

A dual launch for the British MoD and for Turkey

Arianespace will boost two satellites into orbit on its third launch of the year: the military communications satellite Skynet 5C for the British Ministry of Defence (MoD), and the civil communications satellite Turksat 3A for operator Turksat AS, as part of a turnkey contract with Thales Alenia Space.

This launch clearly reflects the strategic advantages of Ariane, which guarantees independent access to space for all European governments. Arianespace continues to set the global standard for launch Service & Solutions, whether for civil or military telecommunications operators.

Europe's Ariane launcher has already orbited the Skynet 4B, 4C, 4E, 4F, 5A and 5B satellites for the British MoD and NATO.

Skynet 5C is the 30th military payload to be launched by Ariane.

Skynet 5C will be launched on behalf of Astrium, which in turn delivers the satellite in orbit to Paradigm. Paradigm provides secure telecom services to the British Armed Forces, NATO and other countries which already use the Skynet military communications satellites, including Skynet 5A and 5B, launched by Ariane in March and November 2007, respectively.

Built by Astrium, Skynet 5C will weigh approximately 4,700 kg at launch.

Turksat 3A will be the fifth Turkish satellite to be launched by Arianespace. It was built by Thales Alenia Space using a Spacebus 4000 B2 platform, within the scope of a turnkey contract awarded by operator Turksat AS. This will be the 53rd platform built by Thales Alenia Space to be launched by Arianespace.

Turksat 3A will weigh 3,110 kg at launch, and will be positioned at 42 degrees East. Fitted with 24 Ku-band transponders, and offering beginning-of-life power of about 8 kW, Turksat 3A will enable Turksat to deliver communications services, as well as broadcast TV channels in Europe, Turkey and Central Asia.

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1. Mission profile

The 183rd Ariane mission will launch two satellites: the military communications satellite Skynet 5C for the British Ministry of Defence (MoD), and the civil communications satellite Turksat 3A for operator Turksat AS, as part of a turnkey contract with Thales Alenia Space.

This will be the 39th Ariane 5 launch.

The launcher will be carrying a total payload of 8,541 kg, including 7,745 kg for the two satellites, which will be released separately into their targeted orbits.

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

Injection orbit

<i>Perigee altitude</i>	250 km
<i>Apogee altitude</i>	35 929 km at injection
<i>Inclination</i>	2° degrees

The lift-off is scheduled on the night of May 30 to 31, 2008 as soon as possible within the following launch window:

Launch opportunity

	<i>Universal time (GMT)</i>	<i>Paris time</i>	<i>Ankara time</i>	<i>Kourou time</i>	<i>Washington time</i>
<i>Between</i>	09:52 pm	11:52 pm	12:52 am	6:52 pm	5:52 pm
<i>and</i>	10:35 pm	00:35 am	01:35 am	7:35 pm	6:35 pm
<i>on</i>	May 30, 2008	May 30-31, 2008	May 31, 2008	May 30, 2008	May 30, 2008

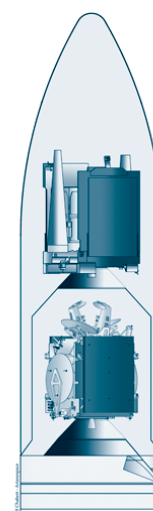
Configuration of Ariane payload

The Skynet 5C satellite was built by Astrium for Paradigm, on behalf of the British Ministry of Defence.

Orbital position : 17.8° West

The Turksat 3A satellite was built by Thales Alenia Space for operator Turksat AS.

Orbital position : 42° East.



2. Range operations campaign: ARIANE 5 - SKYNET 5C/TURKSAT 3A

Satellites and launch vehicle campaign calendar

<i>Ariane activities</i>	<i>Dates</i>	<i>Satellites activities</i>
	February 25, 2008	Arrival in Kourou of TURKSAT 3A
Campaign start review	April 4, 2008	
EPC Erection	April 4, 2008	
EAP transfer and positioning	April 5, 2008	
Integration EPC/EAP	April 7, 2008	
ESC-A and VEB Erection	April 11, 2008	
	April 15, 2008	Beginning of TURKSAT 3A preparation campaign in building S1 B
	April 16, 2008	Arrival in Kourou of SKYNET 5C and beginning of preparation campaign in building S5 C
	April 28/29-May 2/3, 2008	SKYNET 5C filling operations in S5 A building
Roll-out from BIL to BAF	May 6, 2008	
	May 3-6, 2008	TURKSAT 3A operations in S5 B building

Satellites and launch vehicle campaign final calendar

J-11	Wednesday, May 7	SKYNET 5C integration on adaptor (ACU)
J-10	Friday, May 9	SKYNET 5C transfer to Final Assembly Building (BAF)
J-9	Saturday, May 10	SKYNET 5C integration on Sylida and TURKSAT 3A integration on adaptor
J-8	Thursday, May 15	Fairing integration on Sylida - TURKSAT 3A transfer to Final Assembly Building (BAF)
J-7	Friday, May 16	TURKSAT 3A integration on launcher
J-6	Saturday, May 17	Upper composite integration with SKYNET 5C on launcher
J-5	Monday, May 19	ESC-A final preparations and payloads control
J-4	Monday, May 26	Launch rehearsal
J-3	Tuesday, May 27	Arming of launch vehicle
J-2	Wednesday, May 28	Launch readiness review (RAL) and final preparation of launcher
J-1	Thursday, May 29	Roll-out from BAF to Launch Area (ZL), launch vehicle connections and filling of the EPC liquid Helium sphere
J-0	Friday, May 30	Launch countdown including EPC and ESC-A 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, as early as possible in the satellites launch window.

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 launch window, then the launch will be delayed by one, two or more days, depending on the problem involved, and the solution developed.

<i>Time</i>	<i>Events</i>
- 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
- 05,5 s	Command issued for opening of cryogenic arms
- 04 s	Onboard systems take over
- 03 s	Unlocking of guidance systems to flight mode

<i>HO</i>	<i>Ignition of the cryogenic main stage engine (EPC)</i>	<i>ALT (km)</i>	<i>V. rel. (m/s)</i>
+ 7,0 s	Ignition of solid boosters	0	0
+ 7,3 s	Liftoff	0	0
+ 12,5 s	End of vertical climb and beginning of pitch rotation (10 seconds duration)	0.089	37
+ 17 s	Beginning of roll manoeuvre	0.335	75
+ 2 mn s	Jettisoning of solid boosters	67.3	1983
+ 3 mn 11 s	Jettisoning of fairing	107.1	2194
+ 7 mn 47 s	Acquisition by Natal tracking station	174.6	4962
+ 8 mn 56 s	Shut-down of main cryogenic stage	171.9	6884
+ 9 mn 02 s	Separation of main cryogenic stage	171.1	6910
+ 9 mn 06 s	Ignition of upper cryogenic stage (ESC-A)	172.2	6913
+ 13 mn 28 s	Acquisition by Ascension tracking station	173.0	7542
+ 18 mn 08 s	Acquisition by Libreville tracking station	211.6	8306
+ 23 mn 12 s	Acquisition by Malindi tracking station	482.1	9091
+ 24 mn 52 s	Shut-down of ESC-A / Injection	668.2	9339
+ 27 mn 09 s	Separation of SKYNET 5C satellite	1015.0	9104
+ 29 mn 32 s	Separation of Sylva 5	1479.1	8765
+ 31 mn 46 s	Separation of TURKSAT 3A satellite	1899.4	8481
+ 45 mn 52 s	End of Arianespace Flight mission	5429.7	6689

4. Flight trajectory of SKYNET 5C & TURKSAT 3A

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

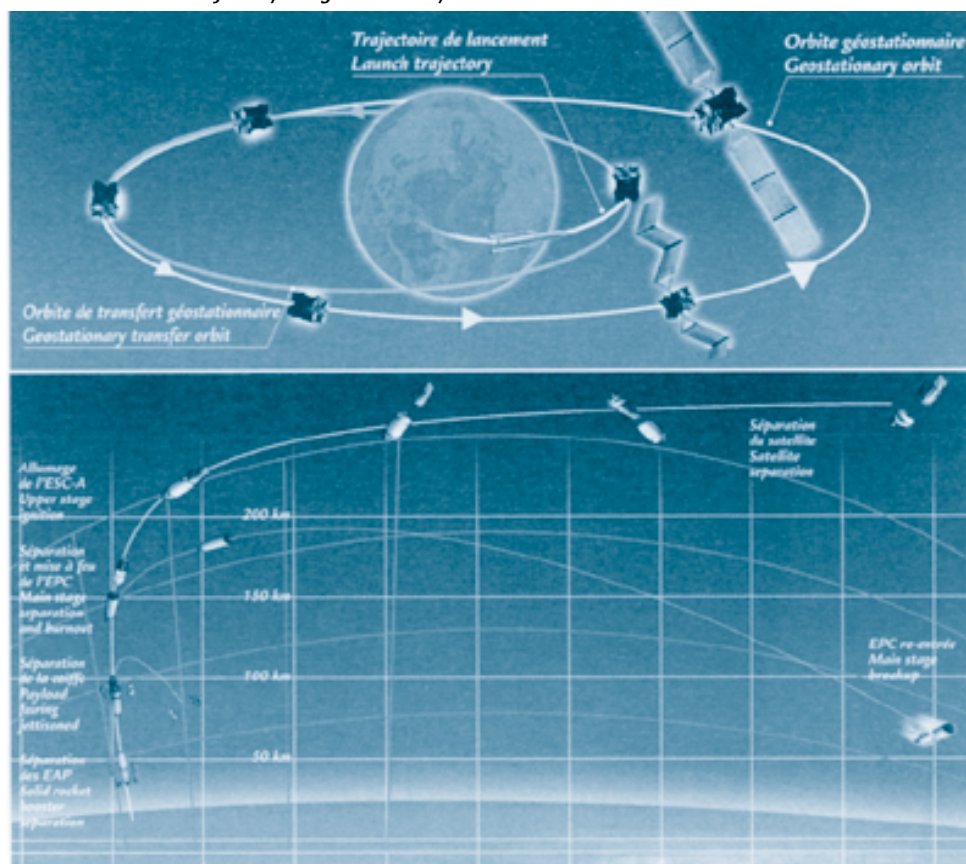
7.05 seconds after ignition of the main stage cryogenic engine at T-0, the two solid-propellant boosters are ignited, enabling liftoff. The launcher first climbs vertically for 6 seconds, then rotates towards the East. It maintains an attitude that ensures the axis of the launcher remains parallel to its velocity vector, in order to minimize aerodynamic loads throughout the entire atmospheric phase, until the solid boosters are jettisoned.

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).

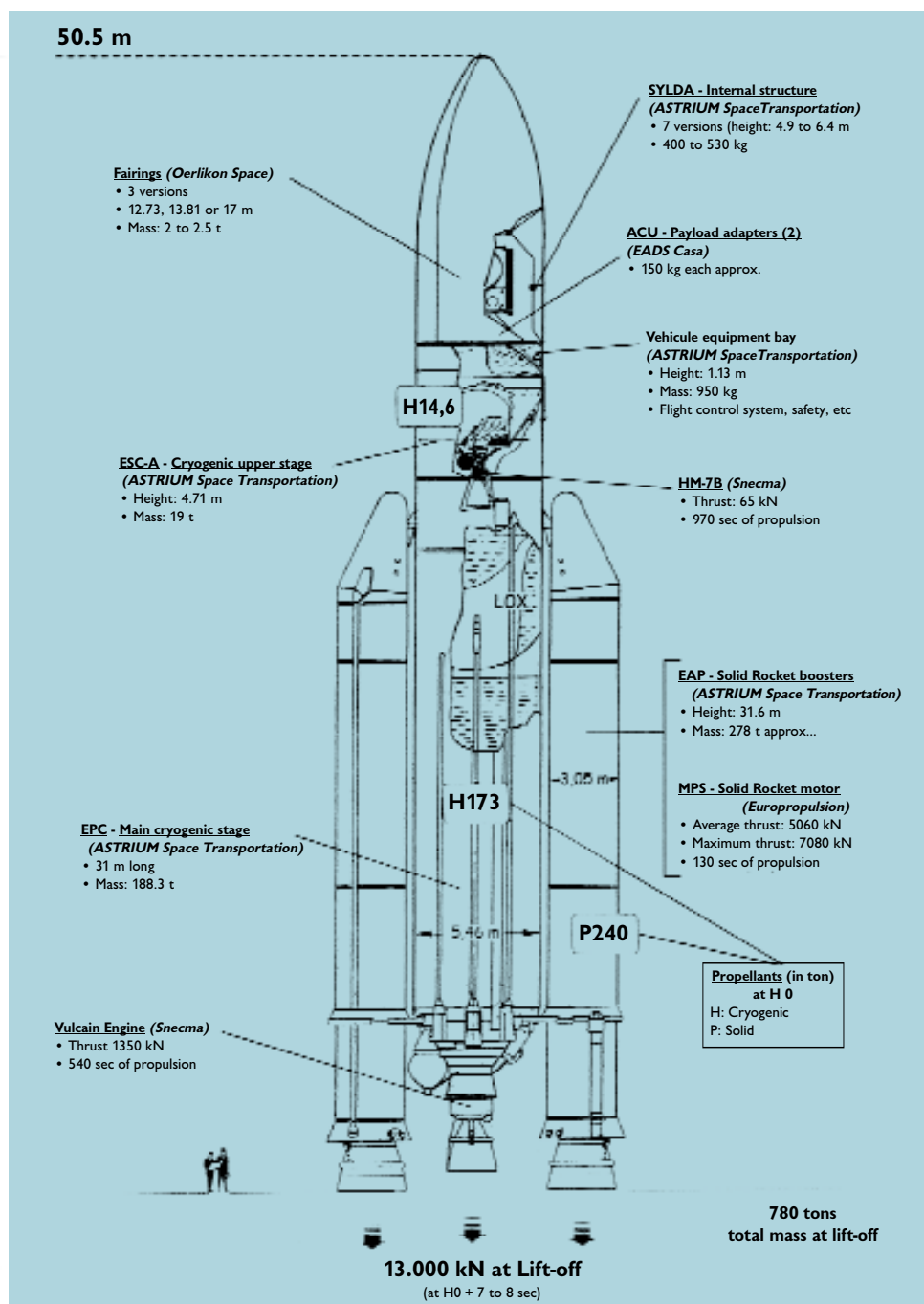
On orbital injection, the launcher will have attained a velocity of approximately 9339 meters/second, and will be at an altitude of about 668 kilometers.

The fairing protecting the SKYNET 5C/TURKSAT 3A spacecraft is jettisoned shortly after the boosters are jettisoned at about T+190 seconds.

Standard Ariane 5 trajectory for geostationary transfer orbit



5. The Ariane 5-ECA (Industrial prime contractor: ASTRIUM SpaceTransportation)



6. The SKYNET 5C satellite



Customer	Astrium for Paradigm	
<i>Prime contractor</i>	Astrium	
<i>Mission</i>	Secure military communications	
<i>Mass</i>	<i>Total mass at lift-off</i>	4 638 kg
<i>Stabilization</i>	3 axis stabilized	
<i>Dimensions</i>	4.5 x 2.9 x 3.7 m	
<i>Span in orbit</i>	34 m	
<i>Platform</i>	EUROSTAR E3000	
<i>On-board power</i>	> 6 kW (end of life)	
<i>Life time</i>	15 years	
<i>Orbital position</i>	17.8° West	

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7. The TURKSAT 3A satellite



Customer	Thales Alenia Space for TURKSAT AS	
<i>Prime contractor</i>	Thales Alenia Space	
<i>Mission</i>	Telecommunications, multimedia and Internet	
<i>Mass</i>	<i>Total mass at lift-off</i>	3 110 kg
	<i>Dry mass</i>	1 272 kg
<i>Stabilization</i>	3 axis stabilized	
<i>Dimensions</i>	2.8 x 1.8 x 2.9 m	
<i>Span in orbit</i>	29.6 m	
<i>Platform</i>	Spacebus 4000 B2	
<i>Payload</i>	24 Ku band transponders	
<i>On-board power</i>	8 300 W (beginning of life)	
<i>Life time</i>	20 years (propellant life time)	
<i>Orbital position</i>	42° East	
<i>Coverage area</i>	Turkey, Europe, Central Asia	

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Appendix 1. Arianespace SKYNET 5C & TURKSAT 3A launch key personnel

In charge of the launch campaign

Mission Director	(CM)	Jean-Marc DURAND	ARIANESPACE
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In charge of the launch service contract

Ariane Payload Manager	(RCUA)	Alexandre MADEMBA-SY	ARIANESPACE
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Ariane Deputy Mission Manager	(RCUA/A)	Christophe BARDOU	ARIANESPACE
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In charge of SKYNET 5C satellite

Satellite Mission Director	(DMS)	Alan WHYTE	ASTRIUM
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Satellite Program Manager	(CPS)	Rick GREENWOOD	PARADIGM
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Satellite Preparation Manager	(RPS)	Philippe GREMILLON	ASTRIUM
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In charge of TURKSAT 3A satellite

Satellite Mission Director & Program Director	(DMS)	Remy LE THUC	THALES ALENIA SPACE
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Mission Manager & Satellite integration Manager	(CPS)	Robert ARNAUD	THALES ALENIA SPACE
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Satellite Preparation Manager	(RPS)	Sandra Cormier/Xavier Picault	THALES ALENIA SPACE
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Satellite Program Manager		Senol GÜLGÖNÜL	TURKSAT AS
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In charge of the launch vehicle

Launch Site Operations Manager	(COEL)	Pierre-François BENAITEAU	ARIANESPACE
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Ariane Production Project Manager	(CPAP)	Denis SCHMITT	ARIANESPACE
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In charge of the Guiana Space Center (CSG)

Range Operations Manager	(DDO)	Bruno GILLES	CNES/CSG
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Range Operations Deputy	(DDO/A)	Thierry VALLEE	CNES/CSG
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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 23 shareholders from ten European countries (including French space agency CNES with 34%, EADS with 30%, and all European companies participating in the construction of Ariane launchers).

Since the outset, Arianespace has signed 292 launch contracts and launched 257 satellites. More than two-thirds of the commercial satellites now in service worldwide were launched by Arianespace.

The company posted sales of more than 900 million euros in 2007, and stayed in the black for the fifth year in a row.

At January 1, 2008, Arianespace had 292 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 under the responsibility of Starsem, a Euro-Russian subsidiary of Arianespace, it will be launched from the Guiana Space Center starting in 2009.
- The Vega light launcher, to be launched from the Guiana Space Center starting in 2009.

Arianespace has also signed a mutual backup agreement with Boeing Launch Services and Mitsubishi Heavy Industries, through an entity called the Launch Services Alliance. This arrangement guarantees that customers' payloads will be launched in case the chosen launcher is unavailable for technical reasons.

With its family of launchers and this backup agreement, 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 bas operation, such as radars, telecom network, weather station, receiving sites for launcher telemetry, etc.
- Payload processing facilities (EPCU), in particular the S5 facility.
- Ariane launch complexes (ELA), comprising the launch zone and launcher integration buildings.
- Various industrial facilities, including those operated by Regulux, Europropulsion, Air Liquide Spacial Guyane and EADS, which contribute to the production of Ariane 5 elements. A total of 40 European manufacturers and local companies are involved in operations.

The Guiana Space Center is preparing to welcome two new launch vehicles, Soyuz and Vega. The Soyuz launch complex (ELS) and the Vega launch complex (SLV) are now under construction.

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 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 rockets throughout their trajectory.

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 EADS 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.