arianespace
service & solutions

LAUNCH KIT

APRIL 2016

VS14

Sentinel-1B

Microscope
Fly Your Satellite!

sentinel-1b

European Commission

esa
European Space Agency

Copernicus

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

MICROSCOPE

fly your satellite!
esa
education

ARIANESPACE'S FIRST SOYUZ LAUNCH IN 2016: SUPPORTING EUROPEAN SPACE APPLICATIONS

For its third launch of the year, which will be the initial mission in 2016 utilizing a Soyuz launcher from the Guiana Space Center in French Guiana, Arianespace will orbit the Sentinel-1B satellite for the Copernicus program, on behalf of the European Commission and within the scope of a contract with the European Space Agency (ESA). Also to be orbited on the mission are the French CNES space agency's Microscope satellite, and three CubSats for Fly Your Satellite! an ESA Education and Knowledge Management Office's program.

As shown by this launch, Arianespace continues to address Europe's need for reliable and independent access to space.

CONTENTS

Sentinel-1B

Sentinel-1B, the second spacecraft in the Sentinel-1 family of synthetic aperture radar (SAR) observation satellites, is part of a vast joint research program by ESA and the European Union called Copernicus.
Copernicus aims to provide operational information on land masses, oceans and the Earth's atmosphere – data that will play a critical role in determining the policies needed to protect our environment and security, and to meet the needs of both consumers and service providers.
ESA's Sentinel program include several types of satellites: Sentinel-1 will ensure continuity with the radar data provided by the ERS and Envisat satellites; Sentinel-2 and Sentinel-3 are dedicated to observation of the Earth's surface and its oceans; and Sentinel-4 and Sentinel-5 missions are dedicated to studying the composition of our atmosphere. Sentinel-6 is an altimeter data mission that will ensure continuity for the Jason satellite missions.

Sentinel-1B is a SAR type C-band observation satellite. It is identical to Sentinel-1A, which was successfully launched on April 3, 2014 by a Soyuz rocket from the Guiana Space Center.
Sentinel-1B will round out the initial capacity offered by Sentinel-1A to provide a comprehensive solution for radar surveillance of the environment and for security issues.
The two satellites working together are capable of imaging any point on the Earth in less than six days. Their powerful radar sensors provide virtually real-time day/night and all-weather coverage of land surfaces and bodies of water in Europe and the polar regions. The Sentinel-1 mission enables the implementation of many operational services and scientific monitoring in a variety of areas, such as surveillance of maritime ice, icebergs, icecaps; maritime surveillance (including detection of oil pollution), the sea state (waves, wind and currents); agriculture; forestry; hydrology; as well as the highly accurate detection of ground movement for applications related to subsidence, volcano monitoring, the analysis of earthquakes, etc. Sentinel-1 also is useful in the management of emergencies, such as flooding.

Sentinel 1-B will be the 51st satellite launched by Arianespace, the European launch services operator, for ESA.
Arianespace has eight more ESA satellites in its current launch manifest, including the Sentinel-3B mission on the Vega launcher.

A EUROPEAN MANUFACTURER: THALES ALENIA SPACE

Thales Alenia Space (TAS) is the prime contractor for Sentinel-1B, responsible for design, development and integration.
Built on the Prima (Piattaforma Italiana Multi-Applicativa) platform developed by Thales Alenia Space Italy for the Italian Space Agency, ASI, the satellite is fitted with a radar from Airbus Defence and Space.
Sentinel-1B will be the 144th satellite built by TAS to be launched by Arianespace.
Arianespace has 12 more TAS satellites to be launched.

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Microscope

The Microscope satellite (Micro-Satellite à traînée Compensée pour l'Observation du Principe d'Equivalence) will test the equivalence principle described by Albert Einstein, with a precision on the order of 10^{-15}. In space, it is possible to study the relative motion of two bodies in almost perfect and permanent free fall aboard an orbiting satellite, shielded from perturbations encountered on Earth (notably seismic), over the course of several months.

To achieve this, two concentric cylindrical test masses made of different materials – one titanium and one a platinum-rhodium alloy – will be minutely controlled to keep them motionless with respect to the satellite inside independent differential electrostatic accelerometers. If the equivalence principle is verified, the two masses will be subjected to the same control acceleration. If different accelerations have to be applied, the principle will be violated: an event that would shake the foundations of physics.

The experiment will be flown on a microsatellite built around CNES's Myriade bus and equipped with cold-gas microthrusters, provided by ESA, capable of compensating for the tiniest trajectory perturbations that might otherwise skew its results. CNES is providing 90% of funding for this mission, for which it is also prime contractor in charge of satellite bus development, satellite integration and testing up to launch, and construction and operation of the mission control center.

Numerous others entities are involved in this project: the European Space Agency; Germany's DLR aerospace center and the ZARM center of applied space technology and microgravity; and France's ONERA national aerospace research center, the Institut National des Sciences de l'Univers (INSU), and Côte d'Azur Observatory (OCA).

Microscope will be the 15th satellite launched by Arianespace for CNES.
Arianespace's launch manifest includes one other CNES satellite (Taranis).

Including Sentinel-1B, Arianespace will have carried out 23 scientific missions overall for its customers. The next two important scientific missions will involve the BEPI-COLOMBO satellite and the James Web Space Telescope (JWST).

Fly Your Satellite!

Fly Your Satellite! is an educational program of the ESA Education and Knowledge Management Office operated in close collaboration with European universities and aimed at complementing academic education.

It is providing university students across Europe with the unique opportunity to gain practical experience in key phases of a challenging, real satellite project: a CubeSat - from integration, test and verification to launch and operations.
Through Fly Your Satellite! and other educational projects, ESA acts to inspire, engage and better prepare students to undertake scientific and technological careers, particularly in the space sector. Fly Your Satellite! is part of the newly-established ESA Education and Knowledge Management Office's program.

As part of the Fly Your Satellite! Program, 3 student-built CubeSats have been selected for launch out of the 6 initial participating teams, and have been working hard to perfect their spacecraft:

- ✓ OUFTI-1 from the University of Liege, Belgium, will test a new communications subsystem;
- ✓ e-st@r-II from the Polytechnic of Turin, Italy, will demonstrate an attitude determination system using measurements of the Earth's magnetic field;
- ✓ AAUSAT-4 from the University of Aalborg, Denmark, will operate an Automated Identification System (AIS) receiver in order to identify and track the position of ships transiting away from coastal areas.

The Fly Your Satellite! CubeSats will be respectively, the 52nd, 53rd and 54th ESA spacecraft launched by Arianespace.

MISSION DESCRIPTION

The 14th Soyuz launch from the Guiana Space Center (CSG) will place:

- ✓ **Sentinel-1B satellite in a Low Earth Orbit (LEO) at an altitude of 686 Km. with an inclination of 98.18° degrees,**
- ✓ **Microscope satellite in a Low Earth Orbit (LEO) at an altitude of 711 Km. with an inclination of 98.23° degrees,**
- ✓ **As auxiliary payload, the three Fly Your Satellite! CubeSats in a Low Earth Orbit (LEO) presenting a perigee at 453 Km and an apogee at 665 Km.**

The launcher will be carrying a total payload of 3,099 kg.
The launch will be from the Soyuz Launch Complex (ELS) in Sinnamary, French Guiana.

DATE AND TIME

Liftoff is scheduled for **Friday, April 22, 2016** at exactly:

> **06:02:13 p.m.**, (Local time in French Guiana)
> **05:02:13 p.m.**, (in Washington, D.C.)
> **09:02:13 p.m.**, (UTC)
> **11:02:13 p.m.**, (in Paris)
> **00:02:13 a.m.**, (in Moscow) on April 23.

MISSION DURATION

The nominal duration of the mission (from liftoff to separation of the satellites) is: **4 hours 00 minutes, 52 seconds.**

SOYUZ PAYLOAD CONFIGURATION

> **Payload (CU 1):** Sentinel-1B
Mass at liftoff: 2,164 kg.

> **Central auxiliary Payload (CU 2):** Microscope
Mass at liftoff: 303 kg.

> **Lateral auxiliary Payload (CU):** Fly your Satellite! (OUFTI-1, e-st@r-II, AAUSAT-4)

> Mass at liftoff: 3 kg.

> **ST Fairing**

> **ASAP-S (Auxiliary Payload Adaptor Structure – Soyuz) built by Airbus CASA Espacio**

> **2 Payload Adaptor Structure built by RUAG Space**

VS14 MISSION PROFILE

THE LAUNCH AT A GLANCE

Following liftoff from the Guiana Space Center, the powered phase of the lower three Soyuz stages will last approximately nine minutes. The third stage of the launcher will then be separated from the upper composite, comprising the Fregat upper stage and the satellites. The three lower stages and the fairing will fall back into the sea.

Fregat will perform an engine first burn lasting about 11 minutes to reach the orbit for separation of Sentinel-1B. Three minutes later, Sentinel-1B, will be deployed.

This separation comes exactly 23 minutes and 35 seconds after liftoff.

Following a ballistic phase lasting approximately 1hour, 36 minutes, Fregat's engine second burn will last 13 seconds

A second ballistic phase lasting about 48 minutes, will be followed by the separation of Fly Your Satellite!

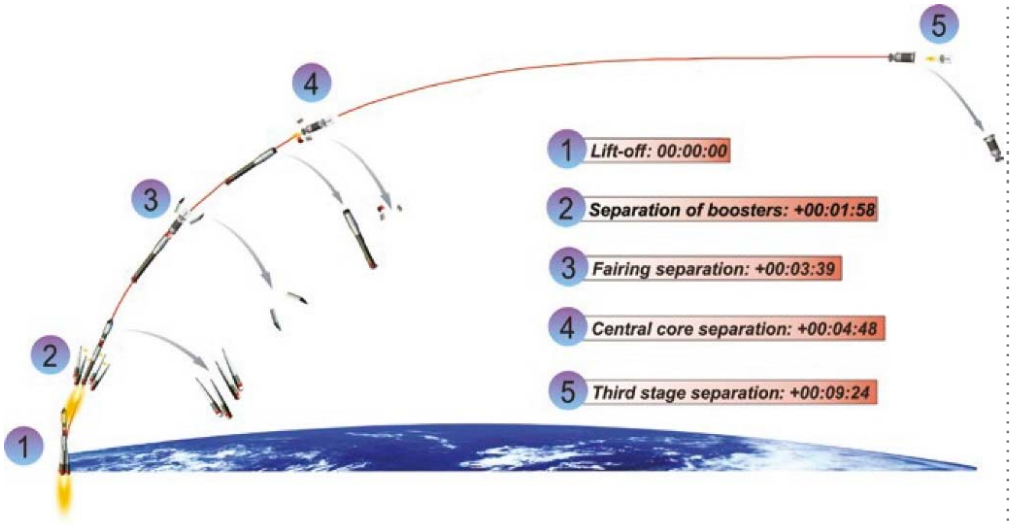
Then, Fregat will perform a series of complementary maneuvers, comprising:

- A ballistic phase lasting 42 minutes, 6 seconds, followed by a 12-second burn of its engine.
- A ballistic phase lasting 24 minutes, followed by an engine ignition lasting 16 seconds.

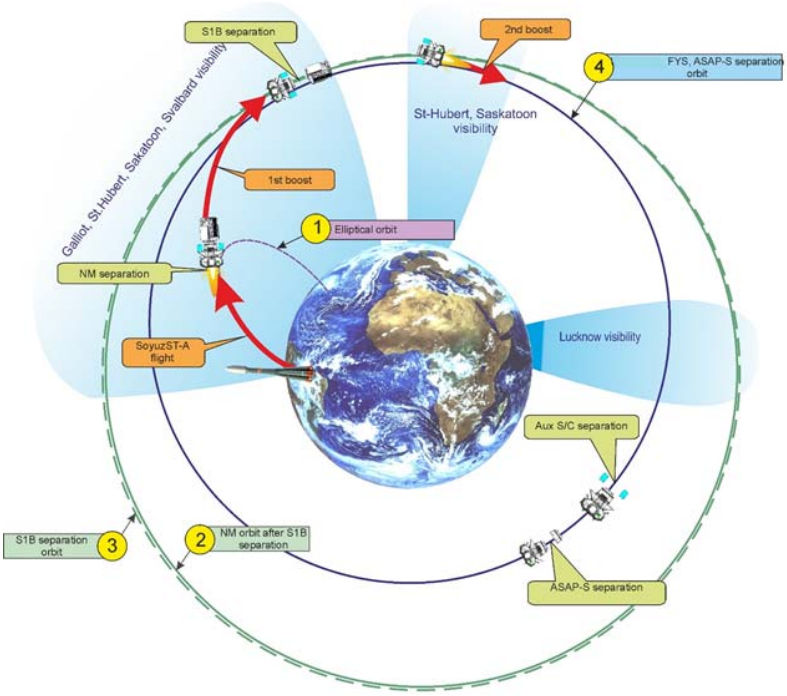
The Microscope auxiliary payload will then be released, 4 hours, 52 seconds after liftoff.

After a fifth and final Fregat engine burn lasting 29 seconds, the stage will be deorbited.

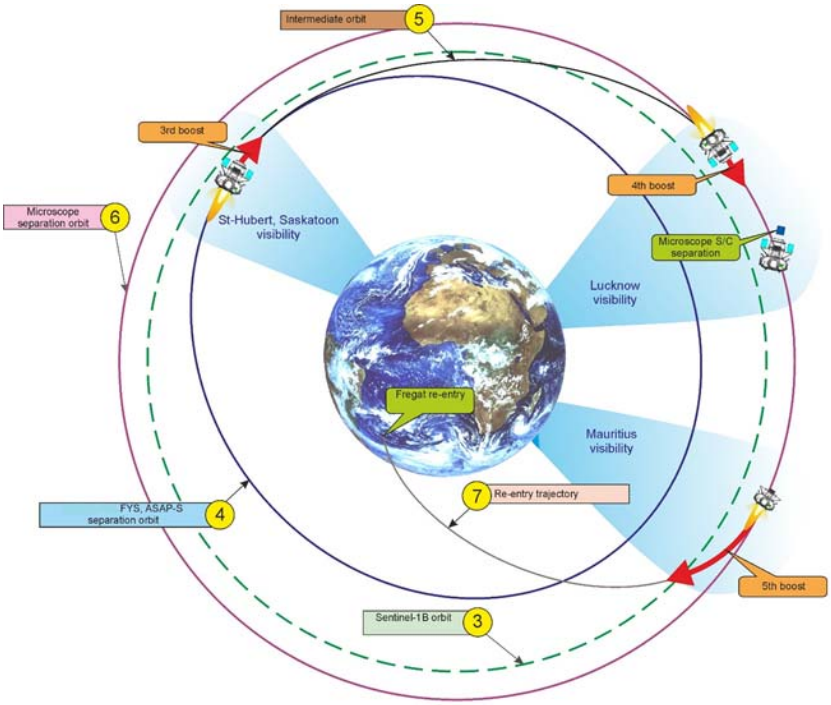
MISSION PROFILE FOR THE THREE SOYUZ STAGES



THE FREGAT MISSION PROFILE - PHASE 1



THE FREGAT MISSION PROFILE – PHASE 2



SENTINEL-1B

CUSTOMER	The European Space Agency (ESA) on behalf of the European Commission (for the Copernicus program)
MANUFACTURER	Thales Alenia Space (Italy)
PLATFORM	PRIMA (Piattaforma Italiana Multi-Applicativa)
MISSION	Earth observation radar satellite (Sentinel-1B will complete Sentinel-1A service in the framework of the Copernicus program)
INSTRUMENTS	C-band synthetic aperture radar
LIFTOFF MASS	Mass at liftoff: 2,164 kg.
DIMENSIONS	Diameter: 2.3 m – Height: 3.41 m
LIFETIME	7 years
STABILIZATION	3 axis
ON-BOARD POWER	5,984 W at end-of-life
ORBIT	Sun-synchronous orbit at an altitude approximately 686 km.

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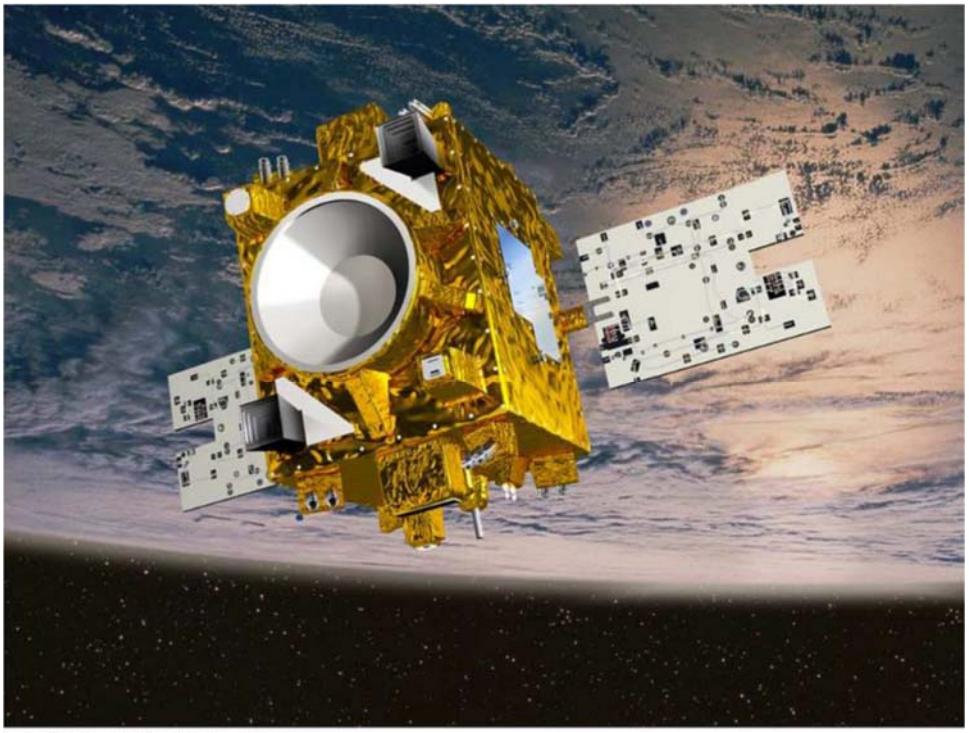
MICROSCOPE (**MICRO**Satellite à trainée **C**ompensée pour l'**O**bservation du **P**rincipe d'**E**quivalence)



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CUSTOMER	CNES
MANUFACTURER	CNES with numerous entities involved: ESA, CNRS, DLR, ONERA, INSU, OCA, ZARM
PLATFORM	Myriade product line platform
MISSION	Scientific, test of the Equivalence Principle (EP)
LIFTOFF MASS	Mass at liftoff: 303 kg.
DIMENSIONS	1.4 x 1 x 1.5 m
STABILIZATION	Low spin
LIFETIME	Minimum 2 years + 1 year extension
ON-BOARD POWER	192 W at end-of-life
ORBIT	Sun-synchronous orbit, at an altitude of approximately 711 km.

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FLY YOUR SATELLITE!

CUSTOMER	European Space Agency (ESA) (ESA Education and Knowledge Management Office)
MANUFACTURER	AAUSAT-4: Aalborg University; e-st@r-II: Politecnico di Torino; OUTFI-1: University of Liège / P-POD separation system: Tyvak International).
MISSION	Educational missions of technology demonstration
PLATFORM	Satellites: three CubeSats / Separation system: P-POD
LIFTOFF MASS	Mass at liftoff: 6 kg: 3 kg. for the 3 CubeSats satellites and 3 kg. for the P-POD
DIMENSIONS	Under the fairing 43 x 23 x 13 cm Each CubeSat: 10 X10 X 11 cm.
LIFETIME	Approximately 1 year for each CubSat
ORBIT	LEO (Low Earth Orbit), presenting a perigee of 453 Km. and an apogee of 665 Km.

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SOYUZ LAUNCH VEHICLE

The Soyuz launch vehicle family has provided reliable and efficient launch services since the start of space exploration. Soyuz rockets, which launched both the first artificial satellite and the first human into space, have been credited with more than 1,845 launches to date. Today, Soyuz is used for manned and unmanned flights to the International Space Station, as well as Russian government launches, and commercial launches with Arianespace as launch operator.

The Soyuz configuration introduced in 1966 has been the workhorse of the Soviet/Russian space program. As the only manned launch vehicle in Russia and the former Soviet Union, Soyuz meets very high standards of reliability and robustness.

The first launch of the Soyuz 2-1a version on November 8, 2004 from the Plesetsk Cosmodrome represented a major step in the launch vehicle's development program. This modernized version of Soyuz, also used to successfully launch MetOp-A on October 19, 2006, features a digital control system providing additional mission flexibility; it also enables control of the launch vehicle fitted with the 4.1-meter ST fairing. This was a necessary step towards the next-generation Soyuz 2-1b launcher, the culmination of a joint European/Russian upgrade program. It adds a more powerful third-stage engine, significantly increasing the launcher's overall performance.

The inaugural flight of the upgraded Soyuz 2-1b launch vehicle was successfully performed on December 27, 2006, orbiting the Corot scientific spacecraft for the French CNES space agency.

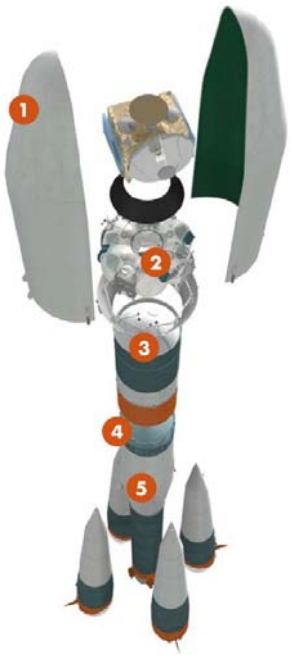
The decision of the European Space Agency to introduce Soyuz launch capability at the Guiana Space Center (CSG) in French Guiana marked a major step forward in expanding the range of missions. With the introduction of Soyuz at CSG, this famed medium-lift Russian launch vehicle is now an integral part of the European launcher fleet, together with the heavy-lift Ariane 5 and the lightweight Vega. Offered exclusively by Arianespace to the commercial market for launches from CSG, Soyuz becomes Europe's standard medium launcher for both government and commercial missions.

On October 21, 2011 Arianespace successfully launched the first Soyuz rocket from the Guiana Space Center, orbiting the initial two satellites in the Galileo constellation.

The Samara Space Center in Russia continues to produce Soyuz launchers. Because of sustained demand from the Russian government, International Space Station requirements and Arianespace's commercial orders, the Soyuz is being produced at an average rate of 15 to 20 launchers per year. The manufacturer can also rapidly scale up to accommodate market demand. In fact, annual Soyuz production peaked in the early 1980s at 60 vehicles per year.

Soyuz is a reliable, efficient, and cost-effective solution for a full range of missions, from LEO (Low Earth Orbit) to Mars or Venus. Offering an unrivaled heritage, Soyuz has already performed almost every type of mission, from launching telecommunications, Earth observation, weather and scientific satellites to manned spacecraft. It is a very scalable and flexible launch vehicle.

The Soyuz version currently offered by Arianespace is a four-stage launch vehicle: four boosters (first stage), a central core (second stage), a third stage, and the restartable Fregat upper stage (fourth stage). It also includes a payload adapter/dispenser and fairing.



SOYUZ
1 - The fairing
2 - The Fregat upper stage
3 - The third stage
4 - The central core (2nd stage)
5 - The boosters (1st stage)

BOOSTERS (FIRST STAGE)

The four cylindrical-conical boosters are assembled around the central core. The booster's RD-107A engines are powered by liquid oxygen and kerosene, the same propellants used on each of the lower three stages. The kerosene tanks are located in the cylindrical part and the liquid oxygen tanks in the conical section. Each engine has four combustion chambers and four nozzles. Three-axis flight control is provided by aerofins (one per booster) and steerable vernier thrusters (two per booster). Following liftoff, the boosters burn for approximately 118 seconds and are then jettisoned. Thrust is transferred to the vehicle through a ball joint located at the top of the conical structure of the booster, which is attached to the central core by two rear struts.

CENTRAL CORE (SECOND STAGE)

The central core is similar in construction to the four boosters, with a special shape to accommodate the boosters. A stiffening ring is located at the interface between the boosters and the core. This stage is fitted with an RD-108A engine, also comprising four combustion chambers and four nozzles. It also has four vernier thrusters, used for three-axis flight control once the boosters have separated. The core stage has a nominal burn time of 286 seconds. The core and boosters are ignited simultaneously on the launch pad, 20 seconds before liftoff. Thrust is first adjusted to an intermediate level to check engine readings. The engines are then gradually throttled up, until the launcher develops sufficient thrust for liftoff.

THIRD STAGE

The third stage is linked to the central core by a latticework structure. Ignition of the third stage's engine occurs approximately two seconds before shutdown of the central core engine. The third stage engine's thrust enables the stage to separate directly from the central core. Between the oxidizer and fuel tanks is a dry section where the launcher's avionics systems are located. The third stage uses either a RD-0110 engine in the ST-A version, or a RD-0124 engine in the ST-B version.

FREGAT UPPER STAGE (FOURTH STAGE)

Flight qualified in 2000, the Fregat upper stage is an autonomous and flexible stage that is designed to operate as an orbital vehicle. It extends the capability of the Soyuz launcher, now covering a full range of orbits (LEO, SSO, MEO, GTO, GEO and escape). To ensure high reliability for the Fregat stage right from the outset, various flight-proven subsystems and components from previous spacecraft and rockets are used. The upper stage consists of six spherical tanks (four for propellants, two for avionics) arranged in a circle and welded together. A set of eight struts through the tanks provide an attachment point for the payload, and also transfer thrust loads to the launcher. The upper stage is independent from the lower three stages, since Fregat has its own guidance, navigation, attitude control, tracking, and telemetry systems. The stage's engine uses storable propellants – UDMH (unsymmetrical dimethyl hydrazine) and NTO (nitrogen tetroxide) – and can be restarted up to 20 times in flight, thus enabling it to carry out complex missions. It can provide the customer with 3-axis or spin stabilization of their spacecraft.

The Fregat upper stage is encapsulated in a fairing with the payload and a payload adapter/dispenser

THE FAIRING

Soyuz launchers operated by Arianespace at the Guiana Space Center use the ST fairing in a standard configuration, with an external diameter of 4.1 meters and a length of 11.4 meters.

ROSCOSMOS AND THE RUSSIAN LAUNCHER INDUSTRY

The Roscosmos State Corporation for space activities is responsible for license allocations and intergovernmental relations. It is the launch authority in charge of range operations. RKTs-Progress (Samara Space Center) is responsible for the design, development, and manufacture of launch vehicles, including the Soyuz launch vehicle's first, second and third stages and fairing. It also integrates vehicle stages and handles flight operations. NPO Lavochkin manufactures and integrates the Fregat upper stage, and is responsible for its launch operations. TsENKI is in charge of launch planning and the provision of associated services, including systems engineering, the design, and technical and operational management of the launch pad and associated facilities dedicated to the Soyuz launcher.

LAUNCH CAMPAIGN :

SATELLITES AND LAUNCH VEHICULE CAMPAIGN CALENDAR

DATE	SATELLITES ACTIVITIES	LAUNCH VEHICULE ACTIVITIES
March 1, 2016		Campaign start review Fregat upper stage preparation at the Soyuz launcher preparation building (MIK)
Mars 8, 2016	Arrival in Kourou of Sentinel-1B; Beginning of preparations in the S5C building	
March 10, 2016	Arrival in Kourou of Microscope; Beginning of preparations in the S5B building	
March 25, 2016	Arrival in Kourou of Fly Your Satellite!; Beginning of preparations in the S5A building	
March 21, 2016		Transfer of the Fregat upper stage to the FCube building for fueling operations
March 21 to April 11, 2016		Fregat upper stage fueling operations in the FCube building
March 21 to April 1, 2016		integration of the 1st and 2nd Soyuz stages in the MIK facility
March 31, 2016	Sentinel-1B transfer from the S5C building to the S3B building	
April 1 to April 15, 2016		Pneumatic and electrical tests on the lower three Soyuz stages at MIK
April 5, 2016	Fly Your Satellite! integration on ASAP-S **(**Auxiliary Payload Adaptor Structure – Soyuz)	
April 6, 2016	Sentinel-1B fueling operations; Microscope integration on ASAP-S	
April 8, 2016	ASAP-S transfer (with Microscope and Fly Your Satellite!) from S5 to S3B	
April 9, 2016		3rd Soyuz stage integration in MIK
April 12, 2016		Fregat upper stage transfer to the S3B building
April 13, 2016	ASAP-S integration (with Microscope and Fly Your Satellite!) on the Fregat upper stage	
April 14, 2016	Sentinel-1B integration on ASAP-S	
Avril 15, 2016		Fregat upper stage final preparation; Encapsulation in the payload fairing

SATELLITES AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

DATE	SATELLITES ACTIVITIES	LAUNCH VEHICULE ACTIVITIES
Monday, April 18, 2016		Final preparation of the lower three Soyuz stages in the MIK and upper composite in the S3B building
Tuesday, April 19, 2016	Rollout of the payload upper composite from S3B to the launch zone; Integration on the launcher	Rollout from MIK to the launch zone; Launch rehearsal at the Spaceport facilities
Wednesday, April 20, 2016	Functional tests and checks on the upper composite	Final launcher verifications
Thursday, April 21, 2016		Preparation for fueling operations Launch rehearsal – Payloads checks Launch readiness review (RAL)
Friday, April 22, 2016		Launcher final preparations Launch countdown Launch vehicle fueling operations

COUNTDOWN AND FLIGHT SEQUENCE

The countdown comprises all final preparation steps for the launcher, the satellite and the launch site. If it proceeds as planned, the countdown leads to the ignition of the core stage engine and the four boosters.

TIME			EVENT
- 05 h			Beginning of the meeting for launcher fueling authorization (BTR)
- 04 h	30 mn		Launch vehicle fueling begins
- 01 h	35 mn		End of fueling operations
- 01 h	10 mn		Mobile gantry withdrawal
	- 5 mn	10 s	Key on start
	- 5 mn		Fregat transfer to onboard power supply
	-2 mn	25 s	Upper composite umbilical drop-off command
		- 40 s	Ground-onboard power transfer
		- 28 s	Lower stage umbilical mast retraction
		- 17 s	Ignition
		- 15 s	Preliminary thrust level
		- 03 s	Full thrust level
T-O		**00 s**	**Liftoff**
	+ 1 mn	58 s	Jettisoning of boosters
	+ 3 mn	29 s	Jettisoning of fairing
	+ 4 mn	48 s	Separation of central core (second stage)
	+ 8 mn	49 s	Separation of 3rd stage
	+ 9 mn	49 s	First Fregat burn
	+ 20 mn	14 s	Fregat shut down and beginning of ballistic phase
	23 mn	35 s	**Sentinel-1B satellite separation**
+ 2 h	00 mn	05 s	Second Fregat burn
+ 2 h	00 mn	18 s	Fregat shut down
+ 2 h	48 mn	11 s	**Fly Your Satellite! satellite separation**
+ 2 h	49 mn	01 s	ASAP-S separation
+ 3 h	32 mn	35 s	Third Fregat burn
+ 3 h	32 mn	47 s	Fregat shut down
+ 3 h	57 mn	46 s	Fourth Fregat burn
+ 3 h	58 mn	02 s	Fregat shut down
+ 4 h	00 mn	52 s	**Microscope satellite separation**
+ 4 h	15 mn	55 s	Fifht Fregat burn
+ 4 h	16 mn	24 s	Fregat shut-down
+ 4 h	16 mn	34 s	Fregat stage de-orbiting; End of the Arianespace mission

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 now has 20 shareholders from 10 European countries (including Airbus Safran Launchers, CNES and all European companies participating in the production of Ariane launchers). Since the outset, Arianespace has signed over 530 launch contracts and launched 520-plus satellites. More than half of the commercial satellites now in service worldwide were launched by Arianespace. The company posted sales of more than 1.400 billion euros in 2015.

The company's activities are worldwide with the 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-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 70 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 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 Safran Launchers - all involved 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 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 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.

For Soyuz, Arianespace supervises the integration and functional checks of the launcher in the MIK facility, carried out by RKTs-Progress for the three lower stages, and by NPO-Lavochkin for the Fregat upper stage. It also coordinates Fregat propellant loading operations in the Fregat Fueling Facility (FCube), and satellite preparations in the EPCU payload preparation facility operated by CNES/CSG. Arianespace then integrates the satellite(s) on the Fregat stage in the S3B building, transfers the launcher and upper composite to the Soyuz launch zone and, along with the Russian entities in charge of the launcher, conducts the final countdown and liftoff operations from the Soyuz Launch Center (CDLS). Arianespace deploys a top-flight team and technical facilities to prepare launchers and satellites for theirs missions.

Building on this unrivalled expertise and outstanding local facilities, Arianespace is now the undisputed benchmark in the global launch services market.