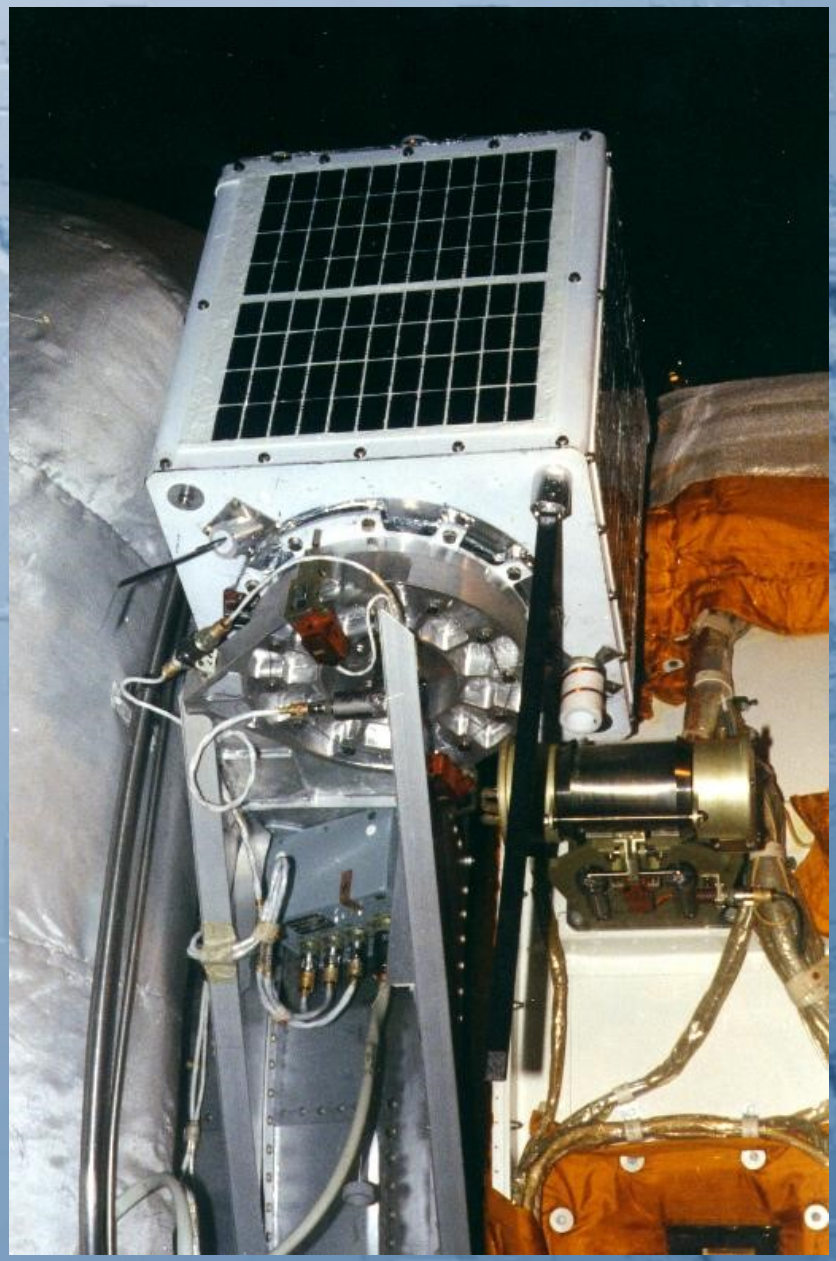
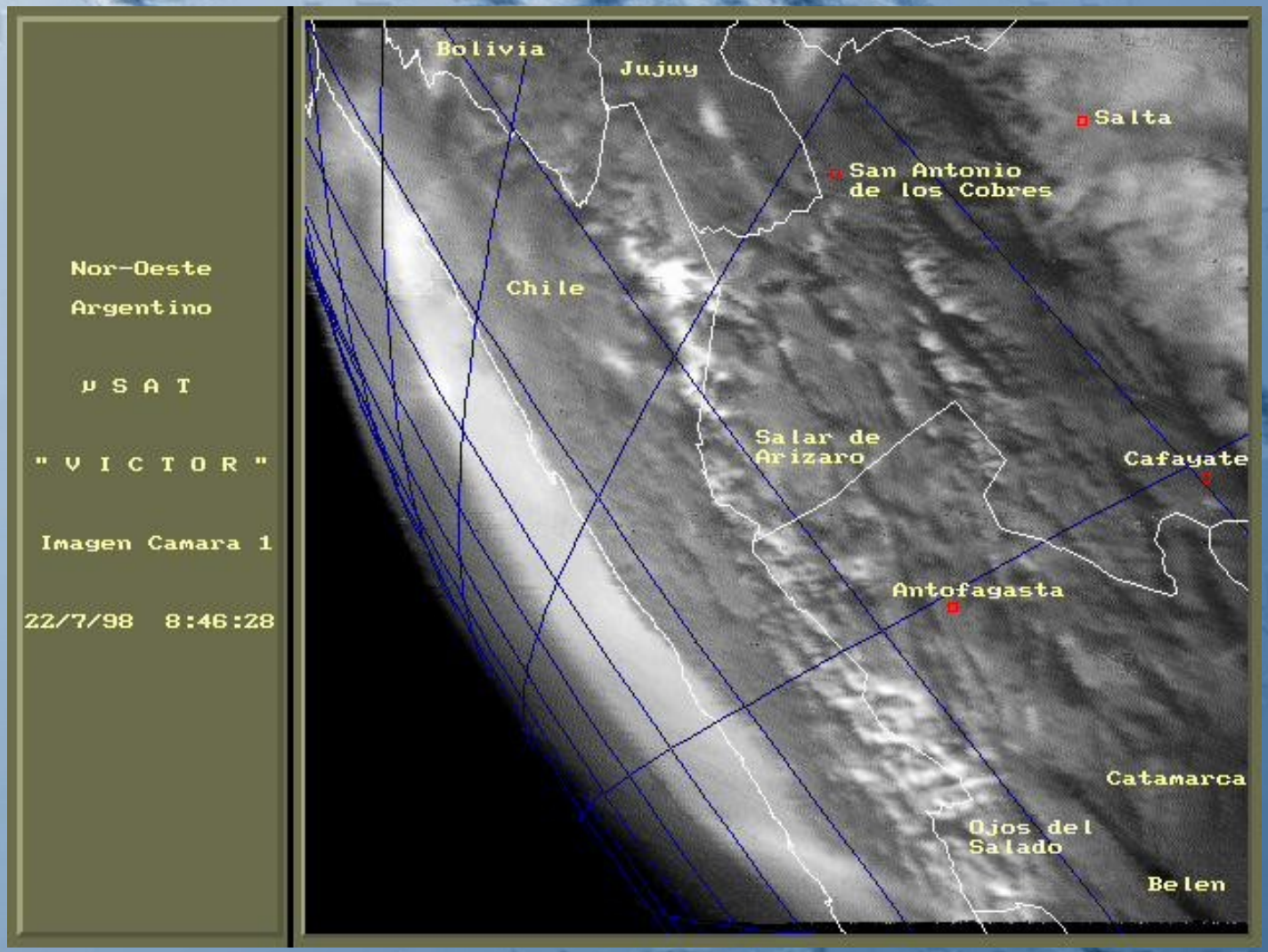
United Nations/Brazil
Symposium on Basic Space Technology

"Creating Novel Opportunities with Small Satellite Space Missions"

Microsatellite μSat-3 Development



μSat-1
"Victor"


Nor-Oeste
Argentino
μ S A T
" V I C T O R "
Imagen Camara 1
22/7/98 8:46:28
Bolivia
Jujuy
Salta
San Antonio
de los Cobres
Chile
Salar de
Arizaro
Cafayate
Antofagasta
Catamarca
Ojos del
Salado
Belen

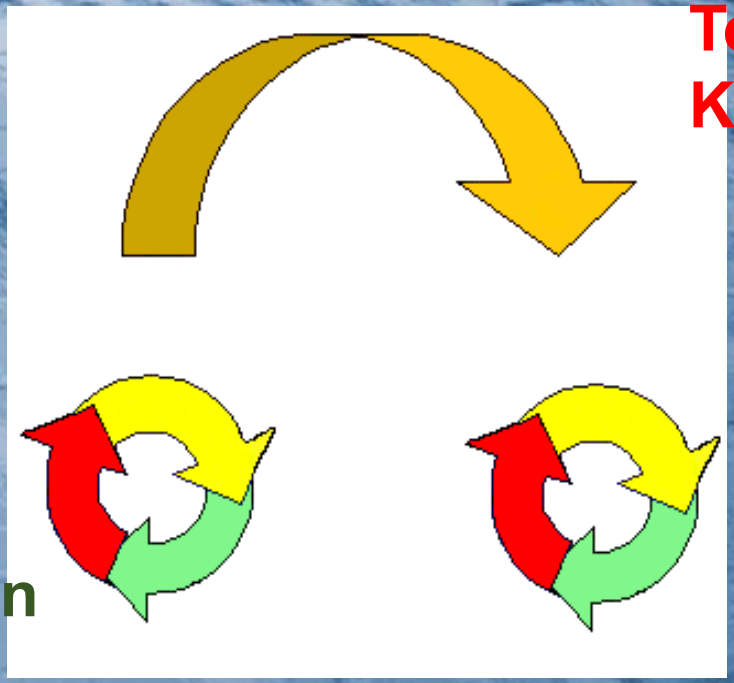
µSat-2

Inner and outer Structure

Paradigm Shift

Know How y
Technology
Foreigners

Greater
Total
Cost



Local
Technology and
Know How

Lower
Total
Cost

Minimum Human
Resources
Training

Important Human
Resources
Training

µSat-3

DEVELOPMENT

PHASE A:
Concept Analysis Feasibility of subsystems is assessed.

PHASE B:
Concept Definition System working at laboratory level.

PHASE C:
Concept Development System working at engineering model level.

PHASE D:
Concept Qualification System working at flight model level.

MAIN OBJETIVES

To ‘take and send’ pictures of the Argentine mainland, both in Low Resolution Mode and in High Resolution mode, as requested by the Ground Station:

- High resolution 10 m/pixel
- Low resolution 100 m/pixel

Revisit Time < 4 days

Maintenance Maneuvers of orbit parameters

Orbital Position Maneuvers for flight in Constellation

Put out of Orbit

Development Philosophy

- Keeping paperwork at the minimum level.

- Producing real hardware and software as early as possible.

-Use of comercial/industrial hardware when possible

-Qualification functional and environmental tests are performed at system level.

- Strong involvement of specialized task groups belonging to Government institutions, Universities and Industry.

- Very simple core group topology with a minimum of authority levels.

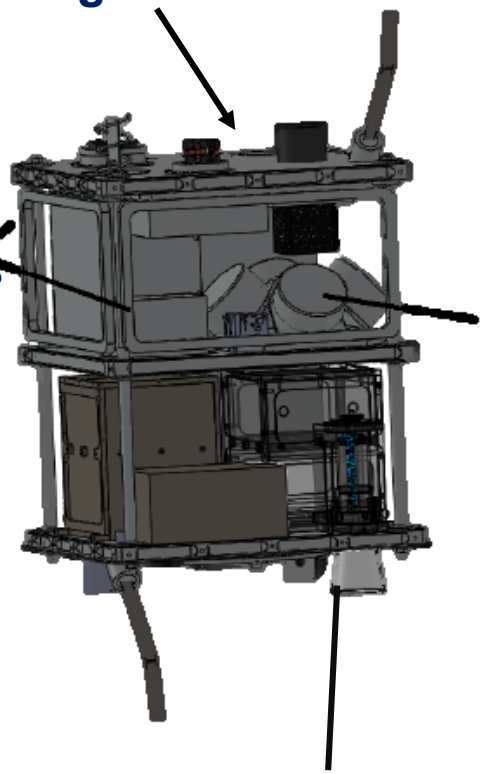
Dimensions : 340 x 340 x 430 mm.

Configuration : Three plates and four struts inner structure, outer lateral shroud.

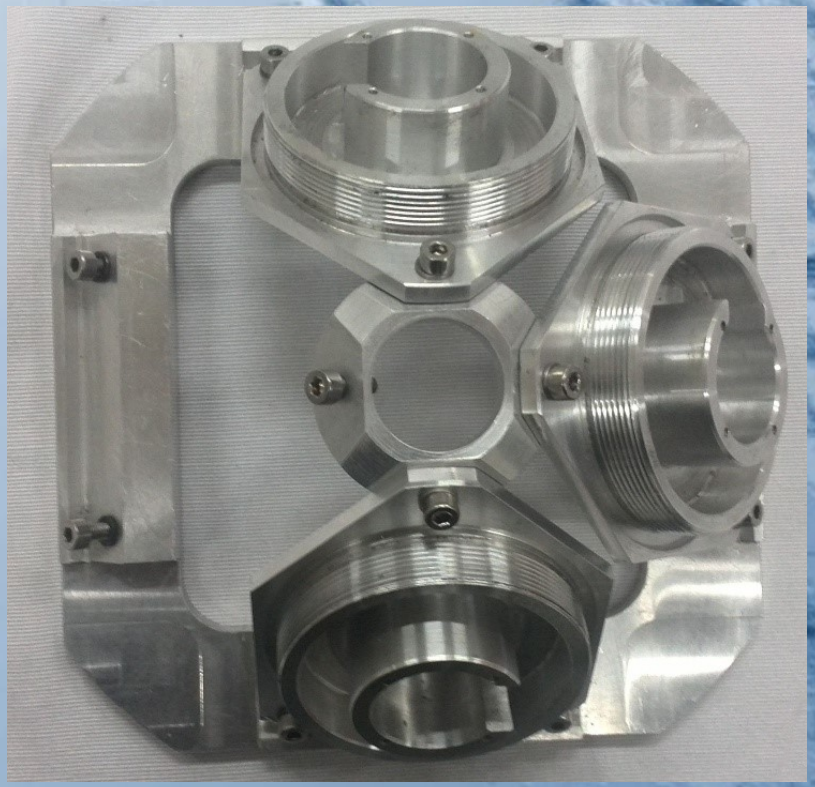
Attach fitting : A single high reliability pyrobolt.

ss : 33 Kg

Vehicle General Layout – Inner and outer Structure



Pulsed Plasma Thrusters



Reaction Wheels

Reaction Wheels

- Mass: 0.250 kg
- Dimensions: 75 mm diam. * 30 mm high
- Angular Moment: $4.45*10^{-2}$ Nmseg
- Angular Speed: 6000 rpm
- Torque max.: $7*10^{-3}$ Nm
- Power Supply: 12 V

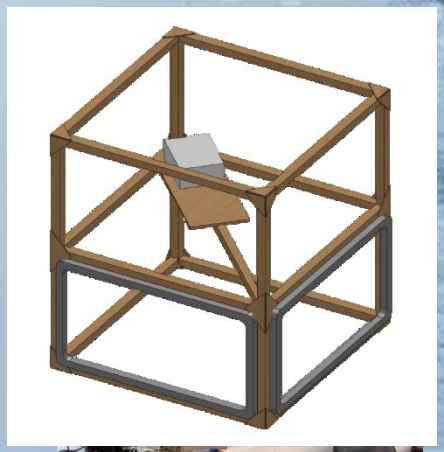
- Error in Position: 60 deg (=> 0.005 deg)
- Error in Speed: 90 rpm (=> 0.044 deg/seg)

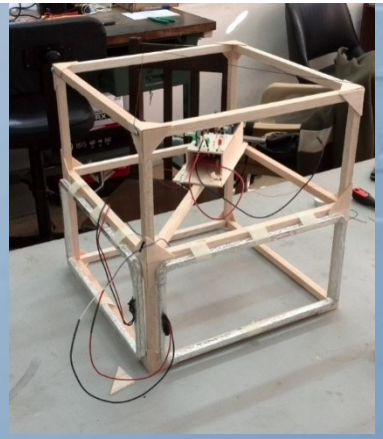
- Ω_{sat} max = 0.48 rpm (3 deg/seg)
- Ω^{dot}_{sat} max = 9 mrad/seg^2 (0.5 deg(seg^2)

Magneto Torquers (Test)

- Based in μSat-2
- 3 Coils (Quadrature Axis), 0.5 A-vuelta-m^2
- Independent Control

Raft Wood





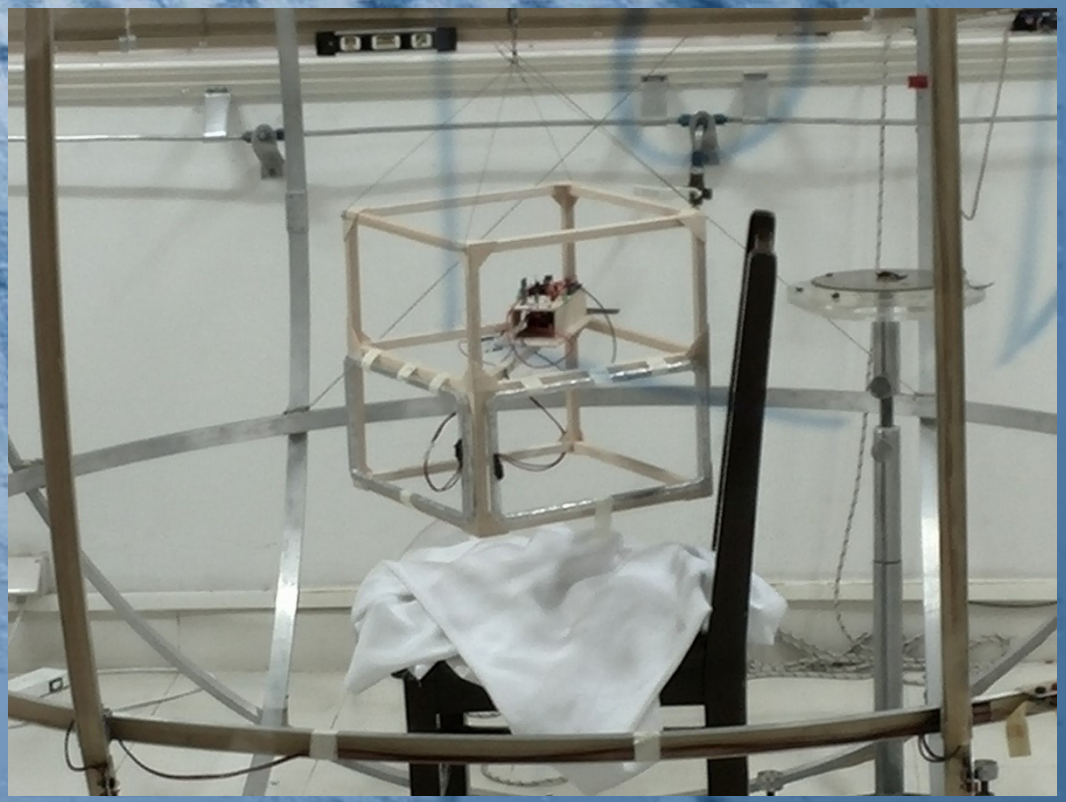
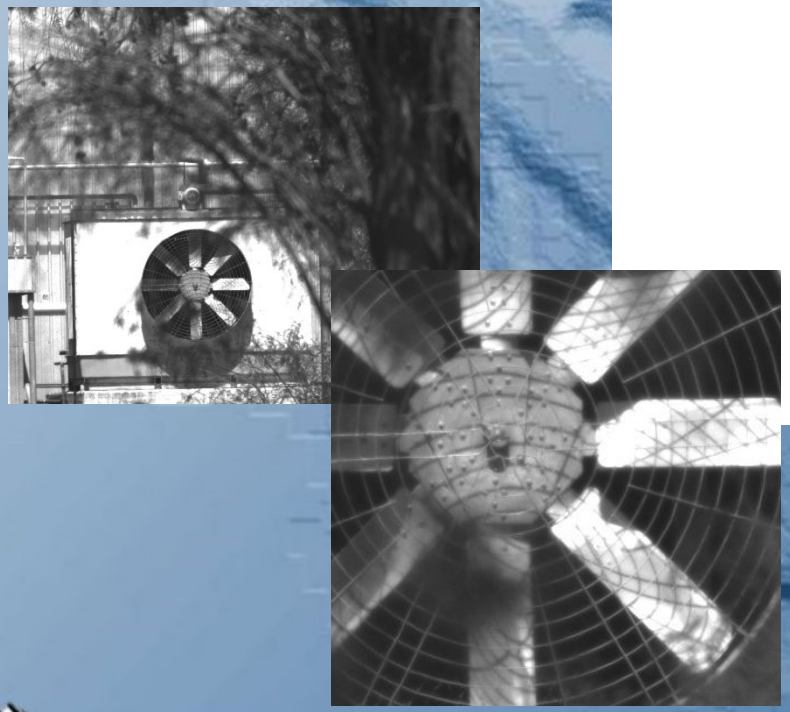
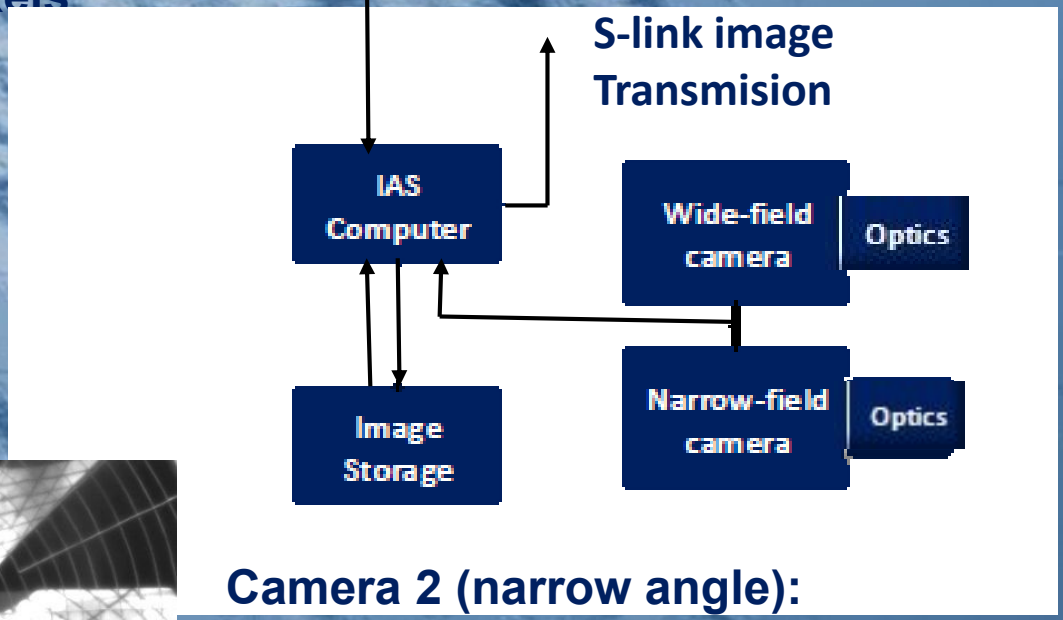


IMAGE ADQUISITIÓN SYSTEM

Camera 1 (wide angle):

Commercial/Industrial Cámera
Resolutión 5 - 15 Megapíxels
Focal Length 50 mm
Maximun Aperture 1:1.4.



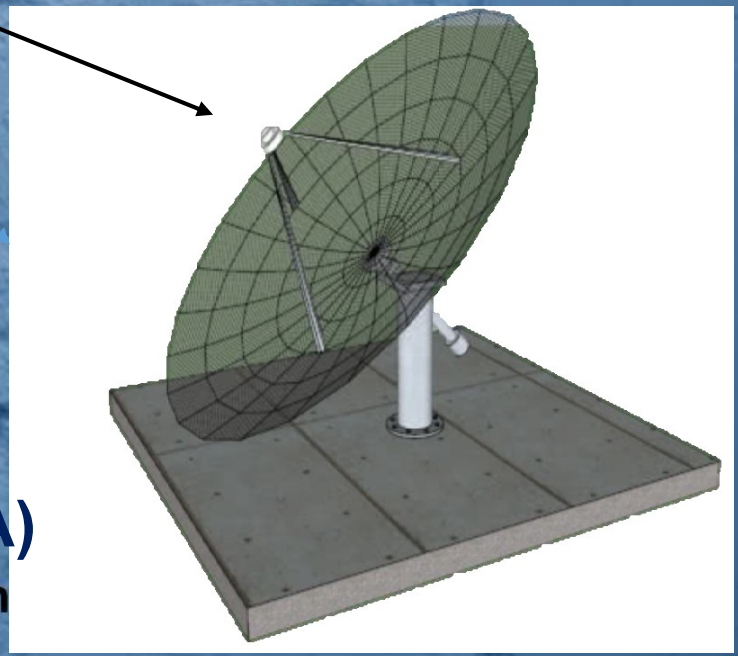


Camera 2 (narrow angle):

Commercial/Industrial Camera
Resolutión 5 - 15 Megapíxels
Focal length 100 – 200 mm
Maximun Aperture 1:2.8

UHF link (Telemetry Data and Commands)
400MHz – FSK – Bit Rate 56Kbps – 5W

Band “S” link (Images)
2260Mhz – QPSK – Bit Rate 2Mbps – 5W

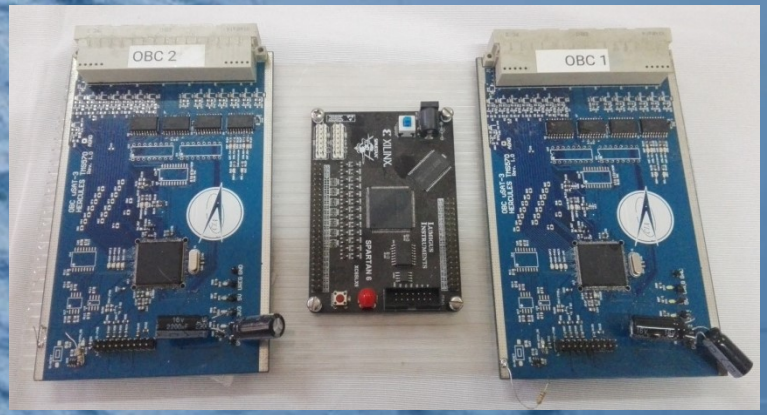


Ground Station (CIA)

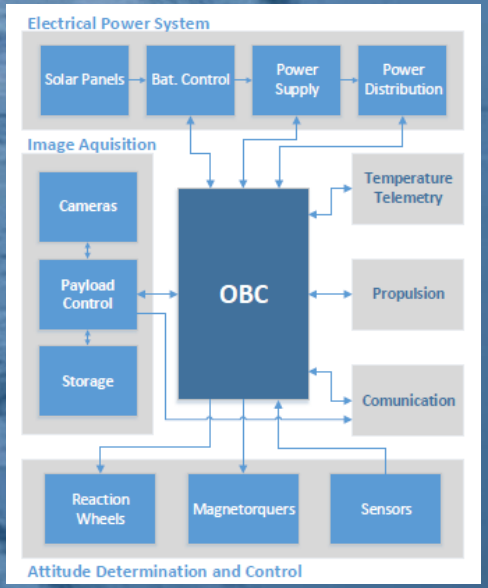
United Nations/Brazil Symposium on

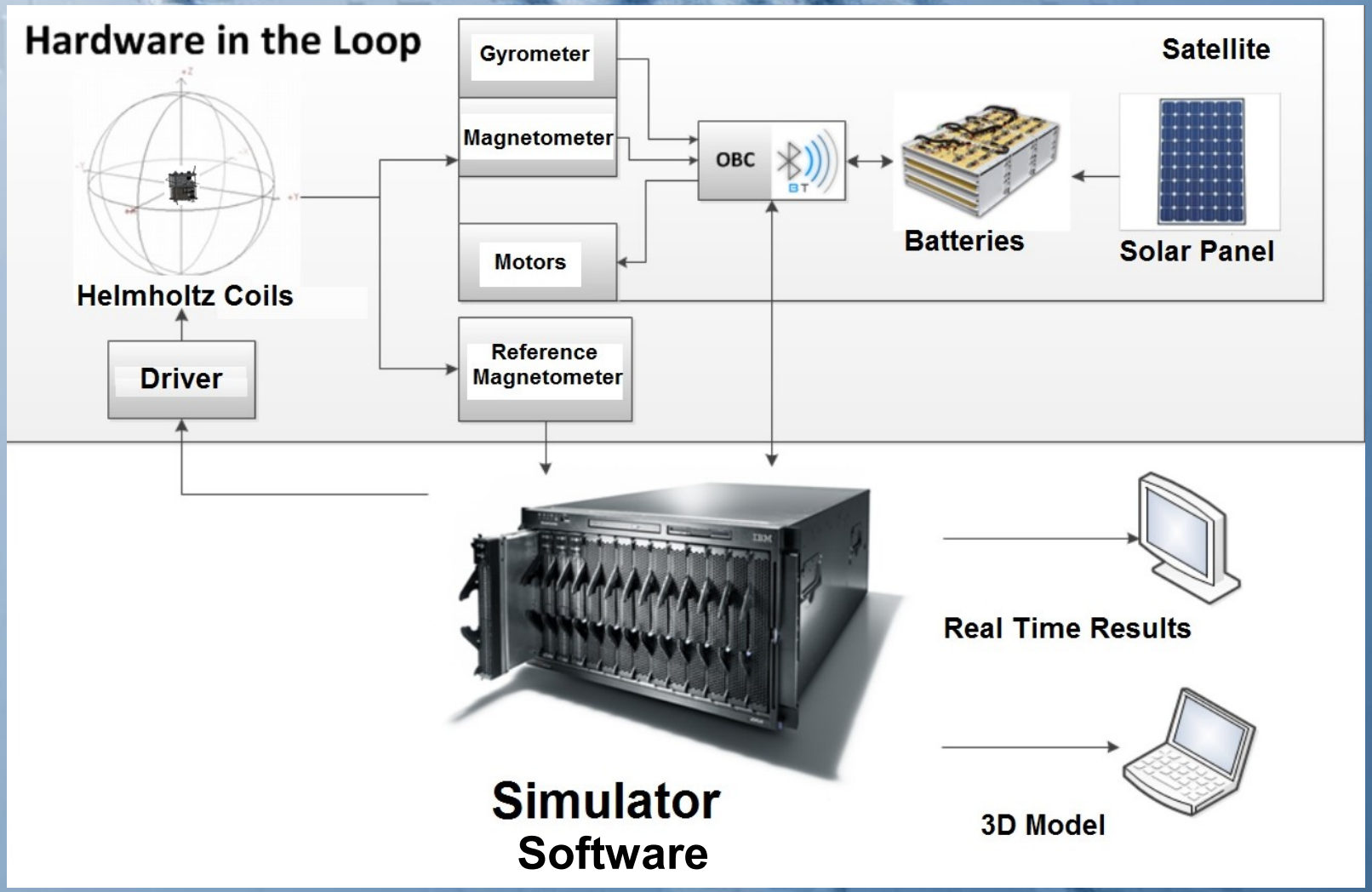
O.B.C.

Cortex-R4F@160Mhz RISC 32 Bits
- 1,66 DMIPS/MHz
- FPU double precision
- 3 MB Flash with ECC
- 256 KB RAM with ECC
- Power Consumption < 2 W
- Eurocard Form FaCTOR

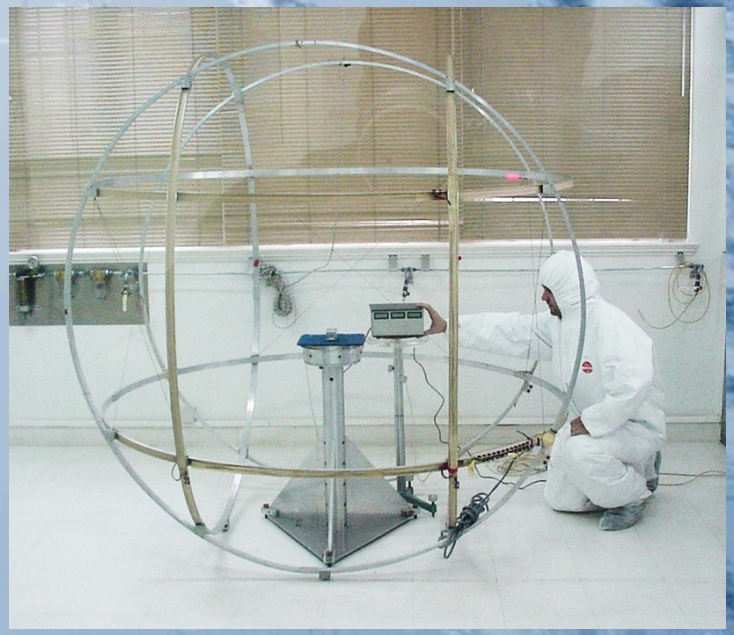


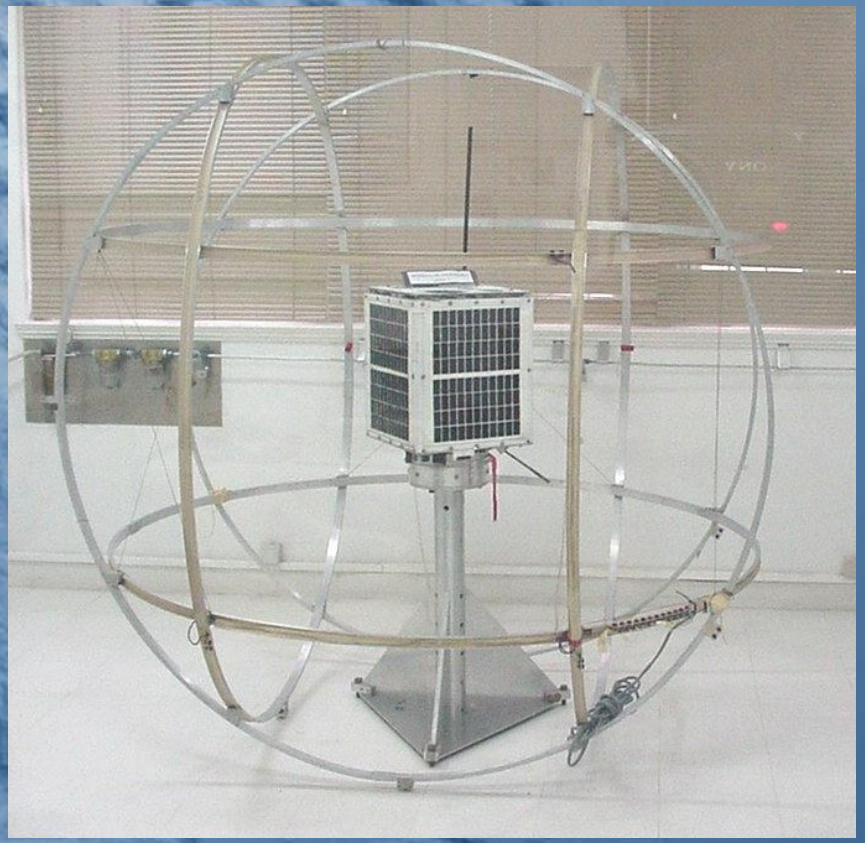
- BIST integrated diagnostics, monitoring,
- Voltage & Clock, redundant Watchdog
- Automatic Switch to backup in case of failure
- Total or partial reconfiguration from ground
- Processor certified for Safety Critical Apps
- Functional Safety. ISO26262
- SafeRTOS Certification Option
- Aerospace DO178C DAL A




Hardware in the Loop
Gyrometer
Magnetometer
Motors
Satellite
OBC
BT
Batteries
Solar Panel
Helmholtz Coils
Driver
Reference Magnetometer
Real Time Results
3D Model
Simulator Software

Magnetic Field Simulation System

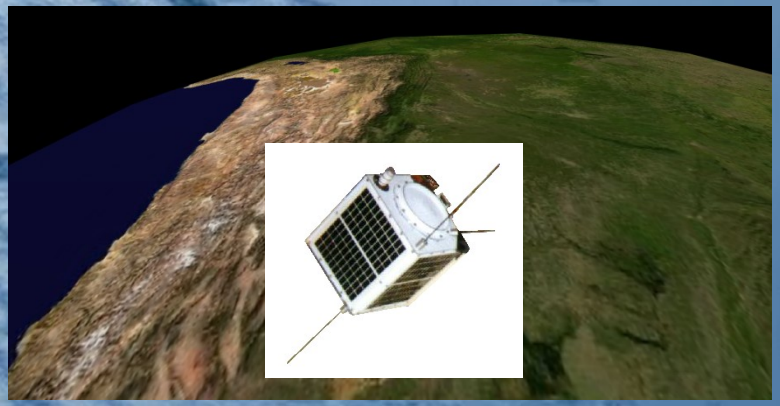


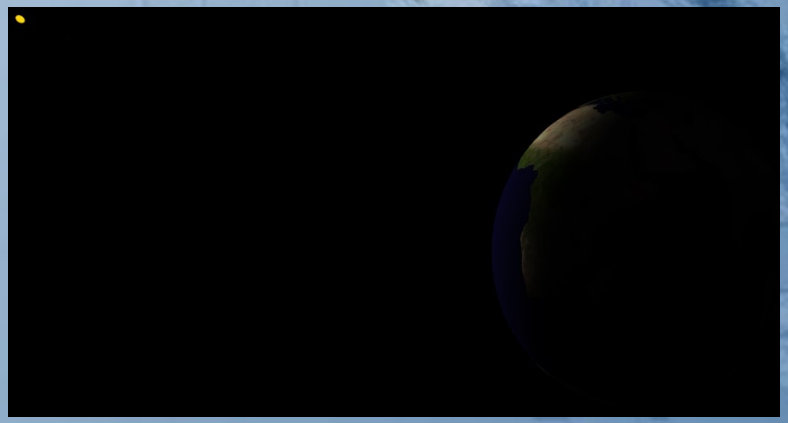


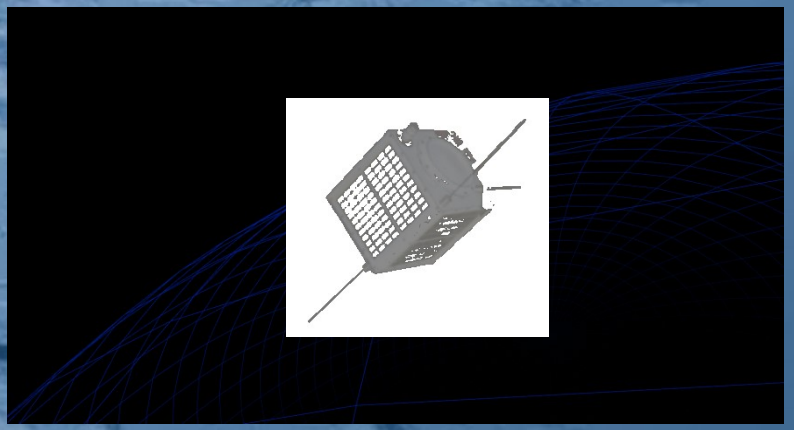
Triaxial Magnetometer

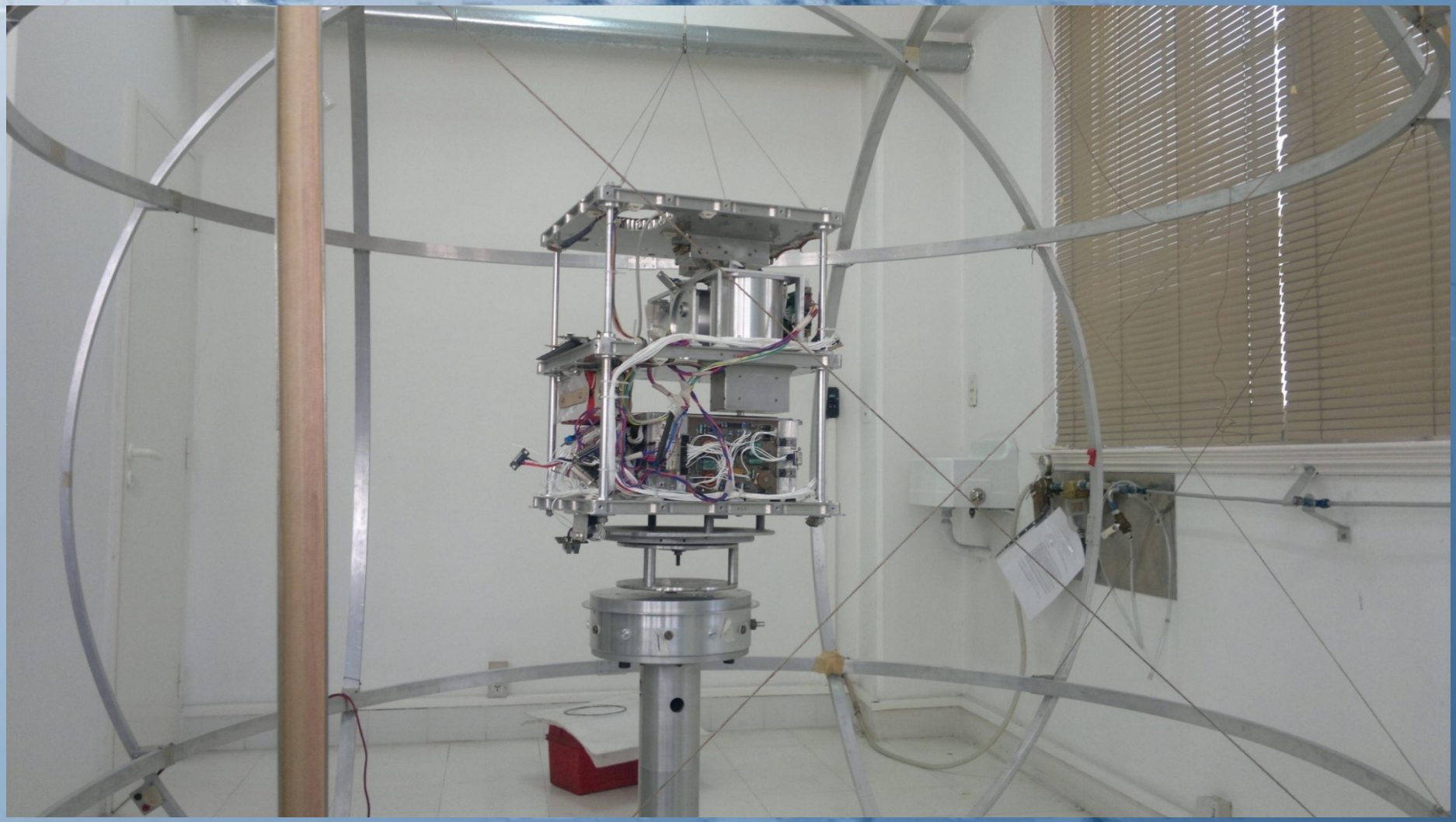
3D Model

- Used OpenGL (Open Graphics Library) en C++
- Centrum of Coordinates Axis in the satellite.
- Sun Light incidence on the satellite.

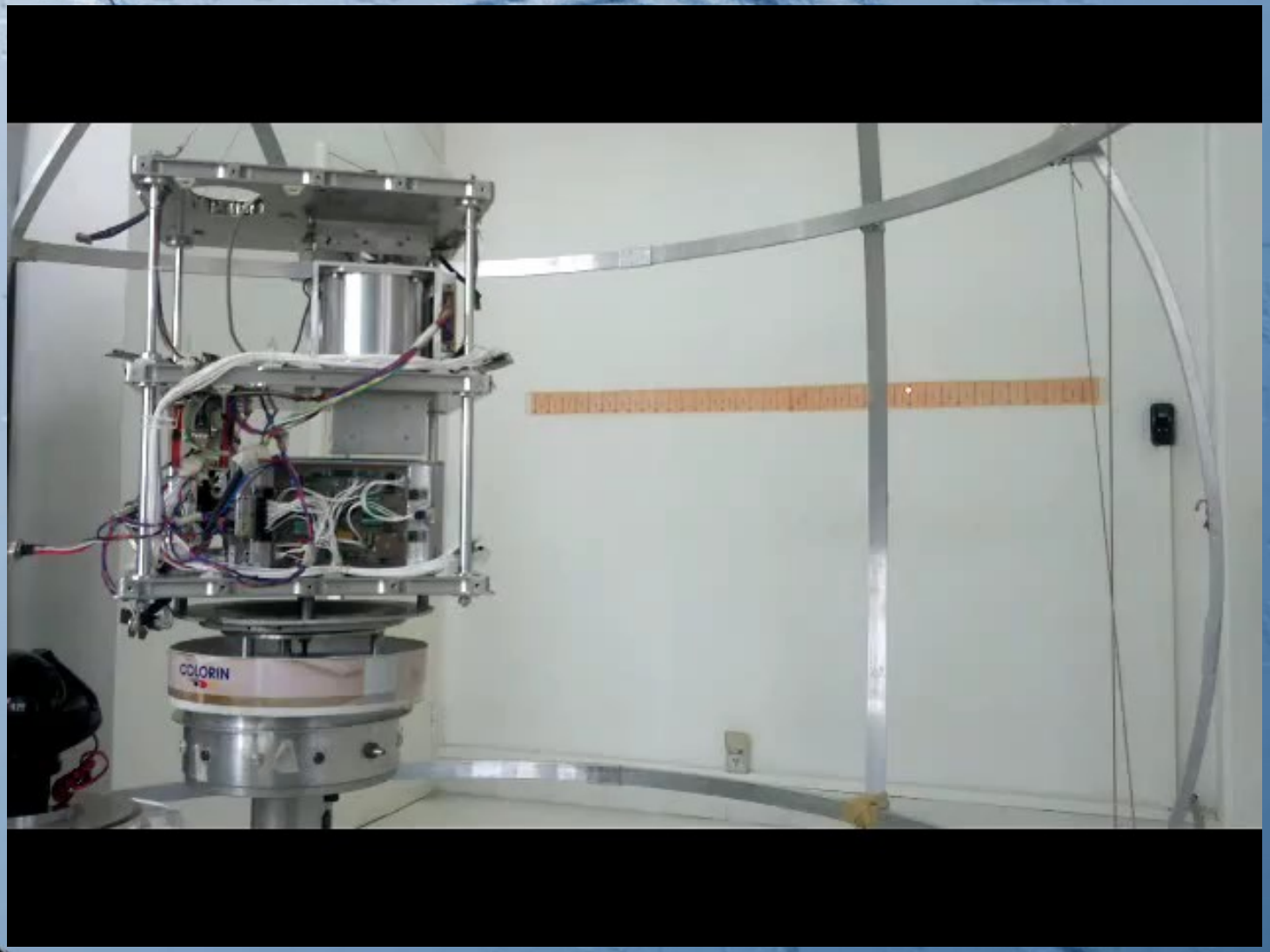









COLORIN

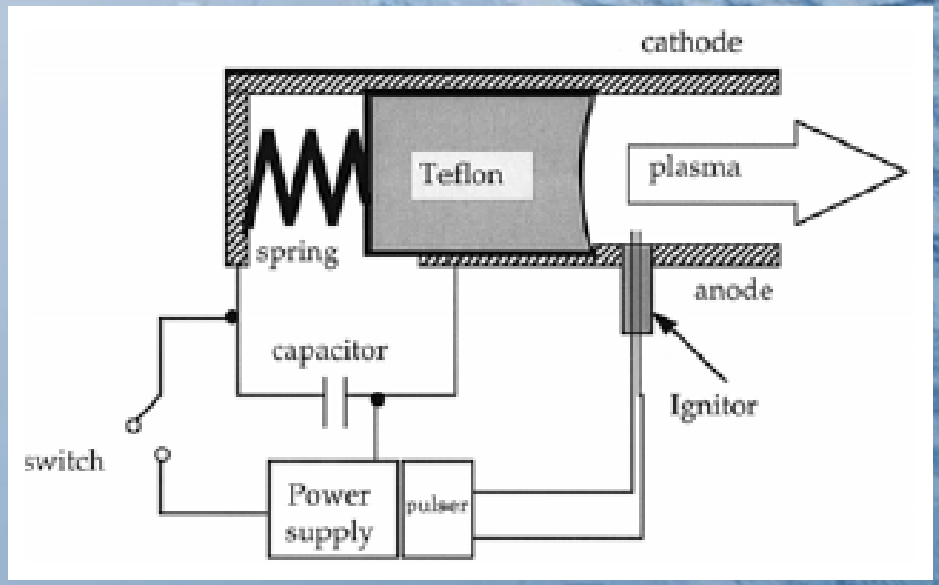

COLORIN

PULSE PLASMA THRUSTER
SOLID PROPELENT - P4S-2

BASIC CHARACTERÍSTICS

Status	: Development Model
Power Required	: 25 Watts
Ejection Velocity	: Between 10.000m/s y 30.000 m/s
Total Impulse	: 1500 N-s
Total Thrust	: 0.28mN
Specific Impulse	: 994s
Total Mass	: < 5kg
Propelente	: PTFE (Teflón)
Aplications	: Attitude Control, orbit change and maintenance

Pulse Plasma Thruster
Solid Propelent



Put Out of Orbit

- 30 days without propultión
- 130 days with inverse propultion
- Final Step 17/18 months (atmospheric braking)