A fourth launch for the International Space Station

For its second Ariane 5 mission of the year, Arianespace will launch the fourth Automated Transfer Vehicle (ATV), dubbed "Albert Einstein", for the European Space Agency (ESA). Like the first three ATV launched in March 2008, February 2011 and March 2012, the ATV 4 will play a vital role in bringing supplies to the International Space Station (ISS).

Weighing more than 20 tons, this will be the heaviest payload ever launched by Ariane 5. An Ariane 5 ES will inject the Albert Einstein ATV into a circular orbit at an altitude of 260 kilometers, inclined 51.6 degrees.

With this launch, Ariane 5 further expands its array of missions, ranging from scientific spacecraft in special orbits to commercial launches into geostationary orbit.

The ATV is designed to bring supplies to the ISS (water, air, food, propellants for the Russian section, spare parts, experimental hardware, etc.), and to reboost the ISS into its nominal orbit. The ISS now weighs more than 418 metric tons, including the European laboratory, Columbus. After being docked to the ISS for up to six months, the ATV will be loaded with waste items by the astronauts, and sent back down.

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. The ATV will remain docked to the ISS for nearly six months, before separating and making a guided reentry and disintegrating in the atmosphere.

The ATV was built by Astrium at the head of 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.

Follow the launch live on the internet broadband
at www.arianespace.com
(starting 20 minutes before lift-off)

1. Mission profile

The 213th Ariane launch will place the European Space Agency's fourth Automated Transfer Vehicle (ATV) into a low Earth orbit inclined 51.6 degrees.

This will be the 69th Ariane 5 launch.

The launcher will be carrying a total payload of 20,252 kg, including 19,887 kg for the ATV itself.

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

Targeted orbit

Circular orbit	***260 km***
Inclination	***51,63° degrees***

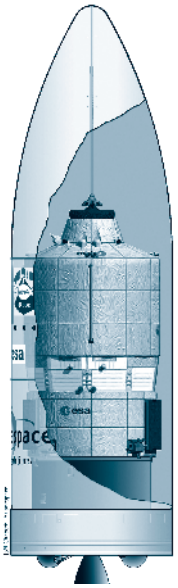
Liftoff is planned for the night of June 5, 2013 at a precise instant.

Launch opportunity

Universal time (GMT)	*Paris time*	*Kourou time*	*Moscow time*
9:52:13 pm	*11:52:13 pm*	*6:52:13 pm*	*1:52:13 am*
June 5, 2013	*June 5, 2013*	*June 5, 2013*	*June 6, 2013*

Payload configuration

The ATV Albert Einstein was built by Astrium, leading a large European industrial consortium



2. Range operations campaign: ARIANE 5 - ATV Albert Einstein

ATV and launch vehicle campaign calendar

Ariane activities	*Dates*	*ATV activities*
	September 18, 2012	*Arrival in Kourou and beginning of the ATV Albert Einstein preparation campaign in building S5C*
	September 26, 2012	*Electrical functional tests*
	Oct. 4-30, 2012	*Propulsion systems tests*
	Nov. 12-26, 2012	*Solar generators integration*
	Dec. 4, 2012 - Janv. 7, 2013	*Loading of water and of dry cargo*
Campaign start review	*February 1, 2013*	
EPC Erection	*February 1, 2013*	
EAP transfer and positioning	*February 4, 2013*	
Integration EPC/EAP	*February 4, 2013*	
Integration equipment bay	*February 8, 2013*	
EPS Erection	*February 8, 2013*	
Roll-out from BIL to BAF	*March 7, 2013*	
	March 15, 2013	*Mechanical mating of the 2 ATV modules*
	March 28, 2013	*Transfer of the ATV from the S5C to the S5B*
	Janv. 18, - Apr. 12, 2013	*Filling operations of the sub-system russian propellants in S5 B*
	Apr. 1-26, 2013	*Filling operations of the sub-system of propulsion of the ATV in S5 B*

ATV and launch vehicle campaign final calendar

Tuesday, May 7, 2013		*ATV transfer to Final Assembly Building (BAF)*
Friday, May 10, 2013		*ATV integration on launcher*
Friday, May 24, 2013		*Fairing integration around ATV*
Friday, May 24, 2013		*Preparations EPS and SCA for filling*
Tuesday, May 28, 2013		*Filling of SCA*
Wednesday, May 29, 2013		*EPS filling with MMH*
Thursday, May 30, 2013		*Launch rehearsal. EPS filling with N2O4*
Friday, May 31 & Monday, June 3, 2013		*Arming of launch vehicle*
Monday, June 3, 2013		*Launch readiness review (RAL) and final preparation of launcher*
Tuesday, June 4, 2013	*J-1*	*Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC liquid Helium sphere*
Wednesday, June 5, 2013	*J-0*	*Start of final chronology and Launch countdown including EPC filling with liquid oxygen and liquid hydrogen*

3. Launch countdown and flight events

The countdown comprises all final preparation steps for the launcher, the satellites 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 HO, then the launch will be delayed by one, two or more days, depending on the problem involved, and the solution developed.

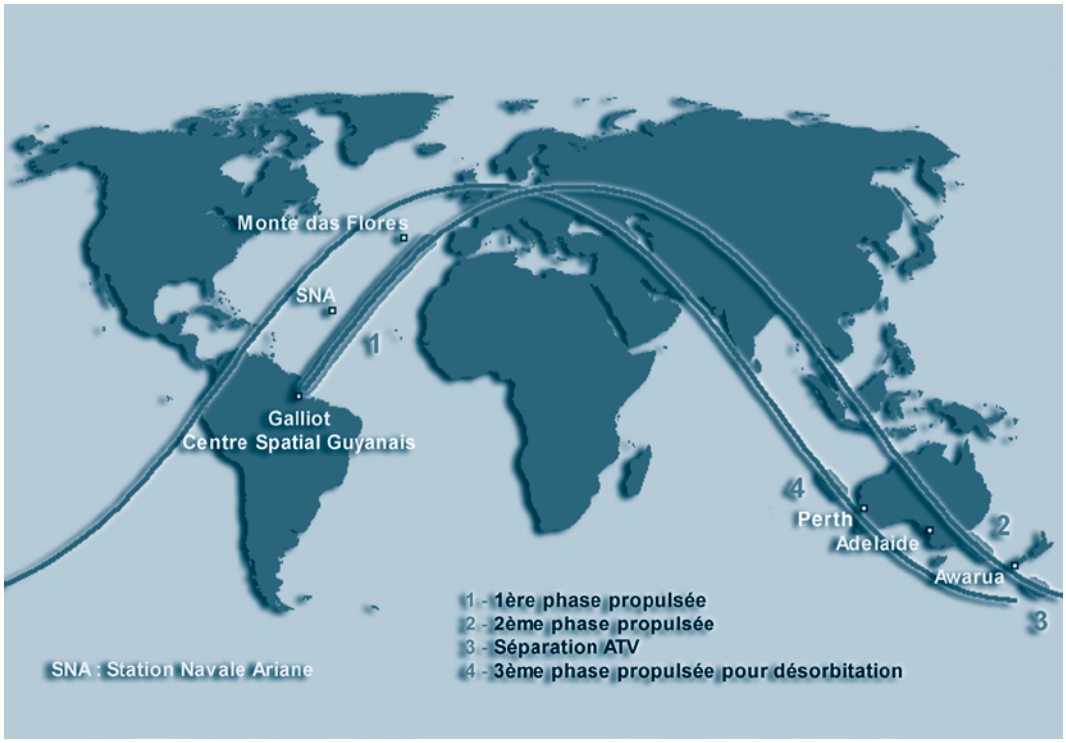
Time	*Events*
- 11 h 30 mn	*Start of final countdown*
- 7 h 30 mn	*Check of electrical systems*
- 4 h 50 mn	*Start of filling of main cryogenic stage with liquid oxygen and hydrogen*
- 3 h 20 mn	*Chilldown of Vulcain main stage engine*
- 1 h 10 mn	*Check of connections between launcher and telemetry, tracking and command systems*
- 7 mn 00 s	*"All systems go" report, allowing start of synchronized sequence*
- 4 mn 00 s	*Tanks pressurized for flight*
- 1 mn 00 s	*Switch to onboard power mode*
- 04 s	*Onboard systems take over*
- 03 s	*Unlocking of guidance systems to flight mode*
HO	***Ignition of the cryogenic main stage engine (EPC)***
+ 7,0 s	*Ignition of solid boosters*
+ 7,3 s	*Liftoff*
+ 12,7 s	*End of vertical rise, beginning of pitch motion*
+ 17,1 s	*Beginning of roll manoeuvre*
+ 2 mn 22 s	*EAP separation*
+ 3 mn 33 s	*Fairing jettisoning*
+ 8 mn 52 s	*End of EPC thrust phase*
+ 8 mn 58 s	*EPC separation*
+ 9 mn 05 s	*Beginning of EPS first thrust phase*
+ 17 mn 16 s	*End of EPS first thrust phase*
+ 17 mn 18 s	*Beginning of ballistic phase*
+ 59 mn 26 s	*Beginning of EPS second thrust phase*
+ 59 mn 55 s	*End of EPS second thrust phase*
+ 59 mn 57 s	*ATV orientation phase*
+ 1 h 3 mn 53 s	***ATV separation***
+ 1 h 4 mn 03 s	*Avoidance and distancing manoeuvres*
+ 1 h 38 mn 30 s	*ATV solar generator system deployment complete.*
+ 2 h 24 mn 21 s	*EPS third boost for deorbitation*
+ 2 h 36 mn 01 s	*End of launch vehicle mission*

4. Ariane 5-ATV trajectory

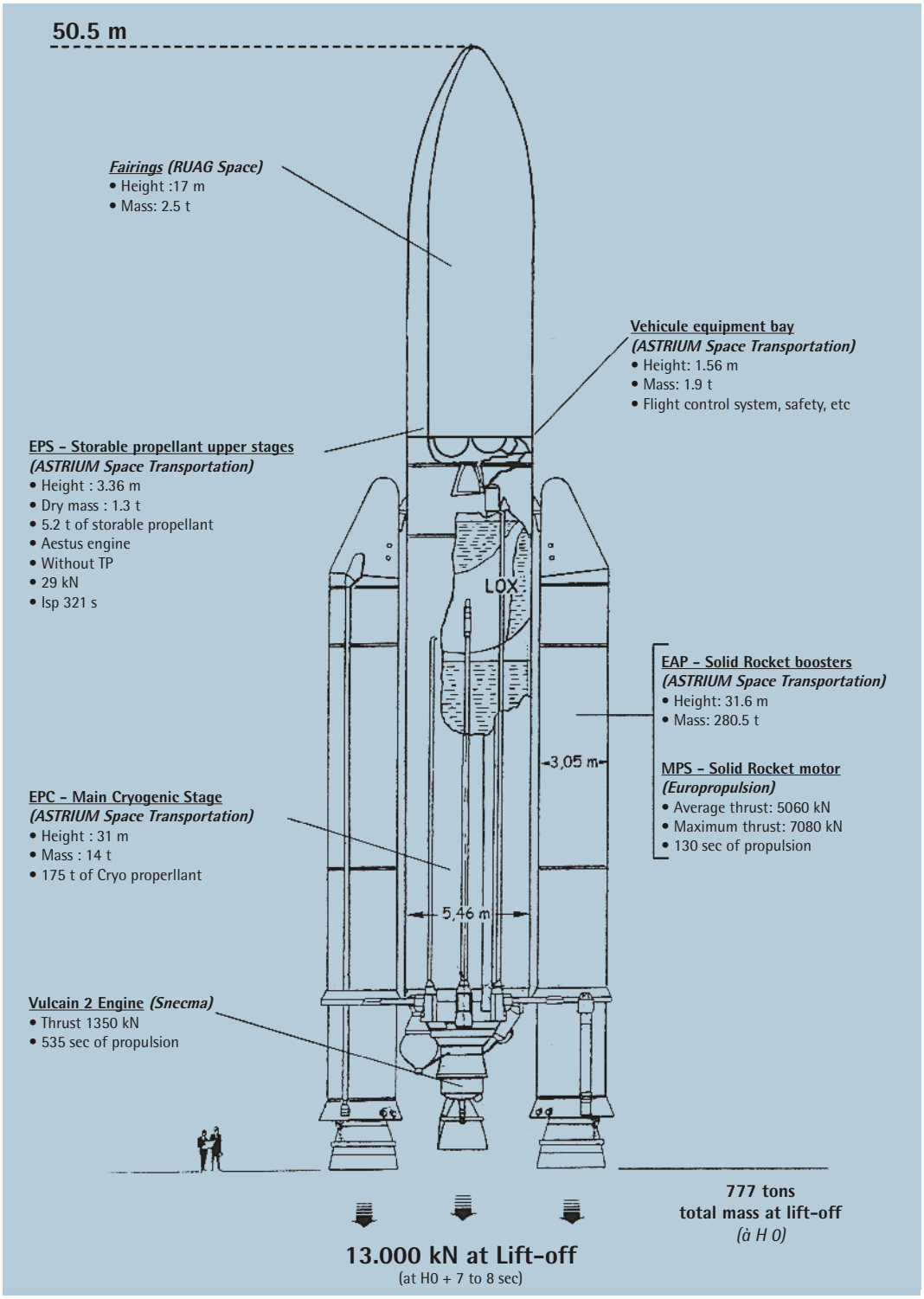
The launcher's attitude and trajectory are entirely controlled by the two onboard computers in the Ariane 5 vehicle equipment bay (VEB).
After the main stage cryogenic engine is ignited and its operation checked, the two solid rocket boosters are ignited to provide liftoff. The launcher rises vertically 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 + 212 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.

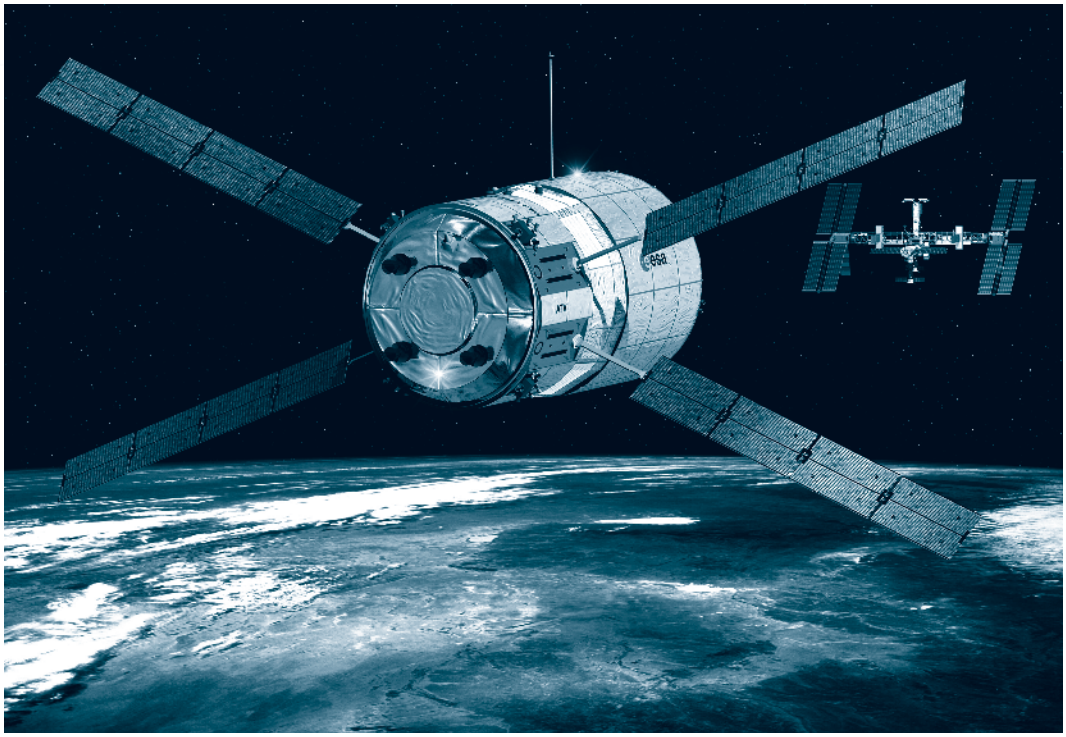
Ariane 5ES - ATV trajectory



5. The Ariane 5ES (Industrial prime contractor: ASTRIUM Space Transportation)



6. The Automated Transfer Vehicle (ATV) Albert Einstein



Customer	The European Space Agency (ESA)
Prime contractor	*Astrium*
Mission	*to provide cargo to ISS, re-boost ISS to higher altitude.*
Mass	*Total mass at lift-off 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 deployed solar arrays*
On-board power	*4600 W (end of life)*

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Appendix 1. Arianespace - ATV Albert Einstein launch key personnel

In charge of the launch campaign			
Mission Director	*(CM)*	*Didier SAÏD*	*ARIANESPACE*
In charge of the launch service contract			
Program Director	*(CP)*	*Pierre - Yves BERTIN*	*ARIANESPACE*
Deputy Program Director	*(CP/A)*	*Christophe BARDOU*	*ARIANESPACE*
In charge of ATV Albert Einstein			
ATV Mission Director	*(DMS)*	*Alberto NOVELLI*	*ESA*
ATV Mission Deputy Director	*(DMS/A)*	*Massimo CISLAGHI*	*ESA*
ATV Program Manager	*(CPS)*	*Wolfgang PAETSCH*	*ASTRIUM*
ATV Program Deputy Manager	*(CPS/A)*	*Gilles DEBAS*	*ASTRIUM*
ATV Preparation Manager ESA	*(RPE)*	*Dominique SIRUGUET*	*ESA*
ATV Preparation Manager	*(RPS)*	*Georg MONIEN / Ralf LEHMANN*	*ASTRIUM*
In charge of the launch vehicle			
Launch Site Operations Manager	*(COEL)*	*Jean-Pierre BARLET*	*ARIANESPACE*
Ariane Production Project Manager	*(CPAP)*	*Didier AUBIN*	*ARIANESPACE*
Launcher Production Quality Manager	*(RQLP)*	*Erika VELIO*	*ARIANESPACE*
Launch Campaign Quality Manager	*(CQCL)*	*Jean-Claude NOMBLOT*	*ARIANESPACE*
In charge of the Guiana Space Center (CSG)			
Range Operations Manager	*(DDO)*	*Jean-Marie BOURGEADE*	*CNES/CSG*
Range Operations Deputy	*(DDO/A)*	*Aimée CIPPE /Joël EGALGI*	*CNES/CSG*

Appendix 2. Launch environment conditions

Acceptable wind speed limits at lift-off range from between 7.5 m/s to 9.5 m/s according to the wind direction. The most critical is a northerly wind. For safety reasons, the wind's speed on the ground (Kourou), and at a high altitude (between 10,000 and 20,000 m) is also taken into account.

Appendix 3. The synchronized sequence

The synchronized sequence starts 7 mn 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, it handles 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 lift-off operations:

- It starts the ignition sequence for the Vulcain main stage engine (T-0).
- It checks engine operation (from T+4.5 to T+7.3 sec).
- It commands ignition of the solid boosters for immediate lift-off 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.

Appendix 4. Arianespace and the Guiana Space Center

Arianespace was founded in 1980 as the world's first launch Service & Solutions company. Today, Arianespace has 21 shareholders from ten European countries (including French space agency CNES with 34%, Astrium with 30%, and all European companies participating in the construction of Ariane launchers).
Since the outset, Arianespace has signed more than 375 launch contracts and launched 313 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of 1329 million euros in 2012.

At January 1, 2013, Arianespace had 320 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 Service & Solutions 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, launched also from the Guiana Space Center.

With its family of launchers, Arianespace 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 Spacial Guyane and Astrium, which contribute to the production of Ariane 5 elements. 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 development of the Ariane, Soyuz and Vega programs at the Guiana Space Center. Once these launch systems are qualified, ESA will transfer 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 plays several roles at the 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. 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.
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 Astrium 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 has created a top-flight team and array of technical resources 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.