LAUNCH KIT

November 2020

VV17

SEOSAT-Ingenio TARANIS

CDTI

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TARANIS

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CENTRE NATIONAL D'ÉTUDES SPATIALES

FLIGHT VV17: A NEW VEGA MISSION AT THE SERVICE OF EUROPEAN INSTITUTIONS DEDICATED TO INNOVATIVE EARTH OBSERVATION AND SCIENCE SOLUTIONS

For its seventh launch of the year - and the 17th to be performed by the Vega launcher since its first liftoff from the Guiana space center in 2012 - Arianespace will orbit two satellites: SEOSAT-Ingenio for ESA, on behalf of Spain's Center for Development of Industrial Technology (CDTI), and TARANIS for CNES, the French space agency.

With this launch, Arianespace reasserts its primary mission by ensuring European independent access to space.

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SEOSAT-Ingenio satellite

By launching SEOSAT-Ingenio, the first Spanish Earth observation satellite, Arianespace reinforces its relationship with Spain (fifth contributor at ESA) – a country that also is very involved in European launchers program.

SEOSAT-Ingenio is a high-resolution optical imaging mission of Spain – the flagship mission of the Spanish space strategic plan. Its mission is devoted to ensure an even coverage of the areas of national interest, providing a large operational capability in the capture of high-resolution multi-spectral land optical images for numerous user groups, as well as supporting and optimizing the development in Spain of teledetection-based applications in Spain.

The overall mission objective is to provide information for applications in cartography, land use, urban management, water management, environmental monitoring, risk management and security.

With its capability to look sideways, it can access any point on Earth within three days, and will be used to help map natural disasters such as floods, wildfires and earthquakes – as well as help with one of humankind's biggest challenges: understanding and responding to climate change.

SEOSAT-Ingenio will be the 57th mission (79th satellite) to be launched by Arianespace for ESA (ESA/Earth observation programs directorate) at the benefit of Spain's Center for Development of Industrial Technology (CDTI - Centro para el Desarrollo Tecnológico Industrial). INTA, the National Institute of Aerospace Technology (in Torrejon de Ardoz-Madrid) will own and operate the satellite.

The SEOSAT-Ingenio spacecraft is the first built by an industrial consortium of the Spanish space sector companies led by Airbus Defence and Space. SEOSAT-Ingenio will be the 128th Airbus Defence and Space satellite to be launched by Arianespace.

There are currently 20 Airbus Defence and Space satellites in Arianespace's backlog. In addition, Airbus Defence and Space is also involved in the design and manufacturing of the OneWeb satellites to be deployed by Arianespace.

There are seven additional ESA missions (for nine satellites) in the Arianespace backlog.

TARANIS satellite

Arianespace at the service of the French space program with TARANIS, the CNES scientific satellite.

TARANIS (Tool for the Analysis of RAdiation from lightNIng and Sprites), the Celtic god of thunder and lightning, is the first satellite designed to observe luminous, radiative and electromagnetic phenomena occurring at altitudes of 20 to 100 km over thunderstorms.

Discovered 20 years ago, such transient luminous events (TLEs) such as red sprites, blue jets, elves, sprite halos, etc. remain shrouded in mystery. They are sometimes accompanied by terrestrial gamma-ray flashes (TGFs). The correlation between these TLEs and TGFs is one of the scientific questions the TARANIS mission hopes to answer. TLEs has been observed for the first time since the ROCSAT-2 satellite, renamed FORMOSAT-2, the second high-resolution Earth Observation satellite for the Taiwanese National Space Program Office (NSPO), manufactured Airbus Defence and Space.

The TARANIS microsatellite will fly over thousands of TLEs and TGFs for at least four years and will be capable of detecting these events and recording their luminous and radiative signatures at high resolution, as well as the electromagnetic perturbations they set off in Earth's upper atmosphere. The payload includes numerous sensors to observe the TLEs and to perform in-situ measurements of perturbations caused on the local plasma (fields, waves and particles).

The TARANIS mission has three main objectives:

- Advance physical understanding of the links between TLEs (red sprites, blue jets, elves, sprite halos… currently named "Transient Luminous Events") and TGFs (Terrestrial Gamma ray Flashes), in their source regions, and the environmental conditions (lightning activity, variations in the thermal plasma, occurrence of extensive atmospheric shower…).
- Identification of the generation mechanisms for TLEs and TGFs and, in particular, the particle and wave field events, which are involved in the generation processes or which are produced by the generation processes.
- Evaluation of the potential effects of TLEs, TGFs, and bursts of precipitated and accelerated electrons (in particular lightning induced electron precipitation and runaway electron beams) on the Earth atmosphere or on the radiation belts.

TARANIS will be the 18th satellite (including Pleiades satellites) to be launched by Arianespace for CNES as a customer.

TARANIS will be the seventh satellite to be launched by Arianespace for CNES as a manufacturer.

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MISSION DESCRIPTION

The 17th Arianespace Vega launch from the Guiana space center (CSG) will place the satellites into a Sun-Synchronous Orbit (SSO).

The launcher will be carrying a total payload of approximately 1,192 kg.

The launch will be performed from the Vega Launch Complex (ZLV) in Kourou, French Guiana.

DATE AND TIME

Lift-off is scheduled for **Monday, November 16, 2020**, at exactly:

- **08:52 p.m.**, Washington D.C., USA time,
- **10:52 p.m.**, Kourou, French Guiana time,
- **01:52** Universal Time (UTC) on November 17,
- **02:52 a.m.**, Paris, and Madrid time, on November 17.

MISSION DURATION

The nominal mission duration (from lift-off to separation of the satellites) is:

1 hour and 42 minutes.

TARGETED ORBIT FOR SEOSAT-Ingenio

Orbit	Altitude at separation	Inclination
SSO (Sun-synchronous orbit)	APPROX. 670 KM.	98,09 DEGREES

TARGETED ORBIT FOR TARANIS

Orbit	Altitude at separation	Inclination
SSO (Sun-synchronous orbit)	APPROX. 676 KM. Semi major axis: 7054 km.	98,19 DEGREES

THE LAUNCH AT A GLANCE

Following liftoff from the Guiana space center, the powered phase of Vega's first three stages will last seven minutes. After this first phase, the launcher's third stage will separate from the upper composite, which includes the AVUM upper stage, a payload adapter and the satellites. The lower three stages will fall into the sea. The AVUM upper stage will ignite its engine for the first time, operating for about seven minutes, followed by a ballistic phase lasting approximately 37 minutes. The AVUM stage will then reignite its engine for about two minutes, prior to releasing the SEOSAT-Ingenio satellite after the engine is shut down.

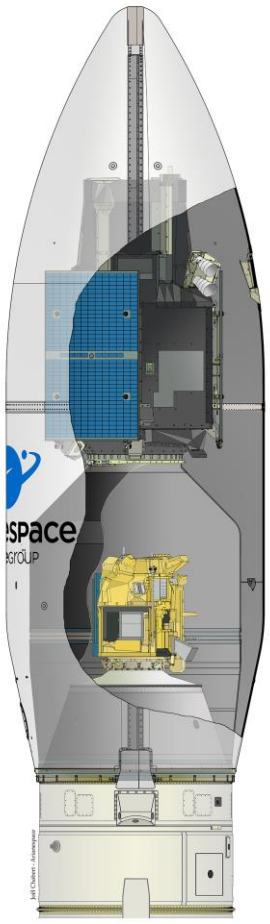
The AVUM upper stage will ignite its engine for the third time, operating for a few seconds, followed by a new ballistic phase lasting approximately 36 minutes. The AVUM stage will then reignite its engine for few seconds, prior to releasing the TARANIS satellite about four minutes after the engine is shut down. The TARANIS satellite will be released at 1 hour and 42 minutes after liftoff.

VEGA PAYLOAD CONFIGURATION

Payload: SEOSAT-Ingenio
Weight at liftoff: 750 kg.

Payload: TARANIS
Weight at liftoff: 175 kg.

> VESPA - Vega Secondary Payload Adaptor (dual launch carrying structure)



SEOSAT-Ingenio SATELLITE

CUSTOMER	**ESA on behalf of CDTI**
PRIME CONTRACTOR	**Airbus Defence and Space**
MISSION	Earth observation
PLATFORM	AstroSat-250
MASS	750 kg
BATTERIES	1 x Li-ion (156 Ah)
PAYLOADS	S-band and X-band
DESIGN LIFE	7 years

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TARANIS SATELLITE

CUSTOMER	**CNES**
PRIME CONTRACTOR	**CNES**
MISSION	Scientific mission
PLATFORM	MYRIADE 200 kg
MASS	175 kg
BATTERIES	80 Li-ion cells (13.5 Ah)
PAYLOADS	S-band and X-band
DESIGN LIFE	4 years

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THE VEGA LAUNCHER

Avio, the production prime contractor, delivers the Vega launcher to Arianespace.

Payload fairing
(RUAG Space)

Payload(s)

Payload adaptor
(Airbus Defence and Space)

AVUM structure
(Airbus Defence and Space)

AVUM integration & testing
(Avio)

AVUM engine
(KB Yuzhnoye)

Interstage - 3/AVUM
(Airbus Defence and Space)

ZEFIRO 9 production, integration & testing
(Avio)

Interstage - 2/3
(Rheinmetall)

ZEFIRO 23 production, integration & testing
(Avio)

Interstage - 1/2
(Airbus Defence and Space)

P80 integration & testing
(Europropulsion)

P80 motor case
(Avio)

Thrust vector control system (P80, Zefiro 9, Zefiro-23 & AVUM)
S.A.B.C.A

Interstage - 0/1
(S.A.B.C.A)

Igniters (P80, Zefiro-9 & Zefiro-23)
APP

P80 nozzle
(ArianeGroup)

Avionics
Thales, IN-SNEC, Selex Avionica, CRISA, RUAG Space, SAFT

LAUNCH CAMPAIGN: VEGA – SEOSAT-Ingenio / TARANIS

SATELLITES AND LAUNCH VEHICLE CAMPAIGN TIMETABLE

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
September 24, 2020	Arrival of the satellites in French Guiana Transfer of the SEOSAT-Ingenio satellite to the S5C payload preparation facility and transfer of the TARANIS satellite to the S5B payload preparation facility	
October 5, 2020		Campaign start review - Transfer of P80 stage
October 8, 2020		Interstage 1/2 integration
October 9, 2020		Z23 integration
October 13, 2020	Fueling operations of the TARANIS satellite	Z9 integration
October 15 and 16, 2020	Fueling operations of the SEOSAT-Ingenio satellite	
October 16, 2020		AVUM integration
October 28, 2020	Integration of the TARANIS satellite on the payload adaptor	
October 29, 2020	Integration of the TARANIS satellite inside the VESPA (Vega Secondary Payload Adaptor) lower part	
October 30, 2020	Integration of the SEOSAT-Ingenio satellite on the VESPA upper part	
November 2, 2020		Synthesis control test
November 4, 2020	Integration of SEOSAT-Ingenio onto the VESPA lower part	
November 6, 2020	Fairing encapsulation	

SATELLITES AND LAUNCH VEHICLE CAMPAIGN FINAL TIMETABLE

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
From Saturday, November 7 to Tuesday, November 10, 2020		Fueling operations for AVUM (Attitude and Vernier Upper Module) and RACS (Roll and Attitude Control Subsystem)
Tuesday, November 10, 2020	Transfer upper part onto PFRCS (Upper Composite Rolling Platform)	
Wednesday, November 11, 2020	Transfer of upper part to the VLZ (Vega Launch Zone)	
Thursday, November 12, 2020	Upper composite integration on the launcher	Functional checks on launcher
Saturday, November 14, 2020		Dress rehearsal Arming of launch vehicle and fairing
Sunday, November 15, 2020		Launch readiness review (LRR), final preparation and inspection of launcher and the fairing
Monday, November 16, 2020		Final launch countdown

COUNTDOWN AND FLIGHT SEQUENCE

The countdown comprises all final preparation steps for the launcher, the satellites and the launch site, including the steps leading up to authorization of P80 first-stage ignition.

TIME		EVENT
- 09 h	10 min	Start of final countdown
- 06 h	25 min	Activation of Multi-Functional Unit (MFU)
- 05 h	55 min	Activation of Inertial Reference System (IRS)
- 05 h	38 min	Activation of telemetry
- 05 h	38 min	Activation of Safeguard Master Unit (SMU)
- 05 h	25 min	Removal of safety devices
- 05 h	05 min	Activation of onboard computer and loading of flight program
- 04 h	50 min	IRS alignment and checks
- 03 h	40 min	Mobile gantry withdrawal (45 min.)
- 02 h	50 min	IRS alignment and checks after withdrawal of gantry
- 01 h	15 min	Activation of the telemetry transmitter after withdrawal of gantry
- 01 h	15 min	Activation of transponders and receptors
- 01 h	05 min	Launcher system ready
- 00 h	10 min	Final weather report prior to launch
- 00 h	04 min	Start of synchronized sequence
T-O		**LIFTOFF**
+ 00 h	02 min	1st stage (P80) separation
+ 00 h	02 min	2nd stage (Zefiro-23) ignition
+ 00 h	04 min	2nd stage (Zefiro-23) separation
+ 00 h	04 min	3rd stage (Zefiro-9) ignition
+ 00 h	04 min	Fairing separation
+ 00 h	07 min	3rd stage (Zefiro-9) separation
+ 00 h	08 min	1st ignition of AVUM
+ 00 h	15 min	1st cut-off of AVUM
+ 00 h	52 min	2nd ignition of AVUM
+ 00 h	54 min	2nd cut-off of AVUM
+ 00 h	54 min	**Separation of SEOSAT-Ingenio**
+ 01 h	01 min	Separation of VESPA upper part
+ 01 h	02 min	3rd ignition of AVUM
+ 01 h	02 min	3rd cut-off of AVUM
+ 01 h	38 min	4th ignition of AVUM
+ 01 h	38 min	4th cut-off of AVUM
+ 01 h	42 min	**Separation of TARANIS**
+ 01 h	52 min	5th ignition of AVUM
+ 01 h	53 min	5th cut-off of AVUM

ARIANESPACE AND THE GUIANA SPACE CENTER

ARIANESPACE, THE EUROPEAN LAUNCH SERVICES COMPANY

Arianespace was founded in 1980 as the world's first commercial launch 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 650 launch contracts and launched more than 740 satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace.

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 Tokyo, Singapore and Washington DC. Arianespace offers launch services of any mass, to any orbit, at any time. These services call on three different 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 Russian cosmodromes in Baikonur and Vostotchny.

> The Vega light-lift launcher, operated from the Guiana space center.

THE GUIANA SPACE CENTER: EUROPE'S SPACEPORT

For more than 50 years, the Guiana cpace center, Europe's spaceport in French Guiana, has offered a complete array of facilities for rocket launches. It comprises primarily the following:

> CNES, the French space agency, including various resources and facilities that are critical to launch base operations, such as radars, the telecom network, weather station, receiving sites for launcher telemetry, etc.

> Payload processing facilities (EPCU), 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. A total of 40 European manufacturers and local companies are involved in launcher operations.

Europe's commitment to independent access to space is based on actions by three key players: the European Space Agency (ESA), CNES, the French space agency, and Arianespace. ESA was 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 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.

CNES 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 Vega, Arianespace supervises the integration and inspection of the launcher constructed by ELV/Avio, the production prime contractor. At the same time, Arianespace coordinates the preparation of satellites in the payload preparation facility (EPCU) operated by CNES/CSG, handles the integration of satellites and preparation of the payload composite up to its transfer on the launcher to the Vega launch zone (ZLV), and also works with ELV/Avio teams in charge of the launcher to conduct the final countdown and launch from Launch Control Center No. 3 (CDL3).

Arianespace deploys a top-flight team and technical facilities to get launchers and satellites ready for launch. Building on this unrivalled expertise and outstanding facilities in French Guiana, Arianespace is the undisputed benchmark in the global launch services market.