



arianespace
arianeGROUP

LAUNCH KIT

April 2018

VA242

DSN-1/Superbird-8

HYLAS 4





VA242

**DSN-1/Superbird-8
HYLAS 4**



ARIANESPACE TO LAUNCH DSN-1/SUPERBIRD-8 FOR SKY PERFECT JSAT AND HYLAS 4 FOR AVANTI

For its third launch of 2018, Arianespace will use an Ariane 5 from the Guiana Space Center (CSG) in French Guiana to launch the DSN-1/Superbird-8 and HYLAS 4 satellites for operators SKY Perfect JSAT and Avanti Communications.

With this 297th mission of its launcher family – the 242nd utilizing an Ariane launcher – Arianespace serves once again the ambitions of leading satellite operators, both globally and regionally.

DSN-1/Superbird-8

DSN-1/Superbird-8 will be the 19th SKY Perfect JSAT satellite assigned to Arianespace for launch. The most recent Arianespace launch for this operator was with JCSAT-15 in December 2016.

SKY Perfect JSAT Corporation is a leader in the converging fields of broadcasting and communications. It is Asia's largest satellite operator with an operational fleet of 17 satellites. SKY Perfect JSAT is a provider of both multi-channel pay TV broadcasting and satellite communications services which also delivers a broad range of entertainment through the SKY PerfectTV! Platform, the most extensive in Japan with a total of 3 million subscribers.

Superbird-8 will carry high-performance Ku and Ka transponders and will provide satellite communications services mainly in the Japanese market. Located at 162 degrees East Longitude, it will replace the Superbird-B2 satellite launched in 2000 by Arianespace.

Superbird-8 was built by MELCO - Mitsubishi Electric Corporation- (with manufacturing management by NEC Corporation) using a DS2000 platform. It will be the 3th MELCO – built satellite to be launched by Arianespace.

As for DSN-1, it is an X-Band Defense Communications Satellite-1 in association with the Program to Upgrade and Operate X-Band Satellite Communications Function, for which the DSN Corporation, a subsidiary of SKY Perfect JSAT, has concluded a program contract with Japan's Ministry of Defense.

HYLAS 4

HYLAS 4 is not only Avanti's 3rd satellite launch but is also the 3rd launch with Arianespace from the Spaceport in French Guiana.

Avanti Communications is a world leader in Ka-band satellite communications across Europe, Africa and the Middle East. Its HYLAS Ka-band fleet provide broadband access to homes, schools, governments and Mobile Network Operators (MNOs) through an elite collection of Service Providers. Avanti has invested in ground infrastructure: it owns and operates its own diverse Gateway Earth Stations in the UK, Cyprus, Turkey, Nigeria and South Africa, with plans for other Gateways in-country, as well as an international fiber ring and cross-connected fiber network, ensuring its customers are always online.

HYLAS 4 will deliver high speed, reliable and secure satellite communications to Internet Service Providers (ISPs), Mobile Network Operators (MNOs), Governments and Satellite Operators across Europe, through its Ka-band capacity. The High Throughput Satellite will also provide services in regions, such as West and Central Africa, and with its steerable beams that provide services in Europe, South America, the Caribbean, and the Middle East.

It is the 28th Orbital ATK satellite to be launched by Arianespace, a series that started with the TOPEX-Poseidon mission in 1992.

Arianespace's current order book includes two other Orbital ATK satellites.

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MISSION DESCRIPTION

Arianespace's second Ariane 5 ECA 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 10,260 kg.

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

DATE AND TIME



Liftoff is planned on **Thursday, April 5, 2018** as early as possible within the following launch window:

- > Between 5:34 p.m. and 6:24 p.m., Washington, D.C. time
- > Between 6:34 p.m. and 7:24 p.m., in Kourou, French Guiana
- > Between 21:34. and 22:24., Universal Time (UTC)
- > Between 11:34 p.m. and 12:24 a.m., Paris time during the night of April 5 to April 6
- > Between 6:34 a.m. and 7:24 a.m., Tokyo time on April 6, 2018

MISSION DURATION



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

33 minutes, 56 seconds.

TARGETED TRANSFER ORBIT



Perigee altitude
250 km.



Apogee altitude
35,786 km.



Inclination
3 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 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.

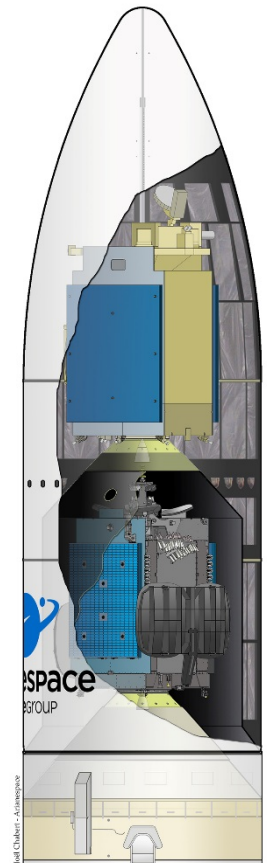
The fairing protecting the payload is jettisoned at T+197 seconds.

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 9,498 meters/second, and will be at an altitude of 639 kilometers.

PAYLOAD CONFIGURATION

- > **Upper payload (CUH): DSN-1/Superbird-8**
Mass at liftoff: 5,348 kg.
- > **Lower payload (CUB): HYLAS 4**
Mass at liftoff: 4,050 kg.
- > Long version of the payload fairing
- > **SYLDA (SYstème de Lancement Double Ariane)**





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DSN-1/Superbird-8
HYLAS 4



DSN-1/Superbird-8 SATELLITE



CUSTOMER	SKY Perfect JSAT Corporation
PRIME CONTRACTOR	NEC Corporation
MISSION	Communications
STABILIZATION	3 axis
PLATFORM	DS2000
DESIGN LIFE	15 years and more
ORBITAL POSITION	162° East Longitude
COVERAGE AREA	Japan (Ku/Ka-band Japan beam), entire visible area (Ku-band steerable beam)

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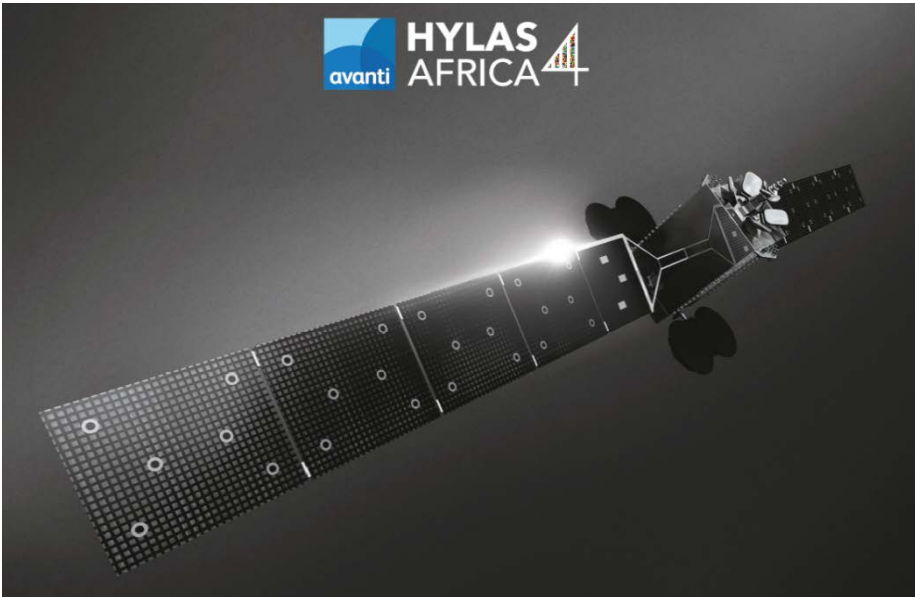


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DSN-1/Superbird-8
HYLAS 4



HYLAS 4 SATELLITE



CUSTOMER	Avanti
PRIME CONTRACTOR	Orbital ATK
MISSION	Broadband and connectivity services
MASS	4,050 kg. at liftoff
STABILIZATION	3 axis
DIMENSIONS	5.18 m. x 3.33 m. x 3.10 m.
PLATFORM	GEOStar™-3
PAYLOAD	Ka-band High-Throughput Satellite (HTS) with 53 Operational User Beams and 4 Operational Gateway Beams
ONBOARD POWER	8.0 kW (end of life)
DESIGN LIFE	15 years
ORBITAL POSITION	33.5° West Longitude
COVERAGE AREA	Africa and Europe

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ARIANE 5 ECA LAUNCH VEHICLE

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

54.8 m.

Fairing

(RUAG Space): 17 m.
Mass: 2.4 t.

780 metric tons
(total mass at liftoff)

DSN-1/Superbird-8

(SKY Perfect JSAT)
Mass: 5,348 kg.

PA - Payload adaptor (2)

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

HYLAS 4

(Avanti)
Mass: 4,050 kg.

SYLDA - Internal structure

7 versions (Height: 4.9 to 6.4 m.)
Mass: 500 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-O**
H: Cryogenic
P: Solid

EPC - Cryogenic main stage

Height: 31 m.
Mass: 188 t.

EAP - Solid rocket boosters

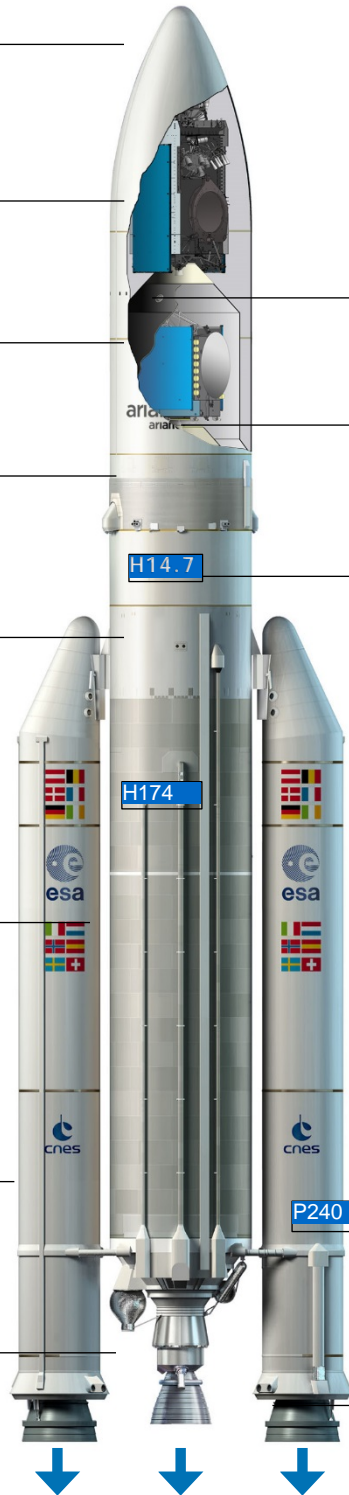
Height: 31.6 m.
Mass: 277 t. approx.

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.)

**VA242**DSN-1/Superbird-8
HYLAS 4

LAUNCH CAMPAIGN - ARIANE 5 DSN-1/Superbird-8 – HYLAS 4

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
January 30, 2018		Campaign start review EPC unpacking - EAP 2 transfer- EPC erection
January 31, 2018		EAP1 transfer - EPC/EAP integration
February 5, 2018		Erection of ESC-A and vehicle equipment bay installation
February 6, 2018	Arrival in French Guiana of DSN-1/Superbird-8 and transportation to the S5C	
February 15, 2018	Arrival in French Guiana of HYLAS 4 and transportation to the S5C	
February 22 to 28, 2018	DSN-1/Superbird-8 fueling operations	
February 27, 2018		Transfer from BIL-BAF
February 27 to March 2, 2018	HYLAS 4 fueling operations	
March 2, 2018	DSN-1/Superbird-8 integration on payload adaptor	
March 13, 2018	DSN-1/Superbird-8 transfer to the Final Assembly Building (BAF)	
March 14, 2018	DSN-1/Superbird-8 integration on SYLDA HYLAS 4 integration on payload adaptor	
March 15, 2018	Payload fairing integration on SYLDA (with DSN-1/Superbird-8 inside)	

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Monday, March 26, 2018	HYLAS 4 transfer to the Final Assembly Building (BAF)	
Tuesday, March 27, 2018	HYLAS 4 integration on launch vehicle	HM7B engine final inspection
Wednesday, March 28, 2018	Completion of composite integration on launcher and payload checks	
Thursday, March 29, 2018		Finalization of the composite/launcher integration, and payload checks
Friday, March 30, 2018		Launch rehearsal
Saturday, March 31, 2018		Arming of launch vehicle
Tuesday, April 3, 2018		Launch readiness review (LRR), final preparation of launcher and BAF for the chronology
Wednesday, April 4, 2018		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Thursday, April 5, 2018		Start of launch countdown, EPC and ESC-A filling with liquid oxygen and liquid hydrogen



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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 shifts outside of 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 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-A 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 s	Ignition of the cryogenic main stage (EPC)
+ 07.05 s	Ignition of solid boosters (EAP)
+ 07.3 s	Liftoff
+ 12.3 s	End of vertical climb, beginning of pitch motion
+ 17.1 s	Beginning of roll maneuver
+ 2 min 31 s	EAP separation
+ 3 min 28 s	Fairing jettisoned
+ 7 min 53 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 48 s	Acquisition by Ascension tracking station
+ 18 min 25 s	Data acquisition by Libreville tracking station
+ 23 min 07 s	Acquisition by Malindi tracking station
+ 25 min 08 s	Injection
+ xx min yys	DSN-1/Superbird-8 satellite separation
+ 32 min 15 s	SYLDA separation
+ 33 min 56 s	HYLAS 4 satellite separation



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DSN-1/Superbird-8
HYLAS 4



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:

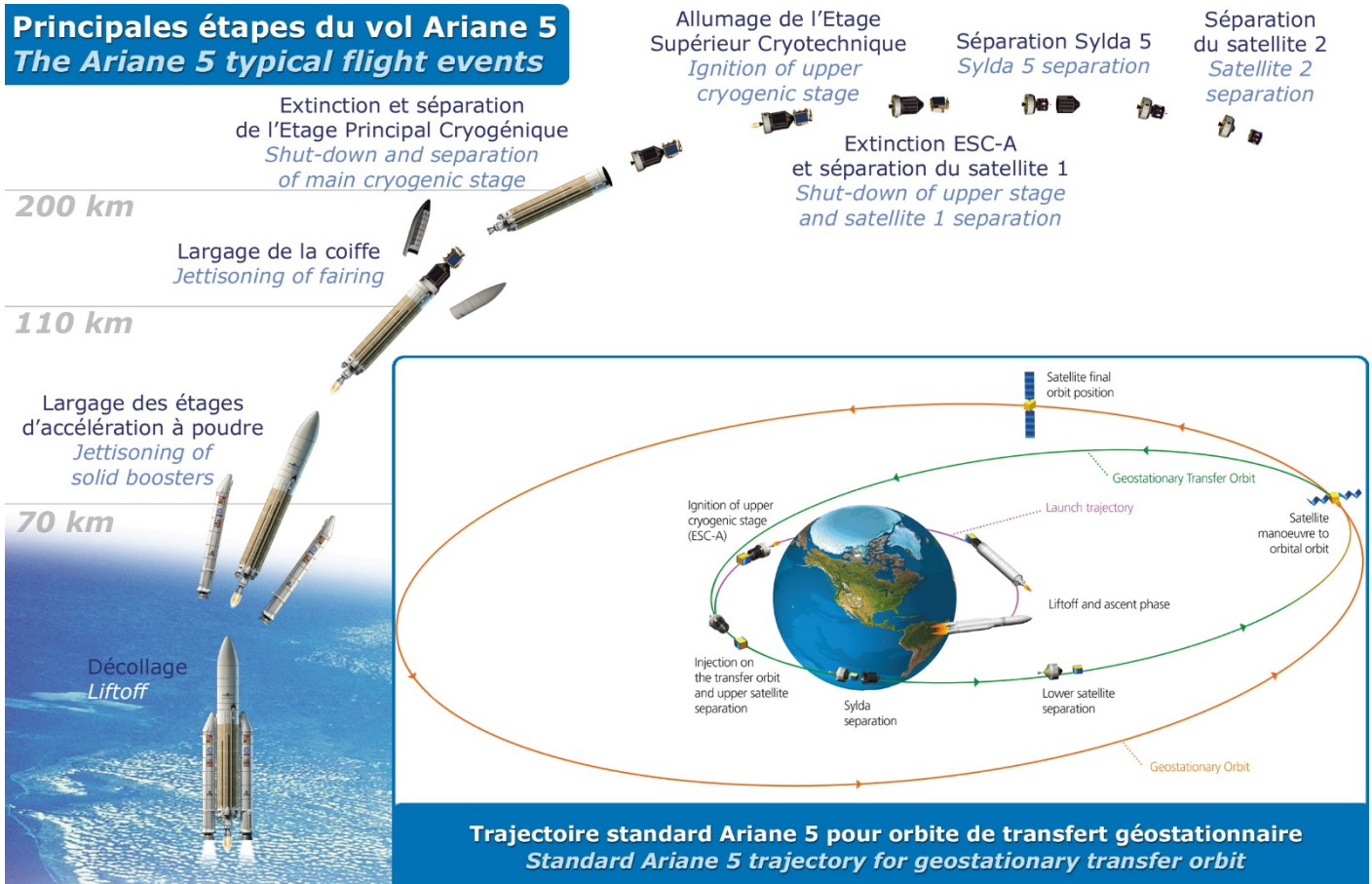
- > Startup of water injection in the flame trenches and exhaust guide (T-30 sec).
- > Hydrogen aspiration for chilldown of the Vulcain engine in the exhaust guide (T-18 sec).
- > Burn-off of hydrogen used for chilldown (T-5.5 sec).

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.

Principales étapes du vol Ariane 5 The Ariane 5 typical flight events





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**DSN-1/Superbird-8
HYLAS 4**



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 17 other shareholders from the European launcher industry.

Since the outset, Arianespace has signed over 530 launch contracts and launched 570-plus satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace. The company posted sales of approximately 1.3 billion euros in 2017.

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 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 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 Regulux, 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.