

VEGA SSMS HEX Module – Aggregation and Integration from EU to French Guiana

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ABSTRACT

The paper describes the SSMS HEX Module Integration for the VEGA SSMS POC Flight. The integration, together with the aggregation of all the nano and picosatellites, took place in different European facilities between Europe and French Guiana. Among them, the SAB Aerospace facility in Brno played a fundamental role in the process. Indeed, all populated deployers have been integrated on the SSMS HEX Module in Brno. During the HEX Module integration, preliminary electrical checks for the satellites release have been performed. Finally, the finalization of the HEX Module has been performed in French Guiana at the Centre Spatial Guyanais in Kourou (CSG) before the final integration between the SSMS Upper Part and SSMS Lower Part.

1 INTRODUCTION

VEGA SSMS (*Small Spacecraft Mission Service*) is the first European ride-share mission carried out on the 18th of June 2020. The SSMS PoC (Proof-of-Concept) Flight is able to aggregate in a single launcher 7 microsattellites and up to 45 CubeSats (nano-and-picosatellites) for a total of 52 satellites. The SSMS Dispenser is conceived as a fully modular system, which enables finalization of mission architecture until advanced phases of the launch campaign have been completed. The 7 microsattellites are accommodated on the Upper Part of the SSMS Dispenser. Besides, the 45 CubeSats are hosted on the so-called SSMS HEXagonal Module, which is located in the Lower Part of the SSMS Dispenser.

In order to shorten the integration time and to have the possibility to work in parallel with the integration of the satellites also in different locations, it has been decided to design the dispenser in such a way that the upper and lower part can be integrated and transported separately with dedicated transport containers.

2 SSMS DISPENSER

The SSMS Dispenser is the hardware developed to optimize multiple small satellite missions on VEGA and VEGA-C. The SSMS Dispenser is a modular structure which can be flexibly configured in order to be adapted to the specific satellite aggregate.

The SSMS dispenser coupled with the VEGA AVUM (Attitude Vernier Upper Module) provides maximum flexibility for rideshare missions, allowing multiple satellite releases in different orbits with different altitudes and/or some inclination change.

3 VEGA SSMS POC FLIGHT

The VEGA SSMS PoC Flight Launch Campaign, for the first time with respect to previous VEGA missions, is partially carried out in Europe as part of the SSMS Proof of Concept goals. All the cubesat/deployers assemblies are integrated onto the lower part of the SSMS dispenser at the SAB Aerospace facility located in Brno (The Czech Republic) under responsibility of SAB Launch Services (SAB-LS), which is also in charge to aggregate part of Institutional CubeSats.

4 PAYLOAD INTEGRATION IN EU

Before the handling of the populated deployers, the SSMS HEX Module is fixed on a dedicated integration stand in a cleanroom equipped with lifting crane in ISO 8 environment.

In order to perform CubeSats Aggregation and Integration into the deployers, SAB-LS provides several private areas to its customers to perform stand-alone operations on their satellites.

All the remaining deployers are delivered to SAB-LS, already populated with Cubesats, for an integration flow of operations lasting maximum two weeks, hereafter reported.

After standard mechanical and electrical fit checks, the Cubesat deployers according to their dimensions are handled and lifted by a crane to be moved close to their dedicated interface on the SSMS HEX Module panels. From inside the hexagonal module, an operator connects the screws with the interface holes in the deployer base plate thanks to the thru-holes inserts on the panel. As needed a dedicated adapter plate is used to connect the deployer to interface holes.

Each panel of the SSMS HEX Module can accommodate up to two 12U-type deployers. The integration flow foresees installation of all deployers on the module by using the crane, but in case of need accessibility to the lower position and dismounting of the deployer is guaranteed until five days before the launch.

The SSMS HEX Module fully integrated is stored in a dedicated transport container equipped with specific shock absorber and devices for environmental parameters control and then shipped to the Centre Spatial Guyanais (CSG) by a commercial flight. Safety was guaranteed in compliance of IATA regulations. SAB-LS verifies that each CubeSat integrated on SSMS HEX Module uses batteries compliant with the required limits.

At CSG, the European Space Port, the last preflight operations are carried out.

After finalization, the SSMS HEX Module fully equipped is mated with the SSMS Upper Part, on which the 7 microsatellites have been mounted.

5 FINALIZATION IN CSG

The SSMS Workflow foresees that the dispenser upper part is shipped (after Acceptance Review) by boat to CSG, while the Hexagonal module remains in the SAB European Facility in Brno (The Czech Republic) to integrate the Nanosatellite Deployers onto it.

All the deployers are delivered by Arianespace to SAB-LS already populated with CubeSats and the payload integration is performed in two weeks.

The stack composed by SSMS HEX Module, deployers and sequencers will be then stored in a dedicated transport container equipped with specific shock absorber and devices for environmental parameter control and then shipped to CSG by a commercial Airfrance flight.

The launch campaign is then finalized in CSG where the last preflight operations are carried out between L-20d and L-8d. Among them:

- Sequencer checks
- Sequencer batteries charging
- Deployers flight preparation
- HDRM setting
- RBF removal
- ABF application

6 CONCLUSIONS

The first SSMS HEX Module integration at SAB facility in Brno can be considered a success. Collaboration among SAB, Arianespace, CNES and ESA proved a consolidated experience for further integrations of payloads in EU. However, there are some points which can be implemented. In particular, the next missions foreseen a smarter schedule with the beginning of all operations fixed approximately at L-6w. It provides more time for the customers' schedule and for a better internal organization. Moreover, new procedures and paperwork shall enable an optimized process from customs for non-EU satellites that have to be integrate in customs bonded area. Finally, new areas and a better security system are going to be developed at SAB facility to provide accommodations and security to the customers' and their satellites.

These new aspects should be available already for the next HEX Module integration, foreseen in September 2020.

7 REFERENCES

[1] Caramelli et al., *The first ride-share mission flight*, 33rd Annual AIAA/USU Conference on Small Satellites