



CENTRE NATIONAL D'ETUDES SPATIALES

# STRATOSPHERIC BALLOONS IN FRANCE, AN INTERESTING SPACE EDUCATION TOOL FOR JUNIORS, FOR 20 YEARS

*Michel Maignan<sup>(1)</sup>, Amandine Gueurce<sup>(1)</sup>, Cyril Arnodo<sup>(1)</sup>, Natacha Pellet<sup>(1)</sup>,  
Anne Serfass-Denis<sup>(2)</sup>, Nicolas Pillet<sup>(2)</sup>*

*<sup>(1)</sup>, Planète Sciences*

*<sup>(2)</sup>, CNES*

May 2011 20<sup>th</sup> ESA Symposium on European Rocket & Balloon

ANSTJ then PLANETE SCIENCES,

40 years activities in the field of scientific education

## History

- ✓ French non-profit organization created in 1962 (ANCS then ANSTJ), with the objectives to make practice technique and sciences by youth people.
- ✓ In first step it manage the « Space Clubs» for the manufacture of small rockets by youth with the support of CNES.
- ✓ In the 70s it diversifies its activities with the same objectives: Astronomy, Robotics, Computing, Environment, Meteorology, Balloons...
- ✓ Since 2002, its name is *Planète Sciences*.
- ✓ Today Planete Sciences is a network of 12 French associations. It has also international activities.

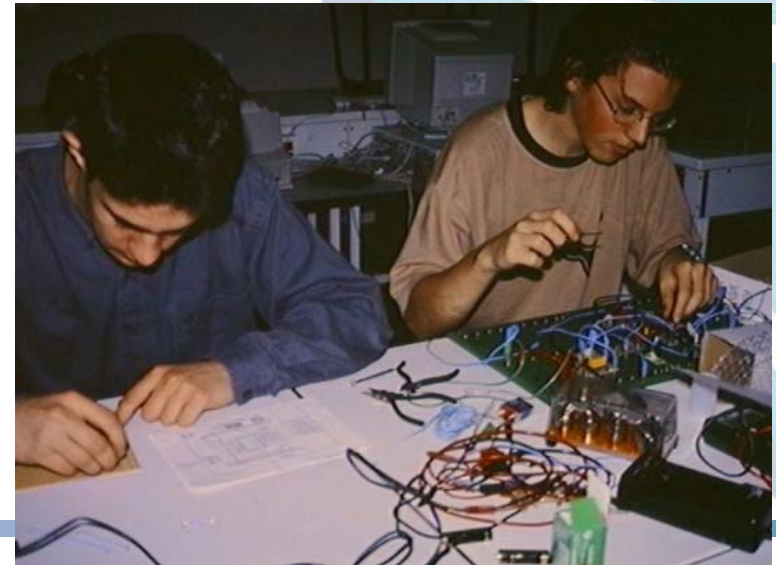


**ANSTJ then PLANETE SCIENCES,  
40 years activities in the field of scientific education**

## Some figures

-The Planete Sciences is:

- **12** associations in network,
  - **75** wage-earners,
  - **1000** volunteers,
- 
- **100.000** youth are concerned each year,
  - **600** scientific clubs,
  - **300** operations in schools,
  - **10** summer camps,



ANSTJ then PLANETE SCIENCES,

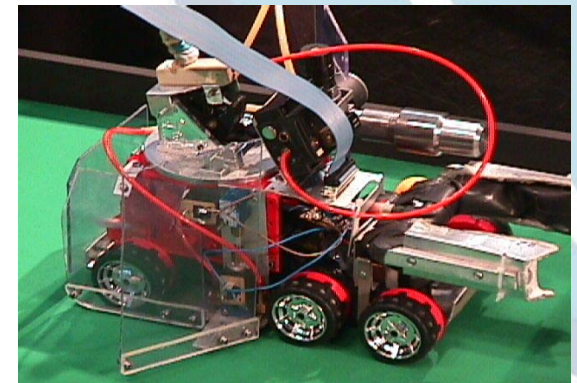
40 years activities in the field of scientific education

## The approach

- To give opportunities to youth to conduct attractive projects in safety conditions,
- To use active pedagogic methods,
- To use natural intellectual curiosity of youth,

*Why don't you measure it yourself?*

- To develop the team work,
- To introduce scientific process and management project to youth,
- To exchange with scientific community,
- To present the results.



## An example of experiment activities: the **Statospheric balloons**

- Activity based on the use of professional meteorological balloons,
- Basket mass < 2,5 kg
- Culmination height = 28 km
- Flight time = 3 hours
- Flight distance = some km to 250 km. Free flight pushed by winds
- Lift-off everywhere in France with an previous information procedure to Aeronautic Authority. Some restrictions near boundaries to suppress the risk of flight above a foreign state.
- Basket are manufactured with light materials (polystyrene, balsa, plastic, electronic components...)
- Balloons are in accordance with International Aeronautic rules in the class: "**light unmanned free balloon**".



## An example of experiment activities: the **Statospheric balloons**

### Activity proposed at:

- ◆ **Youth Clubs**, (friends' teams which group together to practise this activity as a hobby. (20 balloons in 2011)
- ◆ Other: Public demonstration, Summer camps, training, (25 in 2011)
- ◆ And creation in 1992, a specific operation dedicated to **primary and secondary schools**

## **UBPE**

### “Un Ballon Pour L'Ecole”

(100 schools take part in 2011)



To supply to schools (free of charge)

- ◆ **A reliable balloon material** :envelop, radar reflector, parachute, helium cylinder, telemetry system,
- ◆ **A adapted information** written to be as clear as possible in order to be understood by youth themselves, documentation available on paper format and on line.
- ◆ **A project control** during the scholar year with the help of volunteers ( at least 3 interventions in each classroom)
- **A legal framework**: relations with Aeronautical Authority insurance's.



To supply to teachers and volunteers,

- **Training courses** to learn safety lift-off methods (session of 25 hours)  
to learn handle of telemetry system (session of 15 hours)

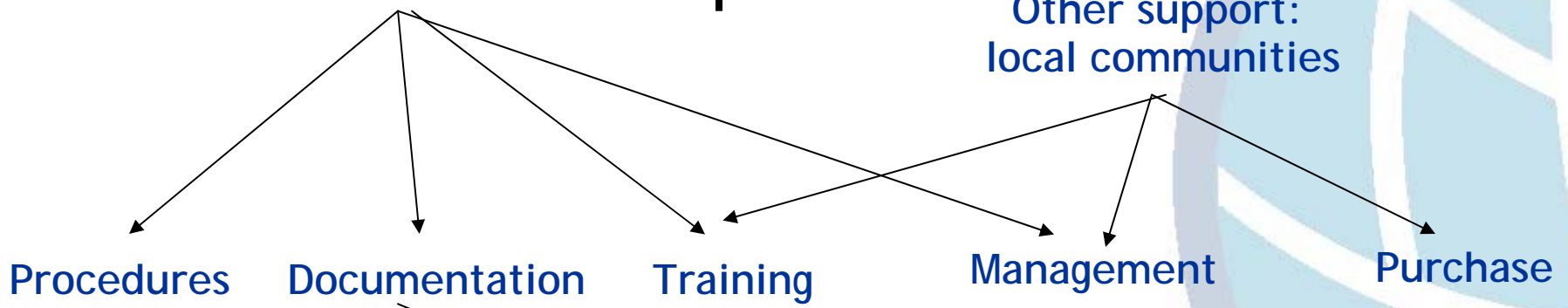


# UBPE organisation

**Volunteers + wage-earners**  
who offer time and skills  
(about 60 people at partial time)

**A main support: the CNES**  
who gives a financial and technical support

Other support:  
local communities



To the benefit of:  
**Primary and secondary schools**  
**High schools**  
**Teachers**  
(3200 youth take part each year)





- To register the project in the frame of UBPE, (school selection)
- The commitment to respect the « Specification Book », (no lift-off if the basket isn't compliance),
- To make herself the basket,
- To take part at 3 progress reviews in the year,
- **The basket has at least one calibrate measurement based on a scientific hypothesis that justify a experiment check,**
- After the flight, the classroom writes a report. (One exemplary for Planete Sciences /CNES)
- To inform the local press ( to invite a journalist for the lift-off day, to send an article to local newspaper...).



# In board experiments

The most common sensors:

Temperature, pressure, altitude, humidity camera, intensity light,  
, flight speed, flight status ...

video, sound, radiometer, GPS tracker, seeds ...

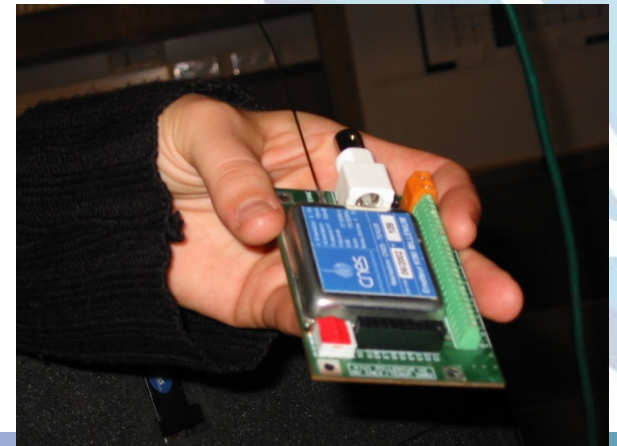
40 % of basket haven't telemetry

60 % of baskets have a telemetry

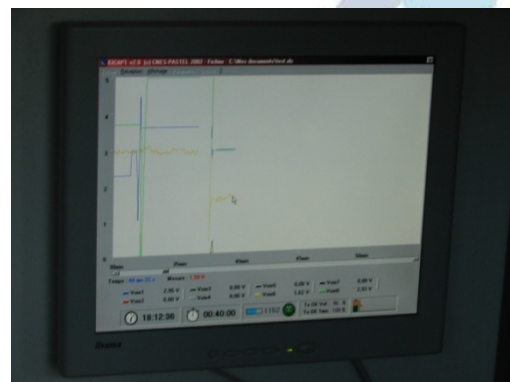
- Graphic recorder,
- MP3 recorder,
- Photographic recorder,
- ...

➤ Data transmission thank to Kiwi telemetric system

50 % of basket are recoved by walkers,  
farmers ... and shake to schools some days  
or weeks after the lift-off.



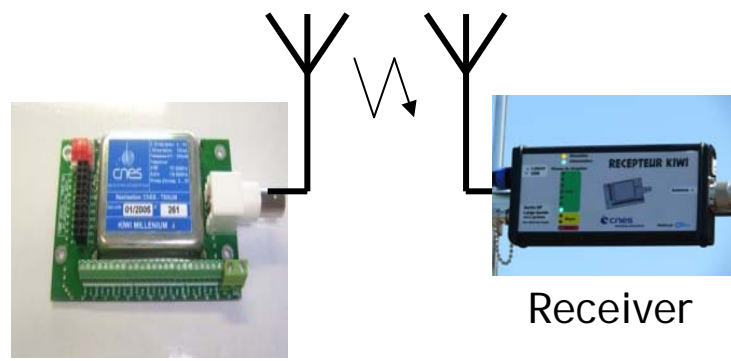
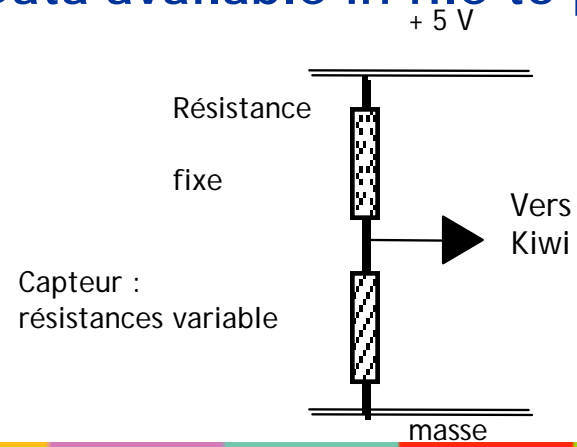
## A small transmitter (VHF) and a portable ground base station



8 analogic channels (0 to 5 volts)

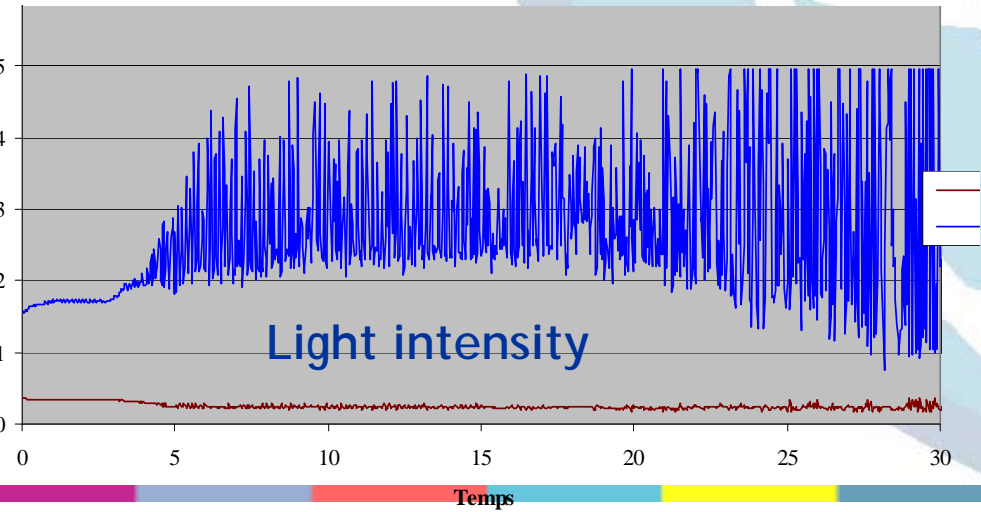
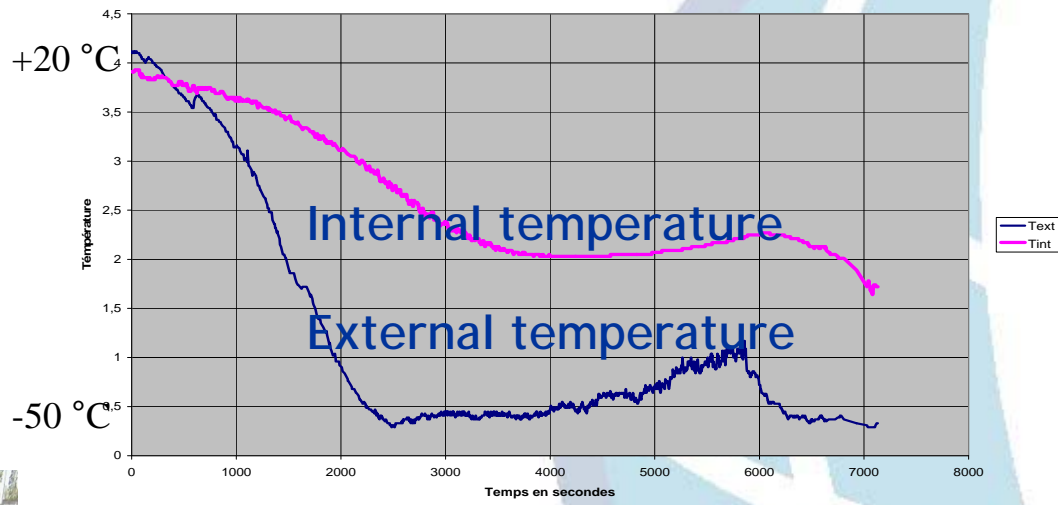
Values transmit in real time each 2 secondes,

Data available in file to post processing with a spreadsheet software

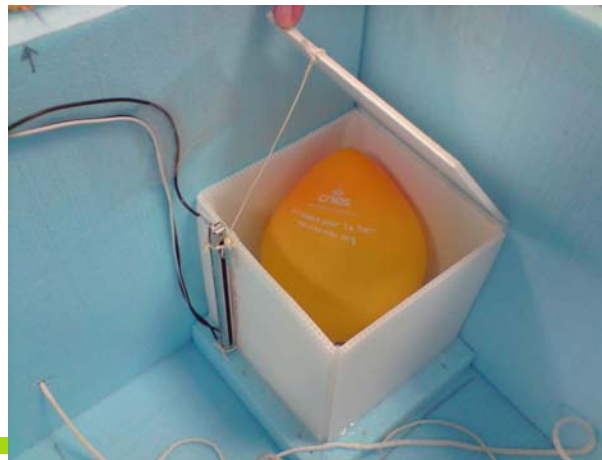
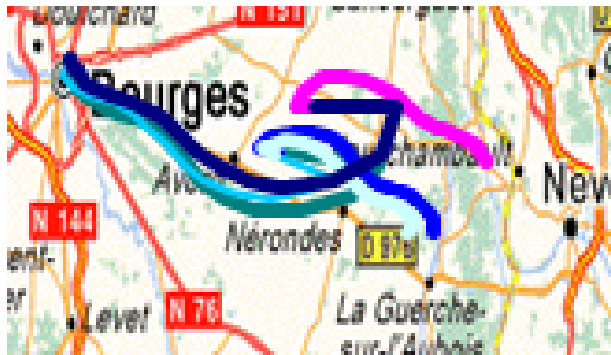
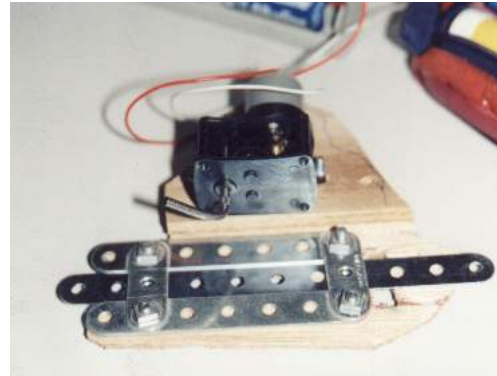


# Telemetry system

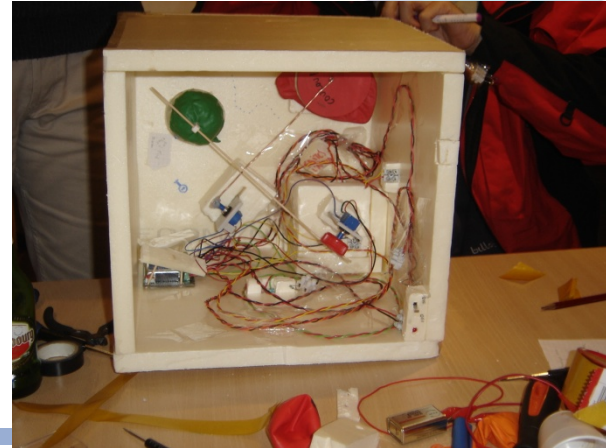
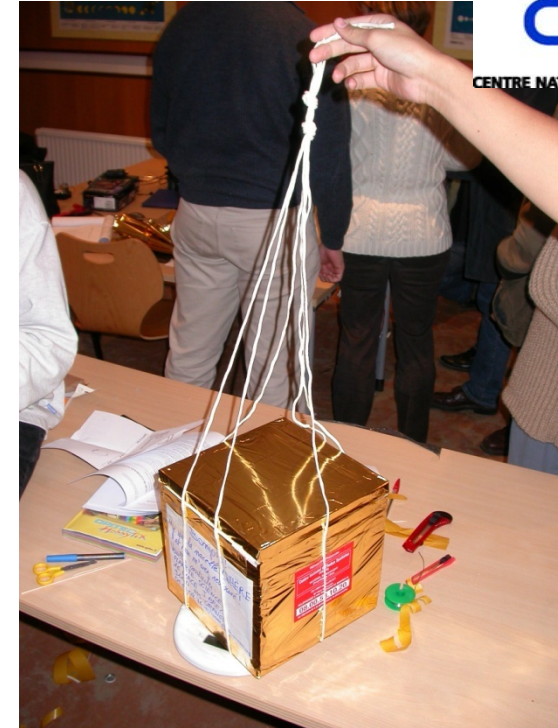
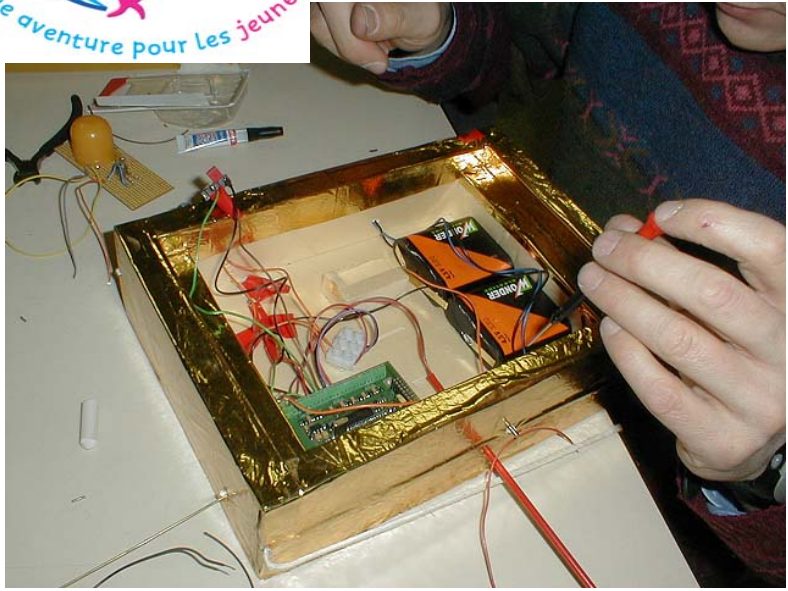
## Examples of experimental results



# Experiment examples



# Examples of baskets



# Pedagogic interests

Teachers use balloon activity like an attractive support in relation with official pedagogic scholar programs. A mean to make love the school!

**Technical:** opportunity to learn how to measure, to cut, to saw, to nail, to iron to connect, to read a data sheet etc. The sensor calibration is directed with care...

**Physics, Mathematics:** opportunity to deepen some basic physical laws and technologies: Archimedes principle, atmospheric profile, space environment...

**Scientific process:** Observation, Assumption, Experiment, Results, Interpretation, Conclusion...

Initiation to **management project:** to define objectives, to respect a schedule, to share tasks, to manage resources, to report...

Writing of texts, Scientific history, Space actuality, Geography, Public talk, Internet research....

# CONCLUSIONS

## STRATOSPHERIC BALLOONS, AN INTERESTING SPACE EDUCATION TOOL FOR JUNIORS,

Thank to an exemplar partnership beetween CNES and Planete Sciences, since 20 years



Thank you for your attention

