

## A NEW ERA OF HIGHLY MINIATURIZED SPACE TECHNOLOGIES, ALLOWING TO DEVELOP HIGH PERFORMING, LIGHT AND AFFORDABLE EARTH OBSERVATION MISSIONS

E SAVARIA<sup>1</sup>

(1) Alcatel Alenia Space, Cannes -la-Bocca, France.

For many years Alcatel Alenia Space has been developing multi-mission concept of satellites for Low Earth Orbit (LEO) scientific or observation applications. These developments led to several families of platforms, today flight proven, offering real recurrent solutions for a wide range of payloads, experimental or operational missions.

These "Off-The-Shelf" products allow to provide optimized solutions, in term of cost, performance, lifetime, development schedule, and risk mitigation. It ranges from low-cost, basic operational performances and light satellites, up to high reliability, high performance systems.

Otherwise, the most recent technological developments in space optical instrumentation, for instance for the french Pléiades instrument, led to provide a set of qualified elementary bricks allowing to define highly integrated and miniaturized high performance cameras and payloads.

The combination of both multi-mission new generation platforms and high performance miniaturized instruments give the capability to accurately adapt these solutions to customer needs in the field of High Resolution Earth Observation, either optical or Radar, and Hyperspectral as well, for environmental monitoring purposes, national security or cartography applications.

The paper illustrates this approach with different families of products, and the performances they provide :

- Proteus : High performance platform (agile, fully redounded), small class satellite (< 500kg), reducing the launch cost. This platform has demonstrated 3 years of nominal life in orbit, and the manufacturing of 5 others satellites is currently in progress, to be launch in the next months, and accommodating various missions like radar altimetry (JASON 2), astronomy (COROT), environment monitoring (SMOS), ...
- Myriade : Light solution (satellite < 150kg), low cost, high performance (large pointing capability, high reliability) platform. 6 satellites based on Myriade are presently flying, cumulating more than 90 months of operations in orbit, as per the end of 2005. They embark various missions concerning scientific measurements (Demeter), military RF signal demonstration, atmosphere observation (PARASOL). Many others mission are in preparation for Earth Observation (SPIRALE), astronomy (PICARD), ...
- An highly integrated and light High Resolution camera, based on recurrent design, technology and equipment from Pléiades, easy to accommodate on the Proteus and Myriade platforms
- Radar instruments derived from Sar-Lupé equipment and gaining benefits from the Cosmo-Skymed program
- Hyperspectral new generation cameras allowing to provide High spatial resolution hyperspectral data.

The latest technological developments in miniaturized electronics, leading to highly integrated instruments, plus an optimized set of requirements at system level, taking benefit of recent on-ground image processing, lead to very light high performing payloads. This miniaturization triggers a "snow ball effect" at all levels of the satellite :

- These payload require less electrical power, then smaller solar arrays on the platform, smaller battery, ...
- Less thermal dissipation,
- Satellite mass and inertia are reduced, leading to smaller reaction wheels for the attitude control, higher satellite agility,
- Smaller propulsion sub-system,
- etc

Finally, in ten years, the same Earth Observation missions can be accommodated aboard ten times smaller satellites, with the same reliability figures and the same life-time design.

On-ground such light satellites require smaller facilities for Assembly, Integration and Testing.

After a presentation of these products, the system level performances and accessible applications are discussed, for different domains :

Optical Earth Observation, from Medium to High resolution,

Radar Earth Observation, operational missions aboard light and low cost satellites,

Hyperspectral Observation, High resolution available for demonstration or operational missions.

Applications developed by Alcatel Alenia Space will be presented in urban monitoring field, HR cartography, risk management, environment monitoring and national security, with a particular focus on the potential benefit of fusion of these new generation sensors.