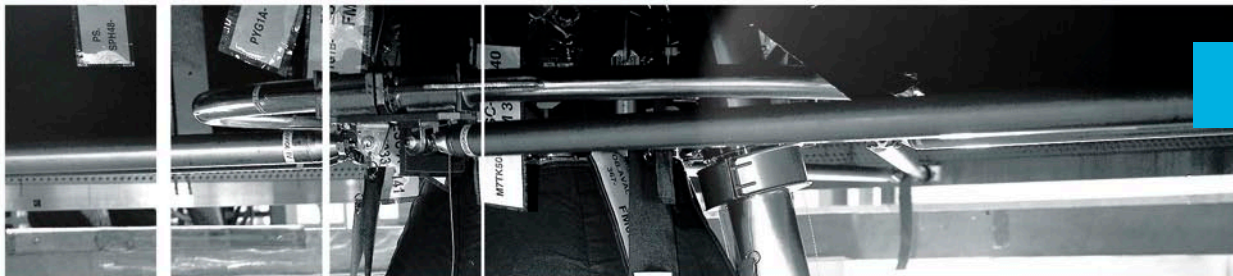


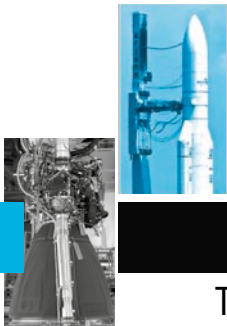
April
2015



VA 222

THOR 7
SICRAL 2





VA 222

THOR 7 - SICRAL 2



FIRST ARIANE 5 LAUNCH OF THE YEAR ALL EUROPEAN!

On its third launch of the year from the Guiana Space Center in French Guiana, and first with an Ariane 5, Arianespace will orbit satellites for two European operators: THOR 7 for the private Norwegian company Telenor Satellite Broadcasting (TSBc), and SICRAL 2 for Telespazio, on behalf of the Italian Ministry of Defense and the French defense procurement agency DGA (Direction Générale de l'Armement, part of the Ministry of Defense).

The year's first mission with the Ariane 5 heavy launcher once again illustrates Arianespace's assigned task of guaranteeing independent access to space for European operators from both the private and public sectors. Since being founded in 1980, Arianespace has placed 224 satellites into geostationary transfer orbit for customers from Europe.

THOR 7

THOR 7 will be the second satellite orbited by Arianespace for the private Norwegian operator Telenor Satellite Broadcasting (TSBc), after THOR 6 in October 2009.

Built by Space Systems/Loral using an LS-1300 platform, THOR 7 will weigh approximately 4,600 kg at launch. It is fitted with 21 active Ku-band and 25 Ka-band transponders and will be positioned at 0.8° West. THOR 7 will provide TV broadcasting services for central and eastern Europe. Its payload will also provide broadband communications for the maritime industry, along with spotbeams covering European waters.

Offering a design life of 15 years, THOR 7 is the 47th satellite built by Space Systems/Loral (or its predecessor companies) to be launched by Arianespace.

SICRAL 2

The SICRAL 2 telecommunications satellite will be the 63rd military payload launched by Arianespace, and the second joint Italian-French military satellite, following Athena-Fidus, which was launched in February 2014.

SICRAL 2 was built by Thales Alenia Space (TAS) using a Spacebus 4000 B3 platform. It will weigh about 4,400 kg at launch and is fitted with UHF and SHF band transponders. Offering a design life of 15 years, SICRAL 2 will handle strategic and tactical communications for the French and Italian armed forces, as well as providing additional reserve telecom capacity for NATO countries.

SICRAL 2 is the 141st satellite built by Thales Alenia Space to be launched by Arianespace.

These first three launches of 2015 clearly show not only that Arianespace guarantees independent access to space for Europe, but also that its family of launchers is a perfect match for all of today's space applications: the Vega light launcher lofted the IXV technology demonstration mission on February 11; the Soyuz medium launcher boosted two Galileo satnav satellites into orbit on March 27, and Ariane 5 will carry the THOR 7 and SICRAL 2 telecommunications satellites into orbit on April 15.



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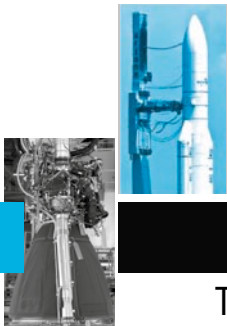


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VA 222

THOR 7 - SICRAL 2



MISSION DESCRIPTION

The 222nd Arianespace launch will orbit two telecommunications satellites: THOR 7 for the operator TELENOR and SICRAL 2 for the operator Telespazio.

This will be the 78th launch of an Ariane 5.

The launcher will be carrying a total payload of 9,852 kg, including 9,000 kg for the THOR 7 and SICRAL 2 satellites, which will be released into their targeted orbits.

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

Targeted orbit

Perigee altitude : 249.4 km

Apogee altitude : 35,934 km

Inclination : 6 degrees

Liftoff is planned on **Wednesday, April 15, 2015**

as soon as possible within the following launch windows:

- between 04:43 pm and 06:37 pm, Kourou,
- between 03:43 pm and 05:37 pm, Washington DC time,
- between 07:43 pm and 09:37 pm, Universal time (GMT),
- between 09:43 pm and 11:37 pm, Paris time.

The launch at a glance

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

7.05 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 THOR 7 and SICRAL 2 spacecraft is jettisoned at T+200 seconds (once the Ariane 5 has climbed through the Earth's dense atmospheric layers), and comes after the launcher's boosters are jettisoned at approximately at T+142 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 falls back off the coast of Africa in the Atlantic Ocean (in the Gulf of Guinea).

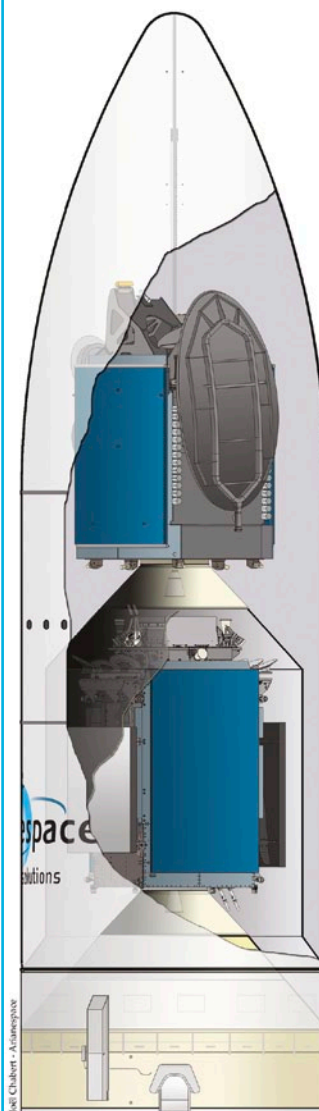
On orbital injection, the launcher will have attained a velocity of approximately 9,365 meters/second, and will be at an altitude of about 643.2 kilometers.

Payload configuration

The THOR 7 satellite was built by Space Systems/Loral in Palo Alto, California (United States) for the operator Telenor.

Orbital position: 0.8° West

The SICRAL 2 satellite was built by Thales Alenia Space in Italy and France for the operator Telespazio.



Mission length

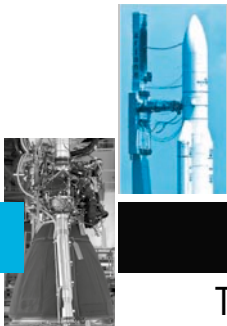
The nominal length of the mission (from liftoff to separation of the satellites) is

**34 minutes
and 23 seconds.**



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VA 222

THOR 7 - SICRAL 2



THE THOR 7 SATELLITE



Customer	Telenor Satellite Broadcasting AS
Prime contractor	SPACE SYSTEMS/LORAL
Mission	Broadcast and broadband services
Mass	Total mass at lift-off approx. 4,600 kg
Stabilization	3 axis
Dimensions	4.7 x 3.4 x 2.7 m
Span in orbit	24.8 m
Platform	LS 1300
Payload	21 Ku band transponders and 25 Ka band active transponders
On-board power	9.9 kW (end of life)
Life time	15 years
Orbital position	0.8° West
Coverage area	Scandinavia, Central Europe and Eastern Europe (Ku band). North Sea, Norwegian Sea, Red Sea, Baltic Sea, Persian Gulf and Mediterranean (Ka band)

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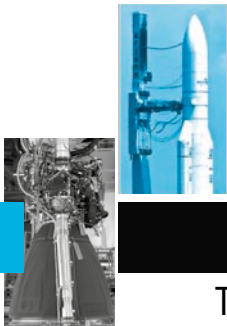
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THOR 7 - SICRAL 2



THE SICRAL 2 SATELLITE



Customer	Telespazio
Prime contractor	Thales Alenia Space
Mission	Telecommunications
Mass	Total mass at lift-off 4,400 kg
Stabilization	3 axis
Dimensions	5.5 m x 2.2 m x 3.1 m
Platform	Spacebus 4000 B3
Payload	UHF and SHF band transponders
On-board power	7 kW (end of life)
Life time	15 years

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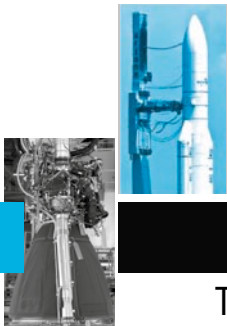
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THOR 7 - SICRAL 2



ARIANE 5-ECA LAUNCH VEHICLE

54.8 m

Fairing

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

THOR 7

- (Space Systems/Loral)
- ▼ Mass: 4.6 t

SICRAL 2

- (Telespazio)
- ▼ Mass: 4.4 t

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 - Main Cryogenic 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

780 tons

(total mass at liftoff)

ACU - Payload adaptor (2)

- (RUAG Space or Airbus Defence and Space)
- ▼ Mass: 140 kg each approx.

SYLDA - Internal structure

- (Airbus Defence and Space)
- ▼ 7 versions (Height: 4.9 to 6.4 m)
- ▼ Mass: 400 to 530 kg

M-7B Engine

- (Snecma)
- ▼ Thrust: 67 kN (in vacuum)
- ▼ 945 sec of propulsion

Propellants (in tons) at T-O

- H** : Cryogenic
- P** : Solid

MPS - Solid Propellant Motor

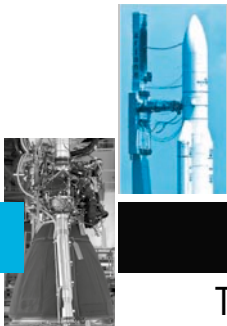
- (Europropulsion)
- ▼ Average thrust: 5,060 kN
- ▼ Maximum thrust: 7,080 kN (in vacuum)
- ▼ 130 sec of propulsion

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



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THOR 7 - SICRAL 2



RANGE OPERATIONS CAMPAIGN: ARIANE 5 - THOR 7 - SICRAL 2

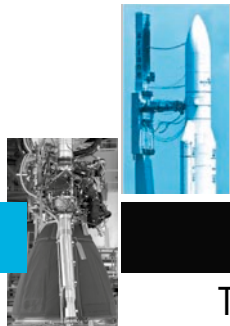
THOR 7 - SICRAL 2 and launch vehicle campaign calendar

Dates	Satellite activities	Launch vehicle activities
November 18, 2014		Campaign start review
November 19, 2014		EPC erection
November 20, 2014		EAP transfer and positioning
November 21, 2014		EPC/EAP integration
November 25, 2014		ESC-A Erection and equipment bay integration
January 19, 2015		Transfer BIL-BAF
February 20, 2015	Arrival of THOR 7 and beginning of preparation campaign in building S5C	
March 2, 2015	THOR 7 transfer to S5B	
March 4, 2015	Arrival in Kourou of SICRAL 2 and beginning of preparation campaign in building S5C	
March 4 - 6, 2015	THOR 7 filling operations	
March 7, 2015	THOR 7 integration on adaptor (PAS) and functional test	
March 9, 2015	THOR 7 transfer to Final Assembly Building (BAF)	
March 10, 2015	THOR 7 integration on SYLDA	
March 23, 2015	SICRAL 2 transfer to S5B	
March 26 - 28, 2015	SICRAL 2 filling operations	
March 31, 2015	SICRAL 2 integration on ACU	
April 1 st 2015	Fairing integration on SYLDA	

THOR 7 - SICRAL 2 launch vehicle campaign final calendar

Dates	Satellite activities	Launch vehicle activities
Wednesday, April 1 st , 2015	SICRAL 2 transfer to Final Assembly Building (BAF)	
Thursday, April 2, 2015	SICRAL 2 integration on launcher	
Tuesday, April 7, 2015	Composite integration with THOR 7 on launcher	
Wednesday, April 8, 2015		Completion of composite integration on launcher
Thursday, April 9, 2015		ESC-A final preparations and Launch rehearsal
Friday, April 10, 2015		Arming of launch vehicle
Monday, April 13, 2015		Launch readiness review (RAL) and final preparation of launcher
Tuesday, April 14, 2015		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Wednesday, April 15, 2015		Start of final countdown and launch countdown, including EPC filling with liquid oxygen and liquid hydrogen





VA 222

THOR 7 - SICRAL 2



COUNTDOWN AND FLIGHT

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 the ignition of the main stage engine, then the two boosters, for a liftoff at the targeted time.

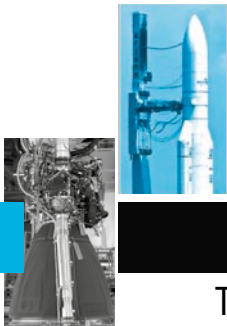
The countdown culminates in a synchronized sequence (see appendix 3), which is managed by the control station and onboard computers starting at T-7 minutes.

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
- 07 mn 00.0 s	"All systems go" report, allowing start of synchronized sequence
- 04 mn 00.0 s	Tanks pressurized for flight
- 01 mn 00.0 s	Switch to onboard power mode
- 05.5 s	Cryogenic arm opening command
- 04.0 s	Onboard systems take over
- 03.0 s	Two inertial reference systems switch to flight mode

T-O	Ignition of the cryogenic main stage engine (EPC)
+ 07.0 s	Ignition of solid boosters (EAP)
+ 07.3 s	Liftoff
+ 12.5 s	End of vertical climb, beginning of pitch motion (10 seconds duration)
+ 17.0 s	Beginning of roll maneuver
+ 02 mn 22.1 s	EAP separation
+ 03 mn 20.0 s	Fairing jettisoned
+ 08 mn 14.2 s	Acquisition by Natal tracking station
+ 08 mn 50.2 s	End of EPC thrust phase
+ 08 mn 56.2 s	EPC separation
+ 09 mn 00.3 s	Beginning of first ESC-A thrust phase
+ 13 mn 46.1 s	Acquisition by Ascension tracking station
+ 18 mn 21.0 s	Acquisition by Libreville tracking station
+ 23 mn 00.8 s	Acquisition by Malindi tracking station
+ 24 mn 52.5 s	End of first ESC-A thrust phase / Injection
+ 28 mn 01.8 s	THOR 7 satellite separation
+ 32 mn 33.0 s	Sylda 5 separation
+ 34 mn 22.6 s	SICRAL 2 satellite separation
+ 47 mn 06.1 s	End of Arianespace mission





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THOR 7 - SICRAL 2



THOR 7 - SICRAL 2 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:

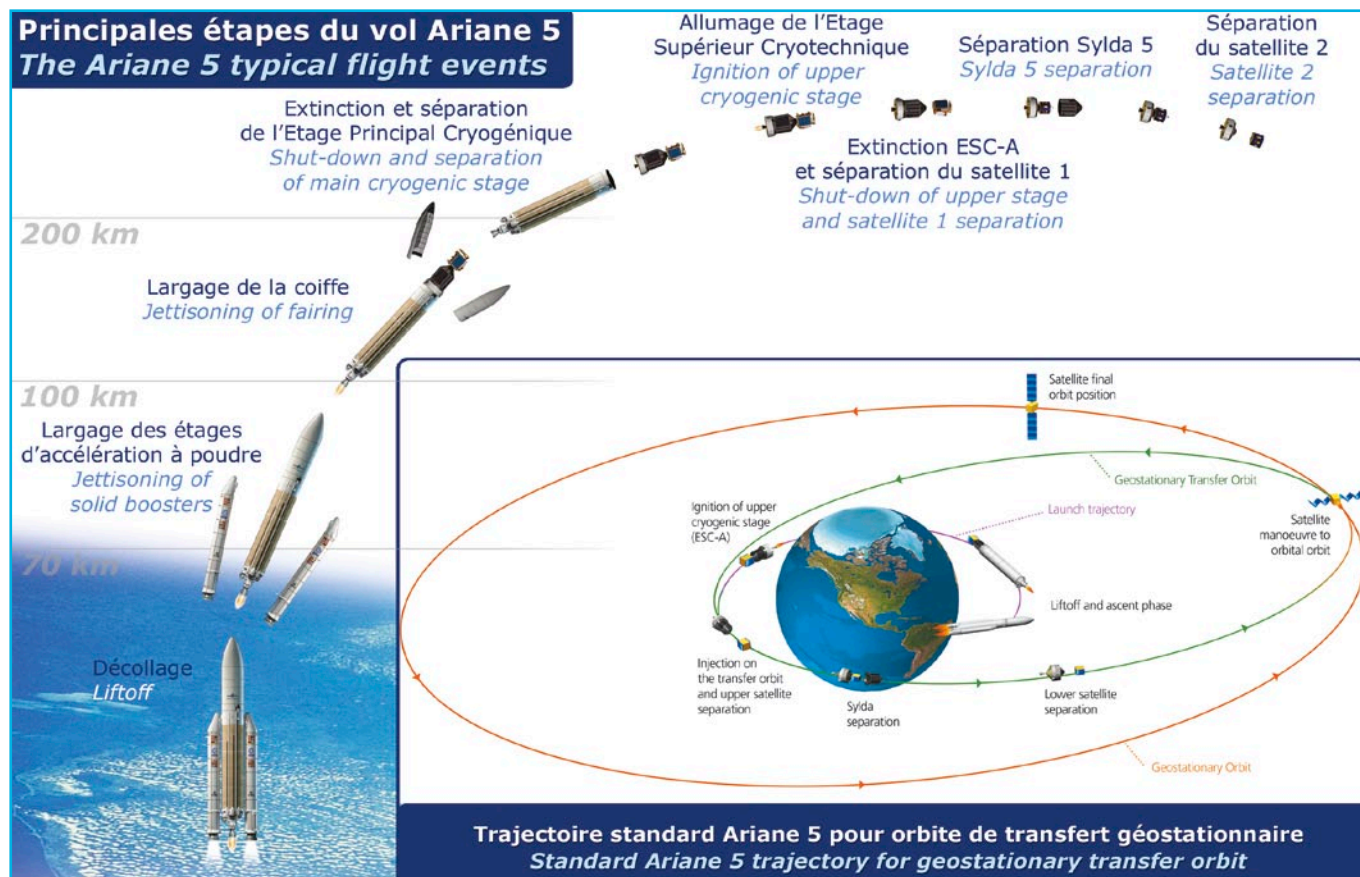
- Startup of water injection in the flame trenches and jet guide (T-30 sec).
- Hydrogen aspiration for chilldown of the Vulcain engine in the jet guide (T-18 sec).
- Burnoff of hydrogen used for chilldown (T-5.5 sec).

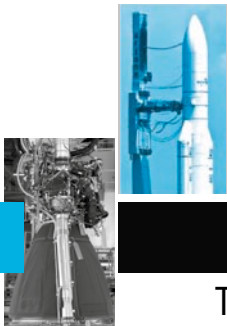
At T-4 seconds, the onboard computer takes over control of final engine startup and liftoff operations. It:

- 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 mn automatically places the launcher back in its T-7 min configuration.

Ariane 5-ECA - THOR 7 - SICRAL 2 trajectory





VA 222
THOR 7 - SICRAL 2



ARIANESPACE AND THE GUIANA SPACE CENTER

Arianespace, the first launch service company in the world

Arianespace was founded in 1980 as the world's first launch Service & Solutions company. Arianespace now has 21 shareholders from ten European countries (including Airbus Safran Launchers 40.99 % , CNES 34 % and all European companies participating in the production of Ariane launchers). Since the outset, Arianespace has signed more than 400 launch contracts and launched 502 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 45 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 (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 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), French space agency CNES 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 launcher for missions. Whether during tests or actual launches, CNES is also responsible for overall coordination of operations, 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 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 (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 satellites 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.

