

# QB50 - BeEagleSat Inner - Outer Design Details and ADCS Testing - Integration

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7<sup>th</sup> European CubeSat Symposium

Liège, Belgium

9-11 September 2015

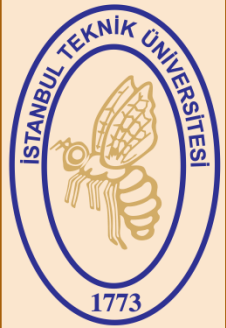
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# Outline

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- BeEagleSat Overview
- Design Requirements
- Subsystem Configuration
- Solar Panel Design
- Access Hatch and RBF
- ADCS Integration & Testing



# BeEagleSat Overview

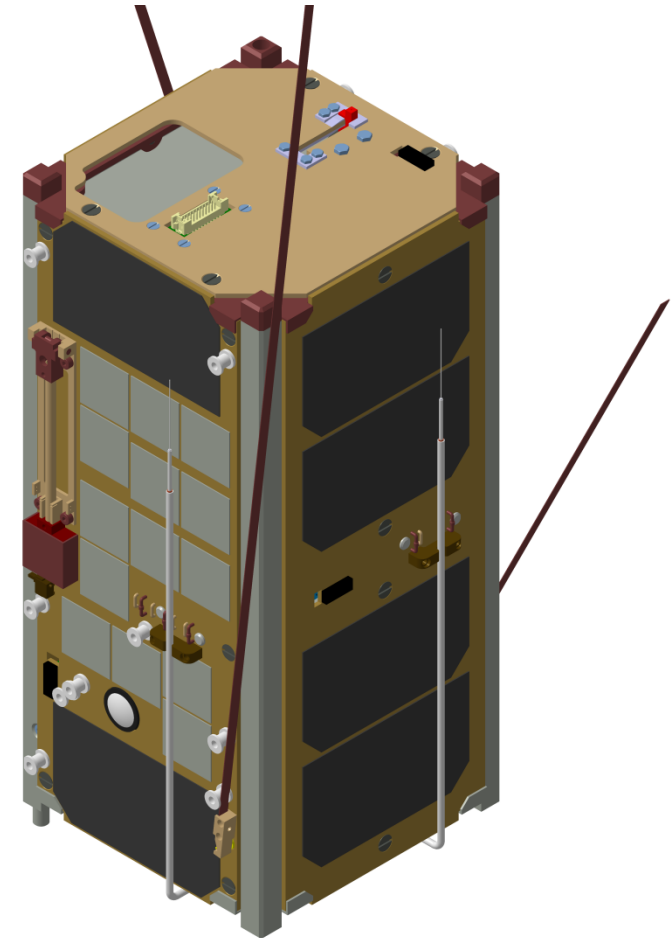
- Collaboration between
  - Istanbul Technical University
  - Turkish Air Force Academy
  - GUMUSH Aerospace & Defense Ltd. Co.
  - ErTek Space Tech. Ltd. Co.
  - HAVELSAN Inc.
- Part of the QB50 project
- Design shall be fitted QB50 requirements.
- Multi Needle Langmuir Probe (mNLP) payload was selected.
- Second Payload X-Ray detector
  - It is developed with collaboration between Sabanci & ITU.



**QB50**, an FP7 Project



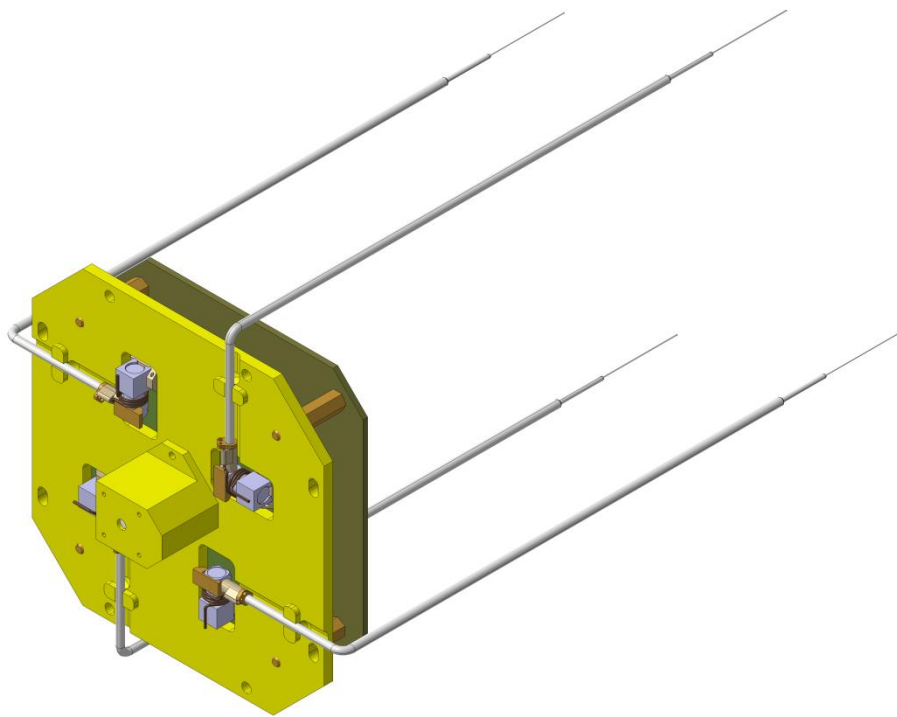
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BeEagleSat ISO View

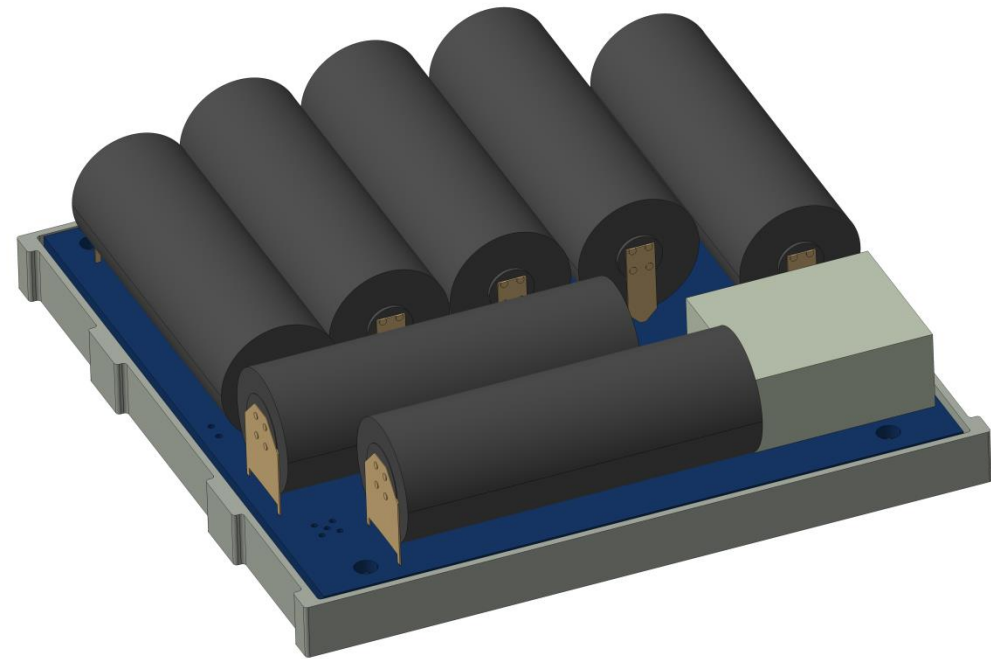
# Payloads of BeEagleSat

MULTI NEEDLE LANGMUIR PROBE (mNLP)



For more information: <https://www.qb50.eu/index.php/tech-docs/category/23-up-to-date-docs>

X-RAY DETECTOR (XRD)



For more information: 5th European CubeSat Symposium, The X-ray Detector on BeEagleSAT, *E. Kalemci, A. Atasever, E. Umit and R. Aslan*

# Design Requirements

- mNLP have to be at RAM direction. -- QB50
- XRD have to be at bottom or upper location. -- Second Payload
- Location of the CubeSat's CoG as far as possible ahead of the CoP in flight direction. – QB50 ADCS
- The CubeSat CoG shall be located within a sphere of 20 mm from its geometric center. – CDS Rev. 12
- The moment of inertia about any satellite body axis for the host satellite on which the QB50 ADCS will be used shall not exceed 0.02 kgm<sup>2</sup> . -- QB50 ADCS
- The Y moment of inertia ( $I_{yy}$ ) shall be at least 5% larger than the X and Z inertia moments ( $I_{xx}$  and  $I_{zz}$ ).

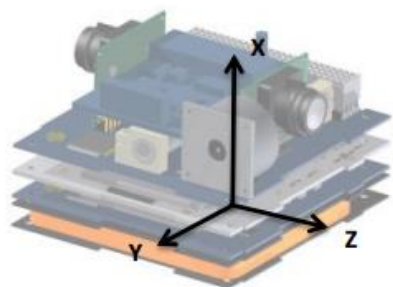


Figure 6 ADCS coordinate system

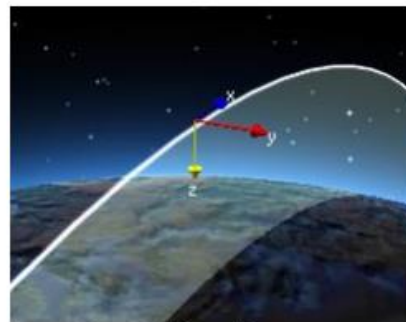


Figure 7 Orbit coordinate system

Ref: QB50 ADCS Interface Control Document Rev. 3

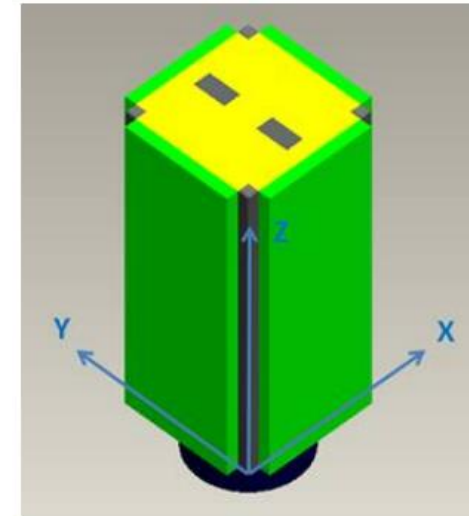
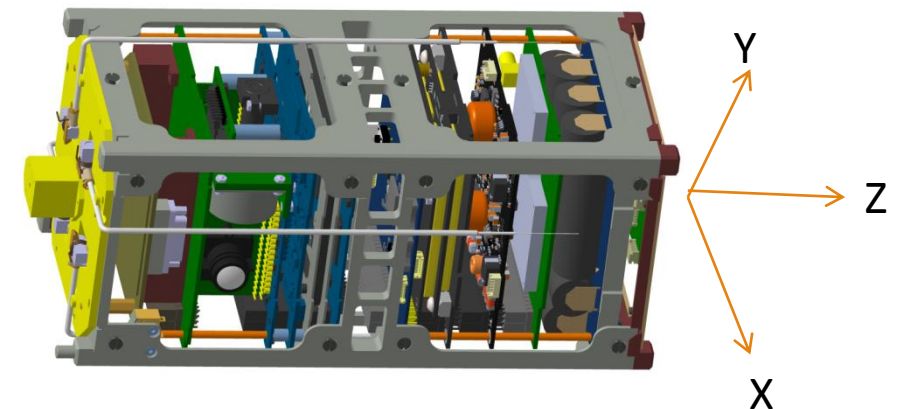


Figure 1: QB50 CubeSat reference frame

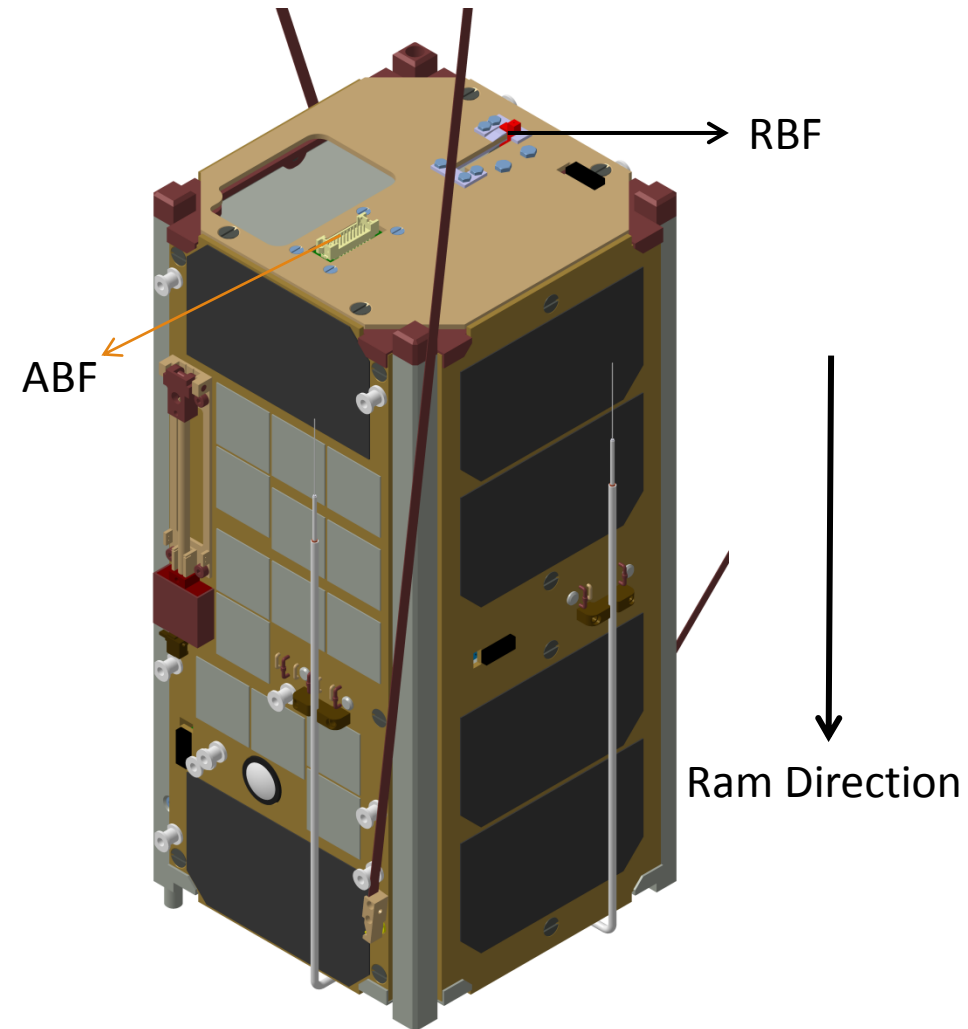
Ref: QB50 System Requirements and Recommendations Issue 7



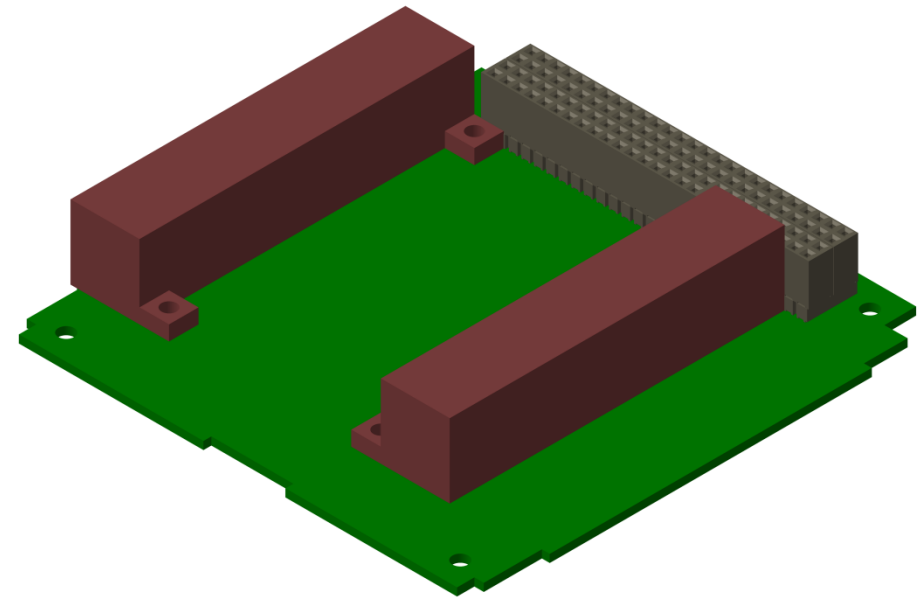
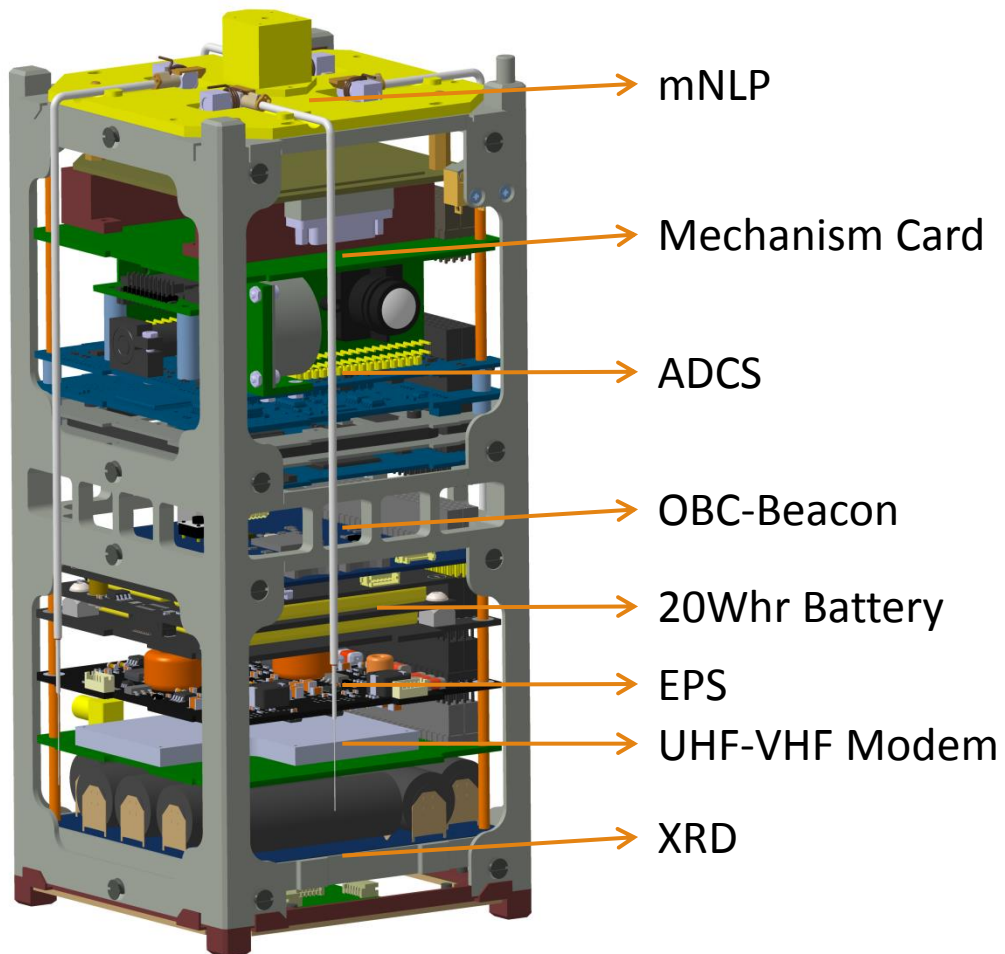


# Design Requirements

- Each Solar panel has to have 4 solar cells(39.7 x 69.1 mm) or equivalent due to power requirement.
- ADCS has two lens & lens` location is fixed due to solar cell location.
- Access hatch shall to be at opposite ram direction.
- Remove Before Flight (RBF) tags should be able to be removed through these access hatches only.
- Likewise, Apply Before Flight (ABF) tags should only be accessible via these access hatches.



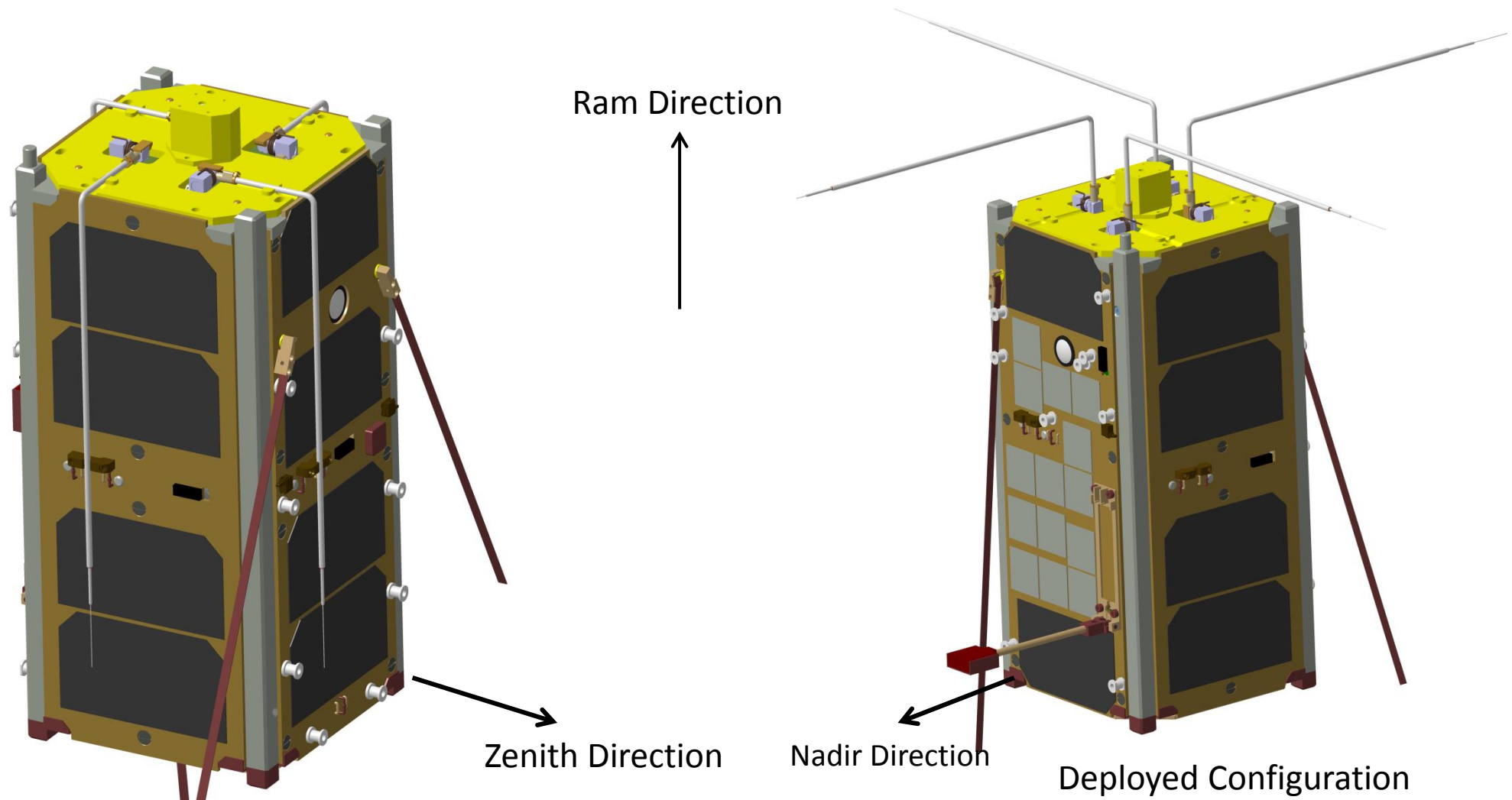
# Subsystem Configuration



## Mechanism Card

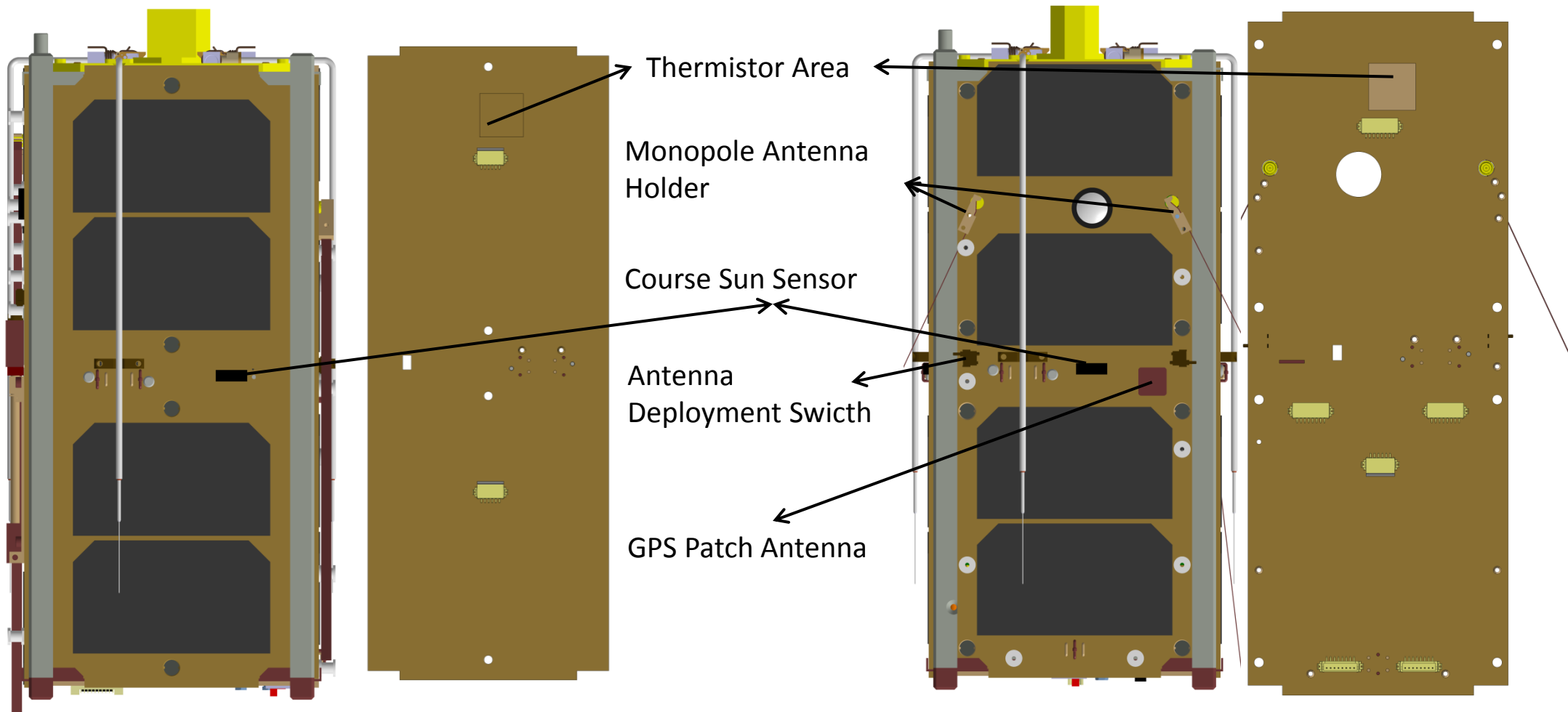
- Control the antenna deployment system
- Edit CoG location and moment of inertias

# BeEagleSat View





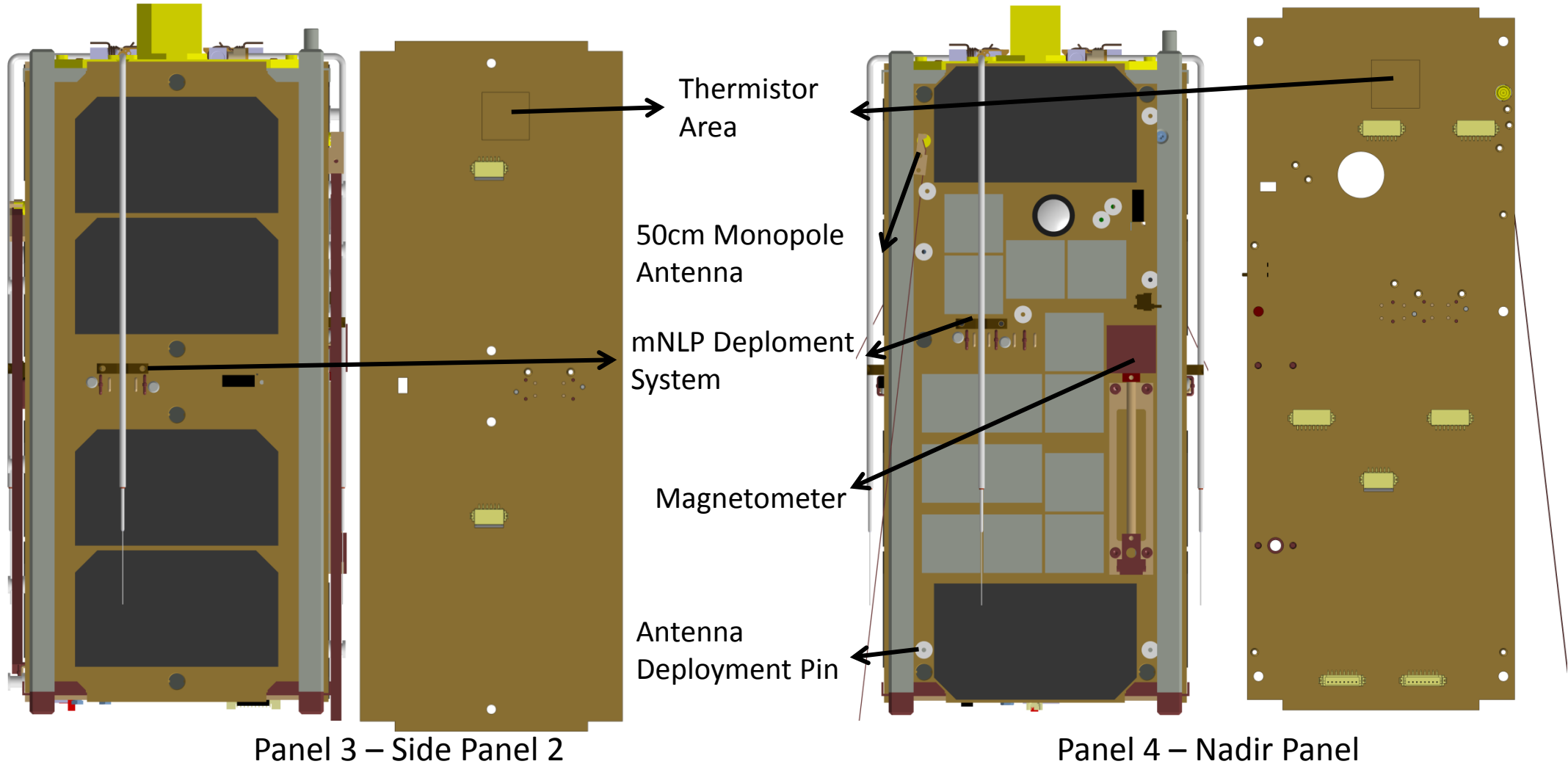
# Solar Panel Design



Panel 1 - Side Panel 1

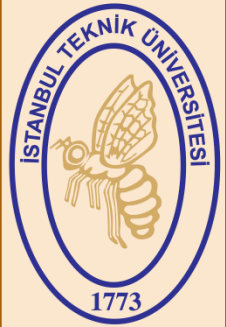
Panel 2 - Zenith Panel

# Solar Panel Design

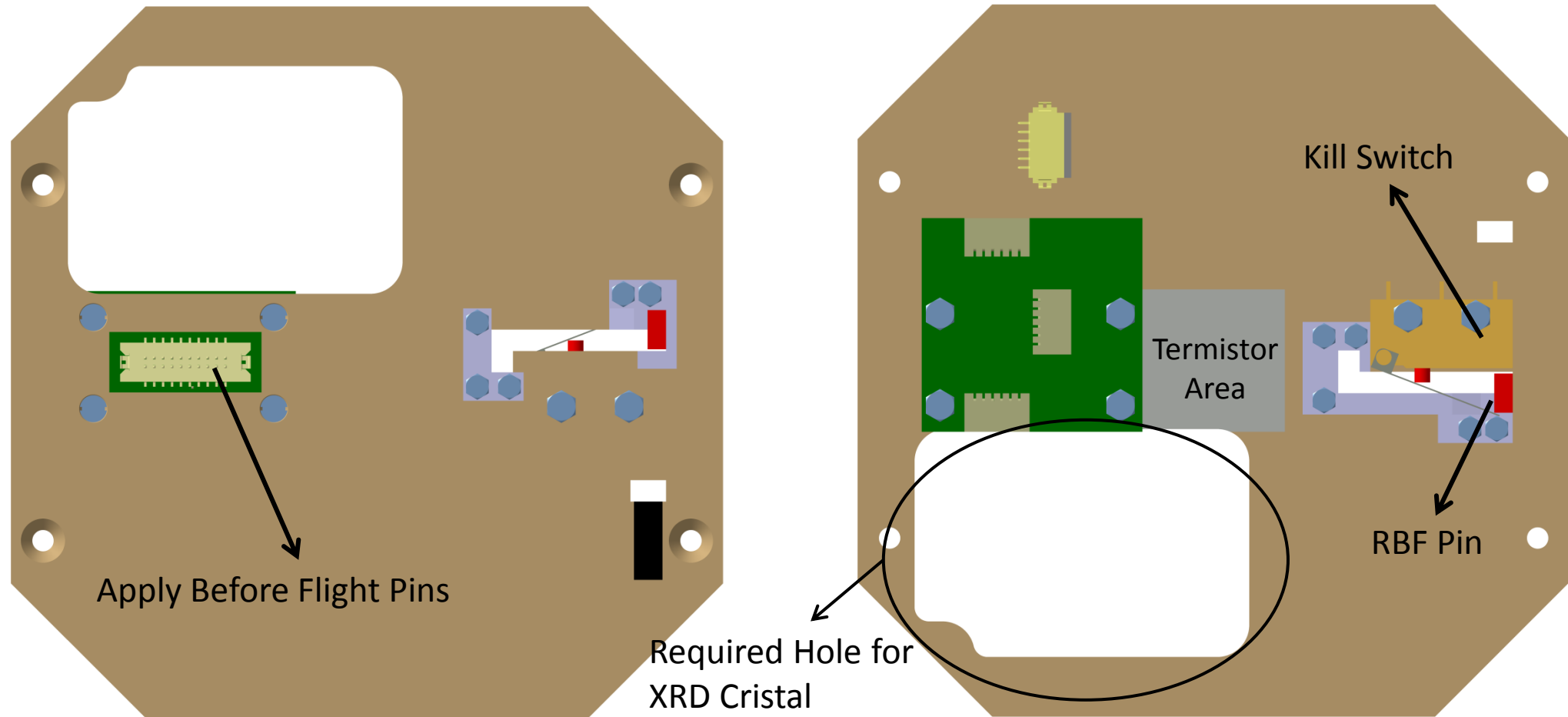




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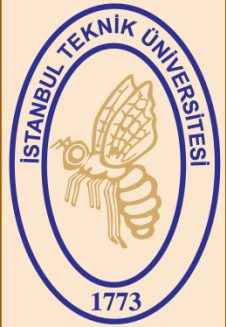


# Access Hatch and RBF

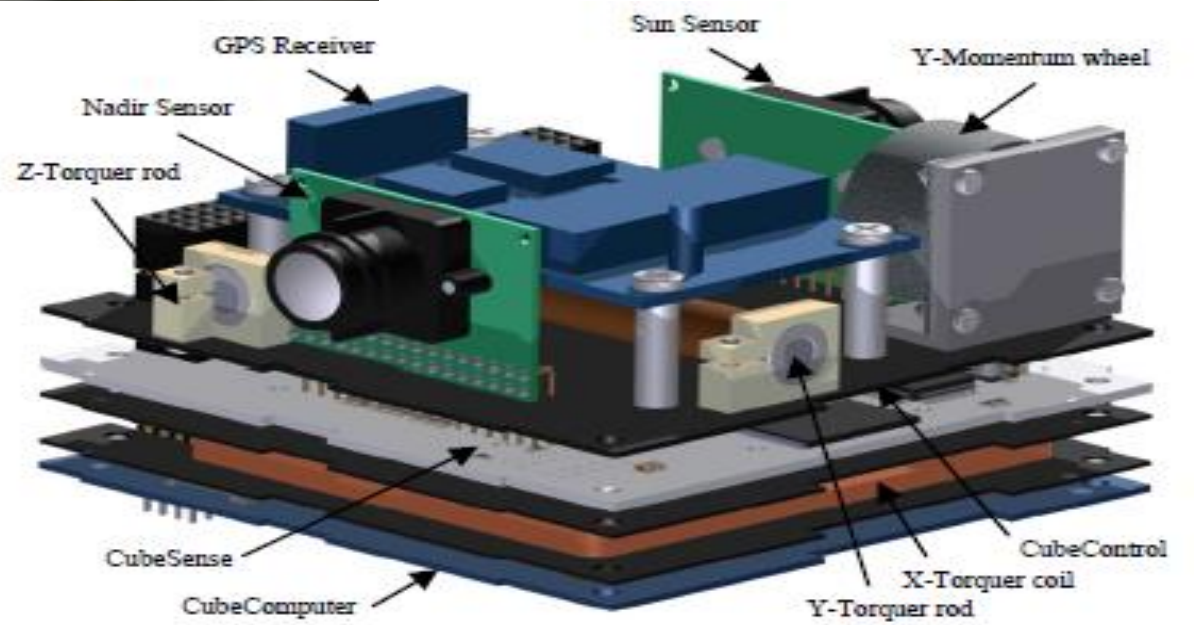
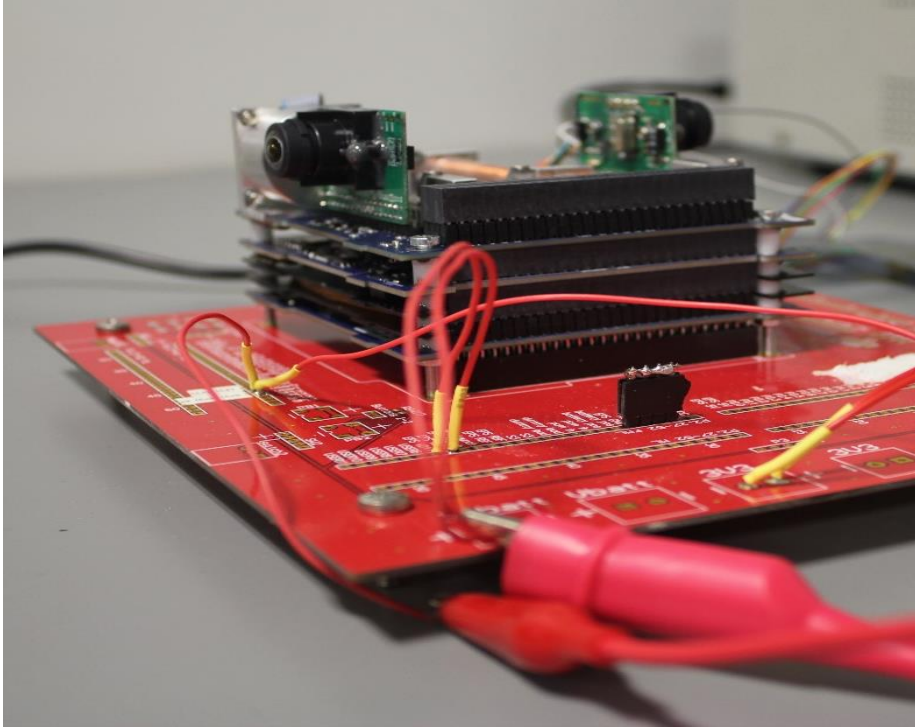




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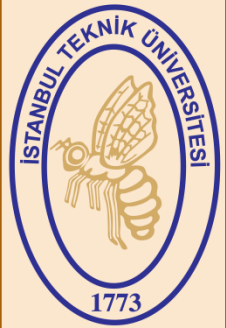
# ADCS Integration & Testing



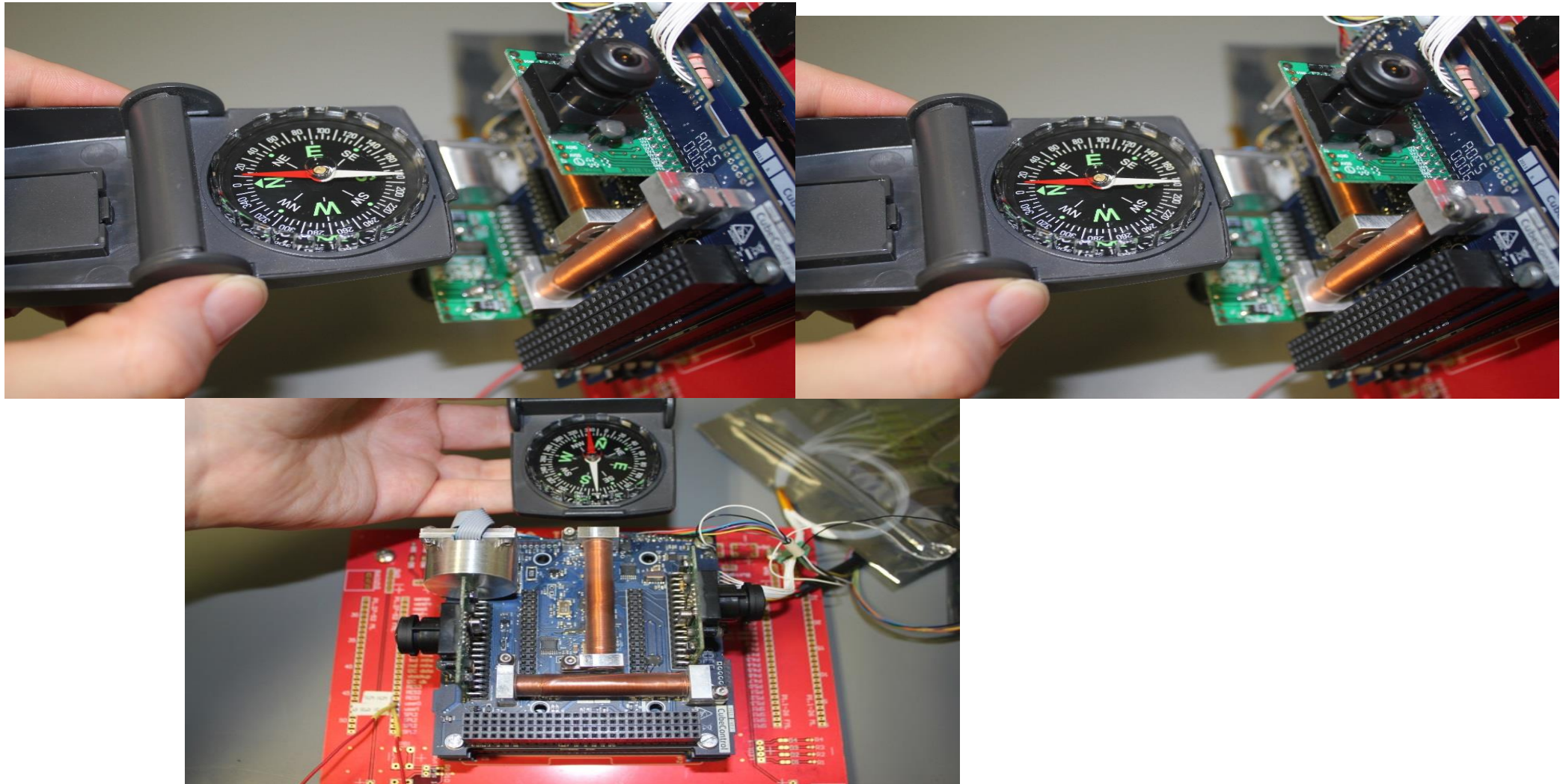




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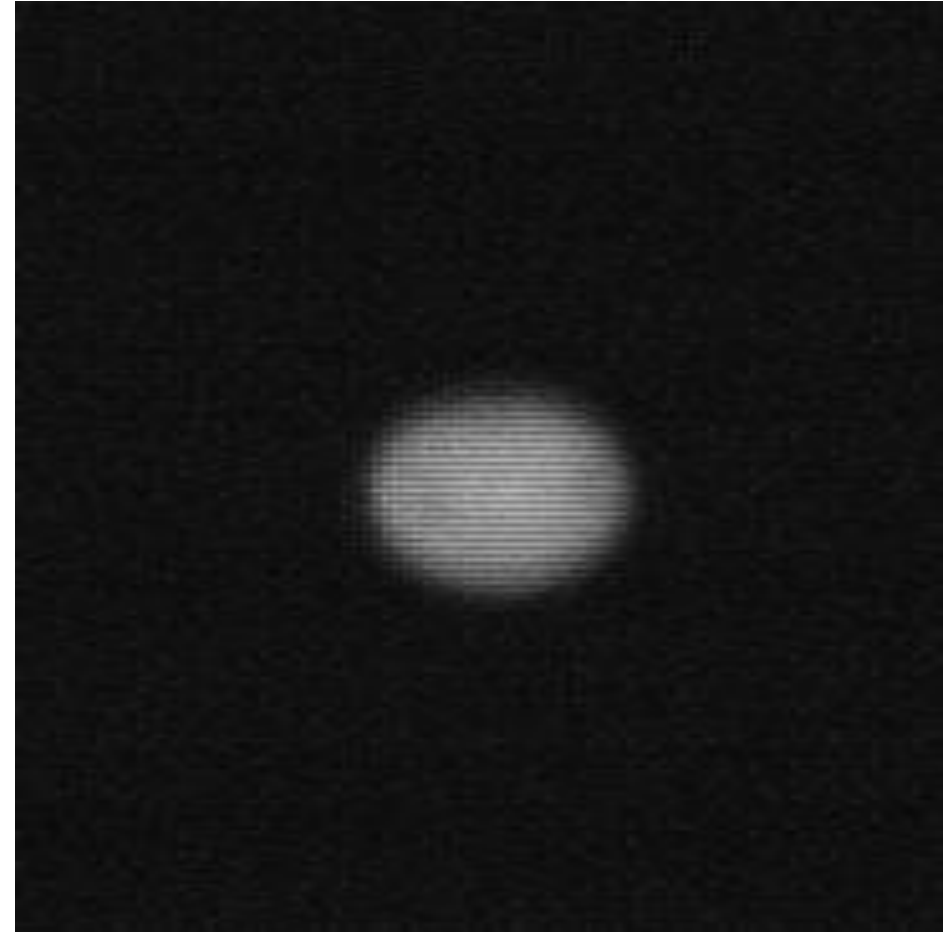


# ADCS Integration & Testing





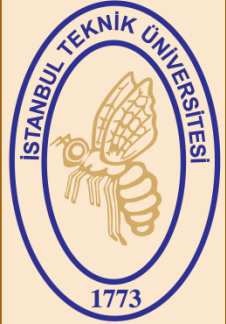
# ADCS Integration & Testing



Sun Sensor testing: focused (left), unfocused (right)



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# ADCS Integration & Testing



Nadir Sensor testing: focused (left), unfocused (right)

# ADCS Integration & Testing

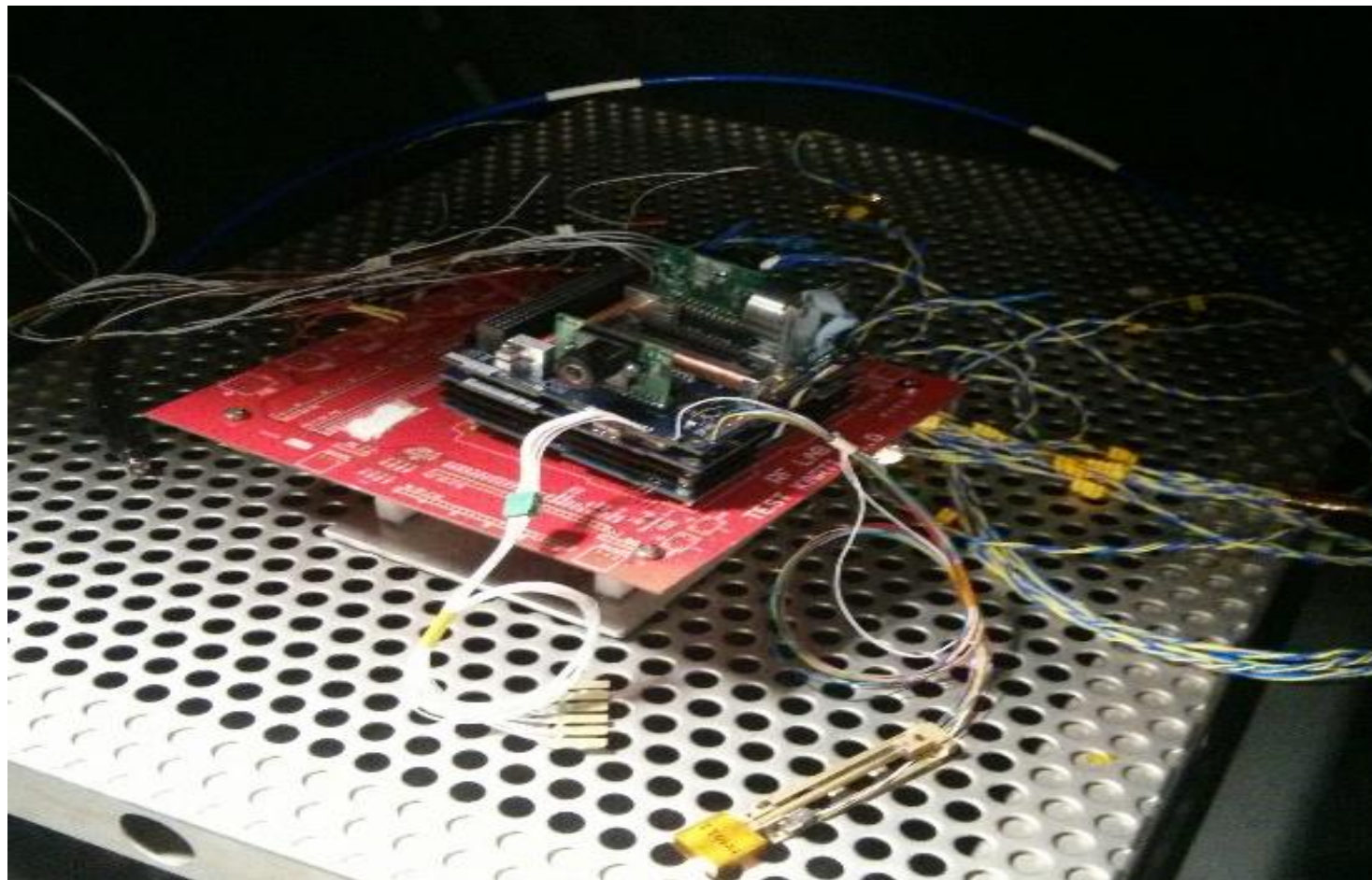
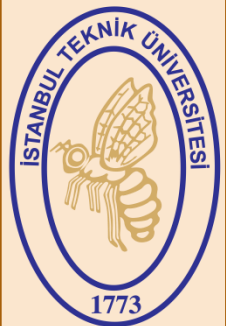


Nadir Sensor (left), Sun (right)

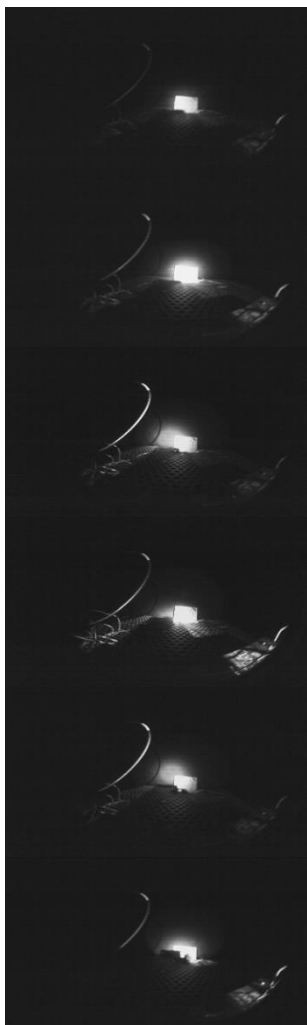




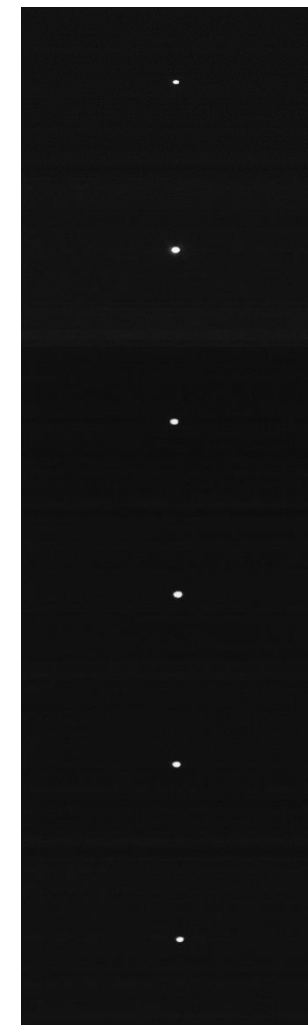
# ADCS Integration & Testing



# ADCS Integration & Testing



Temperature (C)	Vacuum
25,00	NO
22,60	High
50,00	High
50,00	High
40,00	High
30,00	NO



Nadir Sensor (left), Sun (right)

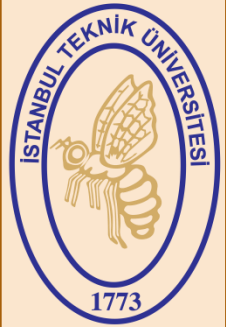


# ADCS Integration & Testing

Measured and controlled status are;

- Enable Status
- Errors
- Sensors
- Power Consumption
  - MCU
  - Reaction Wheel
  - Magnetorquer

Vacuum	Temperature(C)	Temperature of CPU	Temperature of RateSense
NO	25,00	NO	26,00
HIGH	22,60	24,00	30,00
HIGH	50,00	50,00	56,00
HIGH	50,00	50,00	58,00
HIGH	40,00	41,00	-
HIGH	30,00	33,00	-
NO	25,00	25,00	29,00



# Thank you! Questions?

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