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STARSEM

OneWeb

OneWeb Satellites

FLIGHT ST32

This 57th Soyuz mission conducted by Arianespace and its Starsem affiliate will be operated from Vostochny Cosmodrome for the fourth time and represents OneWeb's seventh launch overall.

Realizing revolution in space with ST32 mission: OneWeb will take a new step by increasing its satellite fleet to more than 200 spacecraft.

By operating this flight on behalf of OneWeb, Arianespace participates in the fulfilment of its customer's ultimate ambition: providing internet access for everyone, everywhere, all the time.

OneWeb

Flight ST32, the fourth commercial mission from Vostochny Cosmodrome performed by Arianespace and its Starsem affiliate, will put **36 of OneWeb's satellites** bringing the total fleet to 218 satellites into a near-polar orbit at an altitude of 450 kilometers. After separation, the satellites will raise themselves to their operational orbit.

The first six OneWeb satellites were successfully orbited by Arianespace on Soyuz Flight VS21 from French Guiana on February 27, 2019. On February 7, 2020, Arianespace and its Starsem affiliate launched 34 OneWeb satellites from Baikonur Cosmodrome on Soyuz Flight ST27. On March 21, 2020, the team successfully delivered an additional 34 satellites into orbit on Soyuz Flight ST28. On December 18, 2020, the first Soyuz from Vostochny placed in orbit 36 satellites on Flight ST29. On March 25, 2021, the second Soyuz from Vostochny successfully placed in orbit 36 satellites on Flight ST30. Finally, ST31 mission on April 26, 2021, orbited 36 satellites from Vostochny.

OneWeb's mission is to bring internet everywhere to everyone, by creating a global connectivity platform through a next generation satellite constellation in low Earth orbit. OneWeb's constellation of 650 satellites will deliver high-speed, low-latency enterprise grade connectivity services to a wide range of customer sectors including enterprise, government, maritime and aviation customers. Central to its purpose, OneWeb seeks to bring connectivity to every unconnected area where fiber cannot reach, and thereby bridge the digital divide.

Once deployed, the OneWeb constellation will enable user terminals that are capable of offering 3G, LTE, 5G and Wi-Fi coverage, providing high-speed access globally – by air, sea and land.

In 2021, the company is focused on scaling the satellite constellation to launch commercial services starting at the end of 2021 to the UK, Alaska, Canada, Northern Europe, Greenland, Iceland, and the Arctic Seas.

OneWeb Satellites is a joint venture between OneWeb and Airbus Defence and Space, where OneWeb Satellites is the constellation's prime contractor. The satellites were built thanks to its leading-edge satellite manufacturing process that can build up to two satellites a day on a series production line dedicated to the assembly, integration, and testing of the satellites. The facility is running at full speed, within the coronavirus pandemic guidelines, manufacturing satellites that are tested and ready now, and also for future launches.

With the launch of 36 OneWeb satellites on Flight ST32, Arianespace will put in orbit a total of 349 spacecraft from Airbus Defence and Space (including OneWeb Satellites – a joint-venture between OneWeb and Airbus Defence and Space founded in 2016).

The Arianespace backlog of payloads remaining to be launched for Airbus Defence and Space (excluding the remaining OneWeb satellites) counts 20 additional payloads.

After ST32, 12 Soyuz launches remain under contract with Arianespace which has more than 440 additional satellites to be launched in the Arianespace's backlog.

CONTENTS

PRESS CONTACT

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RUAG Space AB (Linköping, Sweden) is the prime contractor in charge of development and production of the dispenser system used on Flight ST32. It will carry the satellites during their flight to low Earth orbit and then release them into space.

The dedicated dispenser is designed to accommodate up to 36 spacecraft per launch, allowing Arianespace to timely deliver the lion's share of the initial OneWeb constellation.

Arianespace, Starsem and satellite constellations

With its current family of launchers (Ariane 5, Soyuz and Vega) and the future family (Ariane 6 and Vega C), Arianespace is a key player in the growth market of satellite constellations – whether for navigation, telecommunications or Earth observation.

Indeed, since the late 1990s, Arianespace has launched a total of 318 commercial constellation satellites, including 182 satellites for OneWeb, 56 for Globalstar, 30 for Planet, 20 for O3b, 12 for Swarm Technologies, ten for Spire, along with one each for Orbcomm, Satellogic, Kepler Communications, Orbital Solutions/GeoOptics, GHGSat, Airbus Defence and Space, Aurora Insight, and Eutelsat ; as well as 26 institutional satellites for the European Space Agency (ESA) and the European Commission as part of the Galileo constellation project.

Arianespace's backlog, apart from the OneWeb constellation, currently consists of 20 more constellation satellites to orbit on behalf of: Airbus Defence and Space (x3), ESA and the European Commission (x4) + 8 more reservations, Airbus Defence and Space for CNES (x4), and Myriota (x1).

MISSION DESCRIPTION

Arianespace's fourth launch of 2021 will place its satellite passengers into low Earth orbit, at an altitude of 450 km before raising themselves to their operational orbit.

The Soyuz launcher will be carrying a total payload of 5,809 kg.

The launch will be performed from the Soyuz launch complex in Vostochny, Russia.

DATE AND TIME

Liftoff is scheduled for **Thursday, May 27, 2021** at exactly:

- **01:43 p.m.**, in Washington, D.C.,
- **17:43** Universal Time (UTC),
- **07:43 p.m.**, in Paris,
- **08:43 p.m.**, in Moscow,
- **02:43 a.m.**, at Tokyo and Vostochny Cosmodrome, on May 28.

MISSION DURATION

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

3 hours, 51 minutes, 40 seconds.

TARGETED ORBIT

Orbit
LEO
(low Earth orbit)

Altitude at separation
Approx. 450 km.

Inclination
87.4 degrees

THE LAUNCH AT A GLANCE

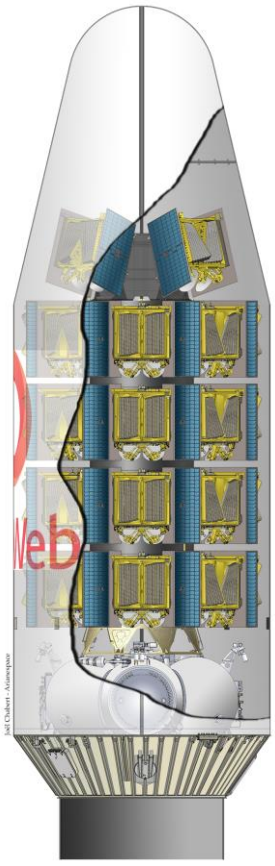
Following lift-off from the Vostochny Cosmodrome, the powered phase of the lower three Soyuz stages will last approximately nine minutes. The launcher's third stage will then be separated from the upper composite, which comprises the Fregat upper stage and the OneWeb satellites. The three lower Soyuz stages and the payload fairing will fall back to Earth.

Prior to release the satellites, the Fregat upper stage will carry out several main powered phases. The 36 satellites will be separated during nine separation sequences.

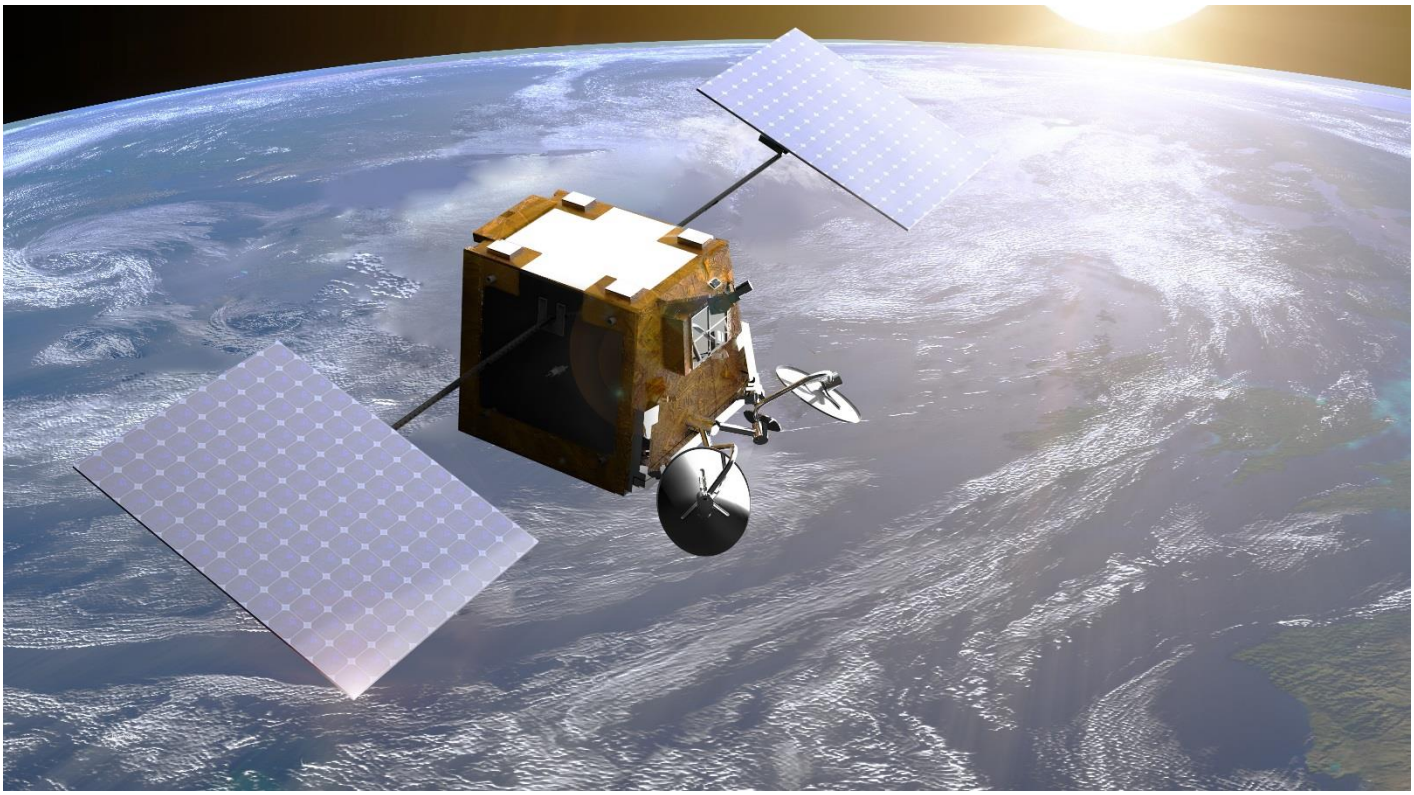
At the end of the mission, one additional firing of the Fregat engine will place Fregat into a re-entry orbit.

SOYUZ PAYLOAD CONFIGURATION

- **Payload:** 36 OneWeb satellites
- **ST Fairing**
- **OneWeb Dispenser System**



ONEWEB SATELLITES



CUSTOMER	OneWeb
MANUFACTURER	OneWeb Satellites (Florida factory)
MISSION	Global connectivity
OPERATIONAL ORBIT	Low Earth orbit, at 1,200 km. altitude and 87.4° inclination
PLATFORM	Specific
PROPULSION	Electric (Xenon HET)
BATTERY	Li-ion
ANTENNAS	Two TTC omni antennas; two Ku-band antennas; two Ka-band antennas
STABILIZATION MODE	3-axis stabilized
COVERAGE	Global

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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 1,925 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.

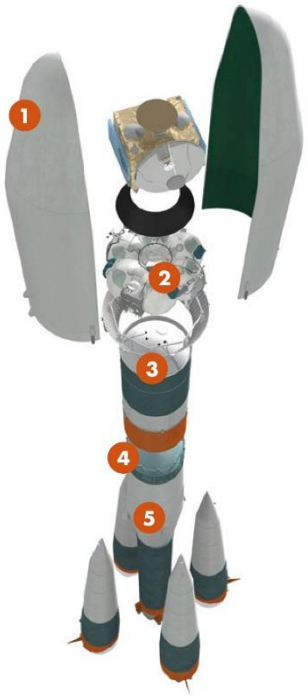
The decision of the European Space Agency to introduce Soyuz launch capability at the Guiana Space Center (CSG) in French Guiana marked a major step forward in expanding the range of missions. With the introduction of Soyuz at CSG, this famed medium-lift Russian launch vehicle is now an integral part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

After the completion of their pre-integration on dispenser sub-structure and testing at OneWeb Satellites' manufacturing facility in Florida, USA, the OneWeb satellites arrived at the Ignatyevo Airport (about 235 km. from the Vostochny Cosmodrome), to enter in the ongoing launch campaign. Activities at the Vostochny Cosmodrome during the first two weeks of the launch campaign included preparation of the Cosmodrome ground segment, the satellites and their integration to the dispenser in the Stack Preparation Facility (SPF). The satellites/dispenser combination was then mated to the Fregat upper stage, and together were encapsulated in the fairing, thereby forming the upper composite. The key events of the OneWeb launch campaign in the final days and moments prior to launch proceed as follows (L = lift-off):

L-6 days:
Upper composite (satellites + dispenser + Fregat with intermediate bay + fairing) is transferred to the launch vehicle assembly facility.

L-6 to L-4 days:
Launch vehicle integration and preparation for roll-out to launch pad. The upper composite is mated to the launch vehicle's third stage, which in turn is mated to the packet "central core + 4 lateral blocs" completing the full assembly of the launch vehicle enabling connections to be verified.

L-4 days:
An overall Readiness review ensures the Soyuz launch vehicle including its payload are ready for roll-out and launch pad systems are ready for LV final preparation and launch.

L-3 days:
Launch vehicle roll-out to launch pad, installation on the launch system. Mobile gantry roll-on and feeding line connections; spacecraft and dispenser status checks; autonomous verifications of the three-stage and associated ground support equipment (first, second and third stages) (Part 1).

L-2 days:
Fregat upper stage functional check autonomous and complex verifications for the three-stage launcher elements (Part 2).

L-9 hours:
Final countdown begins. Systems checks begin for all launch vehicle and ground support equipment.

L-5 hours, 10 minutes:
Automatic launch sequence begins on the Fregat upper stage.
Launch vehicle fueling authorization review.

L-4 hours, 30 minutes:
Launch vehicle fueling begins.

L-1 hour, 5 minutes:
Mobile gantry withdrawal (20 minutes duration).

L-2 minutes, 25 seconds:
Pressurization of propellant tanks umbilical connectors for Spacecraft lines drop-off.

L-40 seconds:
KZM umbilical mast release.

L-16 seconds:
Ignition of lateral blocs and central core engines (first and second stage of the Soyuz 3-Stage).

L-0:
Lift-off!

COUNTDOWN AND FLIGHT SEQUENCE

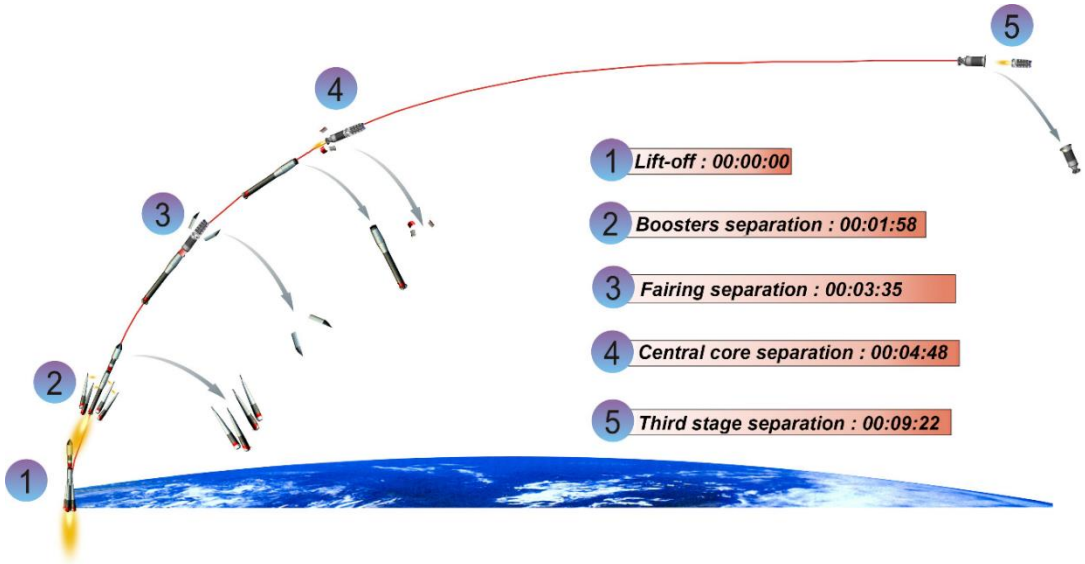
The countdown comprises all final preparation steps for the launcher, the satellites and the launch site. If it proceeds as planned, the countdown leads to the ignition of the core stage engine and the four boosters.

TIME			EVENTS
- 4 h	58 min.	29 s	Meeting for launcher fueling authorization (BTR)
- 4 h	33 min.	29 s	Launch vehicle fueling begins
- 1 h	15 min.	00 s	End of fueling operations
	- 30 min.	00 s	Test bars and 1 kHz tone
	- 6 min.	00 s	Key on start
	- 5 min.	00 s	Fregat transfer to onboard power supply
	-2 min.	25 s	Upper composite umbilical drop-off command
		- 45 s	Ground-onboard power transfer
		- 19 s	Lower stage umbilical mast retraction
		- 16 s	Ignition
		- 11 s	Preliminary thrust level
H0		**00 s**	**Liftoff**
	+ 1 min.	58 s	Jettisoning of boosters
	+ 3 min.	35 s	Jettisoning of fairing
	+ 4 min.	48 s	Separation of central core (second stage)
	+ 9 min.	22 s	Separation of 3rd stage
	+ 10 min.	22 s	First Fregat burn
	+ 15 min.	29 s	First Fregat burn cut-off
+ 1 h	13 min.	40 s	Second Fregat burn
+ 1 h	14 min.	12 s	Second Fregat burn cut-off
+ 1 h	18 min.	20 s	1st separation of four OneWeb satellites
+ 1 h	34 min.	10 s	Fregat ACS ignition
+ 1 h	34 min.	25 s	Fregat ACS extinction
+ 1 h	37 min.	30 s	2nd separation of four OneWeb satellites
+ 1 h	53 min.	20 s	Fregat ACS ignition
+ 1 h	53 min.	34 s	Fregat ACS extinction
+ 1 h	56 min.	40 s	3rd separation of four OneWeb satellites
+ 2 h	12 min.	30 s	Fregat ACS ignition
+ 2 h	12 min.	42 s	Fregat ACS extinction
+ 2 h	15 min.	50 s	4th separation of four OneWeb satellites
+2 h	31 min.	40 s	Fregat ACS ignition
+ 2 h	31 min.	51 s	Fregat ACS extinction
+ 2 h	35 min.	00 s	5th separation of four OneWeb satellites
+ 2 h	50 min.	50 s	Fregat ACS ignition
+ 2 h	51 min.	00 s	Fregat ACS extinction
+ 2 h	54 min.	10 s	6th separation of four OneWeb satellites
+ 3 h	10 min.	00 s	Fregat ACS ignition
+ 3 h	10 min.	08 s	Fregat ACS extinction
+ 3 h	13 min.	20 s	7th separation of four OneWeb satellites
+ 3 h	29 min.	10 s	Fregat ACS ignition

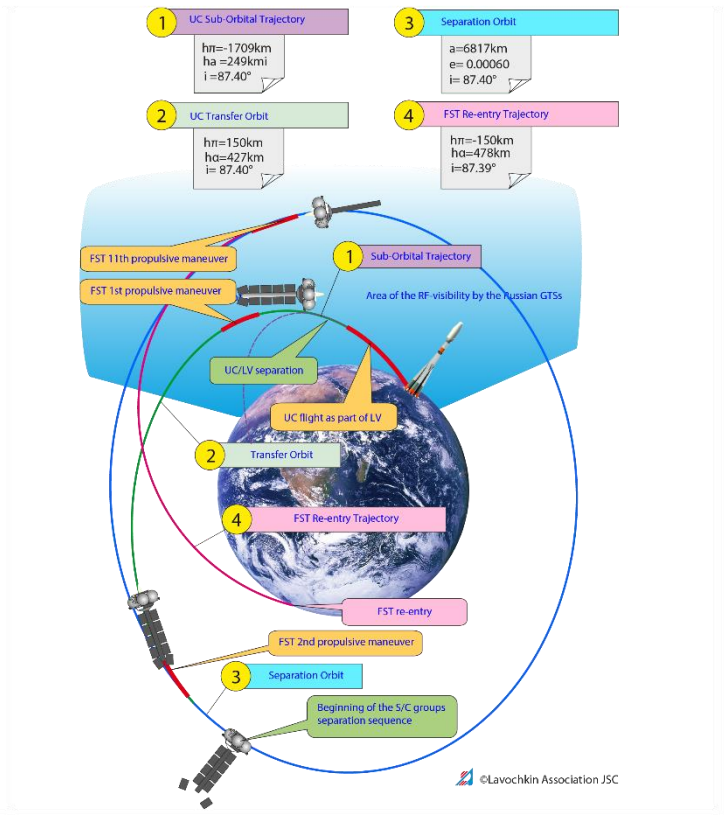
+ 3 h	29 min.	17 s	Fregat ACS extinction
+ 3 h	32 min.	30 s	**8th separation of four OneWeb satellites**
+ 3 h	48 min.	20 s	Fregat ACS ignition
+ 3 h	48 min.	26 s	Fregat ACS extinction
+ 3 h	51 min.	40 s	**9th separation of four OneWeb satellites**
+ 4 h	50 min.	05 s	Third Fregat burn (for deorbiting)
+ 4 h	50 min.	35 s	Third Fregat burn cut-off
+ 4 h	52 min.	58 s	End of the mission

ST32 MISSION PROFILE

MISSION PROFILE FOR THE THREE SOYUZ STAGES



THE FREGAT MISSION PROFILE

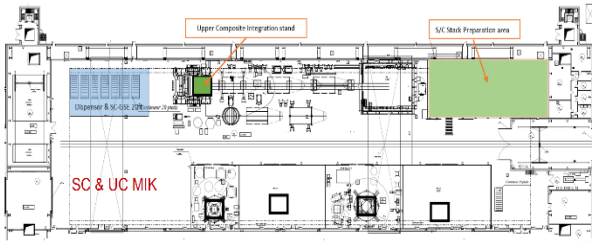


ARIANESPACE AND THE VOSTOCHNY COSMODROME FACILITIES

Vostochny Cosmodrome is a Russian rocket launch site in the far east of the country, approximately 5,600 km. from Moscow. Initiated by the Russian government in 2007, the Cosmodrome will allow Russia to have total autonomy on launches. Closer to the equator than the Russian launch pad at Plessetsk, the Vostochny Cosmodrome currently has launch facilities for the Soyuz 2 rocket, with progress on creating launch pads for the future of Russia's space program. The Soyuz launch pad, primarily modeled after the version created for Soyuz at the Spaceport in French Guiana, also combines the operational know-how from Baikonur Cosmodrome. The first launch from the Vostochny Cosmodrome took place in 2016.

SPACECRAFT MIK (INTEGRATION AND TEST FACILITY)

This facility is the location where customer's spacecraft are prepared, and eventually mated to the Fregat upper stage and encapsulated in the fairing. The spacecraft stack preparation area is a dedicated location of the assembly and integration facility, with six-meter-tall walls. Portable and fixed ventilation systems ensure the proper thermal conditions of the spacecraft until launch. Fail-safe backup power supplies are available in all clean rooms to protect sensitive hardware during processing activities. Dedicated networks allow voice and data exchange between the clean rooms and other facilities. An independent, redundant satellite communications system provides high data rate connections between customers and their home base.



UPPER COMPOSITE MIK

Spacecraft mating with the Fregat upper stage is performed in the upper composite MIK, along with fairing encapsulation. The facility has equipment and personnel airlocks and an on-site control room.

OFFICE AREA

Offices for the mission's customer are located on the 4th floor inside the spacecraft-upper composite MIK, next to the high-bay for the preparation of their spacecraft. This allows customers to have their spacecraft in a controlled environment – from unpacking through encapsulation. Other rooms are dedicated to the monitoring of the spacecraft and upper composite MIK by CCTV, and also for meetings.

STORAGE AREA

Storage for containers, compatible with Class 100,000 standards, is available next to the upper composite integration stand. The storage area is shared between OneWeb, OneWeb satellites, Arianespace and the Russian partners.

LAUNCH SITE

The launch site includes the launch pad, mobile gantry, launch control center, administrative buildings and other facilities. After encapsulation, customer spacecraft are transported in a controlled environment to be mated to the rest of the launch vehicle. Following integration, the vehicle is rolled out to the launch pad.