

EXPRESSO : Teaching and Student Projects

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CNES : French Space Agency



PLAN

1. CNES

- 1. CNES and higher education
- 1. Student projects in space research and development
- 2. Conclusion



1. CNES - An ambitious space policy for France

- France has a highly ambitious space policy implemented in and for Europe with the following aims:
 - To control space from beginning to end
 - To act as a driving force in the construction of the European space sector
- Its purpose is to implement a space strategy to:
 - Guarantee access to space (first strategic field)
 - Guarantee use of space in 4 strategic fields:
 - Mass market
 - Sustainable development
 - Space sciences and technology and preparing the future
 - Security and defence





Fulfilling France's obligations as a launch country



1. CNES

5 main axes



2 Mass market

TV – Telecoms – Broadband Internet – Navigation and Positioning – Health – Education

Sustainable development

Monitoring change in our natural environment Using resources rationally Foreseeing risks





1.CNES

5 main axes

Over the set of the s

Participating in science programmes Keeping abreast of key technologies and innovative concepts





Security and defence

Carrying out the actions assigned to CNES by the Ministry of Defence



1. CNES and its partners

- CNES and European partners
 - Ties with most European nations
- CNES and International partners
 - With the world's leading space players



1. CNES The Centres





Headquarters



EVRY Launchers

Ariane launcher research, design and development

TOULOUSE

250

Orbital Vehicles Satellite research, design, development and control



1. The Toulouse Space Centre (CST)





1. The Toulouse Space Centre (CST)

- Managing orbital system projects (satellites and spaceborne experiments)
- Station acquisition and station keeping
- Developing and implementing balloon-borne scientific experiments



1. CST responsibilities and activities

- The Toulouse Space Centre occupies various levels of responsibility according to the project being developed and may act as:
 - Contracting authority
 - Contracting authority assistant
 - Prime contractor
 - Integrator



1.CNES The programmes (1)

More than 40 projects underway (A, B, C, D and E phases)



ROSETTA



Earth Observation





1.CNES The programmes (2)

PLEIADES

Follow-on from Spot 1, 2, 3, 4 and 5









1. CNES The programmes (3)



GALILEO





EGNOS – PACF



1. CNES The facilities (1) Spot Control Centre



Balloon Launch







Compact Range Facility Antenna Measurement



Computation Centre



1. CNES The facilities (2)



Main Control Room No.1



IASI Laboratory



Station Network: Issus-Aussaguel (Toulouse)



1. CNES Balloons

Launch Centres: Aire-sur-Adour, Gap

 BSO: Open Stratospheric Balloons 290 kg

MIR: Infrared Hot Air Balloon 50 kg

BPCL: Pressurised Boundary Layer Balloon

 BSP: Pressurised Stratospheric Balloon 25 kg

Aeroclipper: underwater CV tracking



science missions technology missions



1. CNES Station Acquisition & Station Keeping (1)

Station Acquisition



52 satellites put into orbit so far

Station Keeping



telecommunication satellites



6 Earth observation satellites



3 science satellites





1. CNES Station Acquisition & Station Keeping (2)

Station Acquisition and Station Keeping on behalf of:

clients

CNES

▶ 6 satellites stationed simultaneously

The future: Galileo





Preparing the future

Current challenges

- Formation flying
- onboard autonomy



1 PASO (Orbital Systems Architecture Unit) working in concurrent engineering

"0" Phase = Mission définition
"A" Phase = Faisability studies



1. CNES – CNES Budgets (in millions of euros)

	2005	2006	2007
National programme	1051.5	1108.1	1161.6
Access to space: launchers and CSG	327.0	396.1	399.8
Use of space	597.0	596.5	645.9
Civil applications	39.4	44.4	43.2
Sustainable development	120.7	117.8	154.0
Space science and preparing the future	116.9	106.5	109.9
Security and defence	170.2	189.4	202.8
Pooled resources	149.7	138.5	136.1
Agency directorates (including VAT)	127.5	115.4	115.8



1. CNES – France's contribution to ESA (in millions of euros)

	2005 ¹	2006 ¹	2007
French contribution	685.00	685.0	685.0
Access to space: launchers	414.05	343.65	319.78
Use of space	425.11	381.08	324.68
Civil applications	124.63	131.80	71.81
Sustainable development	89.61	72.01	63.41
Space science and preparing the future	210.87	177.27	189.46
Security and defence	0.00	0.00	0.00
ESA operations and debt servicing	55.90	54.09	5.42



2. Teaching

Supporting training programmes for young students in space technology and sharing technical and scientific expertise

Based on CNES skills and expertise in its 4 centres

- A few FIGURES AND IDEAS:
 - 1. 4000 hours of teaching





 All subjects, all schools and universities in areas of interest to the aeronautical and space sector.



2. Internships

- Giving students a chance to acquire their first experience in the professional world
- Internships lasting 3 months to 1 year after academic studies
- At the 4 CNES centres
- Open to students from European countries other than France
- Internships available in English

www.cnes.fr



3. Theses

- In all field such as
 - Science of the Universe
 - Planet Earth sciences
 - Microgravity sciences
 - Space transport systems
 - Orbital systems



Number of students

Numbers of students as of 1 January 2006 (according to type of grant)





3. Student projects in space research and development

- Helping to promote space sciences
- Involving the students at every project level
- Making them take part in building their project in on-ground and in-flight tests
- Giving them experience that will be of use to them when they enter the professional world



3. Research and innovation programme

- Stimulating the imagination and creativity of future graduates
- Involving school or university laboratories
- Involving small and medium-sized businesses from outside the space sector: technology transfer
- Promoting the emulation generated by the involvement of multiple teams

Generating innovation and technological breakthroughs



3. EXPRESSO et PERSEUS

- CNES has issued two requests for ideas from students: EXPRESSO AND PERSEUS
- Scope:
 - Orbital systems and balloons for EXPRESSO (supervised by Toulouse)
 - A nanolauncher for PERSEUS (supervised by Evry)
- Visit the CNES website for further details (in French)
 - <u>www.cnes/perseus</u>
 - <u>www.cnes/expresso</u>



3. Involving students

How?

- By integrating projects into the curriculum
- Internships
- Student clubs or associations
 - Under the supervision of teacher-researchers and engineers from CNES and industry

For what type of work?

- System studies
- Subsystem and technological studies
- Experiments, ground or in-flight testing
- Economic studies
- Project management, programming, methods



3. Aims of collaborations

Forming teams of different schools to promote:

- Emulation
- Skill centres
- European collaborations beetween European schools or university and French team are possible



Time span of projects: target of 1 to 3 years

- Detailed and regular supervision by teachers, researchers and external experts is essential
- Co-ordination
 - Ensured by myself Laurence de Botton
 - My Contact address: Projets-etudiants-CST@cnes.fr



Potential sources of funding

- Schools' and universities' own resources
- Subsidies from industry or research organisations
- Regional and national budgets
- European budgets (ESA, EU)
- International budgets (UNESCO, ...)



■ CNES is responsible for co-ordination, proposing:

- Short or long internships
- Doctoral and post-doctoral grants,
- Tests and appraisals
- Technical support
- Flight opportunities: balloons, sounding rockets, aircraft, launcher, orbital vehicles or satellites



Schedule

- 9 June 2006: Submittal of projects proposal
- Examination by a Scientific Committee then submittal to a Steering Board
- Mid July : Projects selected
- September 2006 : Design phase
- Fevrier 2007 : Design work submitted to board of experts
- Manufacturing phase



Projects under consideration

- A nanosatellite system for monitoring and characterising the space radiation environment
- A generic platform for micro gravity experiments on a launcher
- A nanosatellite for telemedecine use
- A parachute for particule occurrence monitoring
- A balloons constellation for fire detection
- A nano satellite for Earth or stars observation through a space requirement level, off-the-shelf telescope



4. Conclusions

Student projects, as seen in Europe and the rest of the world, offer each student a unique opportunity to take part in a concrete project including experimental creations.

An ideal stepping stone to a professional project

CNES organisation and technical support guarantee innovation, risk control and success