SwissCube Space Center EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

No 2 **December 2008** **1/1**

Newsletter

Project NEWS

Maurice Borgeaud

Muriel Noca

SwissCube satellite tested extensively

A lot of things happened in the SwissCube project since the last newsletter!! First, the newsletter No1 announced our selection on the ESA-VEGA launch vehicle. At the end of the summer, two other pieces of news came up: the VEGA launch is delayed till the end of 2009… but, there is a new opportunity to fly on the Indian launch vehicle PSLV in the spring 2009! Well, the decision had to be quick and we made it: we will launch SwissCube aboard PSLV and maybe the twin of SwissCube on VEGA later on!

While doing the paperwork to send our satellite to India, the team assembled and tested the satellite qualification model. This model, a twin of the satellite that will fly in space, has gone through what is called the qualification test campaign. During this campaign, the satellite was tested in conditions that simulate the launch vibrations and shock, that simulates the cycles of eclipse/daylight, and finally that simulates the radio telecommunication between space and the ground station antennas. This campaign happened in October and November and kept us on our toes… you can see the test results in the following pages…

SwissCube qualification model

SwissCube Space Center EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

No 2 **December 2008** **2/2**

Newsletter

Project NEWS

(continued…)

The team also assembled in November the satellite flight model and started testing it in December. Busy times! But rewarding…

Be ready to receive your invitation to the launch ceremony at EPFL or in the partner universities! It will be here before we know it!

Indian PSLV launch vehicle

New Gold Sponsor

BOBST Group has decided to join the sponsor partners by becoming a Gold Sponsor of SwissCube. Welcome to this new partner!

BOBST GROUP

Electronics Corner

Fabien Jordan

Nicolas Steiner

Testing the satellite under vacuum and thermal conditions and through EMC

SwissCube went through the Thermal Vacuum Cycling test at the University of Bern (department of Physics and Planetary Sciences). These tests simulate the environment that SwissCube will see in space. To the very high vacuum (10^{-6} mbars), strong thermal cycles are applied to the satellite (-55 to + 70 ^{o}C), which makes it a very strenuous environment to survive.

Testing had to be stopped twice, once due to problems with the test equipment and once due to a problem on the satellite. Both instances were resolved rapidly (on week-ends - thanks to our great team and engineers!) and testing could resume. The satellite survived the last cycles and the antenna deployment test with brio. We especially thank the University of Bern for their support.

The SwissCube qualification model was then taken into an anechoic chamber to perform electromagnetic compatibility (EMC) tests. The aim of the EMC test is to characterize the electromagnetic radiation of the satellite when working in the different modes. Results are very encouraging! Except at the emission frequency, the satellite is emitting very low electromagnetic radiations, which means that it won't be perturbing other systems. The SwissCube team would like to thank Montena for their support to our project and for having given us the opportunity to perform EMC tests.

Test chamber at Uni Bern with SwissCube.

EMC testing at Montena, the small dot on the wooden table is SwissCube…

Mechanical Corner

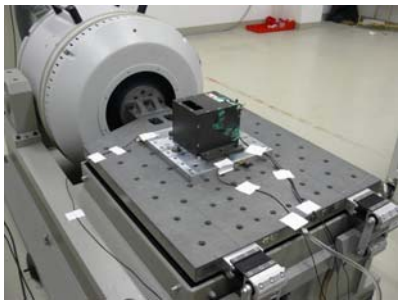
Guillaume Roethlisberger

SwissCube undergoes vibration and pyroshock testing

SwissCube went to Berlin early October at Astro-Feinwerktechnik/DLR facilities to undergo vibration and pyroshock tests. These tests aim at simulating the launch vehicle environment. The satellite went through sinusoidal and random vibrations and responded “alive and perfectly operational” after. It then went through very strong pyroshocks (more than required by our launch vehicle). No defects could be seen, and we were happy to receive again a strong and healthy signal after these impressive gun shots! Many thanks to RUAG-Aerospace which organized and financed these tests!

We are now lining up for similar, but less demanding, tests on the flight model.

SwissCube in the same black box is receiving gun shots (pyroshocks) to ensure it will survive the shocks created by the separation of the different stages of the launch vehicle.



Vibration test facility. SwissCube is inside the black box…

Telecom Corner

Ted Choueiri

Ground to satellite tests in Fribourg

The next step was to perform an end-to-end communication test, meaning a test where the whole chain of communication was checked. This test happened in Fribourg with the satellite on one side of Fribourg and remotely controlled by the (new) ground station on the other side of Fribourg. This way, the mission control software, ground station software, ground antennas, RF path, and communication system on the satellite were utilized.

Attenuators were used on the ground station side to simulate the effective path losses between the ground station and the satellite once in space. The results were very positive, and the whole communication thread was validated. We thank the HES of Fribourg, the HES-ARC and the IMT at the University of Neuchâtel for their great effort that made this test a success.

The power consumption of the COM board was lowered to 1 A (instead of 1.5 A) while keeping the output power at 29-30 dBm. A new software is being developed to receive and decode the CW beacon. Hopefully it will be more effective than MixW (currently used). As for the ground station in Lausanne, it will be finalized at the beginning of February. All helping hands will be welcome!

Fribourg's new ground station antennas.

The telecom team is helped by the amateur radio community, especially the RAV club (Club des Radio Amateurs Vaudois) that has made the design of the EPFL ground station.

Software Corner

Florian George

Five – Four - Three- Two – One – Zero: start satellite!

This is how the test procedure for the satellite starts: with a count-down. The chronometer and satellite "kill-switches" are simultaneously activated by an operator and from this point on, all is handled by the ground and flight software.

Typical satellite missions have complex support software, which is especially developed to test the satellite on the ground. Part of that software is then utilized for mission operations with the satellite in space. In a small project like SwissCube, the same ground software was developed (from scratch) to address the needs of ground testing and of mission operations. This facilitates the training for mission operations and ensures a better reliability between the tests and mission operations.

The ground software is installed on a virtual machine on a single laptop. It will, by demand of an operator, code a command in an ESA compatible protocol, then send it to the ground station modem, which transmits the signal via RF (radio frequency, similar to your car radio). The satellite receives it via its antennas and executes the command. But before that it will send an acknowledgement that the command was correctly received. The command will then be decoded and interpreted by the flight software before being executed.

This whole chain of software interfaces was validated during the qualification test campaign. It turned out to be very robust and reliable.

See the little window on top with all green dots? These green dots are acknowledgements that telecommands were received correctly. This picture was taken a few minutes after the first communication with the satellite entirely at -55°C…

Telescope Corner

Noémy Scheidegger

Calibration and testing of the telescope

The qualification tests for the payload were focused on the robustness of its opto-mechanical configuration: the relative distances between the lenses and the detector have a significant impact on the resolution and the field of view of this little camera. If the variation of the position of one lens with respect to another is too big, the images that will be captured with the payload will be blurred. It is therefore of prime importance that the displacement of the lenses and the detector due to vibrations and thermal cycling is limited.

The resolution and field of view of the payload were verified prior and after each test sequence. No degradation in the performance of the payload could be observed and the camera therefore successfully passed the qualification campaign.

Telescope and electronic board.

Noémy during the optical alignment tests.

Thanks to a special partnership with Oerlikon Space, Noémy can continue the work on the SwissCube telescope as part of her job. The experience gained through this project is a valuable asset and an efficient edification to space projects.

Contact

SwissCube Project
EPFL Space Center
ELD013, Station 11
CH-1015 Lausanne
Tel: 021 693 6948
Fax: 021 693 6940
www.swisscube.epfl.ch

Academic Partners

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

EPFL LMTS Laboratoire des microsystèmes pour les technologies spatiales	Space Center	LMAF	Laboratoire d'Automatique	LMIS3
LCSM Laboratoire de Conception de Systèmes Mécaniques	ELECTRONICS LABORATORY leg	LTEM	Lema Laboratoire d'Electromagnétisme et d'Acoustique	LTC
LAI	lap AQUA	LPM		

Hes·so and n|w Fachhochschule Nordwestschweiz

HEVs	heig-vd Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud	haute école neuchâtel berne jura arc	Ecole d'ingénieurs et d'architectes de Fribourg Hochschule für Technik und Architektur Freiburg

Université de Neuchâtel unine

ESPLAB

Sponsoring Partners

Golden Exclusive

Contribution above 50'000 CHF

SCHWEIZERISCHE EIDGENOSSENSCHAFT
CONFÉDÉRATION SUISSE
CONFEDERAZIONE SVIZZERA
CONFEDERAZIUN SVIZRA
SWISS CONFEDERATION
State Secretariat for Education and Research
Swiss Space Office

RUAG
Aerospace Defence Technology

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Loterie Romande

Golden Pass

Contribution from 10'000 to 49'999 CHF

VILLE DU LOCLE

EADS astrium

oerlikon space

BOBST GROUP

Tantalum Pass

Contribution from 2'000 to 9'999 CHF

BIBUS METALS – SUPPORTING YOUR SUCCESS

OMNETICS CONNECTOR CORPORATION

metallica – Un pour tous ... les métaux

P. NIKLAUS SA

FILTROP AG

SCHOTT – glass made of ideas

dynatec

montena – montena emc sa

NosakiIS – Information Systems

photochemie – hightech solutions

ISIS