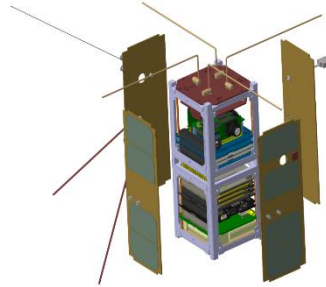


Project Review Forum
Tokyo, Japan
12-15 January 2016

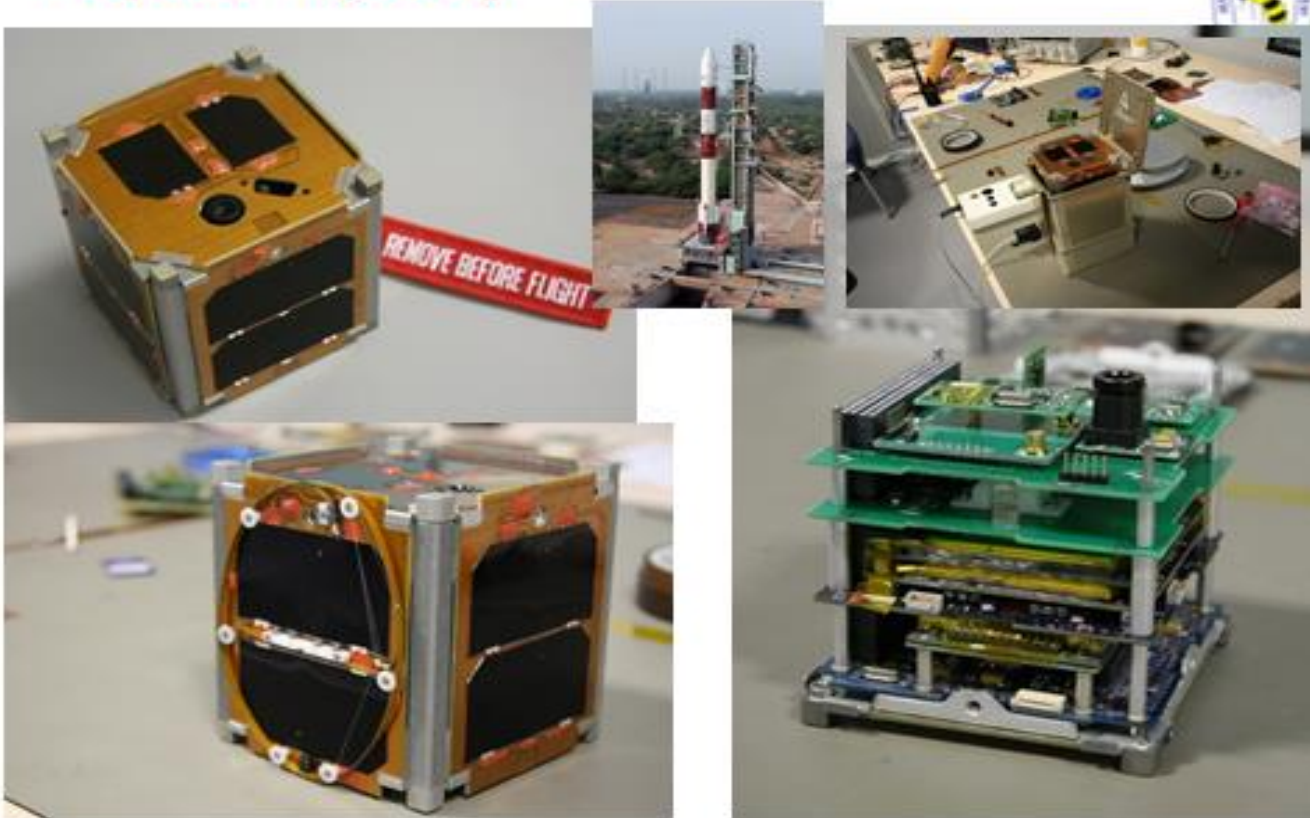
Nano/Micro Satellites Project Reviews at ITU-NanoSat Group



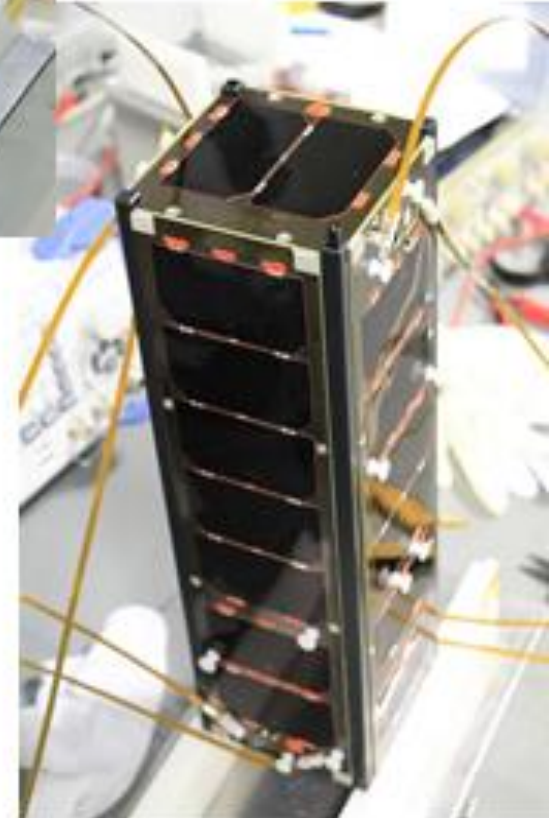
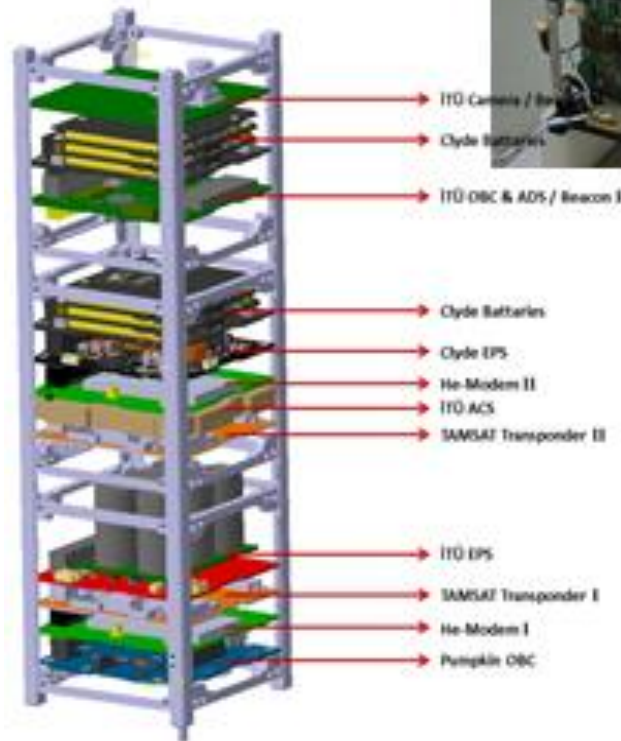
Prof.Dr. Alim Rustem Aslan, UTEB Coordinator, UNISEC Global PoC
Manager, Space Systems Design and Test Laboratory
Istanbul Technical University, Faculty of Aeronautics and Astronautics,
Istanbul, Turkey
aslanr@itu.edu.tr

- Faculty, researcher and students from Astronautical, Aeronautical, Mechanical, Electrics and Electronics departments, other UTEB universities with interdisciplinary team work.
- **Joint work, design and manufacturing capabilities of SMEs and AMSAT-TR**
- Competencies:
 - Design and development of nano/micro satellites, de-orbiting systems, rocketry
 - Modelling, simulation, CNC manufacturing, otomation, workshop
 - Affordable, reliable and fast environmental tests of nano/micro satellites and satellites subsystems (clean room, upto 50kg and 50*50*50cm),
- Small scale spacecraft subsystem development:
 - EPS, OBC, SDR, Lineer Transponder, Modem, passive and active ADCS, structures and mechanisms (low cost, high precision, power and efficiency)
- Reference projects :
 - ITUpSAT1, TURKSAT 3USAT , UBAKUSAT
 - MIC, CLTP,
 - FP7: QB50 (with TurAFA-ASTIN, SU)
 - TURKEY-TUNISIA Project
 - ASAT Project
 - Many Industrial aerospace projects

İTÜpSAT1 (2009)

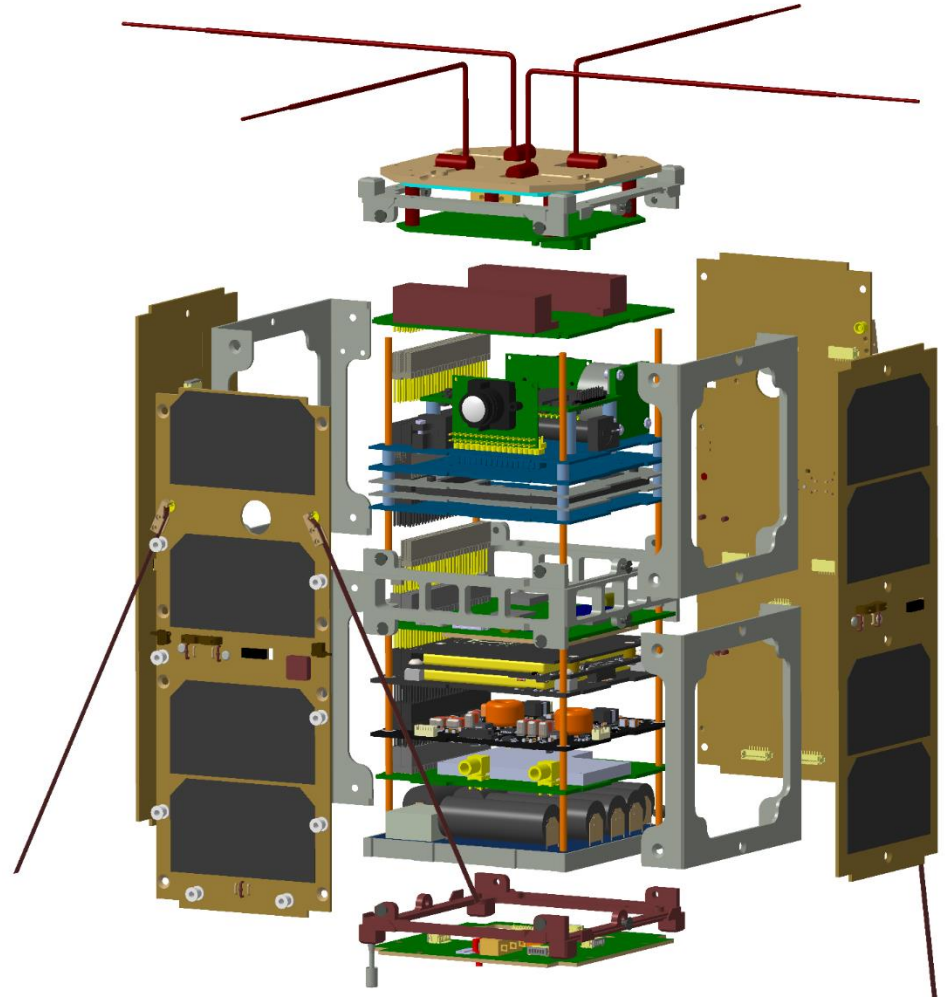
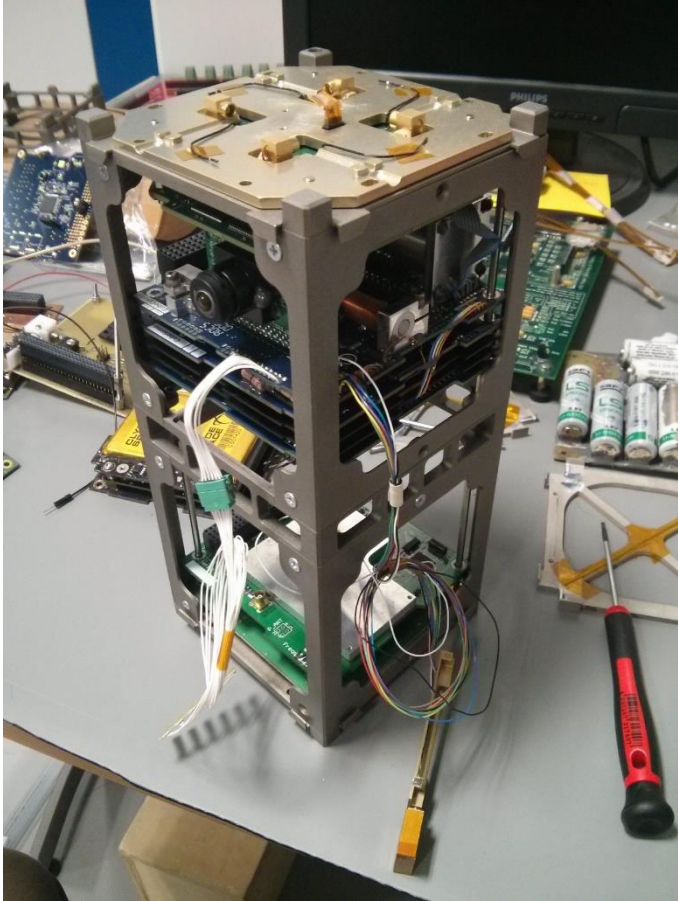


İTUpSAT1, İTÜ Space Eng. first practical space project. Launched on 23.09.2009, still operational. The project was a major step in increasing space awareness among students.

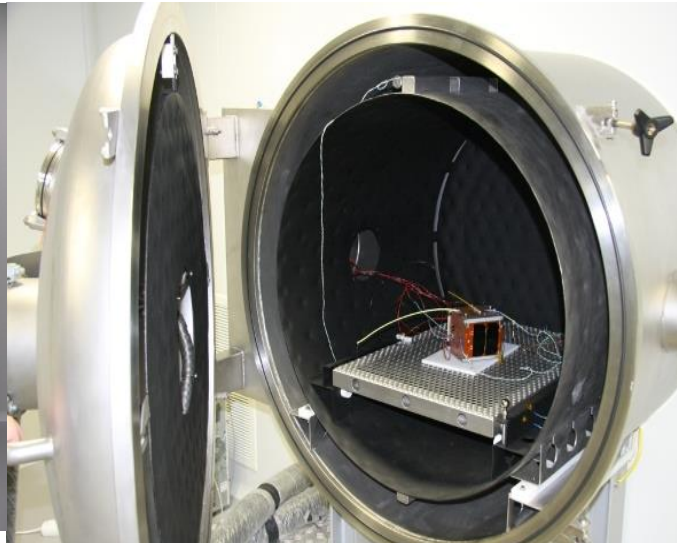
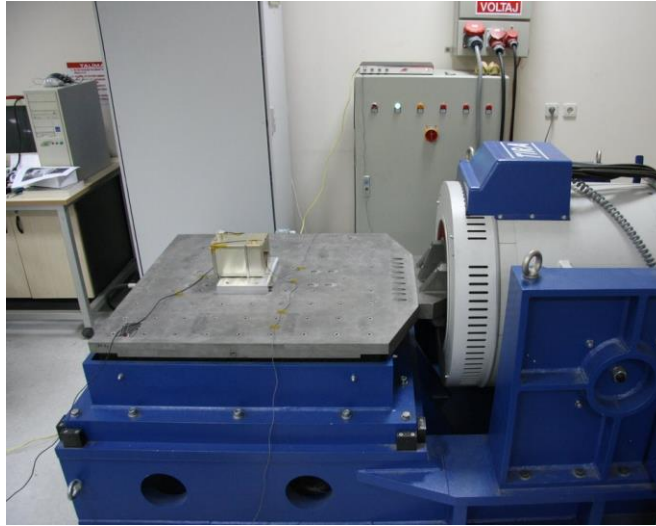


TURKSAT-3USAT, fully industry supported 3 unit communication CubeSat project. Launched on 26.05.2013.

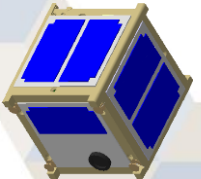
BEEAGLESAT-QB50

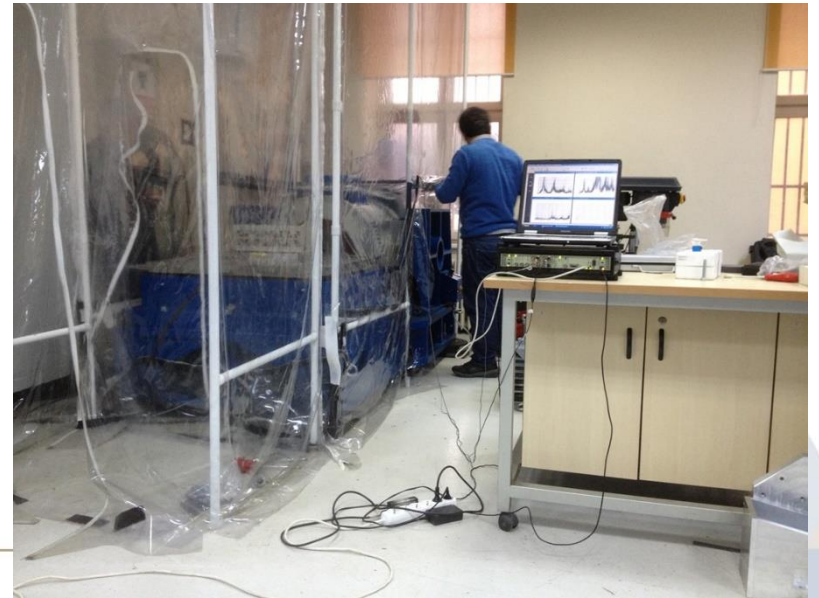
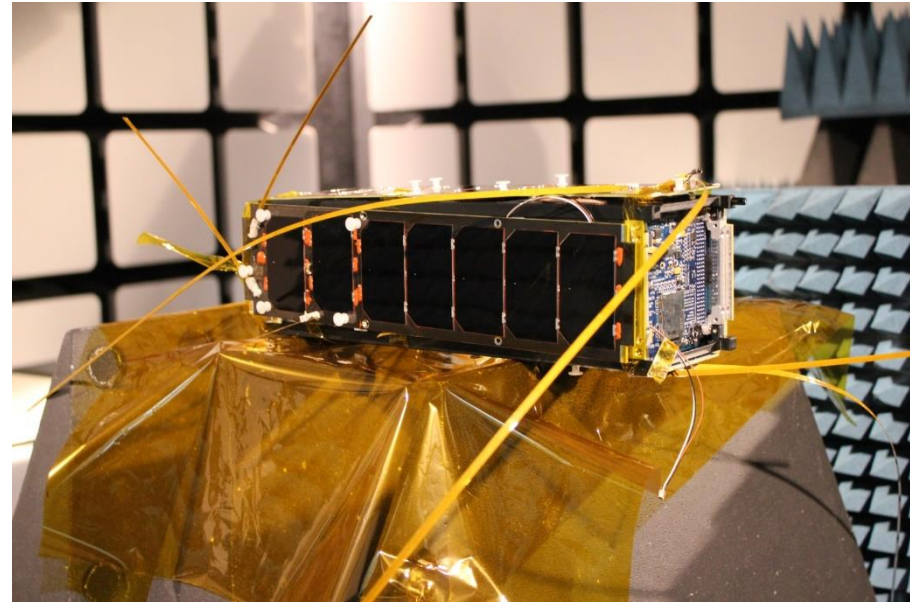






- 350 lt. Thermal Vacuum Chamber
 - 10^{-6} torr pressure,
 - -60 C to 125 C temperature range
 - 1 deg per second control
 - Opens into clean room





- Reviews to have a Project accepted and funded
 - Proposal preparation and submittal
 - Prescreening
 - Referees screening (may include a sight visit)
 - Acceptance or rejection
 - Monitored Project developments
- Reviews to carry out a Project
 - Design philosophy (model preparations, development/testing steps)
 - University/Lab driven management/reviews
 - Customer driven management/reviews
 - Reviewer or review team from the customer (usually includes external specialists in the field)
 - A specialist(s) assigned by the National Science and Technology Council. Project work may include international consultants.

- Spacecraft
- Ground station
- Launch
- software



Project Elements

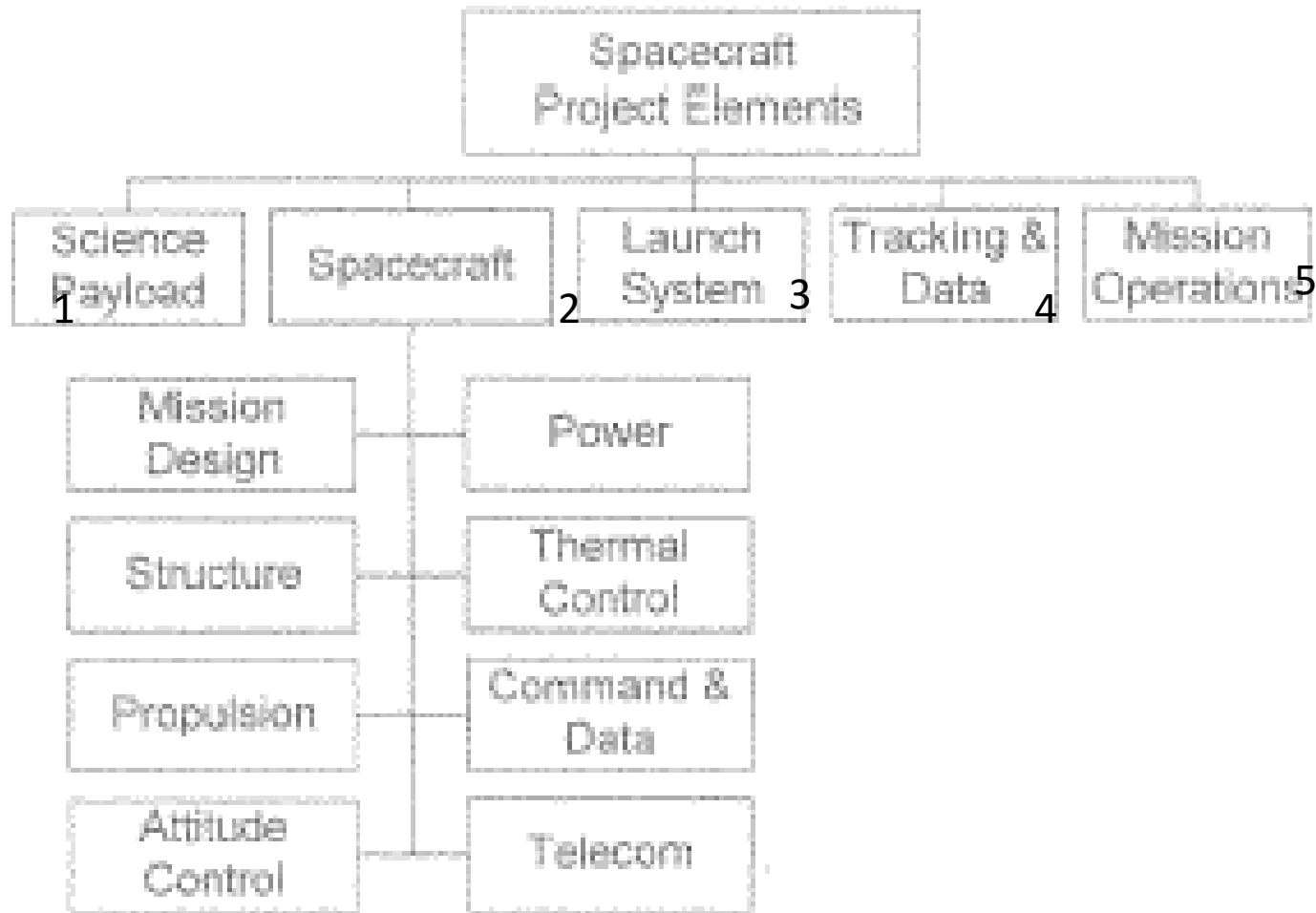
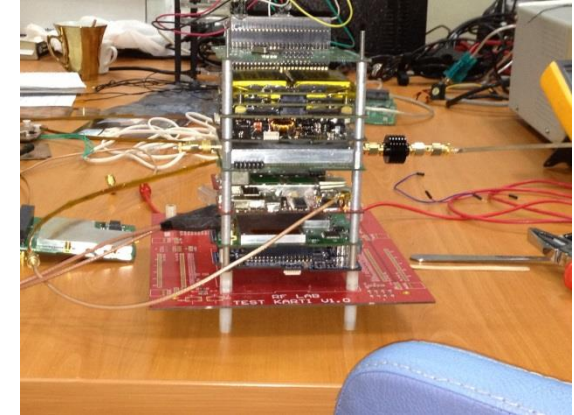
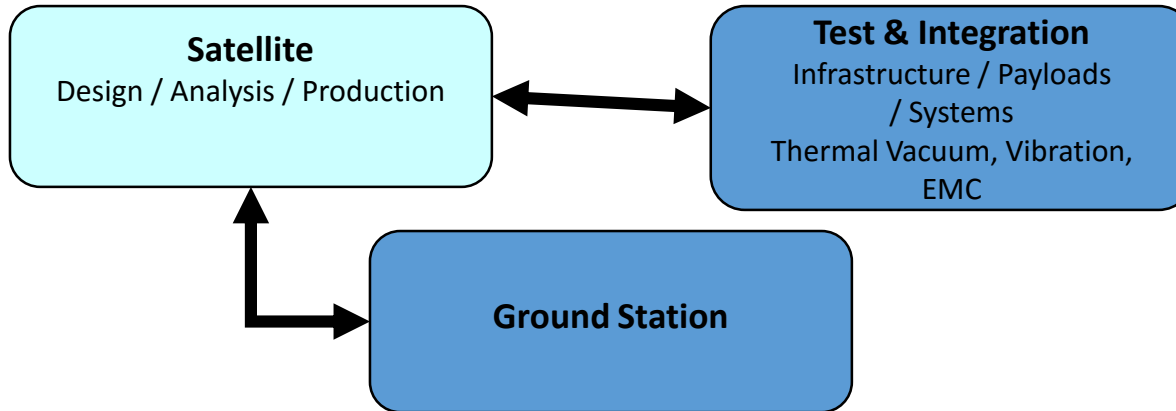
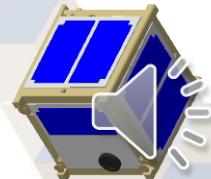
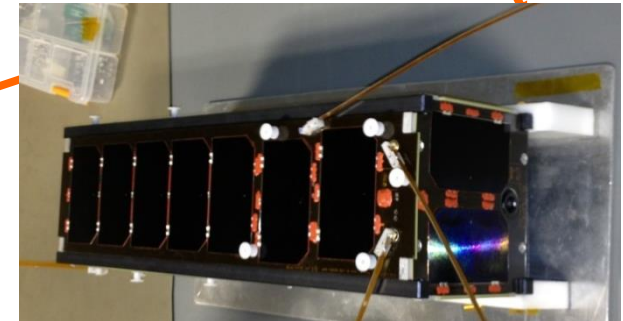
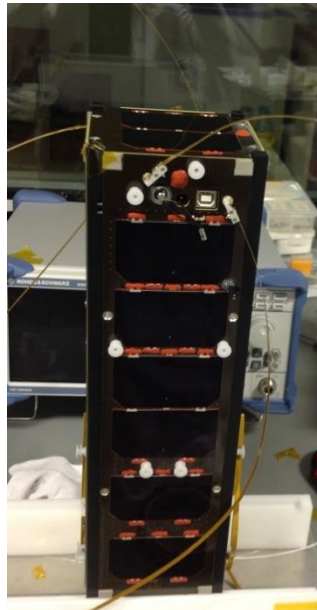


Fig. 2.2 Spacecraft project elements.



- Conceptual design
- Desktop model
- Engineering model
- Flight Model



Project Milestones

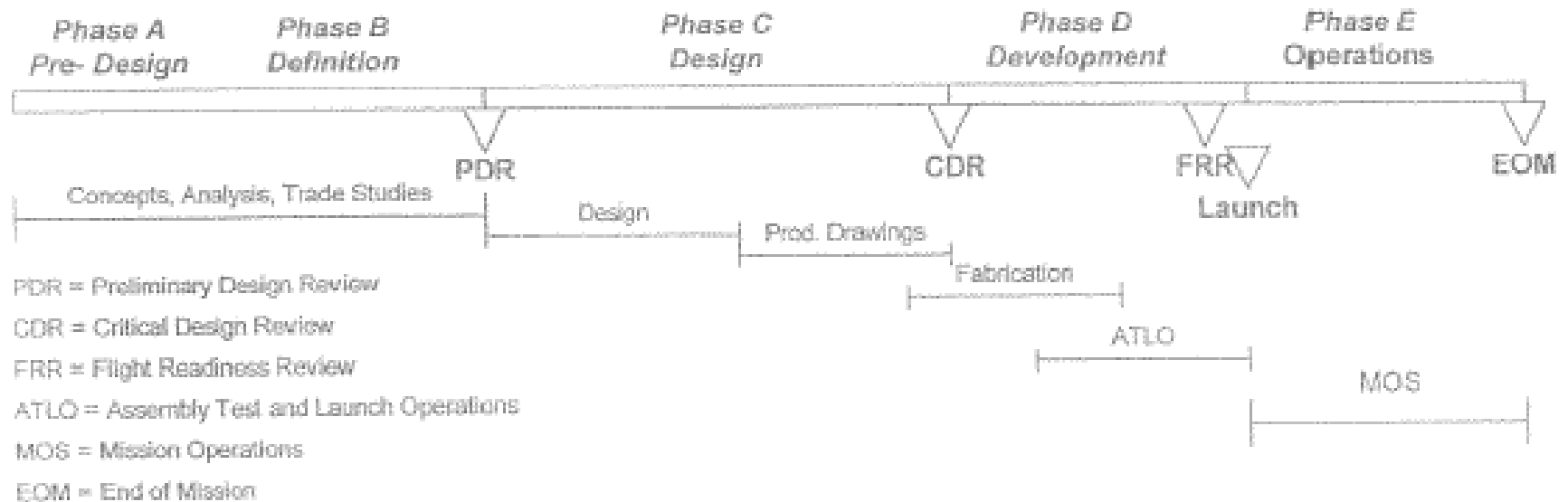


Fig. 2.1 Life cycle of a spacecraft project.

REVIEW DETAILS

PROJECT PHASES	DATE
START	T_0 (Months)
System Requirements Review (MDR)	
Issue Project Management Plan	$T_0 + 1,5$ month
Issue System Management Plan	$T_0 + 1,5$ month
System Requirements definition	$T_0 + 3$ month
SRR Meeting	$T_0 + 3$ month
SRR Approval	$T_0 + 3,5$ month
Preliminary Design Phase (PDR)	
Payload requirements definition doc(final)	$T_0 + 4,5$ month
System design definition doc	$T_0 + 9$ month
PDR Meeting	$T_0 + 10$ month
PDR Approval	$T_0 + 10,5$ month
Critical Design Phase (CDR)	
Payload design definition doc	$T_0 + 16$ month
Payload CDR	$T_0 + 17$ month
Project CDR	$T_0 + 18$ month
CDR Approval	$T_0 + 18,5$ month
Assembly, Integration and Test Phase	
EQM Integration (start)	$T_0 + 18$ month
EQM Tests	$T_0 + 21$ month
System EQM Review Meeting	$T_0 + 24$ month
FM Integration (start)	$T_0 + 24$ month
FM Tests	$T_0 + 26$ month
System Acceptance Review	$T_0 + 28$ month
FLIGHT READINES REVIEW (FRR)	
FR checks and FRR	$T_0 + 29,5$ month
Launch	$T_0 + 30$ month

Procurement decision is given in PDR phase and procurement documents are prepared

Table top/BBM studies are carried out during CDR phase

TVAC screening of certain components
Vibration screening of critical components

Before the end of the CDR long lead items are ordered

COTS subsystems are ordered

Component procurement for subsystem development and production

TVAC tests of subsystems, subsystem PDR and CDRs

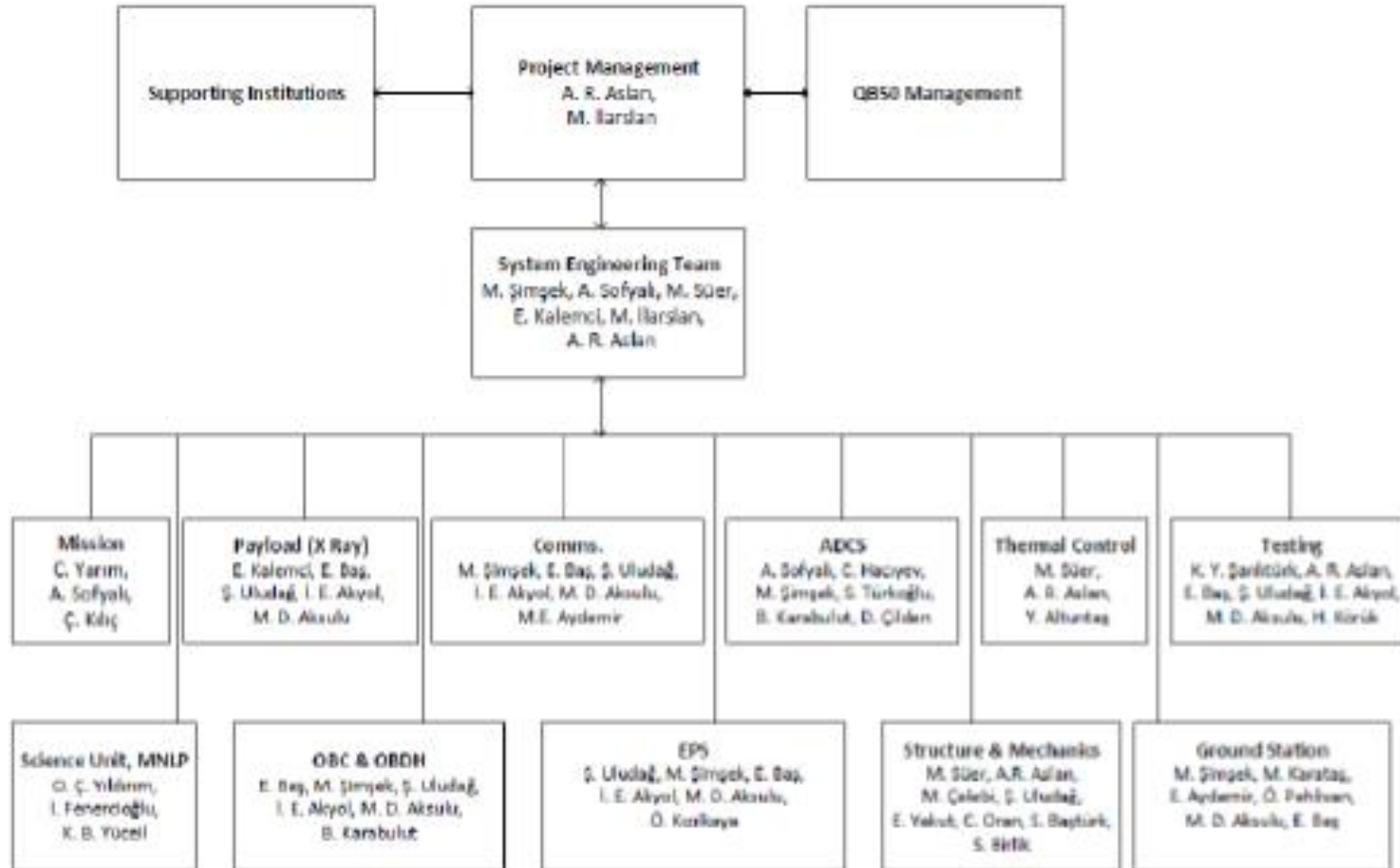
Software issues
GS issues

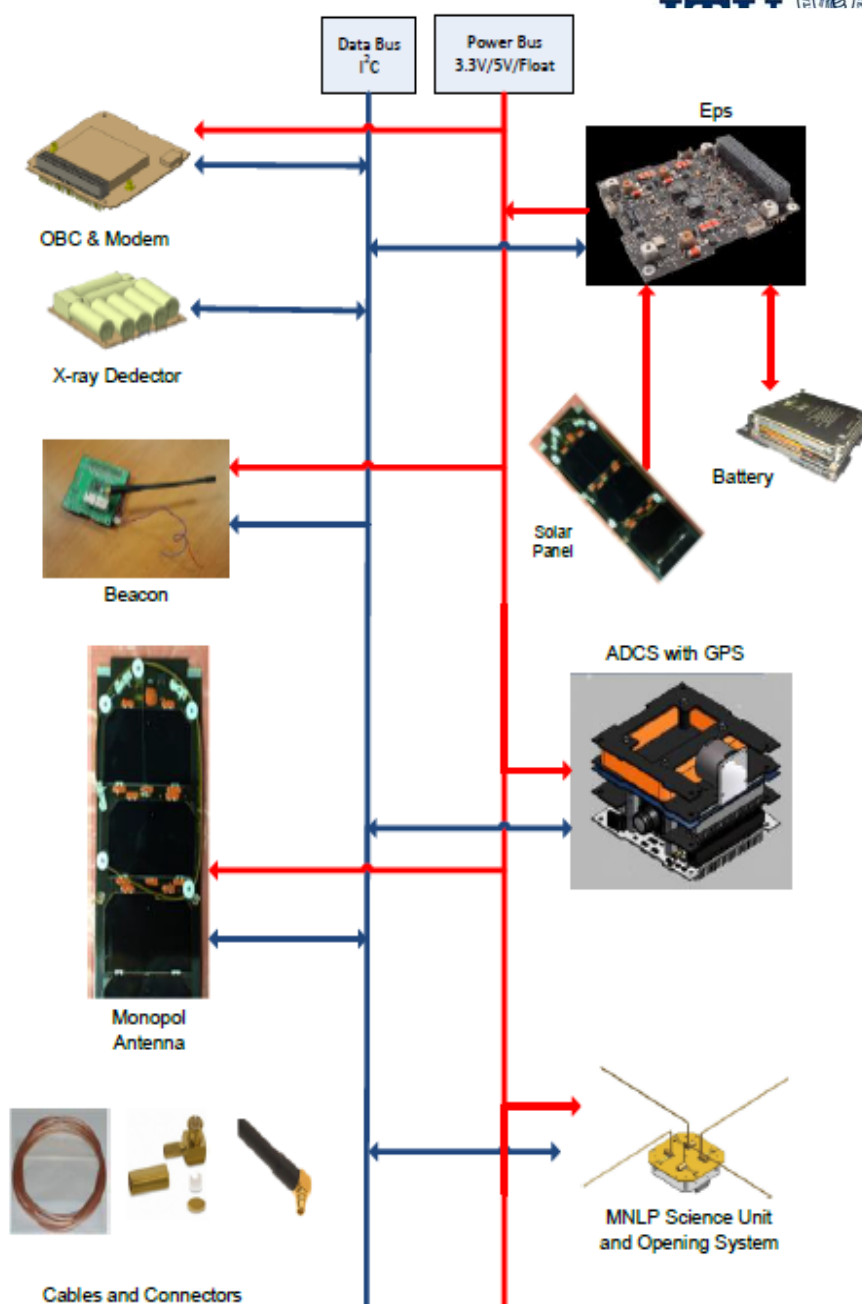
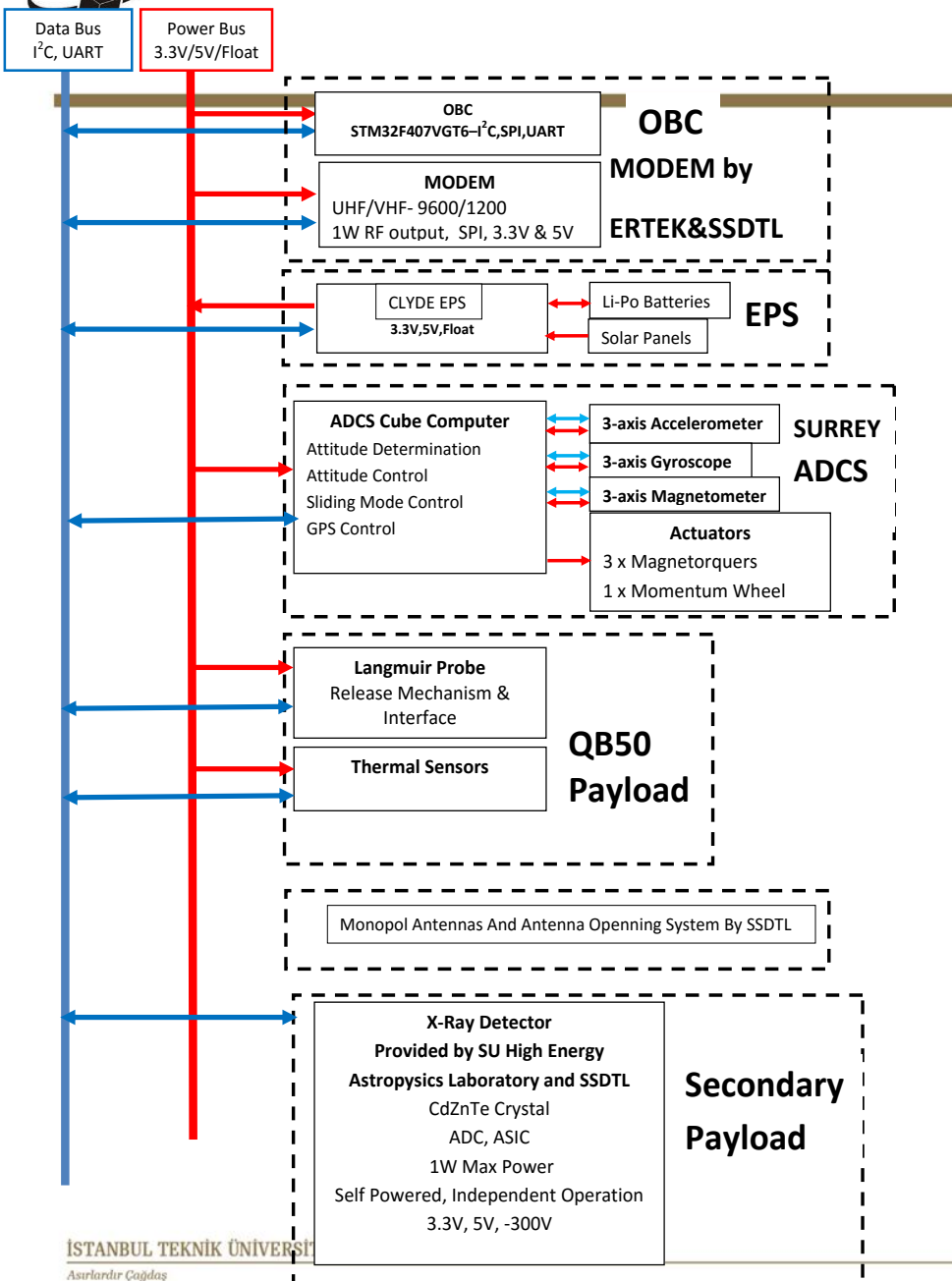
ICDs Interface Control Documents

RIDs Review Item Discrepancy

REVIEW FORMS

Management Plan





PROJECT DEFINITION

Mission Design Review

- Most important, needs most care
- Consider all the details based on the established success criteria
 - Concept shall be feasible and broadly proven
 - Concept tests to make sure
- Students main task is course work
- Time, task, resource, conflict management
- Need always more money/resource, more people
- Documentation!



- Weekly progress meetings
- Interaction of subsystem teams, partners
- ICDs
- Visits, telecons



- CG requirements
- Internal design
- Solar Panel design (holes, attachments)
- All may change the way satellite looks like



1. CubeSat Design Overview
 - a) Excel spreadsheet
 - b) Project System Requirements compliancy table
 - c) Payload Requirements Compliancy table
 - d) Request for Waiver
2. Risk Analysis and Mitigation Plan
3. Assembly, Integration and Test Procedure
4. Management Plan
5. Frequency Coordination Request (form on IARU website)



CDR Procedure Overview

- Teams responsible for own CDR with an external independent reviewer. Inform name of reviewer
- Provide 1 peer reviewer from own teams – to review CDR Data Package of another team.
- CDR Data Package due –
- Use distributed CDR Data Package to the CDR Review Panel
- CubeSat will receive feedback / RIDs
- CubeSat teams are to respond to the RIDs
- Discussion on CDR between main body and CS teams via telecon or on-site meetings



- design maturity
 - analyses missing or incomplete
 - mechanical
 - thermal
 - identification of components/connectors/subsystems
 - mass budget
 - harness not accounted for
 - exceeded
 - antenna (identification)
 - power budget
 - overestimated generation
 - modes/duty cycle
 - not identified/distinguished
 - sunlight, eclipse not accounted for
 - battery heaters
 - redundancy (antennas, battery power)

- AIT plan
 - test procedures
 - model philosophy
- ITAR
- risk analyses incomplete



We Look Forward To a Fruitful Cooperation

Towards being a civilization living
in the Solar System

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