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Current Status of PACE (Platform for Attitude Control Experiment)

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PACE Mission



The mission of the PACE project is to offer students hand-on opportunities to experience through the development process of satellite design, analysis, assembly, integration, test, launch and operation.

→ Primary experiment

Perform three-axis stabilization of a pico-class satellite.

→ Secondary experiment

Verify self-made MEMS sensors for space applications.



PACE Overview

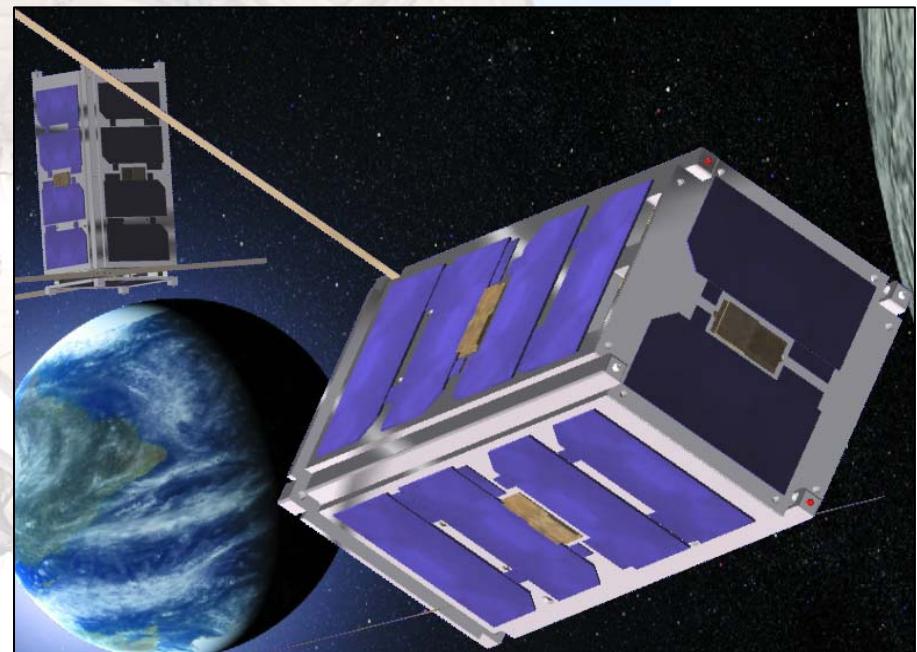
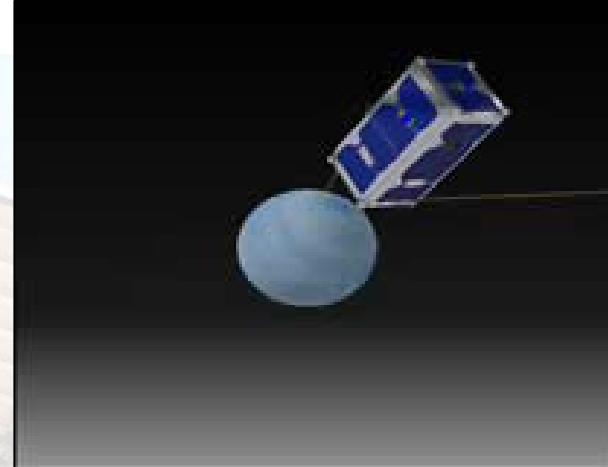


→ A double cube design

→ Three-axis stabilization requirement
-- Pointing accuracy 5°

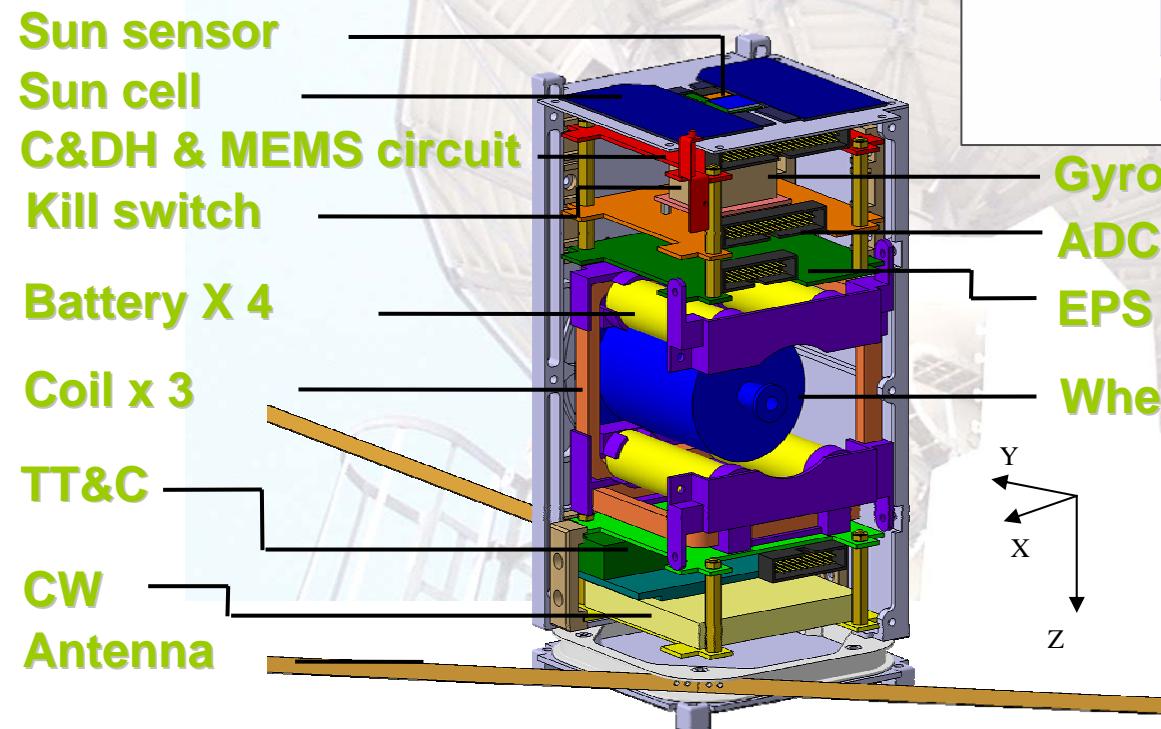
→ Two CPU design
-- 8051-based: C&DH and ADCS

→ MEMS sensor demonstration
-- Coarse sun sensor
-- Temperature sensor





System Configuration

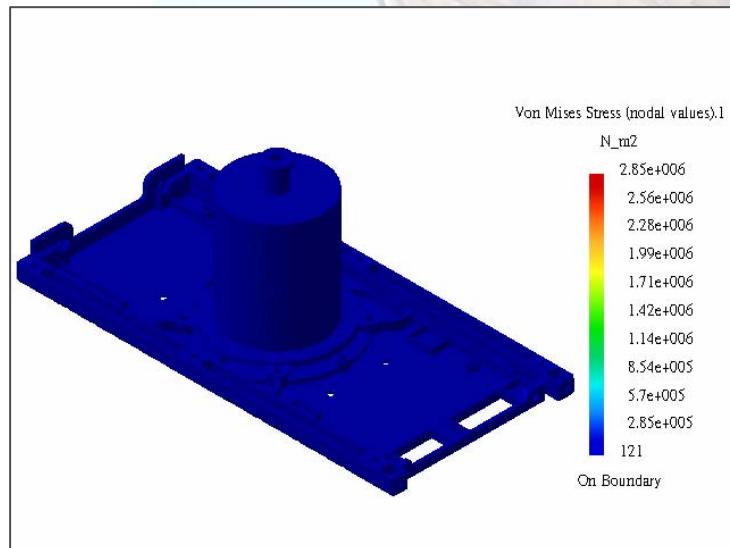
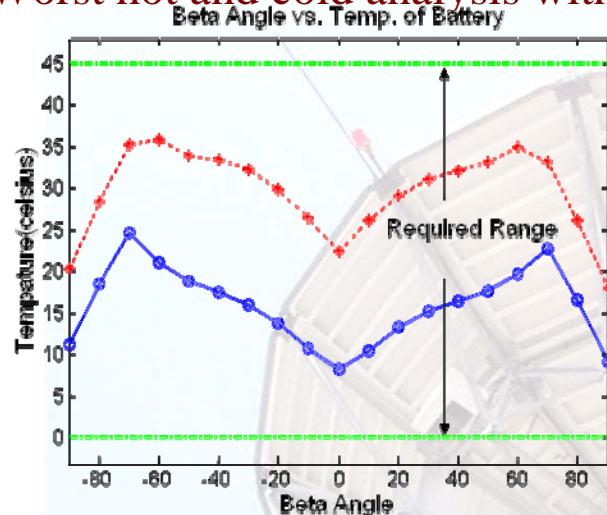


Dimension : 100×100×228 (mm)
Weight : 1656g

Mechanical Design and Analysis

➤ Thermal Analysis

Worst hot and cold analysis with ADCS 3-axis stabilization requirement.



➤ Stress & Dynamic Analysis

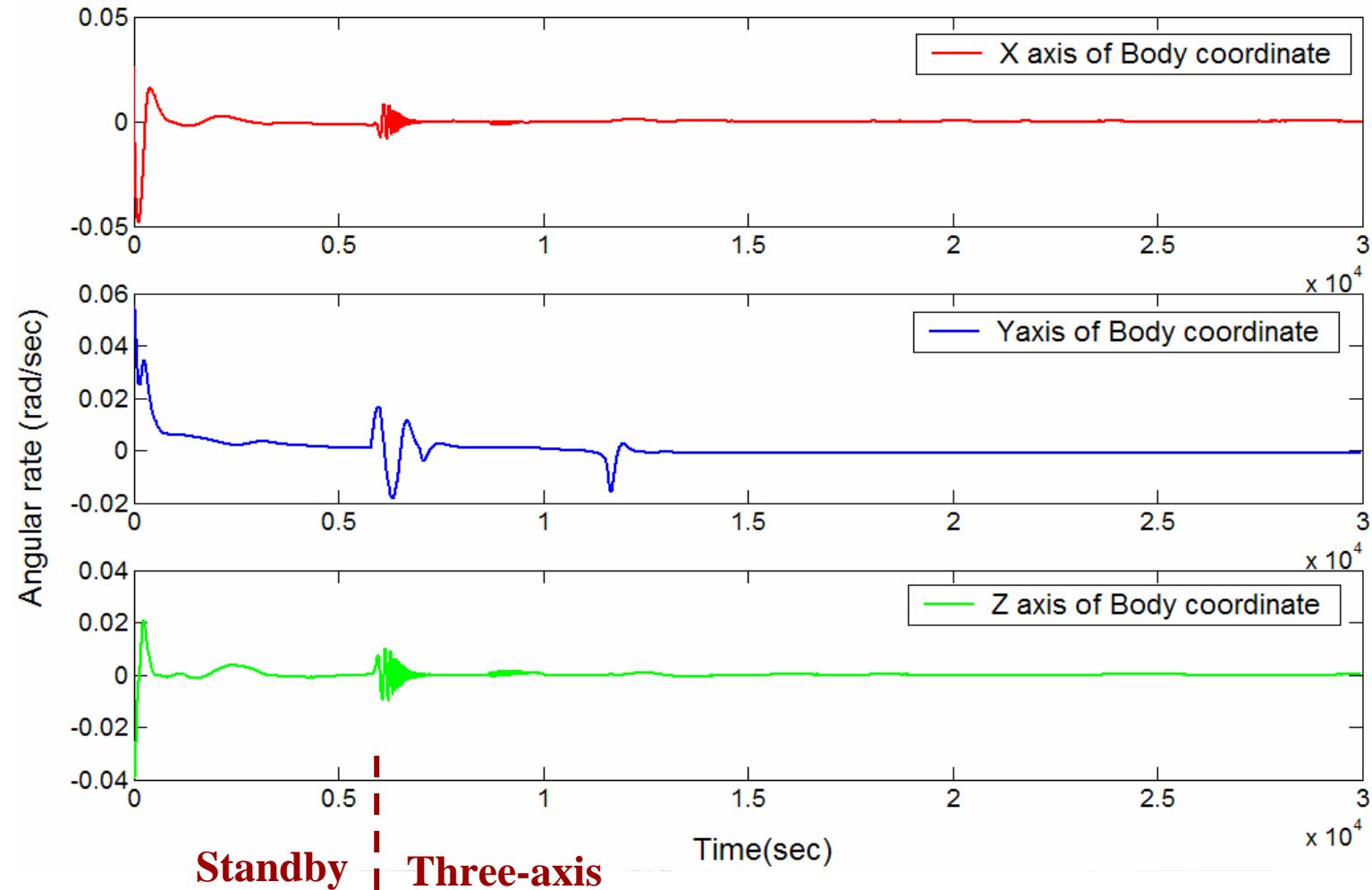
Lateral mode : 652 Hz >> 25Hz

Longitudinal mode : 1079Hz >> 40Hz

Yielding stress : 440MPa >> 30~40MPa

Attitude Control Simulation(1/2)

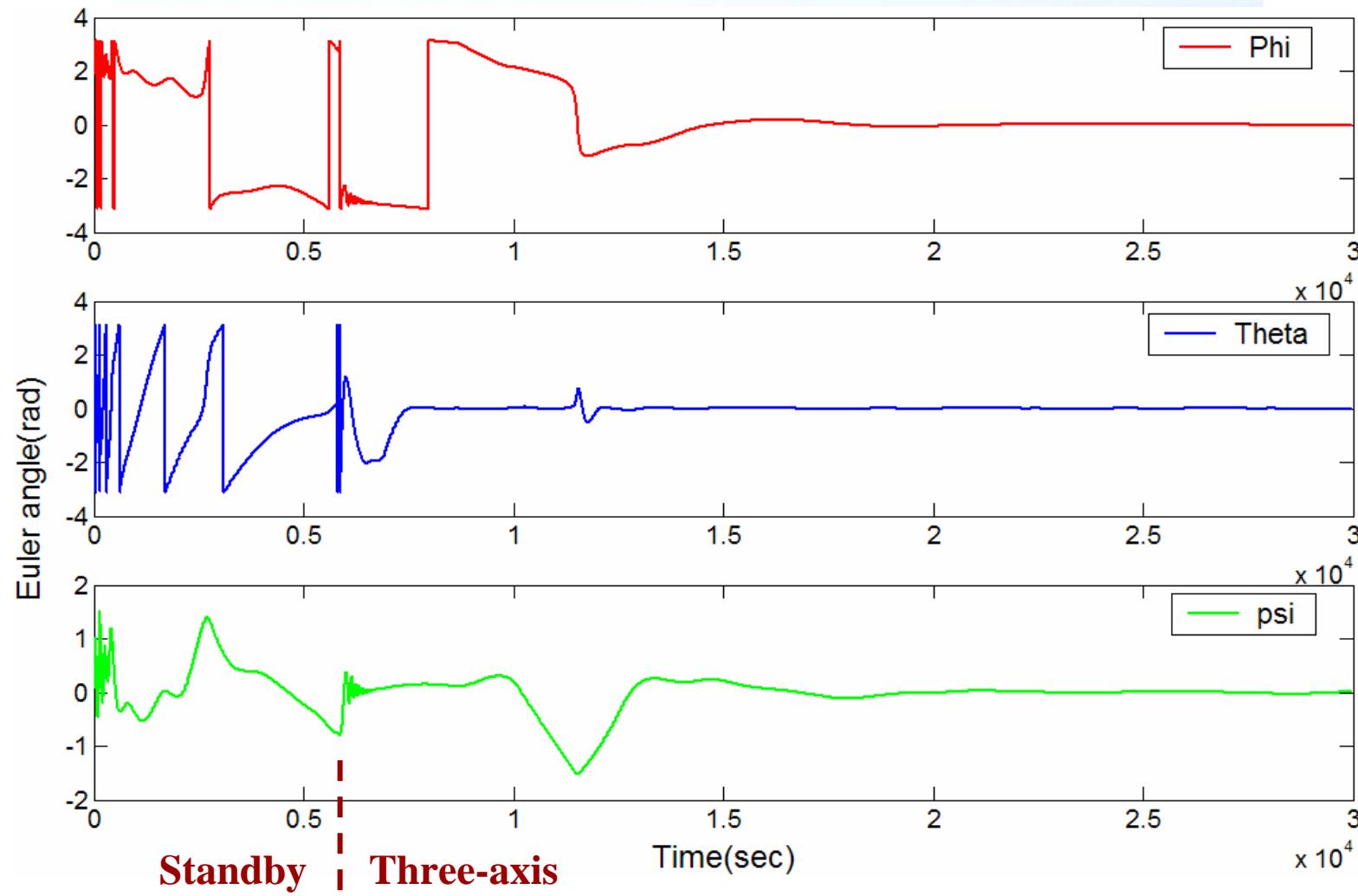
→ Initial → Standby → Three-axis mode





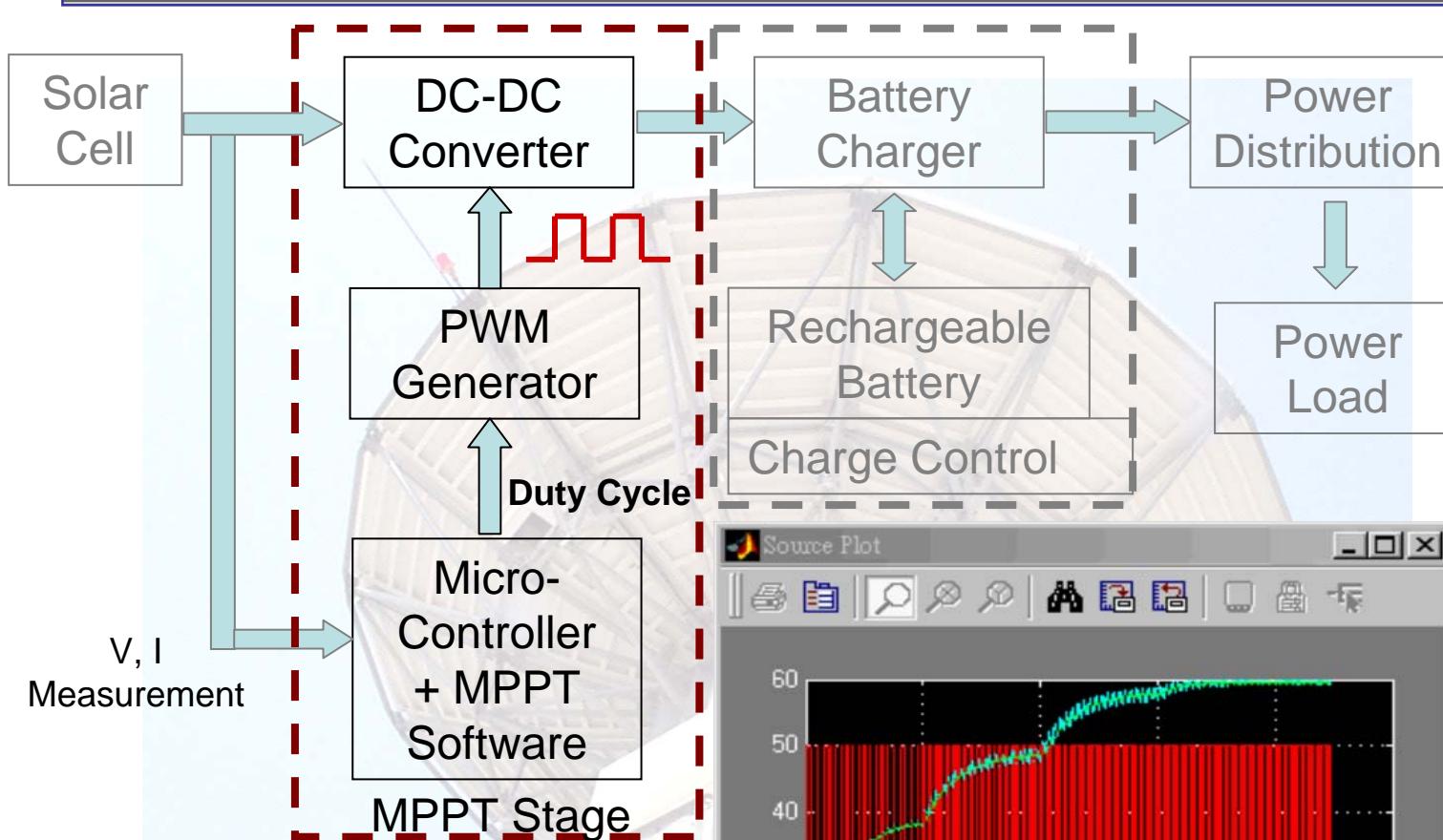
Attitude Control Simulation(2/2)

→ Initial → Standby → Three-axis mode

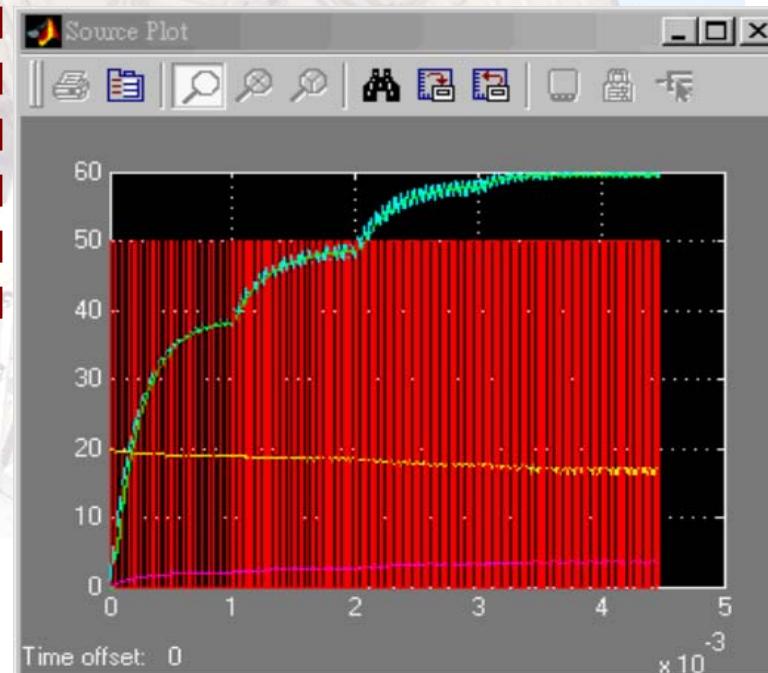




Maximum Peak Power Tracker

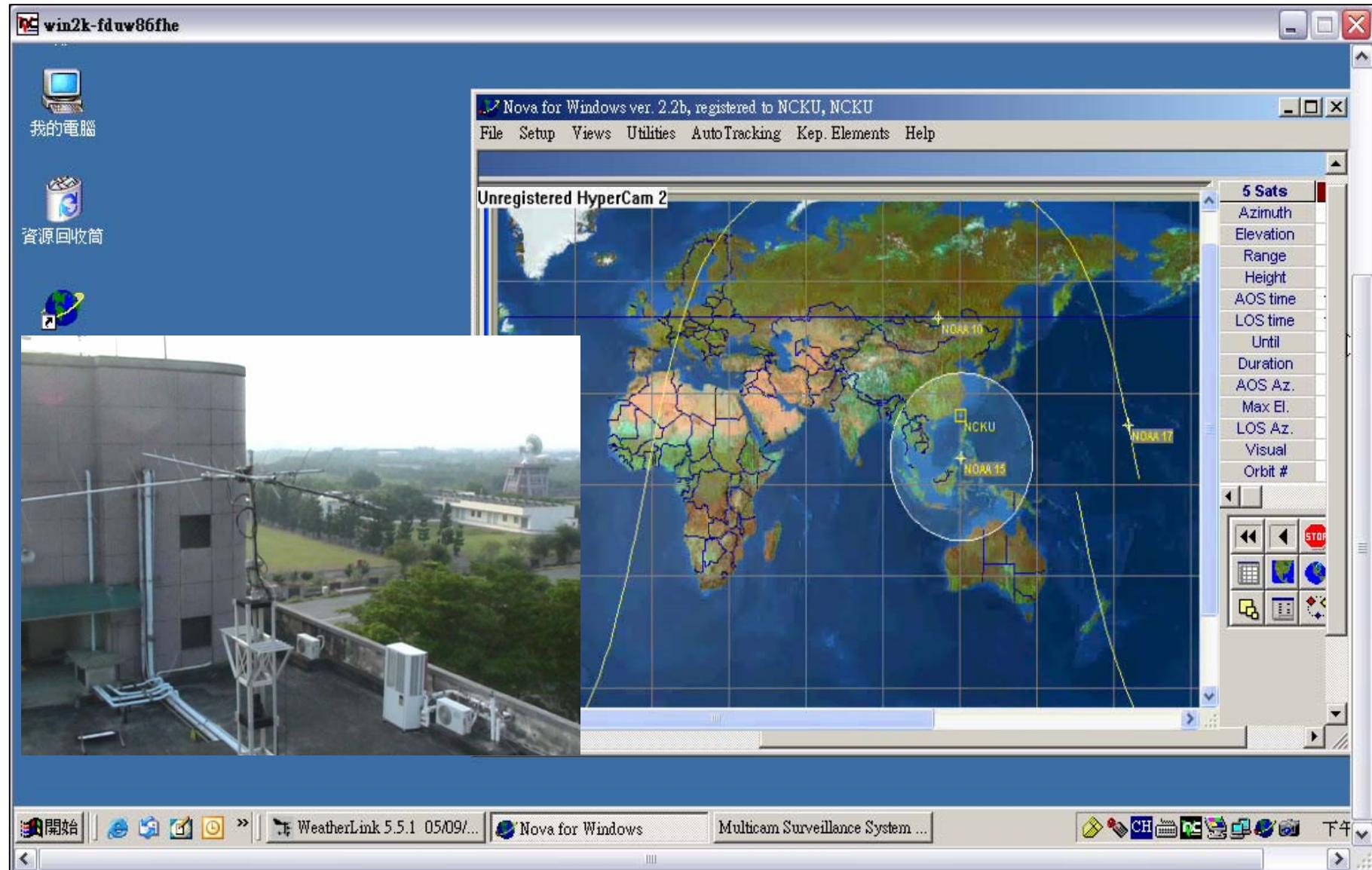


PACE EPS using peak power tracking module to improve solar cell efficiency performance.

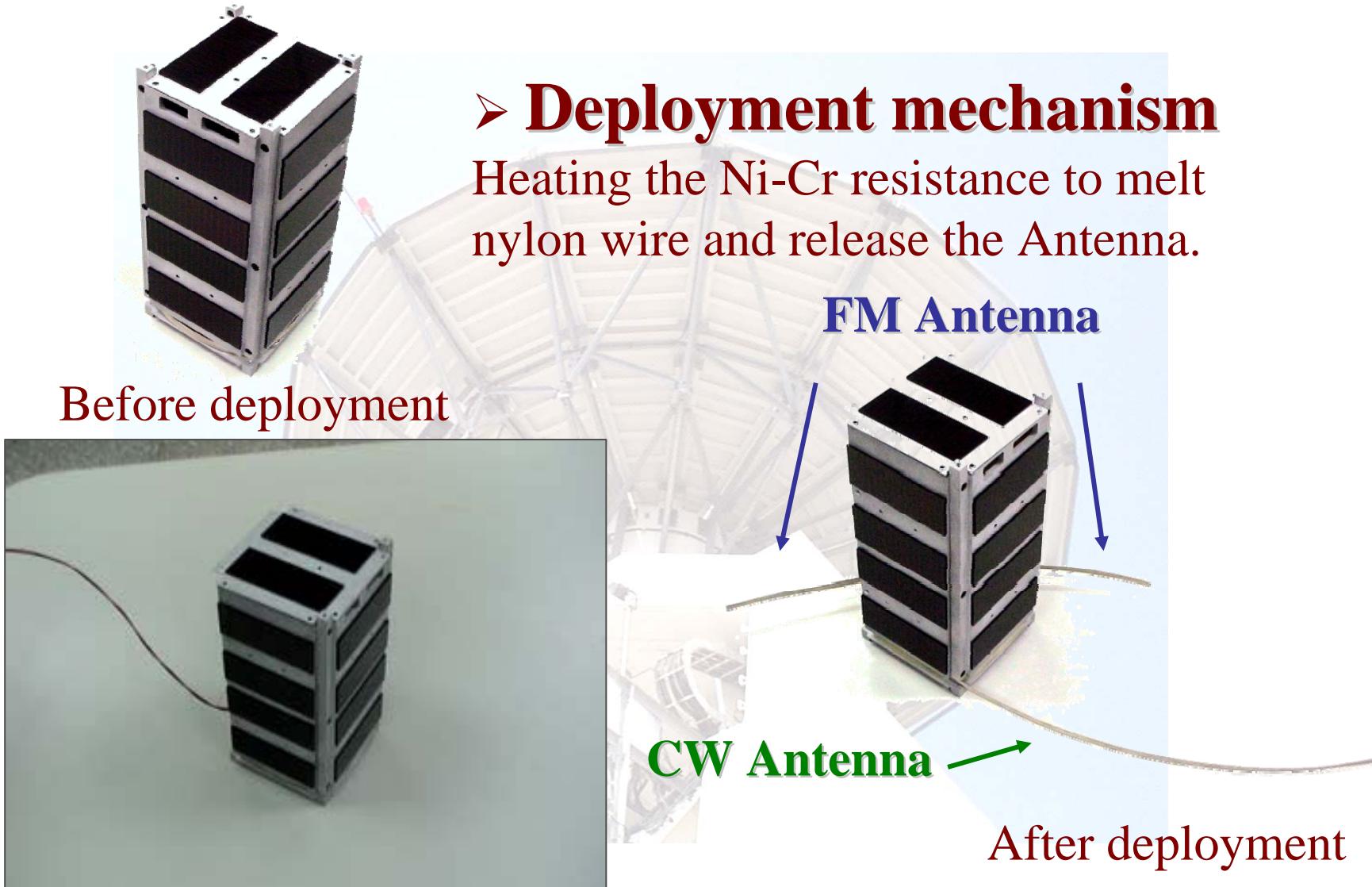




Ground Station

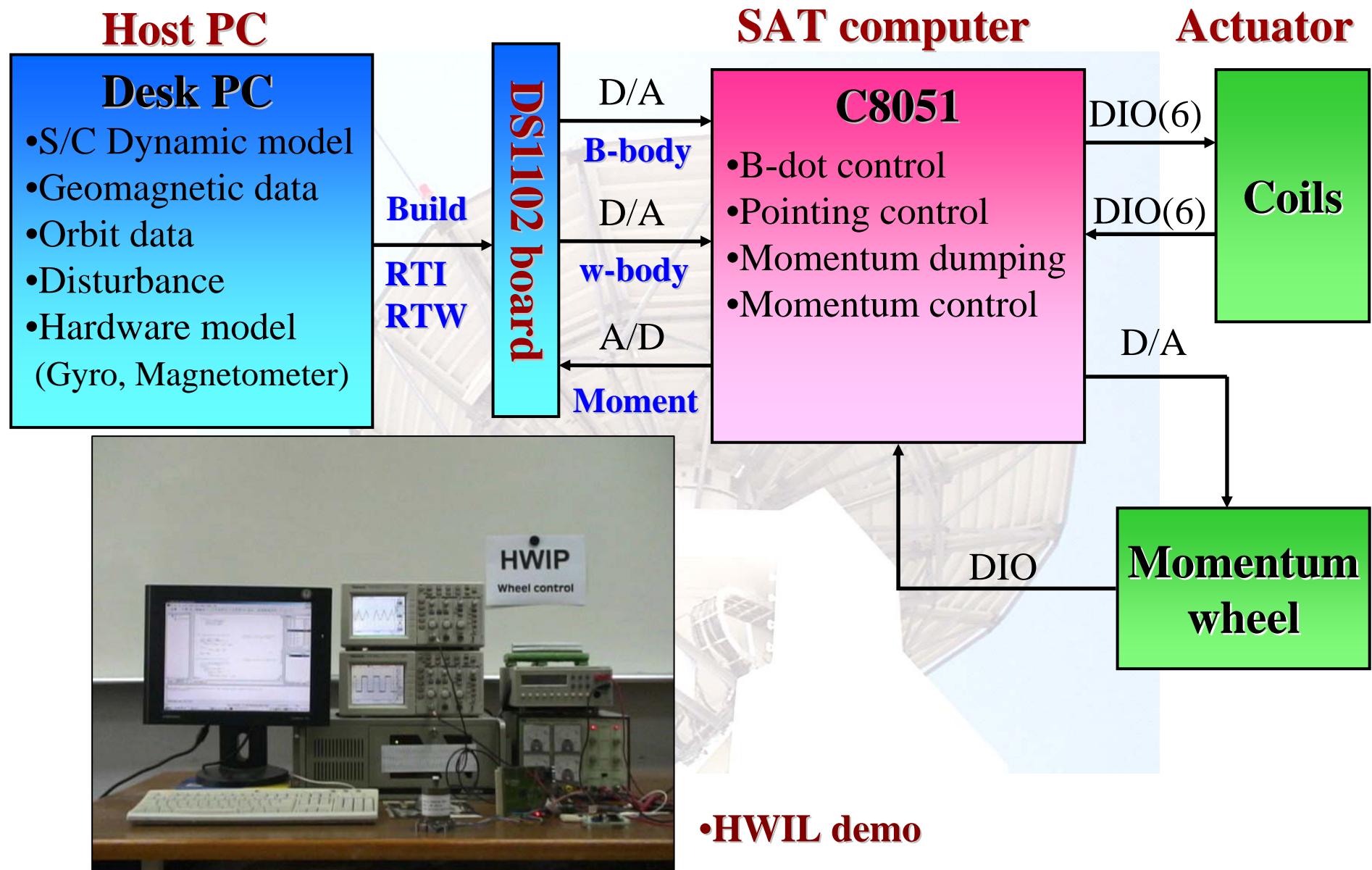


Antenna Deployment



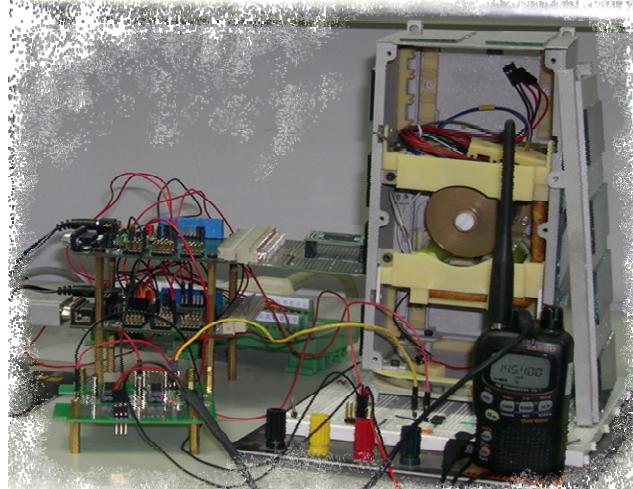


Hardware in Loop (HWIL)



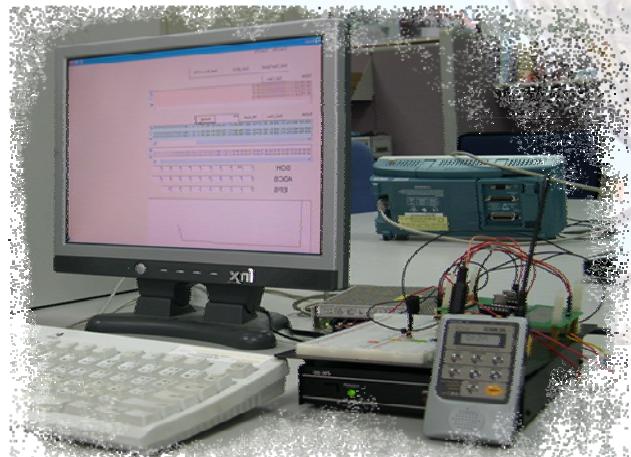


Communication Test



Downlink: AX.25

Uplink: Self-Defined



•ADCS

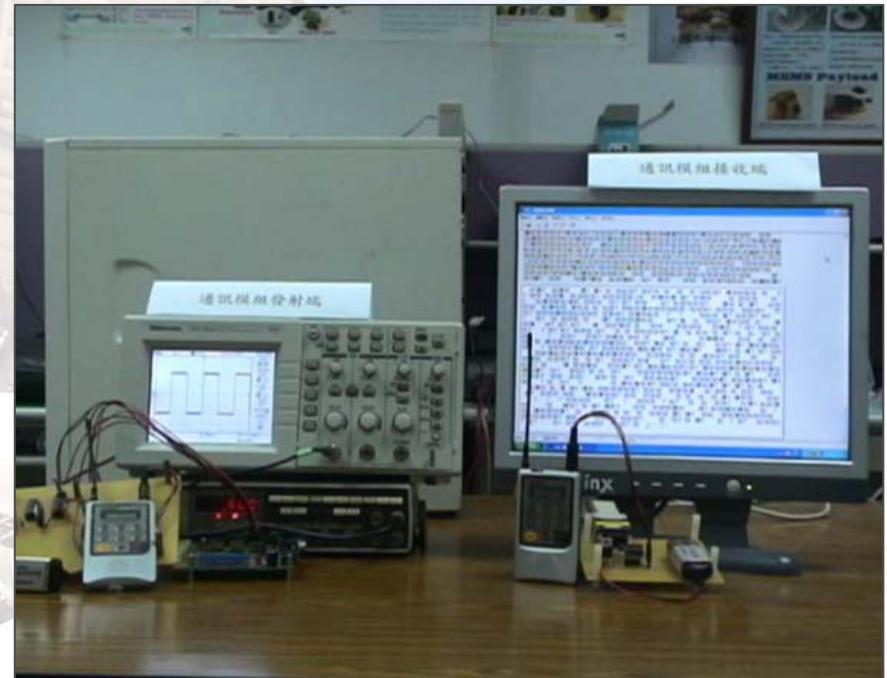
•EPS

•C&DH

•TT&C

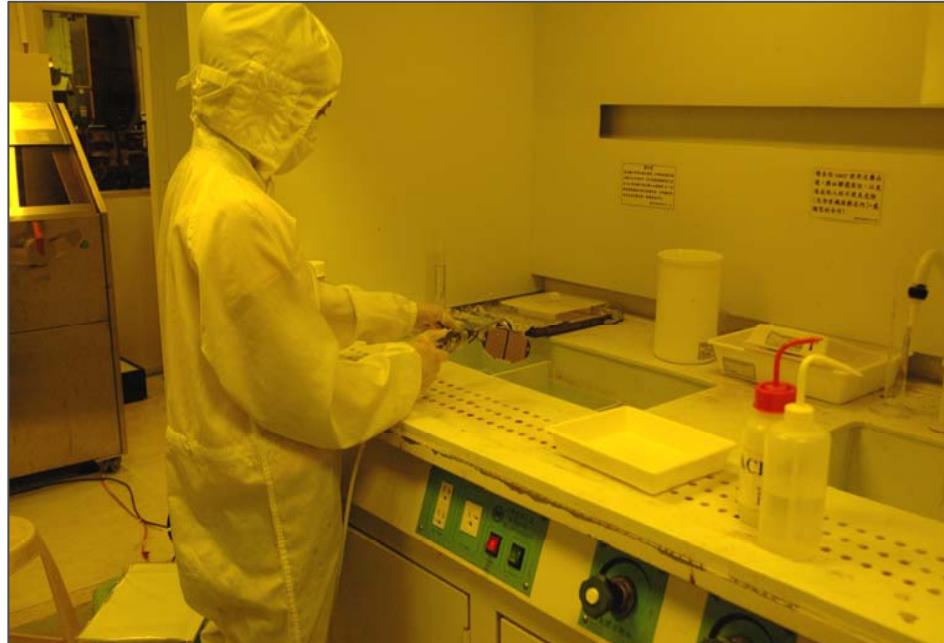
•Ground Station

ADCS, C&DH,
TT&C, EPS ↔ Ground Station

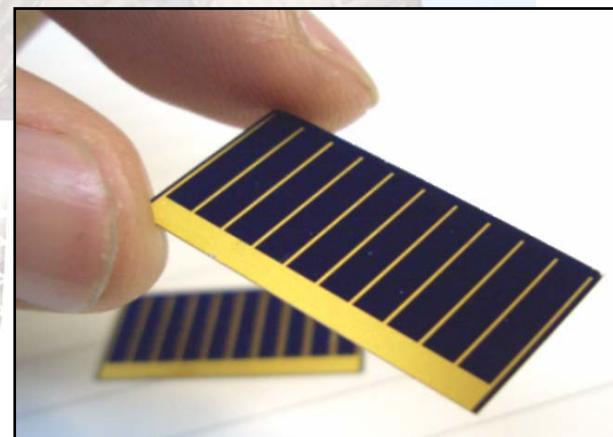
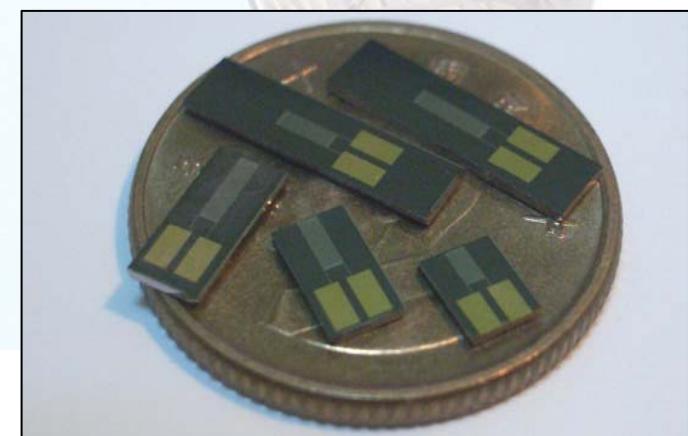


•Experiment Demo

MEMS Sensor



Coarse sun sensor is made of commercial grade solar cell packaged by MEMS fabrication process. Temperature sensor is silicon-based MEMS sensor.



- Coarse sun sensor
- Temperature sensor



Thanks for your attention!



The support of Ministry of Education, Taiwan, to this project is gratefully acknowledged.