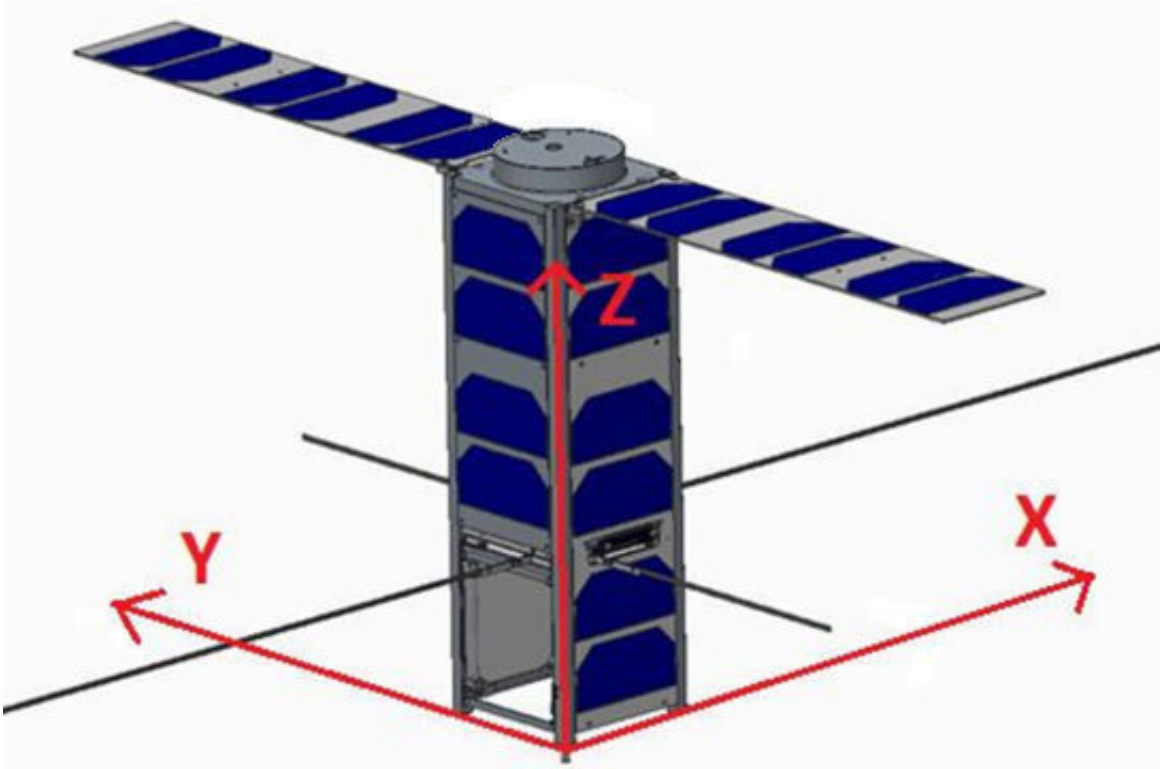
MIST – the MIniature STudent satellite – a short intro

Many universities in the world have built small satellites called Cubesats. The KTH Space Center started its own Cubesat project,MIST, on January 28, 2015.



All purchased satellite and ground station subsystems have been delivered. The technical/scientific experiments are being completed. The ground station is under construction. Final testing of the satellite is expected to be completed in 2022.

Technical information

A detailed technical description of the project can be found **here.** In brief:

- The satellite is a so-called three-unit Cubesat, i.e. it has the volume 3 liters, the outer dimensions 10 x 10 x 30 cm and weighs 3.3 kg.
- The satellite subsystems are purchased from the Dutch company ISISpace except the onboard computer software which is developed by the students.
- The experiments on board are shown in the table below.

Name	Purpose	Developed by
CubeProp	Test with CubeSats propulsion system	GomSpace AB, Uppsala
Piezo LEGS	Sample of a linear piezoelectric motor	Piezomotor AB, Uppsala
CUBES	X-ray Background Explorer	Particle and astroparticle physics, KTH
SiC in Space	Test of electronics made of silicon carbide	Components and Circuits, KTH
SEUD	Test of correcting radiation errors In memories.	Electronics systems, KTH

- The MIST work is carried out in three laboratories, two adjacent rooms in the Alfvén laboratory at Teknikringen 31 and one (for onboard software) at Electrum in Kista.

- The Ground Station antenna system was set up on the roof of Teknikringen 31 during the fall semester 2020. Setting up of radio systems and computers is in progress.

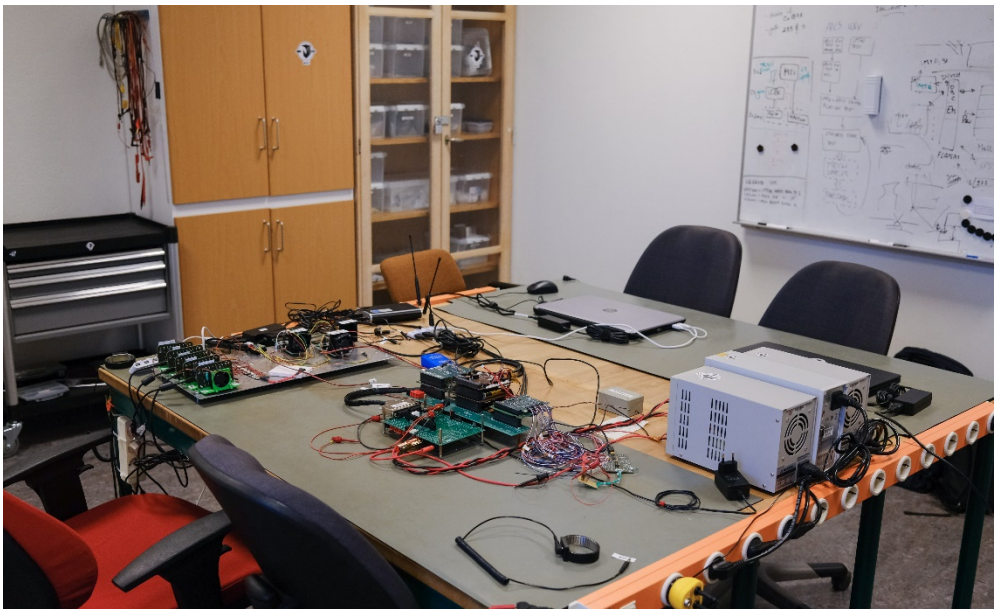


Figure 1 Integration lab at Teknikringen 31.

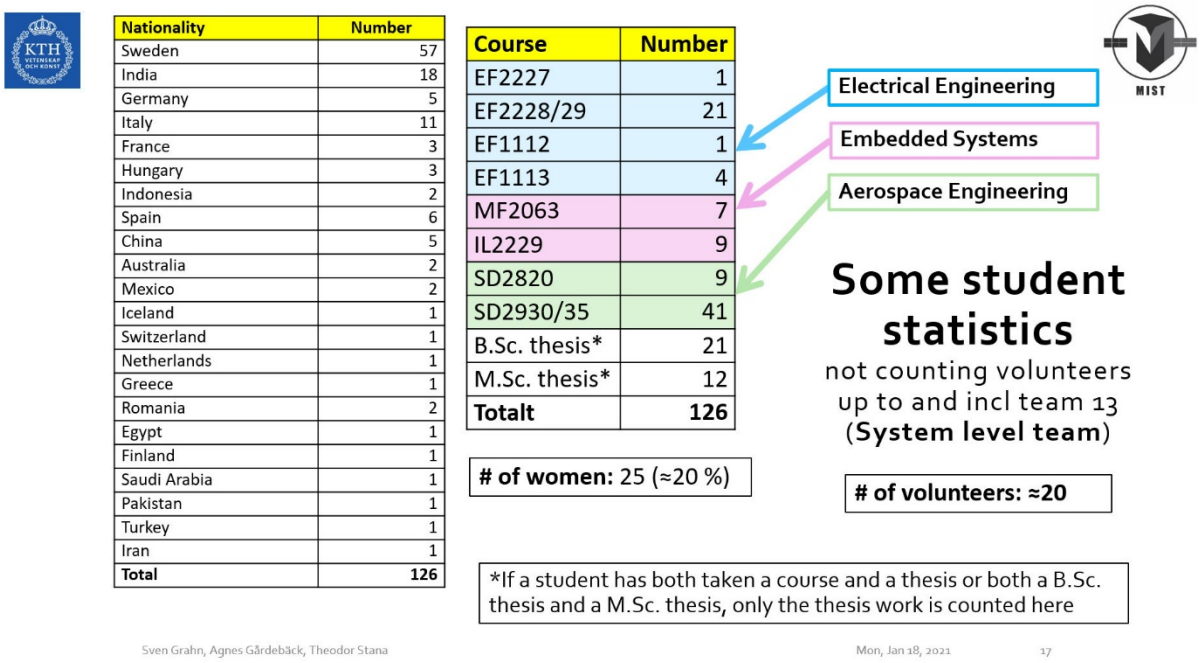
Student work

The idea is that the students should perform analytical, design, verification and management tasks in a real space project and thus learn "project work in real life":

Figure 2 Antenna system the for the ground station.

- In order to provide sufficient depth in learning and to ensure continuity in knowledge transfer between students, students are recruited every semester and they normally stay two semesters in the project.
- Most students join the project at the beginning of the fall or spring semester during their fourth academic year.
- We have/had many B.Sc and M.Sc. thesis workers.
- The students normally work academic credits through project courses in "space technology" within the EECS and SCI schools and "embedded systems" within EECS.
- Occasional "volunteer" students also contribute.

- The table below shows statistics for those who participated/participated up to and through the spring 2021 semester.



Nationality	Number
Sweden	57
India	18
Germany	5
Italy	11
France	3
Hungary	3
Indonesia	2
Spain	6
China	5
Australia	2
Mexico	2
Iceland	1
Switzerland	1
Netherlands	1
Greece	1
Romania	2
Egypt	1
Finland	1
Saudi Arabia	1
Pakistan	1
Turkey	1
Iran	1
Total	**126**

Course	Number
EF2227	1
EF2228/29	21
EF1112	1
EF1113	4
MF2063	7
IL2229	9
SD2820	9
SD2930/35	41
B.Sc. thesis*	21
M.Sc. thesis*	12
Totalt	**126**

Each student is part of a sub-team that can consist of up to 5 students. This sub-team is working on a certain aspect of the project, such as:

- thermal design and test,
- attitude control,
- mechanical design and test,
- on-board software,
- ground station and mission operations,
- functional Testing and mission simulations

The day-to-day work

The members of a team work together on different aspects of their group assignment and have their own team meetings where they plan and evaluate the work. On their own initiative, they contact the project manager, supervisors or courses assistants when needed to determine the most appropriate way forward. Each sub-team also interacts with other sub-teams and holds meetings with them to sort out technical aspects of the interface between the work of the different groups. Each team reports orally at the project meetings (Zoom on Wednesdays) about the status, what should happen next and about any problems that need to be solved. Each student in a sub-team describes his or her part of the work.

Management tasks

The task of chairperson and secretary at the project meetings is taken on in turn by the students - and they themselves organize who will carry out this assignment week by week. This scheme gives each student the chance to lead a fairly large meeting (up to 25 participants) and prepare the agenda - if specific issues need to be addressed.

Reporting

A larger three-hour review of the project situation is held in the middle of each semester (during the first day of the own-study period, before exams). A comprehensive debriefing meeting is held at the end of the semester (also during the first day of the own-studies period, before the exams). The students who are to start their work next semester are often at this end-of-semester meeting. The last semester's final meeting was held with the presence of a technical representative of the Swedish Space Agency.

The students in a team write numerous technical memos, reports, drawings, code, yes what is needed. At the end of their work on the project, they write a report. If it is common to the team,it must be clear who has done and writtenwhat. An important part of this report is what the next group of students needs to address and suggestions how they can organize the job – a handover of the baton! Their report(s) is reviewed by me, supervisors and course assistants and handed over to the formal course coordinator for approval and assignment of course credits - once the report is approved.

Sven Grahn, PROJECT MANAGER FOR MIST
sveng@kth.se, 070-3443844