LAUNCH KIT

AUGUST 2018

VV12

AEOLUS

esa aeolus cnes

FLIGHT VV12: 1ST VEGA FLIGHT OF THE YEAR TO LAUNCH ESA'S WIND MISSION

For its fifth launch of the year, and the first in 2018 with Vega, Arianespace will orbit the Aeolus satellite, the world's first space mission to acquire profiles of Earth's wind on a global scale, on behalf of the European Space Agency (ESA).

This marks the eighth Earth observation mission conducted by Arianespace for ESA. It will also be the 12th mission of the Vega launcher, which once again is to demonstrate its versatility and perfect adaptation to European missions dedicated to Earth observation.

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Aeolus mission

ESA's Aeolus satellite will be equipped with a single instrument: a Doppler wind lidar called Aladin - an advanced laser system designed to timely and accurately measure global wind-profiles from space. Aeolus will probe the atmosphere with pioneering ultraviolet laser pulses, which will enhance the understanding of tropical dynamics and processes relevant to climate variability.

This mission will thus provide much-needed data to improve the quality of weather forecasting as well as contributing to long-term climate research.

For Aeolus prime contractor Airbus Defence and Space, this missions involves its 120th satellite built for launch by Arianespace, while 20 Airbus spacecraft remain in Arianespace's backlog of payloads to be launched.

Arianespace at the service of Europe's institutional missions

There are several additional ESA missions in the Arianespace backlog, among which: BepiColombo, Europe's first mission to the planet Mercury, which will lift off on Ariane 5 in October 2018; the James Webb Space Telescope also on Ariane 5; and CHEOPS on Soyuz.

The Aeolus mission is the embodiment of a long-standing relationship between ESA and Arianespace. Indeed, Flight VV12 will be the 50th mission to be launched by Arianespace for the intergovernmental organization, guaranteeing independent and reliable access to space for Europe and benefitting the world's citizens through space investments.

Vega launcher

After the launch of Aeolus, Arianespace's backlog will comprise nine more missions for Vega and Vega C; one-third are for European institutions and two-thirds are for export customers, clearly confirming the validity of its launch services offering for satellites in the under 1.5-metric-ton class.

The development of Vega C launch vehicle (an ESA program which will be exploited by Arianespace) - which is an upgraded version of the current Vega launcher - is proceeding on schedule, with a first mission planned as soon as 2019.

Between June and September 2017, the first three launch contracts were booked for this lightweight vehicle with both commercial and institutional customers. Compared with the current version, Vega C will offer higher performance in terms of payload capacity (weight and volume), along with the operational flexibility to handle an even larger variety of missions (from nanosatellites to large optical and radar observation satellites), which will further boost the competitiveness of Arianespace's launch services.

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MISSION DESCRIPTION

The 12th Arianespace Vega launch from the Guiana Space Center (CSG) will place its satellite passenger into a Sun-synchronous orbit (SSO).
The launcher will be carrying a total payload of approximately 1,436 kg.

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

DATE AND TIME

Liftoff is scheduled for **Tuesday, August 21, 2018**, at exactly:

- **05:20:09 p.m.,** Washington, D.C. time
- **06:20:09 p.m.,** local time in French Guiana
- **21:20:09,** Universal Time (UTC)
- **11:20:09 p.m.**, Paris time

MISSION DURATION

The nominal mission duration (from liftoff to separation of the satellite) is:
54 minutes, 57 seconds.

TARGETED ORBIT

Orbit	Altitude at separation	Inclination
SSO (Sun-synchronous orbit)	Approx. 320 km. Semi major axis: 6,686 km.	96.7 degrees

THE LAUNCH AT A GLANCE

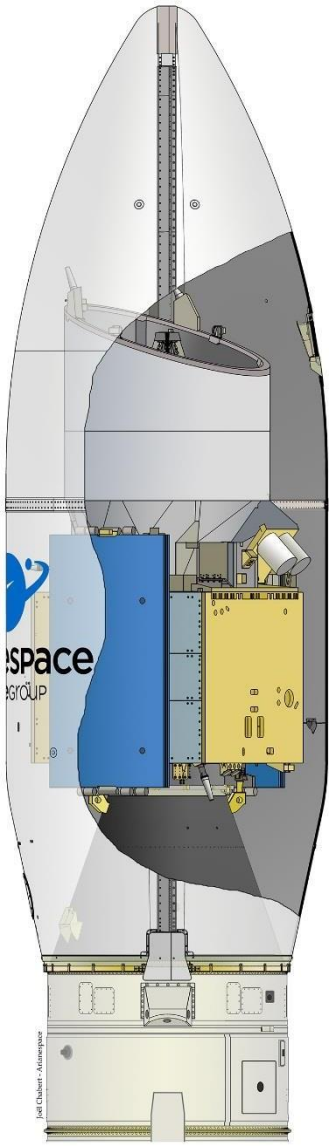
Following liftoff from the Guiana Space Center, the powered phase of Vega's first three stages will last 6 minutes and 30 seconds. After this first phase, the launcher's third stage will separate from the upper composite, which includes the AVUM upper stage, a payload adapter and the satellite. The lower three stages will fall back into the sea.

The AVUM upper stage will ignite its engine for the first time, operating for about eight minutes, followed by a ballistic phase lasting approximately 36 minutes. The AVUM stage will then reignite its engine for about 23 seconds, prior to releasing the Aeolus satellite about one minute and a half after the engine is shut down.

The Aeolus satellite will be released 54 minutes and 57 seconds after liftoff.

VEGA PAYLOAD CONFIGURATION

- **Payload (CU): Aeolus**
  Mass at liftoff: 1,357 kg.
- **Vega payload adapter**
  Mass at liftoff: approximately 77 kg.



THE AEOLUS SATELLITE

CUSTOMER	European Space Agency (ESA)
PRIME CONTRACTOR	Airbus Defence and Space
MISSION	Earth observation
PLATFORM	Based on Mars Express design
MASS	Total mass at launch: 1,357 kg.
STABILIZATION	3 axis
DIMENSIONS	4.00 m x 4.35 m x 1.6 m
TARGETED ORBIT	Sun-synchronous, at an altitude of approximately 320 km.
DESIGN LIFE	Three years operational, three months of commissioning

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THE VEGA LAUNCHER

AVIO – the production prime contractor – delivers the Vega launcher to Arianespace.

Payload faring
(RUAG Space)

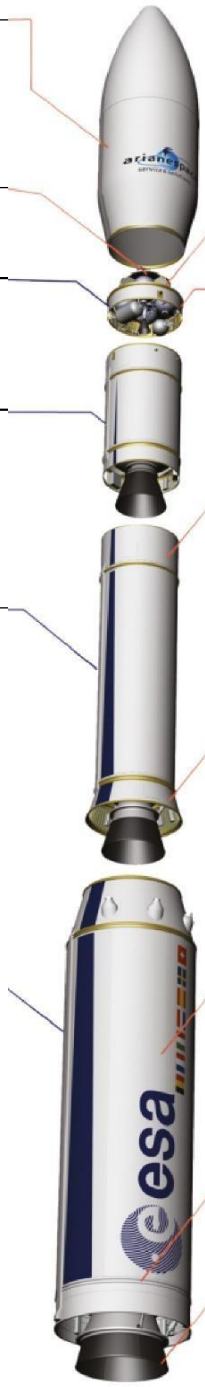
Payload adapter
(Airbus Spain)

Integration and testing
(Avio)
AVUM

Production, integration and testing
(Avio)
ZEFIRO-9

Production, integration and testing
(Avio)
ZEFIRO-23

Integration and testing
(Avio)
P80



AVUM structure
(Airbus)

AVUM engine
(KB Yuzhnoye)

Interstage - 2/3
(Rheinmetall)

Interstage - 1/2
(Airbus)

P80 engine
(Europropulsion)

Interstage - 0/1
(SABCA)

P80 nozzle
(ArianeGroup)

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

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

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

LAUNCH CAMPAIGN VEGA – AEOLUS

SATELLITE AND LAUNCH VEHICLE CAMPAIGN CALENDAR

DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
June 28, 2018	Arrival in French Guiana of Aeolus at Degrad des Cannes Seaport (Cayenne) and transfer to S5B	
July 4, 2018		Campaign start review - Transfer of P80 stage
July 5, 2018	Start of electrical checks	
July 12, 2018		Interstage 1/2 integration
July 13, 2018		Z23 Integration
July 16, 2018		Z9 integration
July 24, 2018		AVUM integration
July 26 and 27, 2018	Aeolus fueling operations	
August 2 to 7, 2018	The assembled payload is encapsulated in Vega's payload fairing	
August 4, 2018		Synthesis control test

SATELLITE AND LAUNCH VEHICLE CAMPAIGN FINAL CALENDAR

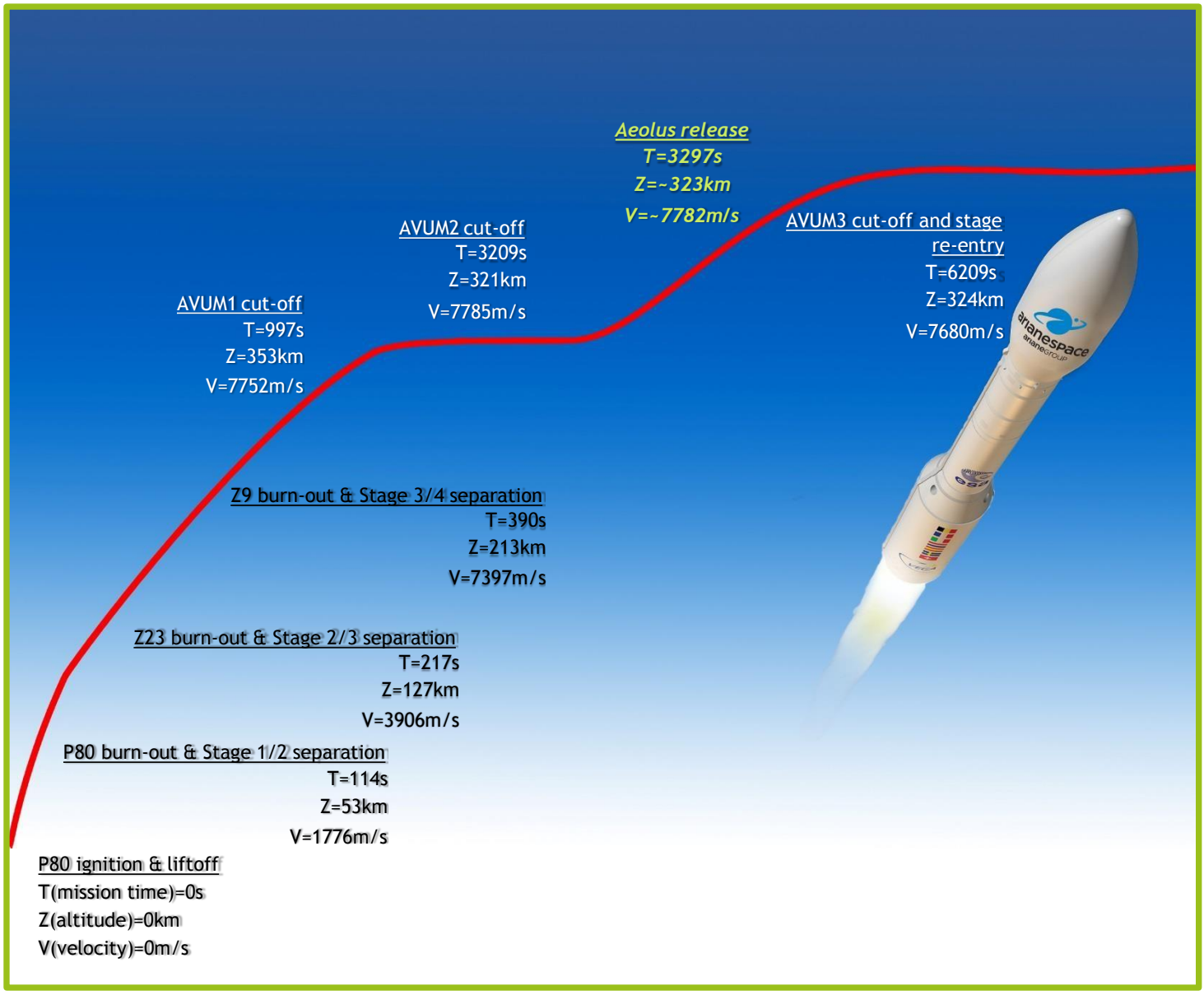
DATE	SATELLITE ACTIVITIES	LAUNCH VEHICLE ACTIVITIES
Thursday, August 9, 2018	Transfer of upper composite to SLV (Vega Launch Site)	
Friday, August 10, 2018	Upper composite integration on the launcher	
Monday, August 13 to Thursday August 16, 2018		Fueling operations for AVUM and RACS (Roll and Attitude Control Subsystem)
Friday, August 17, 2018		AVUM final preparation and rehearsal Arming of launch vehicle (except P80 stage) and fairing
Saturday, August 18, 2018		Arming of P80 stage and final preparation of launcher Final inspection of the fairing
Monday, August 20, 2018		Launch readiness review (RAL), final preparation of launcher
Tuesday, August 21, 2018		Final launch countdown

COUNTDOWN AND FLIGHT SEQUENCE

The countdown comprises all final preparation steps for the launcher, the satellite 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	00 min		Activation of Multi-Functional Unit (MFU)
- 05 h	40 min		Activation of Inertial Reference System (IRS) Activation of telemetry
- 05 h	10 min		Activation of Safeguard Master Unit (SMU)
- 04 h	50 min		Removal of safety devices
- 04 h	40 min		Activation of onboard computer and loading of flight program
- 04 h	30 min		IRS alignment and checks
- 03 h	15 min		Mobile gantry withdrawal (45 min.)
- 02 h	25 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
- 00 h	50 min		Launcher system ready
- 00 h	10 min		Final weather report prior to launch
- 00 h	04 min		Start of synchronized sequence
T-0		**00 s**	**LIFTOFF**
+ 00 h	01 min	54 s	1st stage (P80) separation 2nd stage (Zefiro-23) ignition
+ 00 h	03 min	37 s	2nd stage (Zefiro-23) separation
+ 00 h	03 min	51 s	3rd stage (Zefiro-9) ignition
+ 00 h	03 min	56 s	Fairing separation
+ 00 h	06 min	30 s	3rd stage (Zefiro-9) separation
+ 00 h	08 min	03 s	1st ignition of AVUM
+ 00 h	16 min	37 s	1st cut-off of AVUM
+ 00 h	53 min	06 s	2nd ignition of AVUM
+ 00 h	53 min	29 s	2nd cut-off of AVUM
+ 00 h	54 min	57 s	Separation of Aeolus

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 17 other shareholders from the European launcher industry.

Since the outset, Arianespace has signed over 530 launch contracts and launched 570-plus satellites. More than half of the commercial satellites now in service around the globe were launched by Arianespace. The company posted sales of approximately 1.3 billion euros in 2017.

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 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 700 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 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 participating 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 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 also is 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 implemented by 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 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.