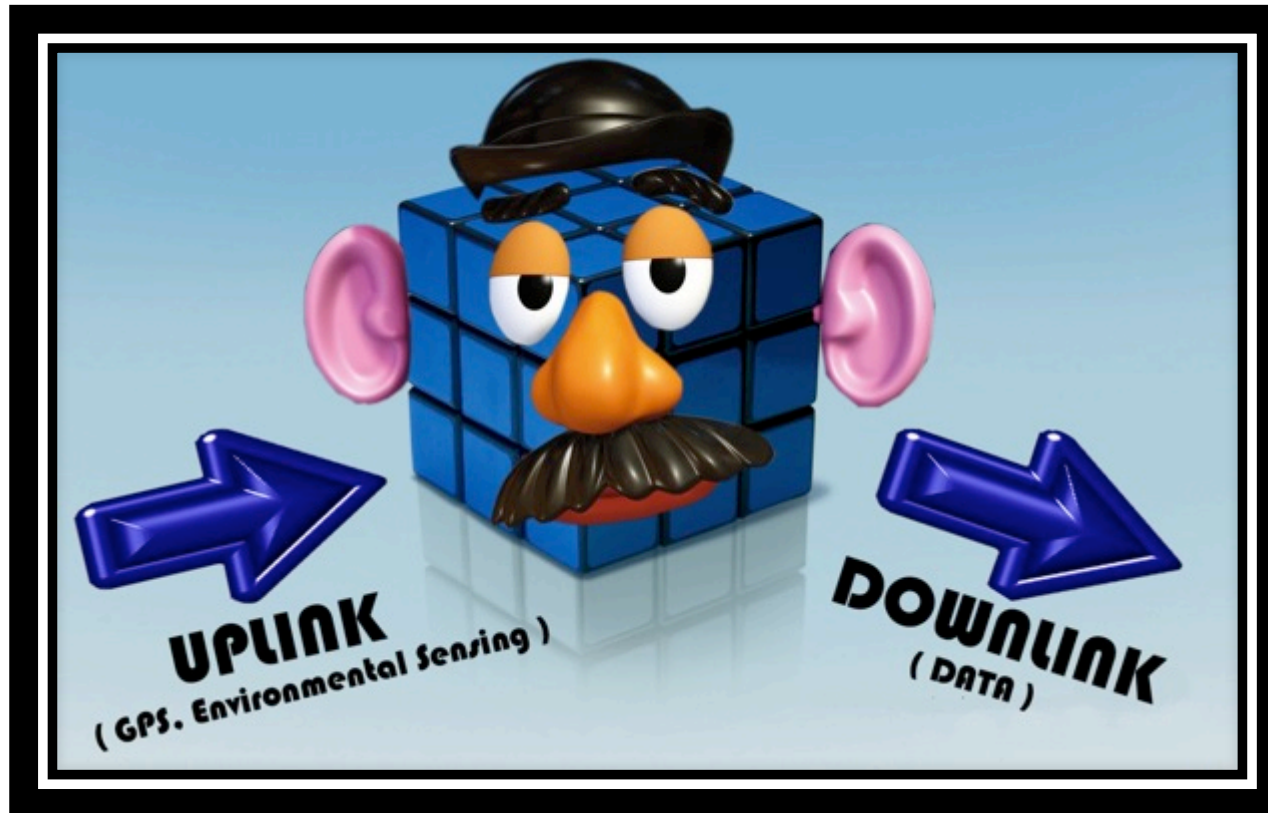


MR Sat



C. Cappelletti, S. Battistini, C. Massimiani, R. DiRoberto, L. Ridolfi, S. Scutti, R. Cica, G. Martinotti, R. DiLauro

Introduction

In 2009 a strong collaboration between GAUSS group at University of Rome Sapienza and Space Science Center at Morehead State University in Kentucky was started.



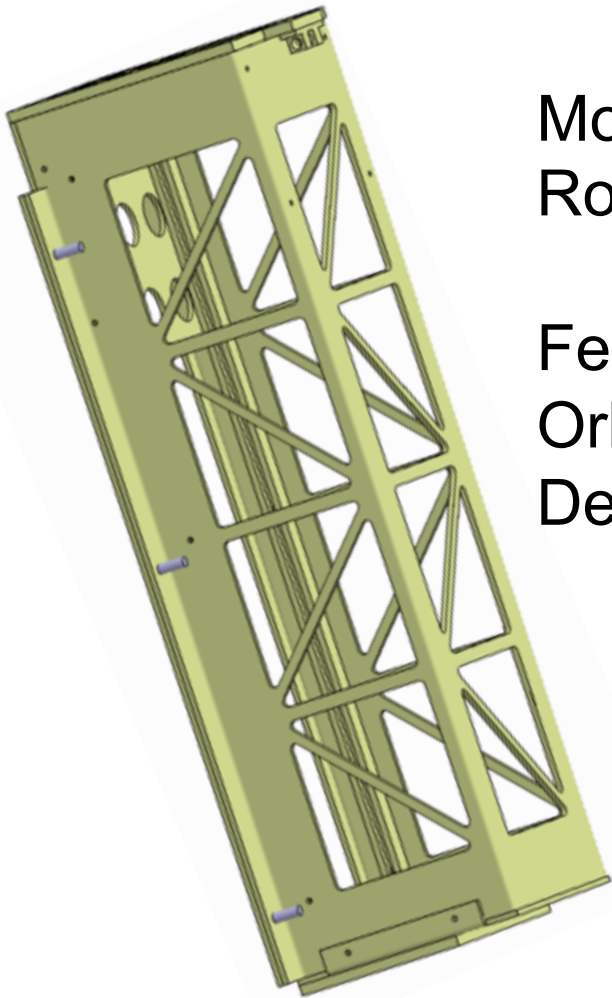
***Space Science Center
Morehead State University
(KY, USA)***



One of the goals of this collaboration is promoting space education among high school students and supporting the qualification and scientific careers of young people
(university students, PhD students and young researchers).

MR FOD

designed by MSU students



Morehead
Rome

Fempto
Orbital
Deployer

MR SAT

designed and built by
italian high school students



with the help of GAUSS
and MSU students

MR SAT

High Schools Educational Project:

- 16 hours for theoretical lessons
- 16 hours for teaching software (Orbitron, Altium, SatPc32, ...)
- 32 hours for laboratory activities

MR SAT

Italian High Schools involved on the project:

- Structure: ITIS Augusta
- Power: Istituto San Gabriele, Roma
- C & DH : Liceo Scientifico, Avezzano
- ADCS: Liceo Lucio Anneo Seneca, Roma
- Payload: ITIS Geymonat, Tradate Varese
- Ground Station: Chris Cappell College, Anzio, Roma

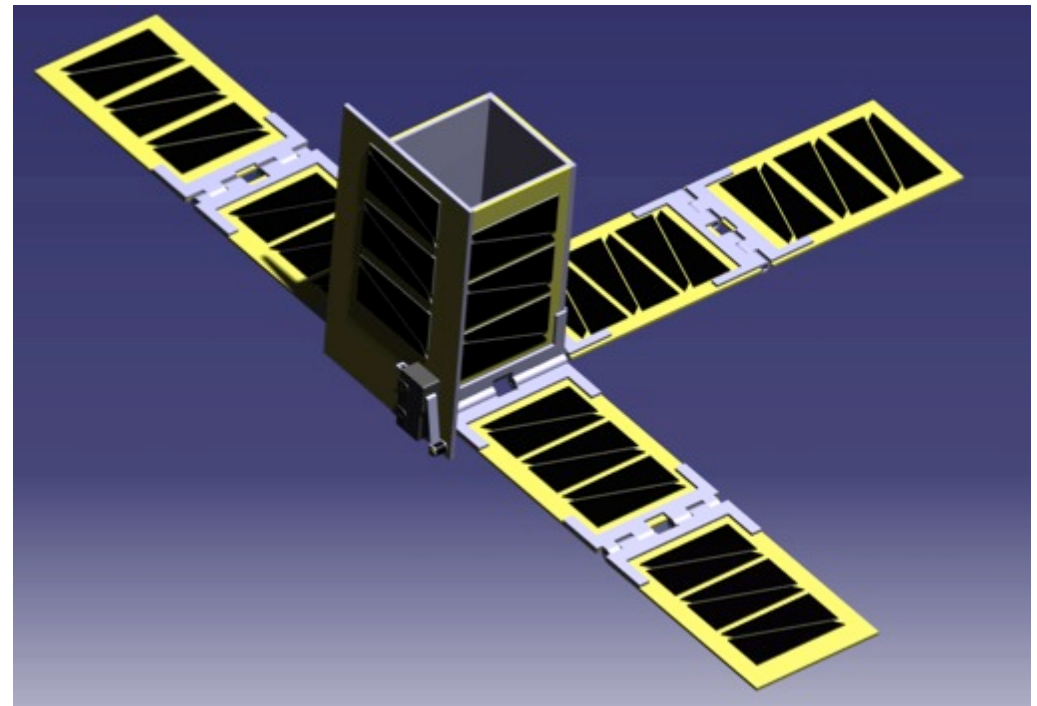




Structure

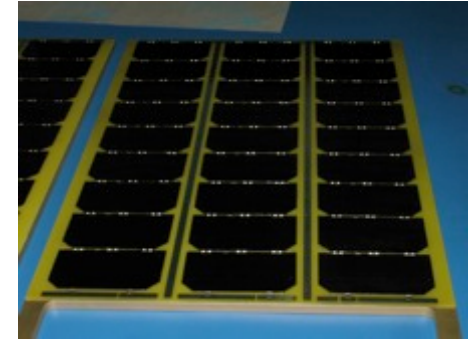
ITIS Augusta, Sicily

- Bus: 5x5x7,5 cm
- Deployable Solar Panels
- Aluminium and fiberglass
- tests will be performed at University of Rome facilities



Power

Istituto San Gabriele, Roma



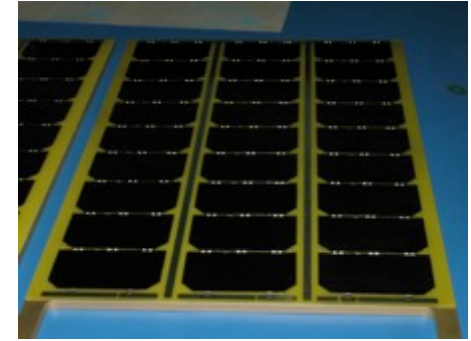
- Triple Junction Task cells
- Rechargeable Lithium polimer 3.7 V 1000mA Batteries

Solar Panels designed and manufactured by high school students using low cost materials and will be tested on GAUSS facilities

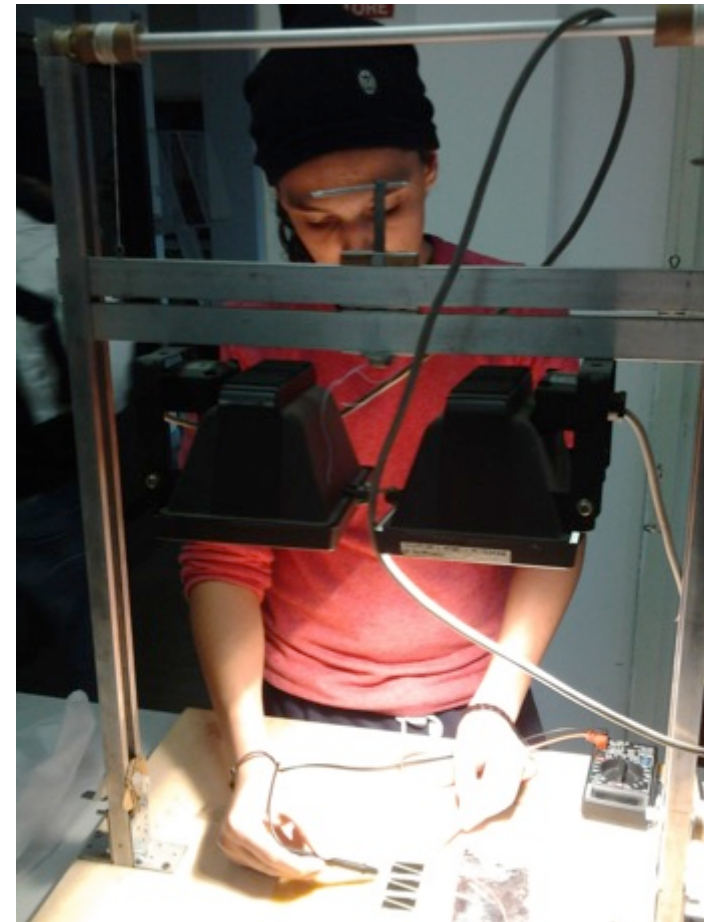


Power

Istituto San Gabriele, Roma

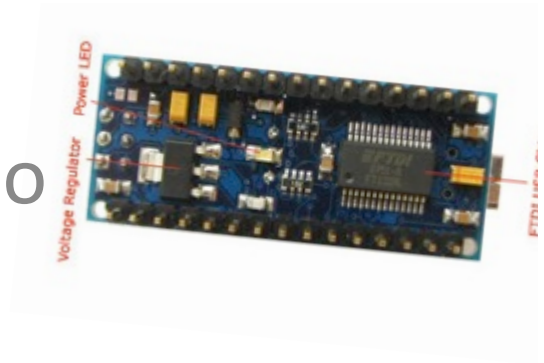


- “Sun Simulator” 2 Lamps 500W



C&DH

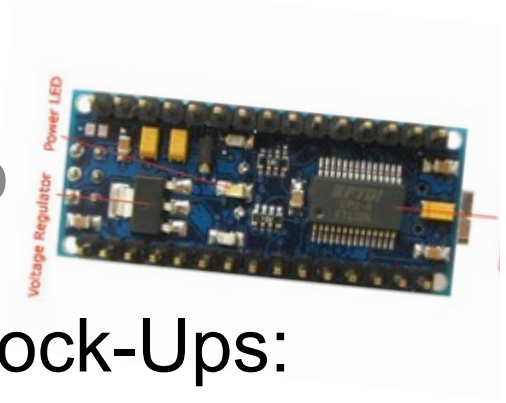
Liceo Scientifico Avezzano



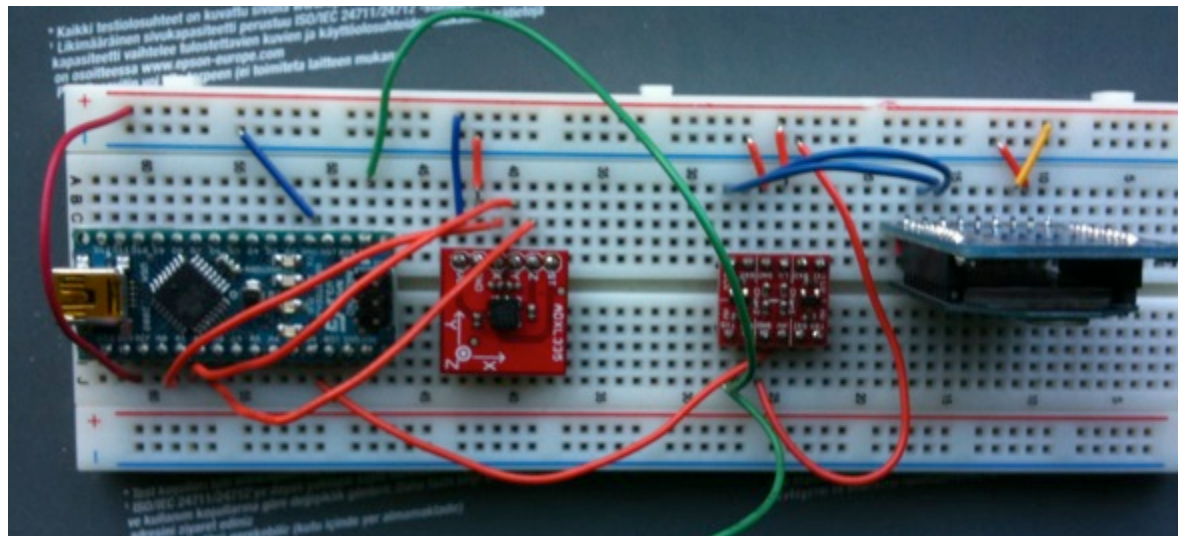
- Arduino Nano Board:
 - Simple
 - Cheap
 - Low Consumption
- Small Size:
 - 0.73"x1.70"
- Convenient Interface:
 - Serial, SPI, I²C
 - Internal A/D Converter
 - USB Programming interface
- Open Source platform
 - Schematic and project of boards freely available
 - Programming Platform available for all majors OSs

C&DH

Liceo Scientifico Avezzano



- Space Version:
 - Arduino
 - Magnetometer
 - Radio
 - Payload Interface
- School's Mock-Ups:
 - Arduino
 - Xbee Modules (for simpler wireless communication)
 - Accelerometer (for funny “shake experiment”)



Ground Station

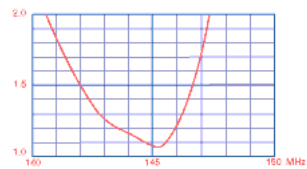
Chris Cappell College Ground Station

UHF & VHF Crossed Elements YAGI antennas

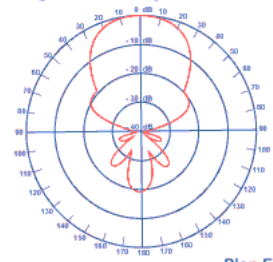
VHF

2x9 Elements, 13,1 dBi
Isotrope gain, 3.57 m

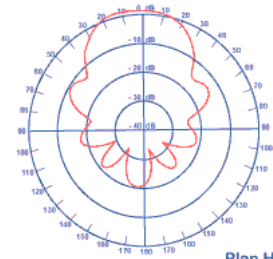
Courbe de ROS



Diagrammes de rayonnement



Plan E



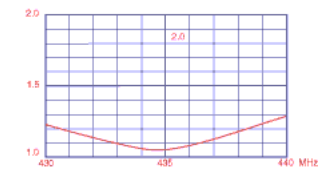
Plan H



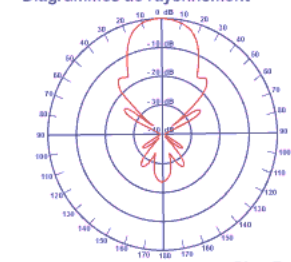
UHF:

2x19 Elements, 16 dBi
Isotrope gain, 3.25 m

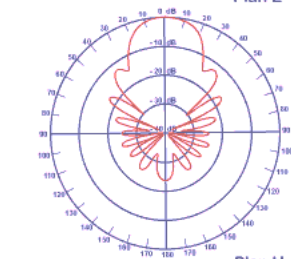
Courbe de ROS



Diagrammes de rayonnement



Plan E



Plan H

Ground Station

Chris Cappell College Ground Station

Antenna Rotor Interface

- Azimuth & Elevation control & Feedback
- LPT port connection to the PC
- Direct Connection to YAESU Rotor Controller
- 2 x 8 bits ADC

ICOM 910h VHF/UHF Satellite Radio:

- 75W UHF / 100W VHF
- Main & Sub channels (simultaneous reception on VHF & VHF)
- SSB, CW and FM compatible
- Data Packet 9600bps ready
- Doppler correction via PC Serial Port



YAESU G-5500 Azimuth and Elevation antenna rotator & controller

- Dual Controller for Azimuth & Elevation
- Rotation time (approx. @60Hz): Elevation (180°): 67 sec.
Azimuth (360°): 58 sec.
- Rotation torque: Elevation: 14 kg-m (101 ft-lbs) Azimuth: 6 kg-m (44 ft-lbs)
Pointing accuracy: ±4 percent

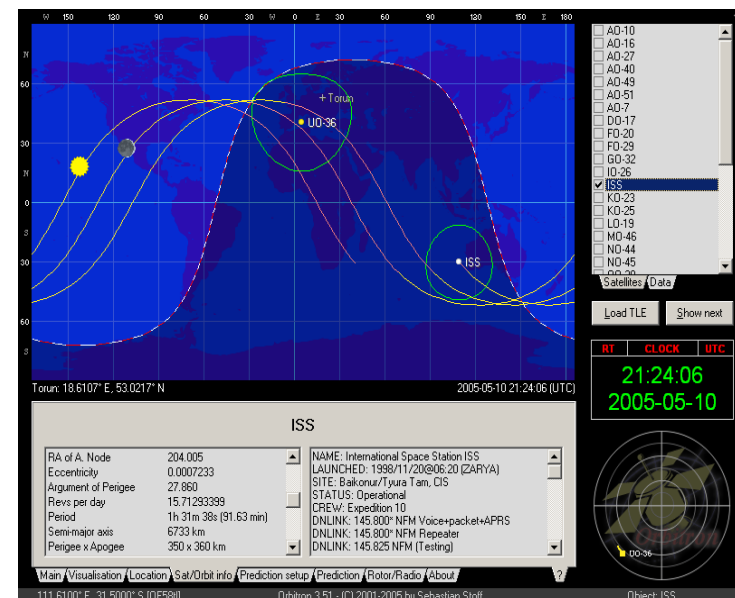
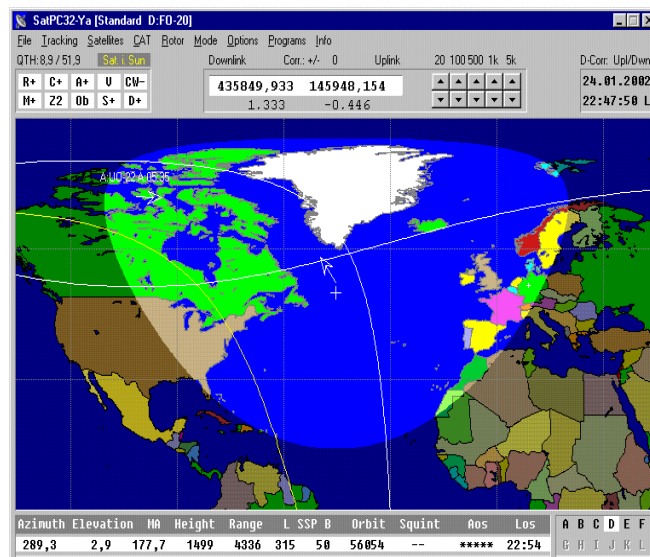
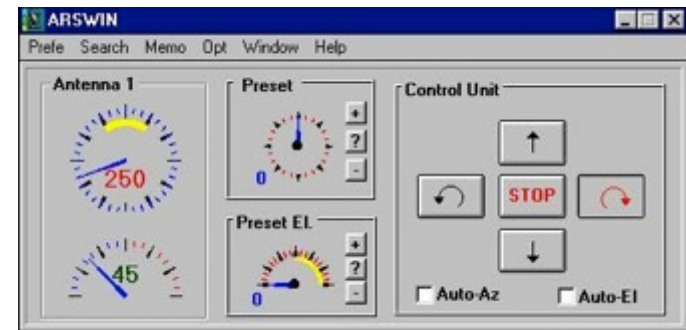
Ground Station

Chris Cappell College Ground Station

PC Workstation

Equipped with :

- ARSWIN, WispDDE, Orbitron, SatPC32, HamLog
- Automatic Doppler Correction during Tracking via Orbitron
- High Speed Internet Access with Automatic TLE Download
- Intel Core 2 Duo E7500 2.93GHz



Ground Station

Chris Cappell College Ground Station

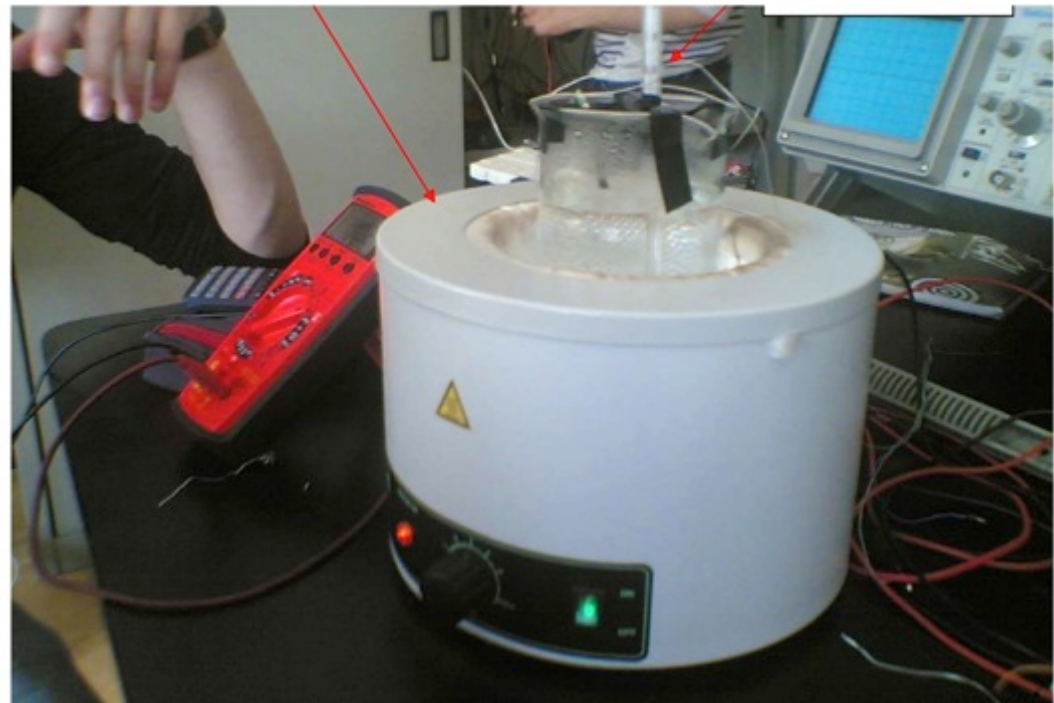
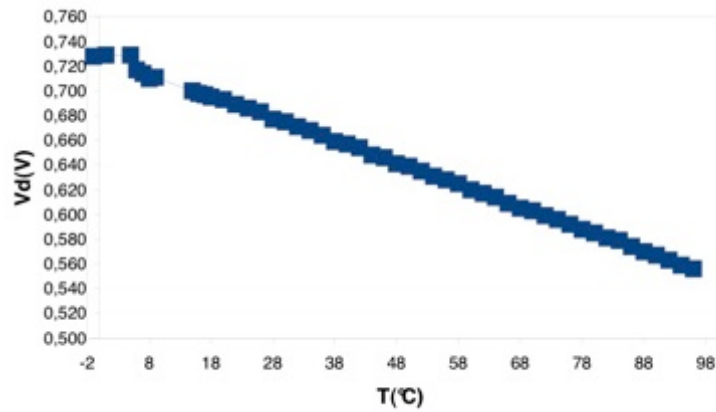


Main payload

ITIS GEYMONAT, Tradate, Varese

temperature sensor

- 2 diodes 1N4148
- LM35



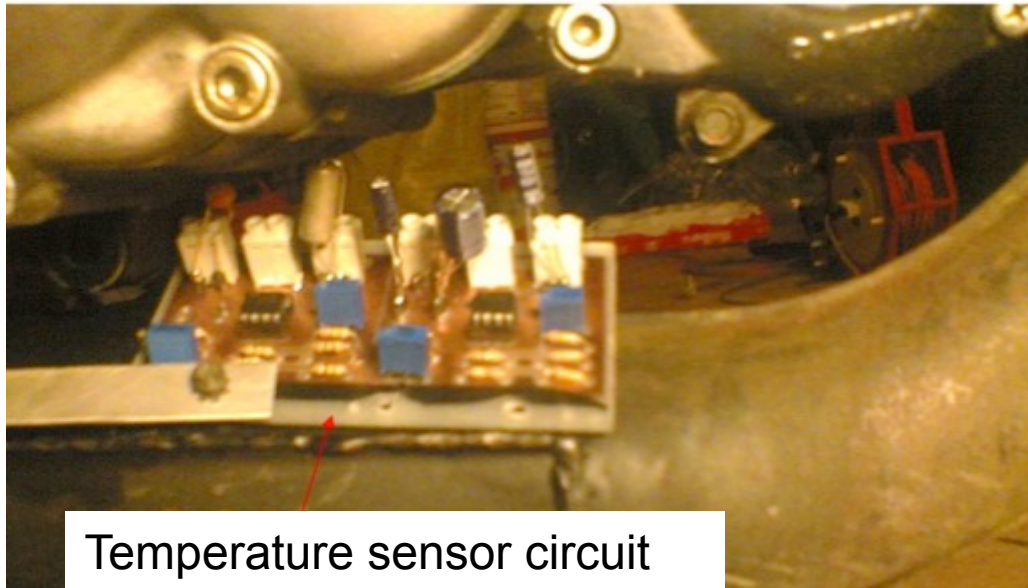
Main payload

ITIS GEYMONAT, Tradate, Varese

PAYLOAD TESTING:

Thermo-vacuum → Geymonat thermo-vacuum chamber

Preliminary vibration test → onboard on a motorcycle



Conclusion

- A MR SAT mockup has been manufactured for each school and is available on their laboratories for tests and simulations
- Each School will manufacture one subsystem for the satellite flight unit (with GAUSS students help).
- All the students will participate to test campaign (vacuum, thermal, vibration)
- Launch will be performed using MRFOD from UniSat-5 satellite (End 2012)