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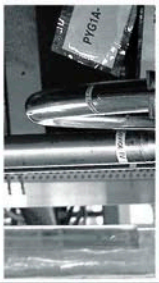
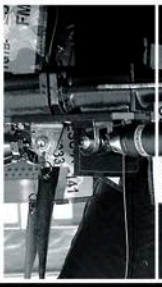
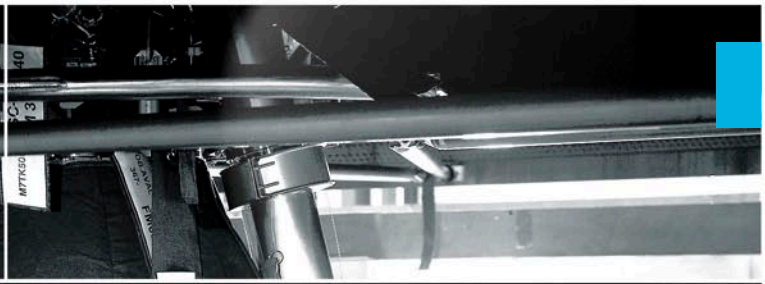
July
2014



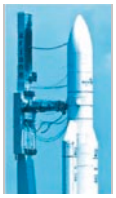
VA 219

ATV
Georges Lemaître

esa

atv5 Georges Lemaître
esa

cnes



VA 219

ATV "Georges Lemaître"

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FIFTH AND LAST ATV LAUNCH FOR THE INTERNATIONAL SPACE STATION

For its third Ariane 5 mission of the year, Arianespace will launch the fifth Automated Transfer Vehicle (ATV), dubbed "Georges Lemaître", for the European Space Agency (ESA). Like the first four ATVs, launched in March 2008, February 2011, March 2012 and June 2013, the ATV-5 will play a vital role in bringing supplies to the International Space Station (ISS). Reflecting the excellence of European space transport, encompassing both the launcher and the payload, this latest mission spotlights Europe's key role in major international space programs.

The ATV mission

The ATV is designed to bring supplies to the International Space Station (water, air, food, propellants for the Russian section, spare parts, experimental hardware, etc.), and reboost the ISS into its nominal orbit. The ISS now weighs more than 420 metric tons, including the European laboratory, Columbus. After separating from the launch vehicle, the ATV will be autonomous, using its own systems for energy (batteries and four large solar panels) and guidance (GPS, star tracker), in liaison with the control center in Toulouse. During final approach, an optical navigation system will guide the ATV to its rendezvous with the Space Station, where it will automatically dock several days after launch.

After being docked to the ISS for up to six months, the ATV will be loaded with waste and other items that are no longer needed, separated from the station and carry out a guided reentry, disintegrating in the atmosphere.

Payload weight record

The ATV-5 weighs more than 20 metric tons, making it the heaviest payload ever launched by an Ariane 5. Over the five ATV launches since 2008, Ariane 5 ES rockets have lofted over 100 metric tons into orbit. The latest Ariane 5 ES launcher will be used to inject the ATV-5 into a circular orbit at an altitude of 260 kilometers, inclined 51.6 degrees.

With this launch, Ariane 5 continues to confirm its ability to handle a wide array of missions, ranging from scientific spacecraft in special orbits to commercial launches in geostationary orbit.

The ATV cargo vessels are built by Airbus Defence and Space, leading a consortium of European manufacturers. A large cylinder measuring about 10 meters long by 4.5 meters in diameter, the ATV comprises two main parts: a service module with the avionics and propulsion systems, and a pressurized cargo carrier.

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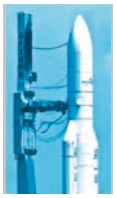

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ATV “Georges Lemaître”

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MISSION DESCRIPTION

The 218th Ariane launch will place the European Space Agency’s fifth Automated Transfer Vehicle (ATV) into a low Earth orbit, inclined 51.6 degrees.

This will be the 74th Ariane 5 launch.

The launcher will be carrying a total payload of 20,060 kg, including 19,926 kg for the ATV itself.

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

Circular orbit targeted
Altitude : 260 km
Inclination: : 51.63 degrees

Liftoff is planned for the evening of **Tuesday July 29, 2014** at precisely:

- 8:44:03 pm Local Time in French Guiana,
- 7:44:03 pm in Washington DC,
- 23:44:03 UTC,
- 1:44:03 am on July 30 in Paris,
- 3:44:03 am on July 30 in Moscow.

The launch at a glance

After the main stage cryogenic engine is ignited and its operation checked, the two solid rocket boosters are ignited to provide liftoff. The launcher rises vertically for about five seconds, then tilts towards the northeast. It will maintain its attitude to keep the launcher’s axis parallel to its airspeed vector in order to minimize aerodynamic loads throughout the atmospheric phase of the launch, until the solid boosters are jettisoned. The fairing protecting the ATV is jettisoned shortly after the boosters, at about T + 144 seconds.

Once the first part of the flight is completed, the onboard computers optimize the trajectory in real time to minimize fuel burn. The launcher reaches the targeted position for the extinction of the main stage engine, then the intermediate orbit targeted at the end of the first firing of the upper stage.

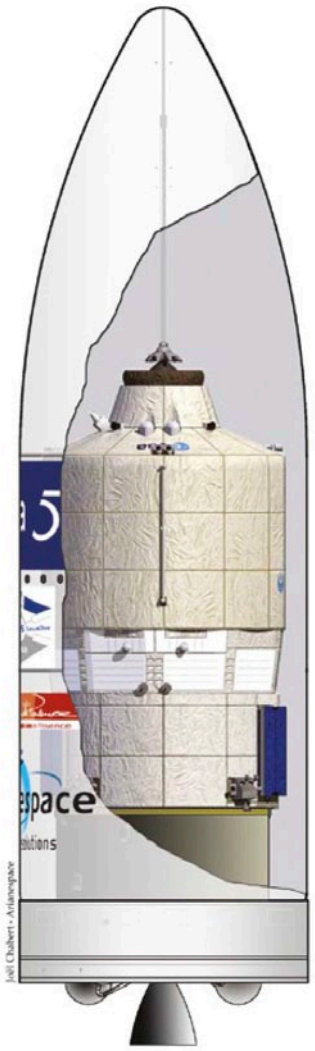
On this mission, the main stage will fall back into the Atlantic Ocean off the coast of Portugal.

Following a ballistic (“coasting”) phase lasting 45 minutes, the upper stage is then reignited to circularize the orbit, directing the ATV, once separated, into its targeted final orbit at an altitude of 260 kilometers and a speed of about 7,600 meters/second.

Once the ATV has separated, the launcher starts a second long ballistic phase (making nearly a complete revolution around the Earth). The upper stage is then reignited once more to deorbit the upper segment of the launcher, sending it towards a deserted area of the South Pacific.

Ariane payload configuration

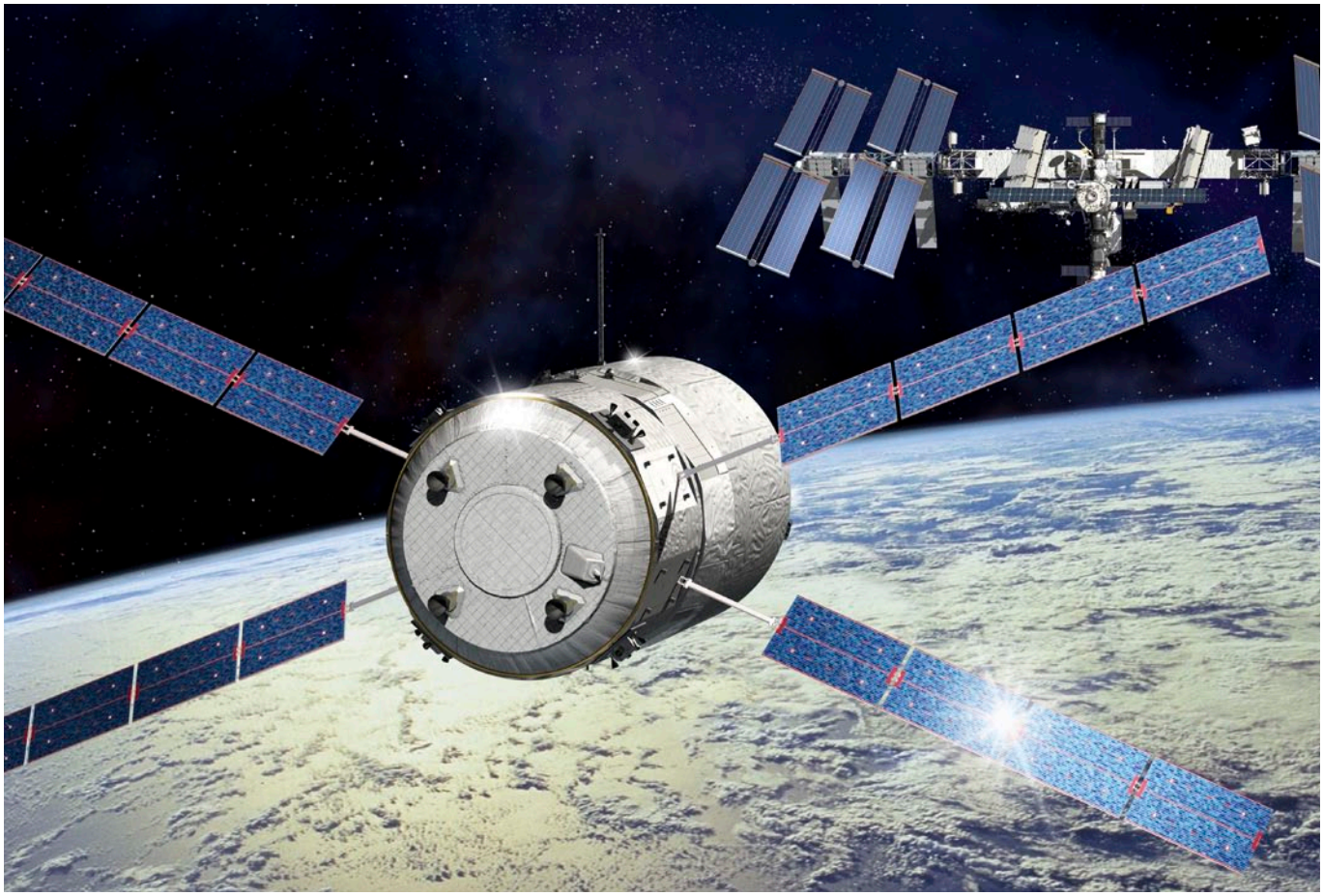
The ATV “Georges Lemaître” was built by Airbus Defence and Space, leading a large European industrial consortium.



Mission length

The nominal length of the mission (from liftoff to separation of the ATV) is **1 hour 3 minutes and 56 seconds.**

THE AUTOMATED TRANSFER VEHICLE (ATV) "GEORGES LEMAÎTRE"



Customer	**The European Space Agency (ESA)**
Manufacturer	**Airbus Defence and Space**
Mission	**Carry cargo to the ISS, re-boost the ISS's altitude**
Mass	**Total mass at liftoff 20,060 kg** **Dry mass 9,778 kg**
Stabilization	**3 axis**
Dimensions	**10.27 m length** **4.48 m diameter (max.)**
Span in orbit	**22,3 m with solar arrays deployed**
Onboard power	**4,600 W (end of life)**

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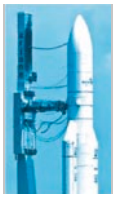

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ATV "Georges Lemaître"

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ARIANE 5-ES LAUNCH VEHICLE

50.5 m

Fairing
(RUAG Space)
- 17 m
- Mass: 2.6 t

773 tons
(total mass at liftoff)

ATV 5 Georges Lemaître
(Airbus Defence and Space)
- Mass: 19.9 t (without adapteur)

EPS - Storable propellant upper stage
(Airbus Defence and Space)
- Height: 3.36 m
- Aestus engine
- Without TP
- 29 kN

Vehicle Equipment Bay
(Airbus Defence and Space)
- Hauteur : 1.56 m
- Masse : 1.7 t

EPC - Main Cryogenic stage
(Airbus Defence and Space)
- Height: 31 m
- Mass: 188.3 t

EAP - Solid Rocket Boosters
(Airbus Defence and Space)
- Height: 31.6 m
- Mass: 278 t approx.

Propellants (in ton) at T-O
L: Storable propellant
H: Cryogenic
P: Solid

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

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

13.000 kN at Liftoff
(at HO + 7 to 8 sec)

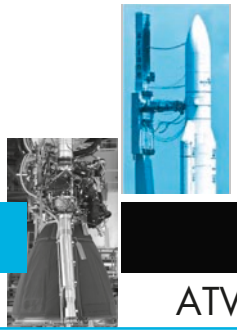
RANGE OPERATIONS CAMPAIGN: ARIANE 5 - ATV "GEORGES LEMAÎTRE"

ATV and launch vehicle campaign calendar

Dates	ATV activities	Launch vehicle activities
October 24, 2013	Arrival in Kourou and beginning of the ATV Georges Lemaître preparation campaign in the S5C building	
November 4, 2013	Electrical functional tests	
Nov. 29 - Dec. 19, 2013	Propulsion system tests	
January 8-24, 2014	Solar array integration	
Feb. 12 - March 5, 2014	Loading of water and of dry cargo	
April 22, 2014		Campaign start review
April 22, 2014		EPC erection
April 23, 2014		EAP transfer and positioning
April 23, 2014		EPC/EAP integration
April 28, 2014		Equipment bay integration
April 28, 2014		EPS erection
May 6, 2014	Mechanical mating of the 2 ATV modules	
May 16, 2014	Transfer of the ATV from the S5C to the S5B	
May 20-28, 2014	Filling operations of the Russian propellant subsystem in S5 B	
June 5, 2014		Rollout from BIL to BAF
June 5-13, 2014	Filling operations of the ATV propulsion subsystem in S5 B	

ATV and launch vehicle campaign final calendar

Dates	ATV activities	Launch vehicle activities
Monday June 23, 2014	ATV transfer to Final Assembly Building (BAF)	
Thursday June 26, 2014	ATV integration on launcher	
Friday July 11, 2014	Fairing integration around ATV	
Friday July 11, 2014		EPS and SCA preparations for filling
12 to 21 July 11, 2014		Additional checks
Tuesday 22 July 2014		Filling of SCA
Wednesday July 23, 2014		EPS filling with MMH
Thursday July 24, 2014		Launch rehearsal. EPS filling with N2O4
Friday July 25, 2014		Arming of launch vehicle
Saturday July, 26 2014		Launch readiness review (RAL) and final preparation of launcher
Monday July 28, 2014		Rollout from BAF to Launch Zone, launch vehicle connections and filling of the EPC liquid helium tank
Mardi July 29, 2014		Start of final countdown and launch countdown, including EPC filling with liquid oxygen and liquid hydrogen



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-0			Ignition of the cryogenic main stage engine (EPC)
		+ 07.0 s	Ignition of solid boosters (EAP)
		+ 07.3 s	Liftoff
		+ 12.8 s	End of vertical rise, beginning of pitch motion
		+ 17.1 s	Beginning of roll maneuver
	+ 02 mn	24.0 s	EAP separation
	+ 03 mn	33.0 s	Fairing jettisoned
	+ 08 mn	48.0 s	End of EPC thrust phase
	+ 08 mn	54.0 s	EPC separation
	+ 09 mn	00.0 s	Beginning of first EPS thrust phase
	+ 17 mn	12.0 s	End of first EPS thrust phase
	+17 mn	14.0 s	Beginning of ballistic phase
	+ 59 mn	03.0 s	Beginning of second EPS thrust phase
	+ 59 mn	58.0 s	End of second EPS thrust phase
+ 01 h	00 mn	00.0 s	ATV orientation phase
+ 01 h	03 mn	56.0 s	**ATV-5 separation**
+ 01 h	04 mn	12.0 s	Avoidance and distancing maneuvers
+ 01 h	38 mn	39.0 s	ATV solar array deployment complete
+ 02 h	24 mn	22.0 s	Third EPS boost for deorbiting
+ 02 h	35 mn	55.0 s	End of Arianespace mission

ATV "GEORGES LEMAÎTRE" 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, it 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:

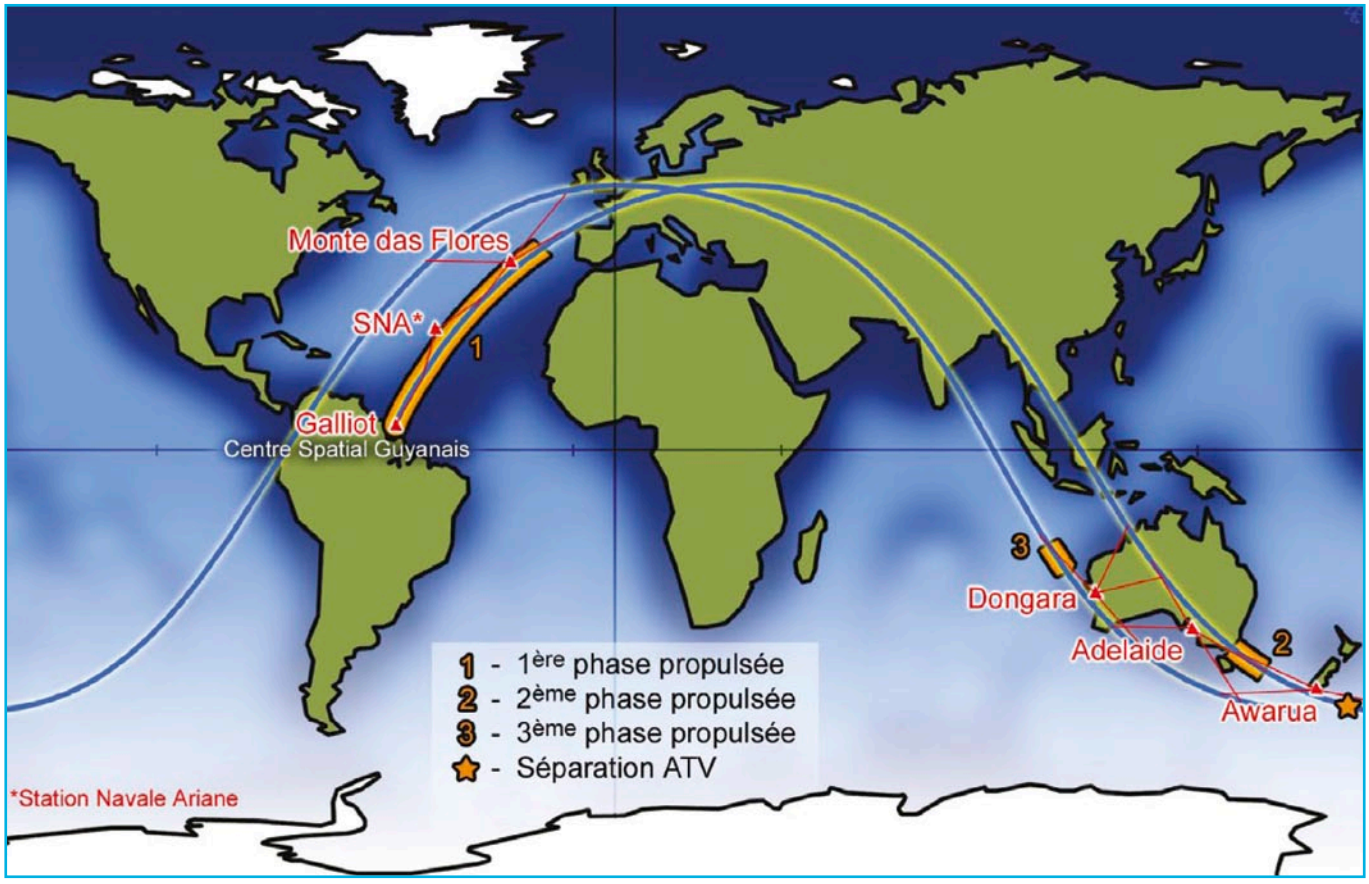
- Startup of water injection in the flame trenches and jet guide (T-30 sec).
- Hydrogen aspiration for chilldown of the Vulcain engine in the jet guide (T-18 sec).
- Burnoff of hydrogen used for chilldown (T-5.5 sec).

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 5ES - ATV trajectory



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 French space agency CNES with 34%, Airbus Defence and Space with 30%, and all European companies participating in the construction of Ariane launchers). Since the outset, Arianespace has signed more than 350 launch contracts and launched 320 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of about 989 million euros in 2013.

At January 1, 2014, Arianespace had 330 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 Service & Solutions 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 Kourou, French Guiana.
- The Soyuz medium launcher, currently in operation at the Baikonur Cosmodrome in Kazakhstan and the Guiana Space Center.
- 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 last two years. Arianespace now has a backlog of more than 40 satellites to be launched.

The Guiana Space Center: Europe's Spaceport

For over 30 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), 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.

French space agency CNES has several main responsibilities at the Guiana Space Center : It designs all infrastructures 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 in the Launcher Integration Building (BIL), built by Airbus Defence and Space as production prime contractor. It then carries out acceptance tests of the launcher, while coordinating satellite preparations in the Payload Preparation Complex (EPCU), operated by the Guiana Space Center (CSG). Arianespace then 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 get launchers and satellites 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.