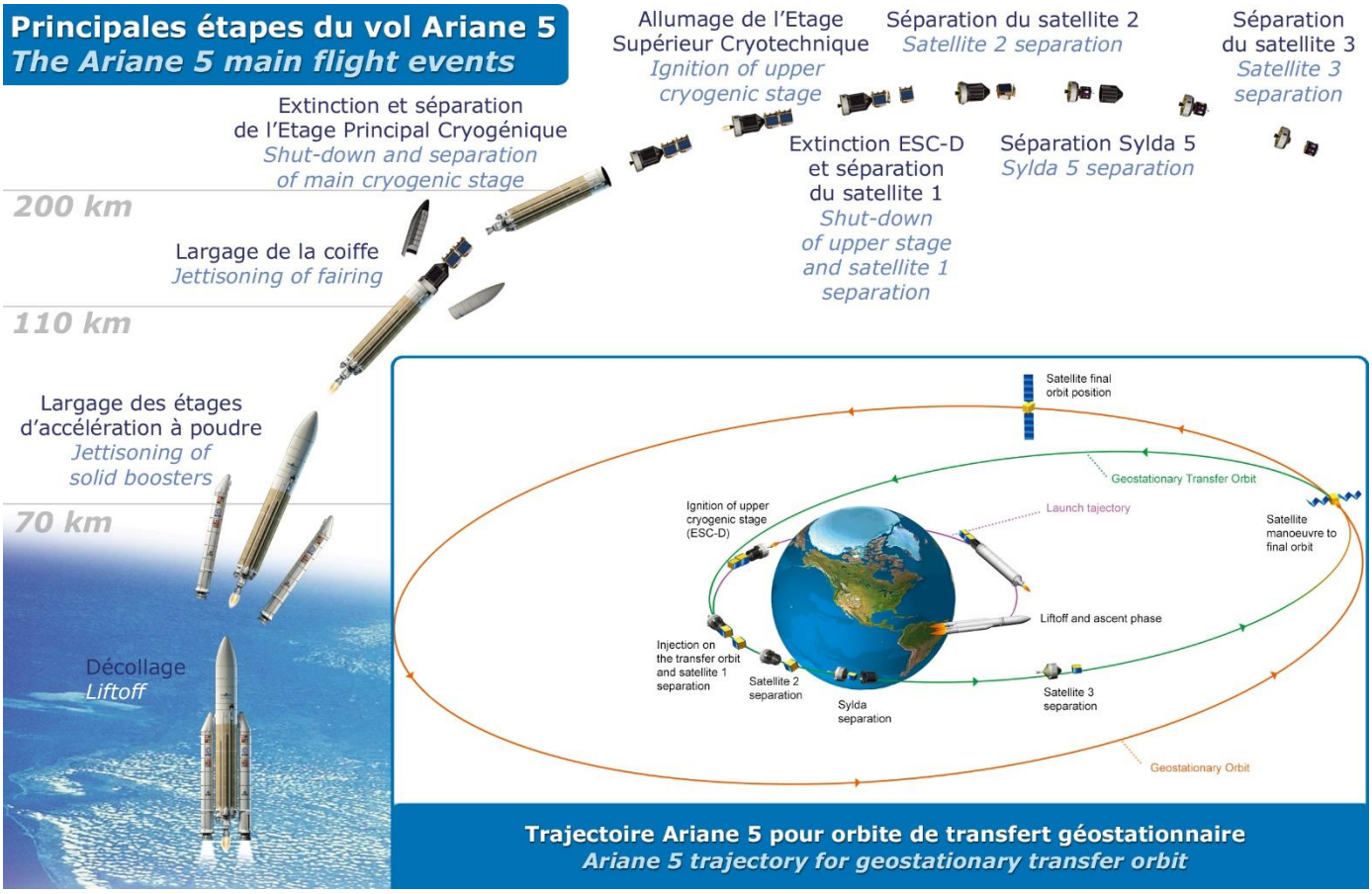
The synchronized sequence starts seven minutes before ignition (T-0). It is primarily designed to perform the final operations on the launcher prior to launch, along with the ultimate checks needed following switchover to flight configuration. As its name indicates, the sequence is fully automatic, and 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).
- Burn-off 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 15 other shareholders from the European launcher industry.

Since the outset, Arianespace has signed over 600 launch contracts and launched more than 650 satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace.

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 GEO commercial launch contracts up for bid worldwide in the past two years. Arianespace now has a backlog of more than 750 satellites to be launched.

THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For more than 50 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 participate 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 checks of the Ariane launcher – which is built under ArianeGroup responsibility as the production prime contractor; coordinates the satellite preparations that are performed in parallel inside the Payload Preparation Complex (EPCU) [which is operated by the Guiana Space Center - CNES/CSG], followed by the payload's integration on the launcher in the Final Assembly Building (BAF); and also works with ArianeGroup teams in charge of the launcher to conduct the final countdown and launch from 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.