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LAUNCH KIT

December 2019

VS23

COSMO-SkyMed Second Generation

CHEOPS

ANGELS / Eye-Sat / OPS-SAT

esa

esa AIRBUS

cheops

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

FLIGHT VS23: FOR ITS NINTH MISSION OF 2019, ARIANESPACE AT THE SERVICE OF ITALY, ESA AND CNES

On its ninth and final mission of 2019 —the third this year with the Soyuz medium-lift launcher from the Guiana Space Center (CSG) in French Guiana - Arianespace will perform a multiple launch at the service of innovative satellite solutions for European institutional needs.

The COSMO-SkyMed Second Generation satellite for the Italian Space Agency and Minister of Defence will be the primary passenger of this flight, along with the Characterising Exoplanet Satellite (CHEOPS) on behalf of the European Space Agency (ESA). Three auxiliary payloads also will be on board: ANGELS and EYESAT for the French CNES space agency,; and OPS-SAT for Tyvak (on behalf of ESA).

As demonstrated by this 49th Soyuz mission for Arianespace, the European launch services provider continues to address all Europe's need for flexible, reliable and independent access to space.

CONTENTS

COSMO-SkyMed Second Generation

The COSMO-SkyMed Second Generation satellite is an Earth observation spacecraft featuring state-of-the-art technologies and engineering solutions, further bolstering Italian leadership in this sector. It will be the fourth satellite launch by Arianespace for the Italian Space Agency (ASI) and the ninth performed in total for Italy (comprising ASI, the Italian Ministry of Defence and Telespazio).

This second-generation system, including its ground segment, will set a new performance standard for space-based radar observation systems in terms of precision, image quality and the flexibility of user services. It is a dual (civil/military) system, designed to address the requirements of both commercial and government customers, as well as the scientific community.

The COSMO-SkyMed Second Generation satellites are equipped with synthetic aperture radar (SAR), capable of observations under any weather or light conditions, day or night.

Manufactured by Thales Alenia Space (Italy), COSMO-SkyMed Second Generation will be the 162nd satellite manufactured by this constructor to be launched by Arianespace.

There currently are five Thales Alenia Space's satellites in Arianespace's backlog.

CHEOPS

The Characterising Exoplanet Satellite (CHEOPS) is an ESA mission implemented in partnership – in particular with Switzerland. This 74th satellite to be launched by Arianespace for ESA will mark the 52nd mission conducted by the launch services provider at the service of this space agency.

CHEOPS is the first mission dedicated to studying bright, nearby stars that already are known to host exoplanets in order to make high-precision observations of the planet's size as it passes in front of its host star. The spacecraft will focus on planets in the super-Earth to Neptune size range, with its data enabling the bulk density of the planets to be derived – a first characterization step towards understanding these alien worlds.

It will be the 25th scientific mission (and the 32nd satellite) to be launched by Arianespace.

Airbus in Spain is prime contractor for the mission, with the University of Bern being responsible for the telescope. Airbus led a consortium of 24 companies (seven From Spain) representing 11 European countries. The spacecraft was built in two years.

CHEOPS will be the 128th Airbus satellite to be launched by Arianespace.
There currently are 21 Airbus satellites in Arianespace's backlog.

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3 auxiliary payloads: OPS-SAT / EYESAT / ANGELS

OPS-SAT	OPS-SAT is a 3U CubeSat and the first satellite to be launched by Arianespace for Tyvak on behalf of ESA. Tyvak offers access to space by providing end-to-end, cost-effective space systems using agile aerospace processes and accelerating on-orbit access especially for the small-, nano- and CubeSat categories of satellites. Tyvak International of Italy provided the deployer and launch service for OPS-SAT on behalf of ESA. OPS-SAT is the world's first free-for-use, in-orbit testbed for new software, applications and techniques in satellite control. It enables new software to be tested in orbit, bringing Europe forward to a new era of space flight innovation and commercial opportunity. In the first year of operation, OPS-SAT will host over 100 in-flight experiments submitted from many ESA Member States. OPS-SAT was developed by the Graz University of Technology with subcontractors from Austria, Germany, Poland and Denmark. It will be operated by ESA from the European Space Operations Centre (ESOC) in Germany.
EyeSat	EyeSat is a 3U CubeSat designed to study the zodiacal light and image the Milky Way. It has three main objectives: • Scientific, • To demonstrate new satellite technologies, and • To train students in space engineering professions. The EyeSat is being financed and developed by the French CNES space agency (Centre National d'Etudes Spatiales) within the scope of the Janus project (Jeunes en Apprentissage pour la réalisation de Nanosatellites des Universités et des écoles de l'enseignement Supérieur), which is designed to encourage students in universities and engineering schools to develop their own very small satellites. The EyeSat satellite is in the form of a 3U CubeSat and is fitted with an instrument called IRIS, which is a small space telescope. EyeSat will be the 16th satellite (including Pleiades satellites) to be launched by Arianespace for CNES. There is one additional CNES satellite to be launched in the Arianespace's backlog: TARANIS.
ANGELS	ANGELS (for: Argos Néo on a Generic Economical and Light Satellite) is jointly financed and developed by the French CNES space agency (Centre National d'Etudes Spatiales) and Hemeria - an innovative industrial group active in the aerospace, defense, energy, rail and automotive markets (which is an affiliate of Nexeya). ANGELS is a 12U CubeSat, and is the French industry's first nanosatellite. The satellite will be fitted with a miniaturized ARGOS Néo instrument, which is 10-times smaller than the equivalent previous-generation device. The instrument collects and determines the position of low-power signals and messages sent by the 20,000 ARGOS beacons now in service worldwide. Two project teams – CNES and Hemeria for ANGELS; and CNES, Thales Alenia Space and Syrlinks for ARGOS Néo – are working together on this French space project. ANGELS paving the way for French industry to build operational nanosatellites within the "new space" environment. ANGELS will be the 17th satellite (including Pleiades satellites) to be launched by Arianespace for CNES.

With COSMO-SkyMed Second Generation, CHEOPS, ANGELS and EyeSat, Arianespace will have launched 130 missions (159 satellites) for the European institutions of seven different countries (excluding ESA), using the entire Arianespace family of launchers: Ariane, Soyuz and Vega.

MISSION DESCRIPTION

The 23rd Soyuz launch from the Guiana Space Center (CSG) will place its satellite passengers into Sun Synchronous Orbits (SSO).

The Soyuz ST-A launcher will be carrying a total payload of 3,250 kg.

The launch will be performed from the Soyuz Launch Complex (ELS) in Sinnamary, French Guiana.

DATE AND TIME

Liftoff is scheduled for **Tuesday, December 17, 2019** at exactly:

> **03:54:20 a.m.,** in Washington, D.C.
> **05:54:20 a.m.,** in Kourou, French Guiana
> **08:54:20** Universal Time (UTC)
> **09:54:20 a.m.,** in Paris
> **09:54:20 a.m.,** in Rome
> **11:54:20 a.m.,** in Moscow

MISSION DURATION

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

4 hours, 13 minutes and 14 seconds.

TARGETED ORBITS

✓ **COSMO-SkyMed Second Generation in a Sun-synchronous orbit with a semi-major-axis at 6,997 km. with an inclination of 97.81° degrees,**

✓ **CHEOPS in a Sun-synchronous orbit with a semi-major-axis at 7,078 km. with an inclination of 98.22° degrees,**

✓ **Three auxiliary payloads: OPS-SAT / EyeSat / ANGELS, in a Sun-synchronous orbit altitude at approximately 500 km.**

SOYUZ PAYLOAD CONFIGURATION

> **Payload:**

COSMO-SkyMed Second Generation
Mass at liftoff: 2,205 kg.

CHEOPS
Mass at liftoff: 273 kg.

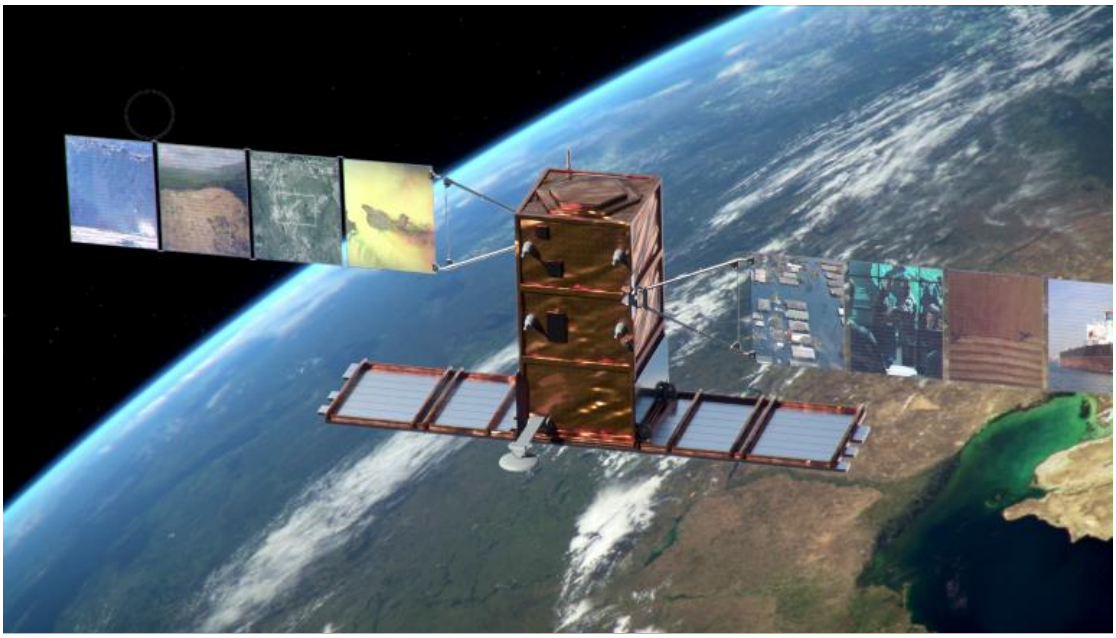
OPS-SAT
Mass at liftoff: 7 kg.

EyeSat
Mass at liftoff: 7 kg.

ANGELS
Mass at liftoff: 27 kg.

> **ST fairing**

COSMO-SkyMed Second Generation



CUSTOMER	**Thales Alenia Space Italy**
FINAL CUSTOMER	**Italian Space Agency / Italian MOD**
MANUFACTURER	Thales Alenia Space
PLATFORM	PRISMA
MISSION	Earth observation
PAYLOAD	TTC in S-Band, and X-band SAR antenna
MASS AT LIFTOFF	2,205 kg.
BATTERIES	1 Li-Ion
STABILIZATION	3-axis
COVERAGE	Global (16-day repeat cycle)
LIFETIME	7 years

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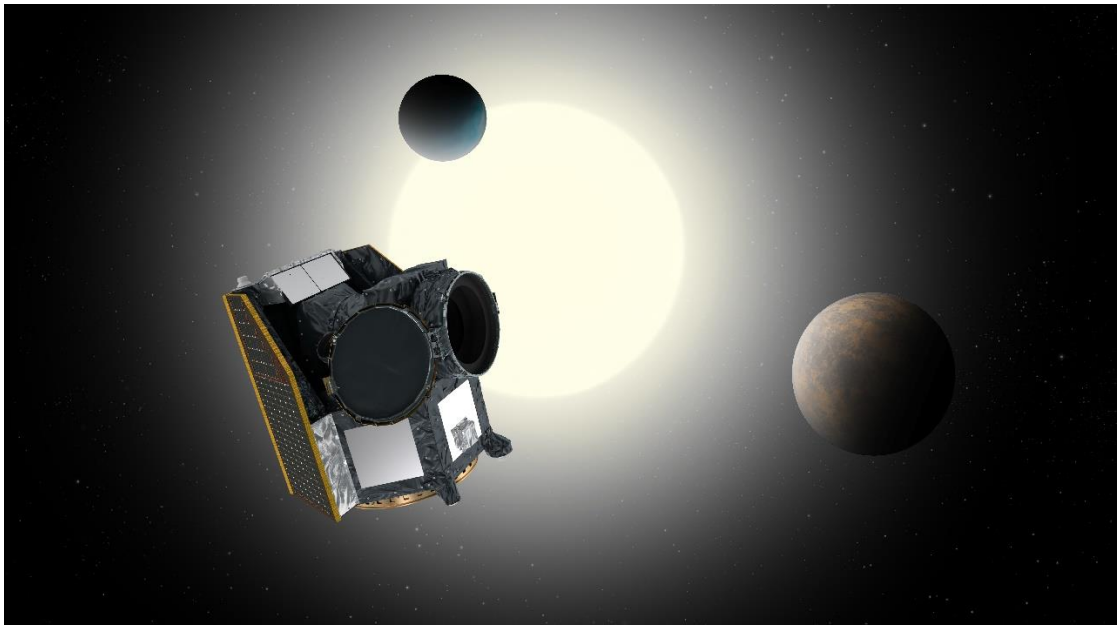
CHEOPS



CUSTOMER	**ESA**
MANUFACTURER	**Airbus (Spain)**
MISSION	Scientific – space exploration
PAYLOAD	High-accuracy photometer
MASS AT LIFTOFF	273 kg.
STABILIZATION	3-axis
COVERAGE	Planetary exploration
LIFETIME	3.5 years

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OPS-SAT / EyeSat / ANGELS

ANGELS & Eye-Sat in orbit

OPS-SAT	EyeSat	ANGELS
CUSTOMER: **Tyvak** **FINAL CUSTOMER:** **ESA** **MANUFACTURER:** **Graz University of Technology (Austria)** **MISSION:** Technology demonstration **PAYLOAD:** S-band transceiver and X-band transmitter **MASS AT LIFTOFF:** 7 kg. **COVERAGE AREA:** Global **LIFETIME:** 1 year (minimum)	**CUSTOMER:** **CNES for JANUS project (ISIPOD)** **MANUFACTURER:** **CNES for JANUS project** **MISSION:** Scientific and technology demonstration **PAYLOAD:** IRIS **MASS AT LIFTOFF:** 7 kg. **COVERAGE AREA:** Global **LIFETIME:** 1 year (minimum)	**CUSTOMER:** **CNES** **MANUFACTURER:** **Hemeria & CNES** **MISSION:** Data relay for ARGOS – Advanced miniaturized location and data collection demonstrator **PAYLOAD:** Advanced miniaturized location and data collection demonstrator **MASS AT LIFTOFF:** 27 kg. **COVERAGE AREA:** Global **LIFETIME:** 2 years

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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 performed more than 1,900 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.

Introduced in 1966, Soyuz 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 Soyuz launch vehicle's development program. This modernized version, also used to successfully launch MetOp-A on October 19, 2006 from the Baikonur Cosmodrome, features a digital control system providing additional mission flexibility; it also enables control of the launch vehicle fitted with the 4.1-meter ST payload 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 upgraded Soyuz 2-1b launch vehicle's inaugural flight was successfully performed from Baikonur Cosmodrome on December 27, 2006, orbiting the Corot scientific spacecraft for the French CNES space agency.

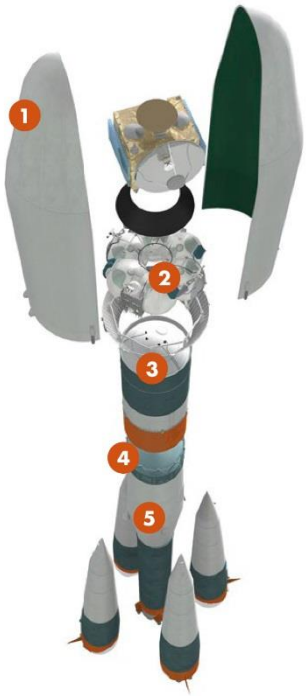
The decision of the European Space Agency to introduce Soyuz launch capability at the Guiana Space Center (CSG) in French Guiana marked a major step forward in expanding the range of missions. With the introduction of Soyuz at CSG, this famed medium-lift Russian launch vehicle is now an integral part 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-lift launcher for both government and commercial missions.

In October 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, Soyuz is being produced at an average rate of 15 to 20 launchers per year. The manufacturer also can 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 interplanetary trajectories to Mars or Venus. Offering an unrivaled heritage, Soyuz already has 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 composed of: 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 - Fairing
2 - Fregat upper stage
3 - Third stage
4 - Central core (2nd stage)
5 - 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, which are 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 Soyuz ST-A (2-1a) version, or a RD-0124 engine in the ST-B (2-1b) 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 Soyuz launcher's capability, now covering a full range of orbits (LEO, SSO, MEO, GTO, GEO and Earth escape). To ensure high reliability for the Fregat stage 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, as 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 three-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 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 (the Samara Space Center) is responsible for the design, development, and manufacture of launch vehicles, including the Soyuz launch vehicle's first, second, 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:
COSMO-SkyMed Second Generation
CHEOPS
OPS-SAT / EyeSat / ANGELS

CAMPAIGN CALENDAR FOR THE SATELLITES AND LAUNCH VEHICLE

DATE	ACTIVITIES WITH THE SATELLITES	LAUNCH VEHICLE ACTIVITIES
October 14, 2019		Campaign start review – beginning of Fregat upper stag preparation at the Soyuz launcher preparation building (MIK)
October 16, 2019	Arrival of the CHEOPS and ANGELS satellites at Félix Eboué Airport in Cayenne CHEOPS preparation in S1B building	
October 17, 2019		Start of Integration of the three Soyuz stages at the Soy launcher preparation building (MIK) Transfer of the Fregat upper stage to the FCube buildin for fueling operations
November 12, 2019	Arrival of the COSMO-Skymed Second Generation satellite at Félix Eboué Airport in Cayenne COSMO-Skymed Second Generation preparation in S1A building Transfer of CHEOPS from S1B to S5C	
November 14, 2019 to December 4, 2019		Fregat preparation and fueling GHe, N204, UDMH and N2H4 activities in the FCube building
November 18, 2019	Transfer of CHEOPS from S5C to S5A	
November 22, 2019	Arrival of the EyeSat satellite at Félix Eboué Airport in Cayenne	
November 23, 2019	Transfer of CHEOPS from S5C to S5A	
November 25 to 29, 2019		Pneumatic and propulsion system tests on the lower thr Soyuz stages in the MIK
November 27, 2019	Arrival of the OPS-SAT satellite at Félix Eboué Airport in Cayenne	
November 28, 2019	Integration of CHEOPS on the adapter in the S5 building Transfer of COSMO-Skymed Second Generation from S1A to S3B	
November 29, 2019	Integration of CHEOPS inside the ASAP-S in S5A building Transfer of CHEOPS from S5A to S3B inside CCU2	
November 30, 2019	Assembly of ANGELS, EyeSat and OPS-SAT on the ASAP-S platform in S3B	
December 2 to 3, 2019	Fueling of COSMO-Skymed Second Generation in S3B	
December 2 to 10, 2019		Electrical and functional verifications on the lower three Soyuz stages in the MIK
December 4, 2019	Integration of COSMO-Skymed Second Generation to the adapter in S3B	
December 5 ,2019		Transfer of the Fregat upper stage from the FCube building to the S3B clean room
December 6,2019	Integration of the ASAP-S on FREGAT (with CHEOPS inside)	
December 9, 2019	Integration of COSMO-Skymed Second Generation on the ASAP-S on top of FREGAT	Fregat upper stage final preparation
December 10, 2019		Encapsulation Fregat in Fairing

FINAL CAMPAIGN CALENDAR FOR THE SATELLITES AND LAUNCH VEHICLE

DATE	ACTIVITIES WITH THE SATELLITES	LAUNCH VEHICLE ACTIVITIES
Wednesday, December 11, 2019		Final preparation of the three Soyuz stage for installation on the transporter/erector
Thursday, December 12, 2019	Payload upper composite arrival from the S3B on the launch zone; Integration on the launcher	Roll-out of the three-stage Soyuz launcher in the ZLS
Friday, December 13, 2019		Final verifications of the lower three Soyuz stages
Saturday, December 14, 2019		Launch readiness review (RAL) Fregat countdown rehearsal
Monday, December 16, 2019		Final launcher checks Launch vehicle final preparations
Tuesday, December 17, 2019		Fueling operations for the three Soyuz stages Final countdown

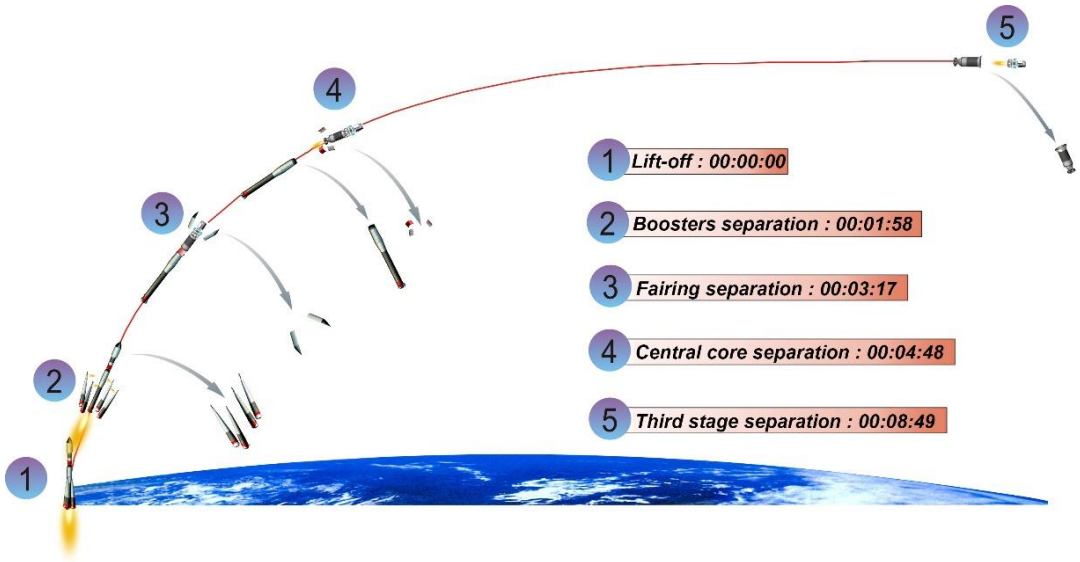
COUNTDOWN AND FLIGHT SEQUENCE

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 core stage engine and the four boosters.

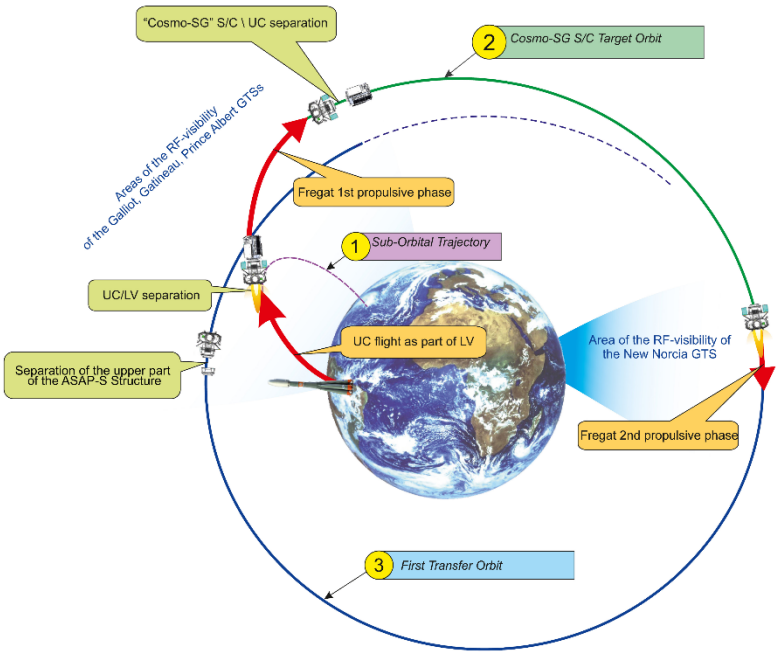
TIME			EVENTS
- 5 hrs.		00 s	Meeting for launcher fueling authorization (BTR)
- 4 hrs.	30 min.	00 s	Launch vehicle fueling begins
- 1 hr.	35 min.	00 s	End of fueling operations
- 1 hr.	10 min.	00 s	Mobile gantry removal
	- 5 min.	09 s	Key on start
	- 5 min.	00 s	Fregat transfer to onboard power supply
	-2 min.	25 s	Upper composite umbilical drop-off command
		- 40 s	Ground-onboard power transfer
		- 28 s	Lower stage umbilical mast retraction
		- 16 s	Ignition
		- 14 s	Preliminary thrust level
		- 01 s	Full thrust level
H0		**00 s**	**Liftoff**
	+ 1 min.	57 s	Jettisoning of boosters
	+ 3 min.	16 s	Jettisoning of fairing
	+ 4 min.	47 s	Separation of central core (second stage)
	+ 8 min.	49 s	Separation of 3rd stage
	+ 9 min.	49 s	First Fregat burn
	+ 20 min.	13 s	First Fregat burn cut-off
	+ 22 min.	43 s	**Separation of COSMO-Skymed Second Generation**
+ 1 hrs.	00 min.	55 s	Second Fregat burn
+ 1 hrs.	01 min.	07 s	Second Fregat burn cut-off
+ 1 hrs.	41 min.	40 s	Separation of the ASAP-S upper portion
+ 1 hrs.	52 min.	35 s	Third Fregat burn
+ 1 hrs.	52 min.	46 s	Third Fregat burn cut-off
+ 2 hrs.	20 min.	55 s	Fourth Fregat burn
+ 2 hrs.	21 min.	21 s	Fourth Fregat burn cut-off
+ 2 hrs.	24 min.	41 s	**Separation of CHEOPS**
+ 3 hrs.	29 min.	15 s	Fifth Fregat burn
+ 3 hrs.	29 min.	31 s	Fifth Fregat burn cut-off
+ 4 hrs.	02 min.	35 s	Sixth Fregat burn
+ 4 hrs.	02 min.	52 s	Sixth Fregat burn cut-off
+ 4 hrs.	10 min.	44 s	**Separation of OPS-SAT and EyeSat**
+ 4 hrs.	13 min.	14 s	**Separation of ANGELS**
+ 5 hrs.	47 min.	35 s	Seventh Fregat burn
+ 5 hrs.	47 min.	54 s	Seventh Fregat burn cut-off
+ 5 hrs.	52 min.	10 s	End of the Arianespace mission

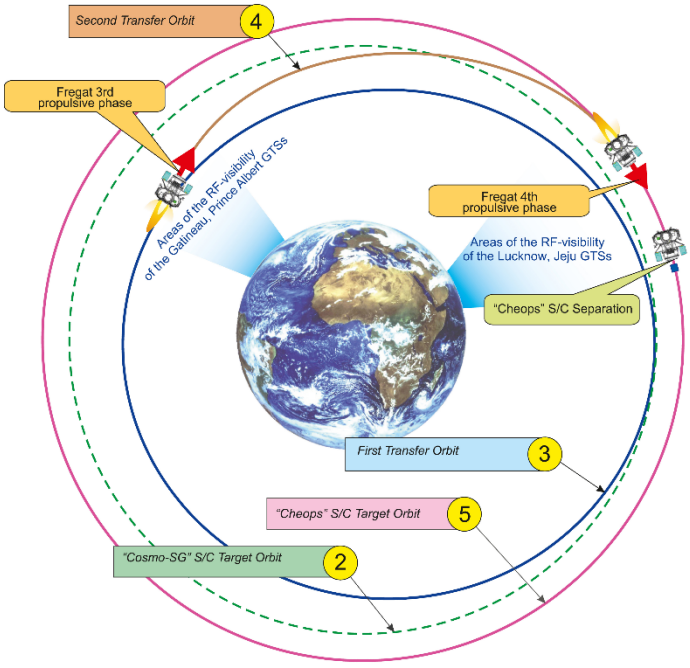
VS23 MISSION PROFILE

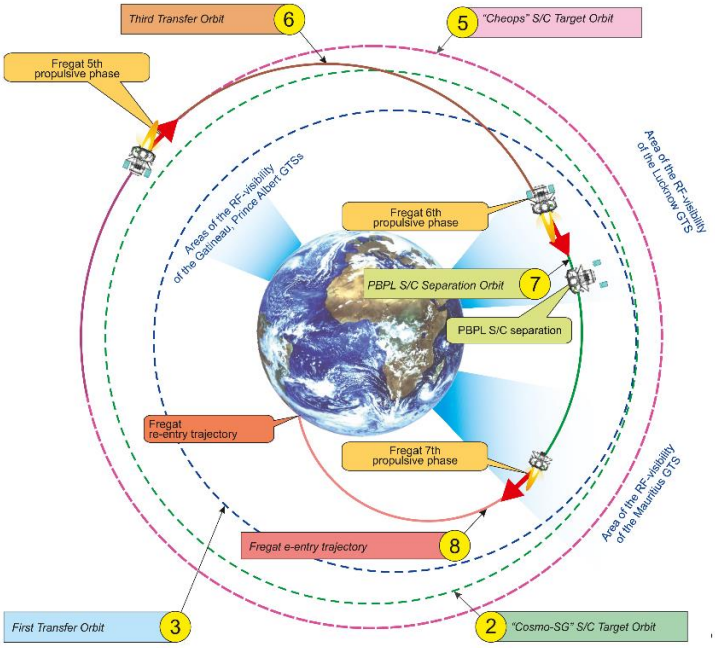
MISSION PROFILE FOR THE THREE SOYUZ STAGES

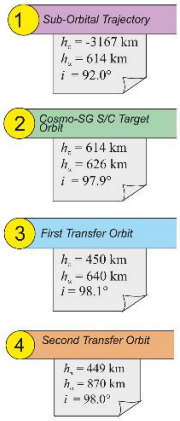


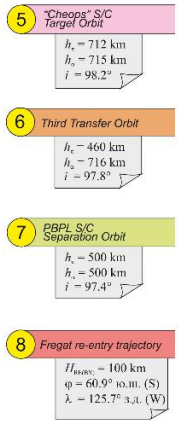
THE FREGAT MISSION PROFILE











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 is a subsidiary of ArianeGroup, which holds 74% of its share capital; the balance is held by 15 other shareholders from the European launcher industry.

Since the outset, Arianespace has signed over 580 launch contracts and launched more than 600 satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace.

The company posted sales of approximately 1.4 billion euros in 2018.

The company's activities are worldwide, with the headquarters in Evry, France (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, at the Baikonur Cosmodrome in Kazakhstan, and soon at the Vostochny Cosmodrome in Russia.

> 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 710 satellites to be launched.

THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For more than 50 years, the Guiana Space Center (CSG), Europe's Spaceport in French Guiana, has offered a complete array of facilities for rocket launches. It primarily comprises the following:

> The 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 ArianeGroup – all participate in the production of Ariane 5, Soyuz and Vega 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 France's space program, the Guiana Space Center has evolved into 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 the 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 5, Soyuz and Vega.

For Soyuz, Arianespace supervises the launcher's integration and functional checks 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 their missions.

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