CENTRE NATIONAL D'ÉTUDES SPATIALES

RISTRETTO

A French Space Agency Initiative for Student Satellite in Open Source and International Cooperation

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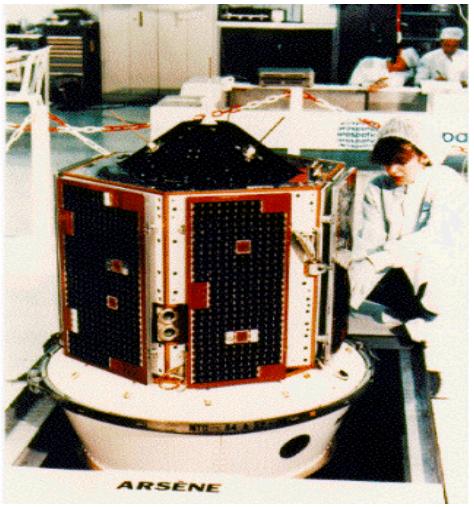
Outline

- Background of the French Student Space Projects
- EXPRESSO
- RISTRETTO
  - *Feasibility studies*
  - *Program organisation*
- Conclusion

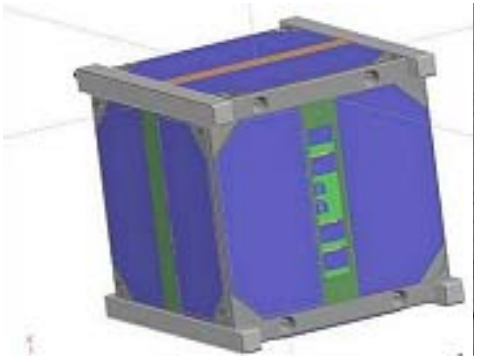
Background of the French Student Space Projects

- **French Universities**
  - Theoretical studies are promoted over other studies
  - Intensive programs are not really suitable for long projects involving lots of students
- **Few space projects**
  - 2 main French Student Projects
    - → SARA launched in 1991 (Astronomy Radio ham Satellite)
    - → ARSENE launched in 1993 (Telecommunications radio ham satellite)
- **A fresh wave**
  - Student interest in Space is growing up
    - → New Engineering Schools specialized in Space field
    - → French students take part of European projects
  - Universities start to be eager to follow the move
    - → Trying to adapt their programs



EXPRESSO

ROBUSTA cubesat



- **EXPRESSO label evokes :**
  - **Quickly done**
  - **Concentrated**
  - **Strong taste**
- **The project drivers**
  - **Stimulate students interest in space field**
  - **Lead on cooperation between universities**
  - **Providing support on projects (e.g. from CNES experts)**
- **Outcome**
  - **Ignited by CNES in 2006, with a first call for ideas**
  - **3 projects selected among 10 : PLAGE / PARAPOM / ROBUSTA**
    - → ROBUSTA cubesat (Radiation on Bipolar for University Satellite Test Application) developed by Montpellier University
    - → ROBUSTA launch is scheduled for Oct. 2010 on the new European VEGA rocket

**EXperimentations et Projets Etudiants dans le domaine des SystèmeS Orbitaux*
TR : Student Projects & Experimentations in Space Systems Field

EXPRESSO 2 - RISTRETTO

Labeled RISTRETTO to be in tune with EXPRESSO program

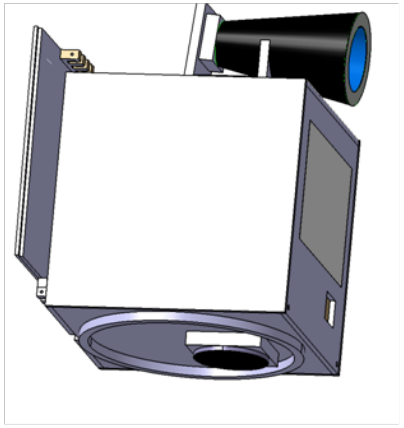
- **RISTRETTO guidelines**
  - **Develop a line of satellites (using the “same” bus)**
  - **Be able to perform the largest range of mission**
  - **High payload capacity to allow ambitious missions (technological demonstrators as well as scientific missions or application)**
  - **Cooperation of French and international universities**
  - **Making it in “Open Source”**
  - **Important use of COTS**

***RISTRETTO : Réseau International de SysTèmes oRbitaux ETudiants basés sur une Technique de développement en Open source**

RISTRETTO - *Feasibility studies*

Mission analysis showed that

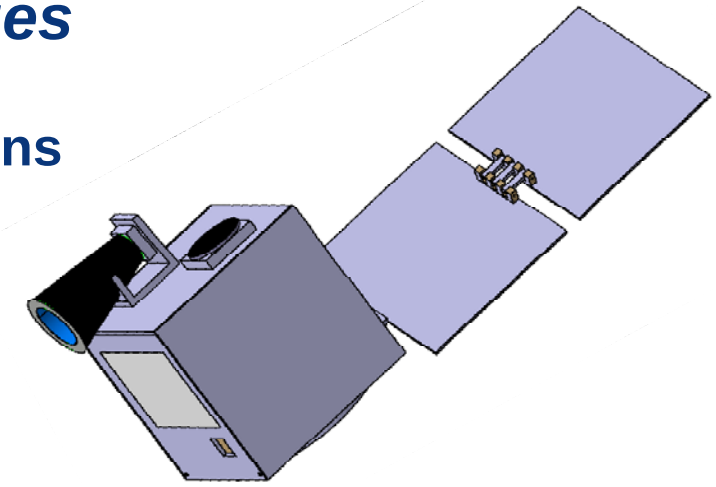
- **There are potential interesting missions for a family of satellites in the 30kg, 30W, 30L range**
  - **Demonstration/Qualification of new technical solution**
    - → Components (e.g. thin films cells)
    - → Equipment (e.g. sensors, multi-spectral cameras)
    - → Subsystems (e.g. micro propulsion, solar veil)
  - **Scientific missions in astronomy, earth study…**
    - → Measure of space environment (plasma , radiations, CO2, magnetic field measurement)
  - **Applications**
    - → Telecommunication, mobiles localisation,…
    - → Earth observation (ground surface, atmosphere, waters, infrared detection, …)



What could be feasible

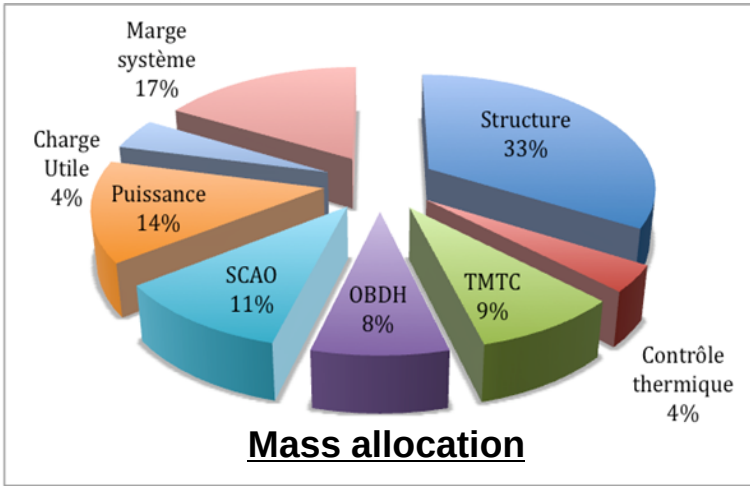
- In about 3 years in universities context
- With a light cost (about 400 K€ for the bus)

RISTRETTO - *Feasibility studies*



Satellite bus preliminary specifications

- Orbit : LEO, GTO
- Life duration : > 1 year
- Satellite mass : ~ 30kg / payload ~ 5kg
- Volume : ~ 30 L
- **Power Capacity : 30 W** / payload > 5W
- **Use of Orientated Solar Array** System (SADM)
- **3 axes stabilized**, high pointing accuracy
  - → **use of a star tracker** & reaction wheels
- End of life de-orbitation possible (with **propulsion system** based on liquefied butane)
- TT&C : S-band with patch antennas on board



Mass allocation

Those specification have been validated through various studies but remain to be decided with partners ready to contribute to the design and development of RISTRETTO

RISTRETTO - *Feasibility studies*

- **Open source**
  - **Well adapted to study and development in university frame**
  - **Technologies not freely available must be excluded**
  - **RISTRETTO generic bus to be made available in open source once developed and validated**

    in each reuse, any modification, improvement of the bus would be put available in similar conditions (i.e. Open source) than the original RISTRETTO to the space community

Chart of open source has to be defined and validated (software like principle)

- **Launch**
  - **Compatible with most launchers as secondary payload or prime passenger**
  - **Adapter to be developed**
  - **Launch campaign of reduced duration (tbd), for example no assembly on pad, just fueling and final check, …**

RISTRETTO - *Final technical specifications and solution*

- The previous studies already result from Student Projects since 2007
  - **VIMANA** project, study on a satellite with a radiative environment payload in GTO orbit by a student team from IPSA high school in Paris
  - **3CSAT** project, study on missions analysis and needs specifications by a team from ISAE high school in Toulouse.
  - Study on **Open Source** by a student from Paris university specialized on law studies
  - **OPUS-30 project,** Study on electrical power and propulsion subsystems by a student team from Ecole des Mines de Douai (North of France)
  - **RISTRETTO phase 0** analysis by two CNES trainees

  and a state of art on missions and technical solutions in that range of satellites, by EADS/Astrium and Thales Alenia Space
- Final Specifications to be decided with the partners involved in the project
- Detailed definition may change the specification and solutions
  - However CNES has now the conviction that this project is feasible and offers a good answer to clearly expressed or latent needs

RISTRETTO - *Program organisation*

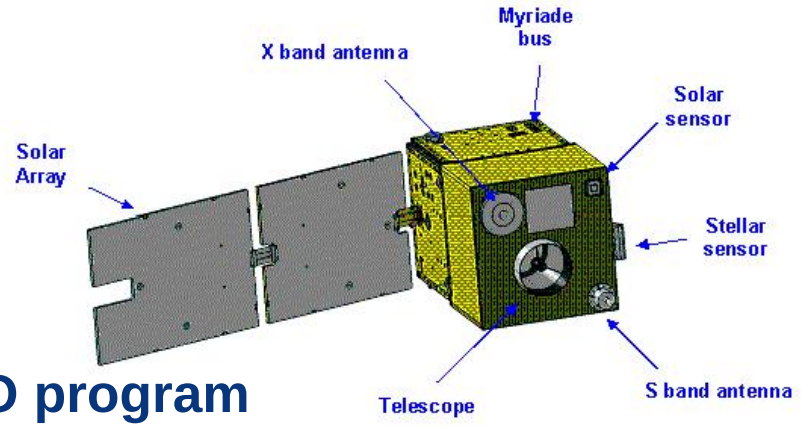
- **Small international team in Toulouse for Project management and system coordination within a legal French "association" with**
  - Representatives from universities, agencies, research laboratories
  - People from industrials if agreement on the open source chart
  - Technical engineers from space industry and agencies + retired people (really motivated, available, experience of space projects)

    ⇨ **to conduct the general definition and organize detailed definition**

    ⇨ **to manage the relations with all partners in charge of equipments, sub-systems or services**

    ⇨ **to maintain in the duration the open source files and agreements**
- **Several different university teams to study and develop the various sub-systems and components**

Conclusion



- **Next steps expected for RISTRETTO program**
  - Go - No go decision to be taken
  - Set up of the French “association” legal organisation in Toulouse
  - **Choice of the first mission by a call for ideas to universities, laboratories, industrials**
  - Preparation/elaboration of the Technical Requirements and call for proposal
  - **Contacts with potential interested partners and/or call for proposal**
  - **Partnership and organisation to be set up**
  - Start of RISTRETTO program
- **To summarize**,

  The interest and feasibility of such a new platform have been studied.

  CNES is ready to continue pushing and helping for its development.

  However it is not foreseen to set it up as a CNES project. **It should be an international program with a strong university involvement**