

## **The NIMPH Project**

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The next generation of telecommunication satellites operating in the Ku and Ka bands consider radio over optical fibre (RoF) technologies as a good candidate for the future flexible payloads. During the last 10 years CNES has supported the evaluation of optical components for spatial requirements. At present, experimental feedback in real environment would accelerate the introduction of RoF technologies for spatial needs. It is in this context that Thales Alenia Space and CNES offered the opportunity to the students of Toulouse University to realize a nanosatellite dedicated to the orbital test of a RoF transmission. This 2 years old ongoing project is entitled: Nanosatellite to Investigate Microwave Photonics (NIMPH).

More precisely, the scientific objective of this project is to setup, to launch and monitor a 3U nanosatellite with an on board opto-microwave payload dedicated to the measurement of erbium doped fibre degradation exposed to spatial radiations. The two years mission length and the low orbital trajectory (between 300 to 1500 km altitude) are increasing the challenge represented by this initiative. Indeed, the low radiation dose exposure (10 krad during two years) requires the build-up of a measurement architecture which is sensitive enough to the low gain and noise figure degradation of erbium doped fibre (~1 dB). Measured data will be sent to a terrestrial radio station. Moreover, harsh environmental conditions and spatial law require a strict design of the payload responding to spatial reliability requirements. However scientific overbid in the payload design could endanger the success of the whole project. Even if this project allows a very good opportunity to promote the new technology, the nanosatellite resources allocated to the erbium fibre aging test are low: few hundreds grams of mass, few watts (~7 W) of power consumption and telemetry low bandwidth rate. These limitations will reduce the scope of the experimentation however as an educational project they are very challenging. Indeed, the nanosatellite project NIMPH represents a unique opportunity and a modern educational instrument to attract and retain students in the science, technology and engineering disciplines. At present the students involved come from MSc AeSS (Aerospace and Space Systems), Supaero's Engineers (french « Grandes Ecoles ») of ISAE and MSc ESET (Electronic of Embedded Systems and Telecommunication) from Paul-Sabatier University in Toulouse. The realization of this project embraces numerous scientific skills ranging from electronics, photonics, mechanics to radio communication, computer science and spatial mission handling.