Aster in Space Recruit Information

Team structure, recruit requirements, recruit selection procedure

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Foreword

The purpose of this document is to provide detailed information to those who are interested in joining Aster in Space. This information encompasses the general team structure, the roles and functions within Aster in Space, the requirements and expectations posed to new recruits and the recruit selection procedure. This document is regularly updated to reflect the current structure of **Aster in Space** and the applicable expectations and requirements posed to the new recruits. The website of **Aster in Space** is always hosting the most up-to-date version of *Aster in Space Recruit Information*. Observe the "*Rev.x"* tag in the header of the document to ensure that you are reading the most up-do-date version. **Do note** that minor differences between the information found in this document and the reality on the ground may occur, **a new revision to *Aster in Space Recruit Information* is issued if we deem that the changes compared to the previous revision are significant.**

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Aster in Space Team Structure

Aster in Space is a non-profit Student Team (*stichting* per art. 2:285 BW) hosted by Innovation Space of the Eindhoven University of Technology. Aster in Space was founded with the intent of providing students in the Eindhoven region access to space engineering. While Aster in Space saw its beginnings as a space-enthusiast community initiative with loosely defined objectives, in early 2025 we have been entrusted with developing the vehicle for a pathfinder mission by the Department of Electrical Engineering of the Eindhoven University of Technology. This mission is a monumental shift in the trajectory of Aster in Space, which necessitates a due change in the structure and functioning of the team. We are currently transforming the team from a community of enthusiasts into an effective, efficient and enduring space engineering organization, without compromising on the foundational premise of providing students with an access to space engineering.

As most (viable) actors do, Aster in Space has multiple objectives that become conflicting once we factor in the finiteness of the resources available to us. Furthermore, Aster in Space has legal obligations to fulfill, a societal role and aspirational goals. To give a short summary:

PRIMARY MATERIAL OBJECTIVE:	Deliver the 3U CubeSat vehicle required by the mission of the Dept. of Electrical Engineering.
PRIMARY ASPIRATIONAL OBJECTIVE:	Ensure that Aster in Space provides students with an access to space engineering, an enjoyable and motivating environment.
PRIMARY LEGAL OBLIGATION:	Ensure that Aster in Space functions as viable *stichting*.

The strategy of Aster in Space is then the multi-objective optimization based on the objectives, constraints and preferences of our organization, which in turn implies the structure that enables highly efficient processes to execute this strategy.

Aster in Space is lead by a **Board** and the organization is divided into two branches; the **Tech Team** and the **PR Team**. The **Tech Team** is lead by the **Tech Lead** and the **PR Team** is lead by the **PR Lead**. Note that there is a significant overlap of functions between the Tech Team and PR Team (in areas of procurement, securing sponsorships, tech demos, etc...). *Fig. 1.* displays a graph of the team structure of Aster in Space. While the Board and the PR Team have no further subdivisions into sub-teams, the Tech Team is divided into **Subteams**. The **Subteam** division of the **Tech Team** is driven by the grouping of tasks and responsibilities of a space mission into a *Work Breakdown Structure (Fig. 2).* Each *Subteam* is lead by a **Subteam Lead**.

The following three chapters are describing the Board, Tech Team and PR Team, in particular their

- Tasks & Responsibilities,
- Roles.

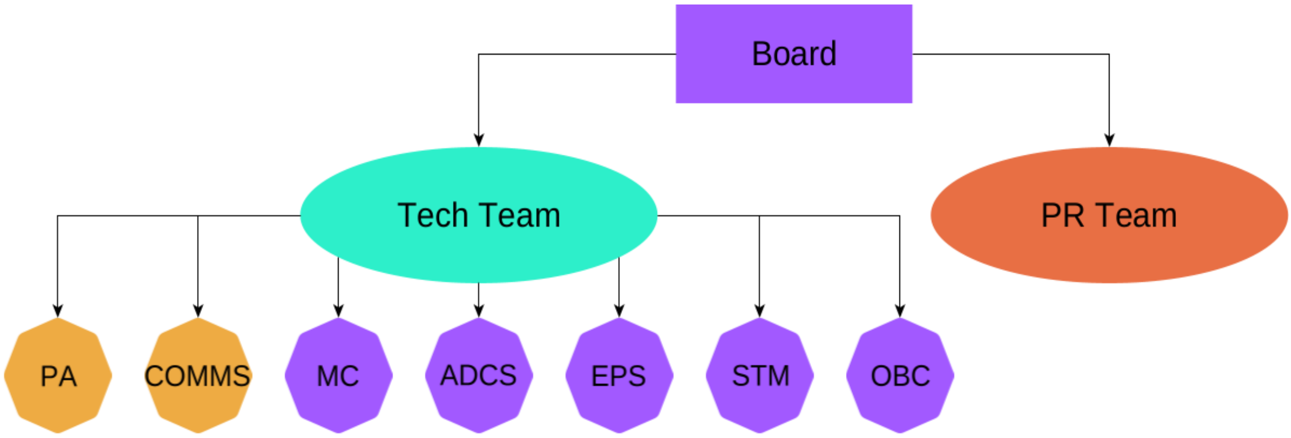

Figure 1: Graph of the team structure of Aster in Space. The purple-colored Subteams are functioning, the orange-colored Subteams are currently under planning organization.

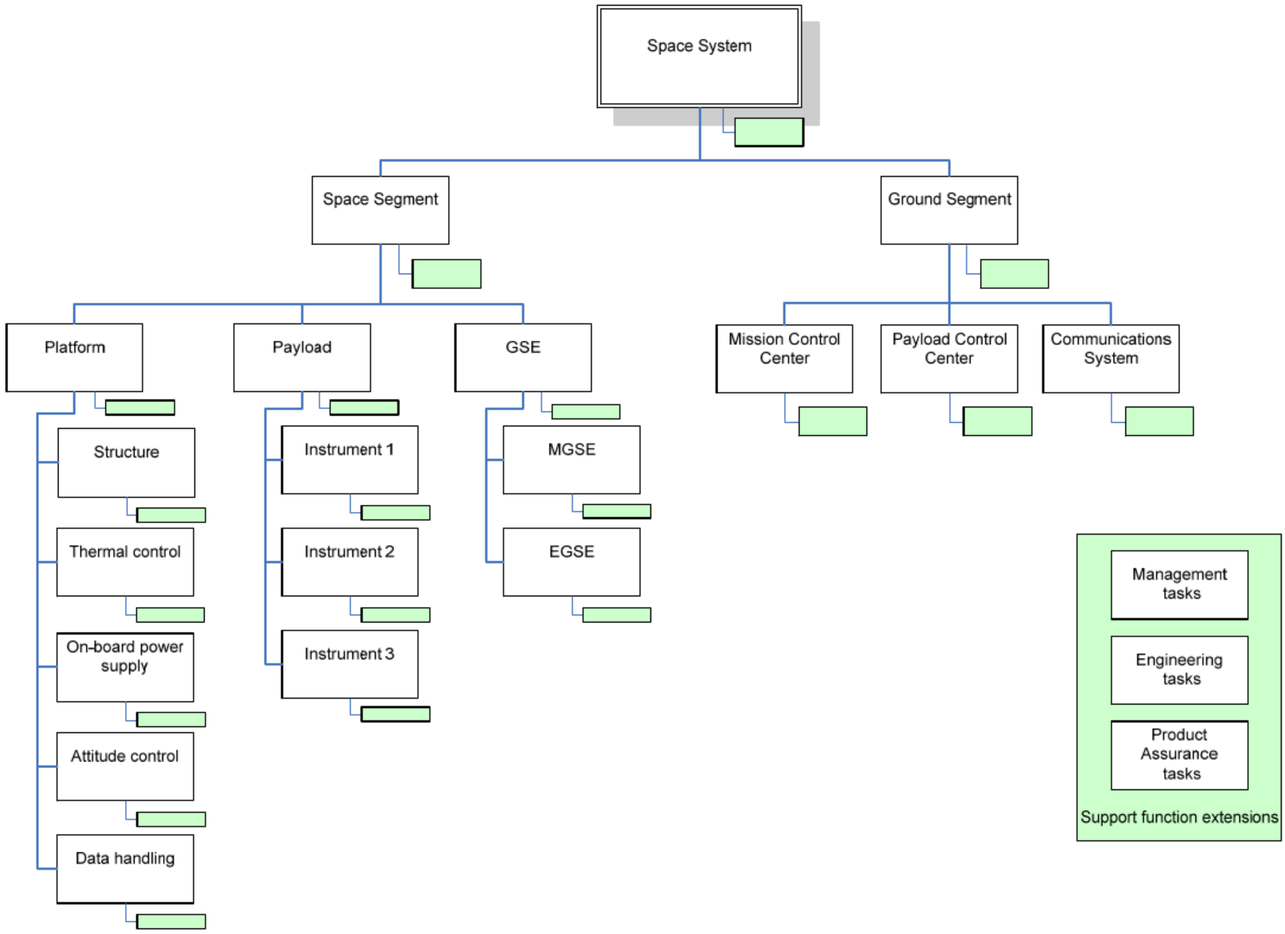

Figure 2: Typical Work Breakdown Structure (WBS) of an ESA mission. Retrieved from ECSS-M-ST-10C Rev. 1, at URL = https://ecss.nl/standards/active-standards/.

Board Description

Aster in Space is at all times governed by a board of at least three members in order to fulfill our obligation as a *sticthing*. The fundamental duty of the board is represent the will of the team members both internally and externally, furthermore, to represent the entity Aster in Space externally. Do note that the board **does not operate** in the manner of a corporate management; we intend to *lead* and not *manage*.

Tasks & Responsibilities	a) Represent the will of the team members, both internally and externally. b) Represent the entity Aster in Space externally. c) Make high-level decisions. d) Plan team strategy. e) Manage the finances of Aster in Space. f) Resolve conflicts within the team.
Roles	**Team Lead**, **Tech Lead**, **Financial Manager**

Tech Team Description

The **Tech Team** -as the name suggests- is the branch of Aster in Space responsible for the tech tasks, which can be broadly grouped into the following categories;

- Literature research,
- Design work,
- Manufacturing & assembly,
- Testing and evaluation,
- Documentation and knowledge transfer.

Furthermore, large-value procurements, arranging sponsorship deals and the presentation-grade finishing of demo setups is a <u>shared</u> responsibility between the Tech Team and the PR Team. In performing these tasks, the Tech Team can use the vast amounts of resources made available for us by *Innovation Space*. Furthermore, we have initiated a series of infrastructural changes that aim to significantly increase the efficiency of the Tech Team. To name a few:

- We have adopted the OpenProject FOSS project management software.
- We are currently implementing a Wiki-style internal documentation system for reducing documentation overhead and increasing knowledge transfer.
- We are currently working on adopting the CDP4-COMET by Starrion, the new model-based concurrent engineering platform of ESA.
- We intend to migrate our data base from OneDrive to the GitLab server of TU/e.

The vast majority of the *Tech Team*'s effort is currently (and for the foreseeable future) spent on the development of our 3U CubeSat, hence the sub-division of the Tech Team conforms to the areas of tasks and responsibilities of a Low-Earth Orbit satellite mission. There are also other miscellaneous tech tasks within Aster in Space such as finishing up our Ground Station.

Due to our limited finances, our engineering heavily leans into in-house manufacturing and using "automotive-grade" components instead of "space-grade" components wherever possible (usually a 1000-fold price difference between the two classes). Some of these space-grade parts are not easily substitutable with an automotive-grade part (ADCS reaction-wheel assemblies, star-tracker, etc...), hence we heavily emphasize and encourage finding creative solutions for expensive problems, even better if the aforementioned solution is already flight-proven. <u>**It is nevertheless of paramount importance that the 3U CubeSat and auxiliary deliverables delivered by Aster in Space are compliant with the regulations of**</u>

- **The ECSS standards.**
- **ESA regulations**[1]**.**
- **CubeSat Design Specification**[2]**.**
- **Dutch national regulations.**

We are not on our own in the pursuit of our goals. We are in contact with senior engineers in ESA and NLR who are mentoring us, critiquing our work and regularly giving presentations to Aster in Space. We are also frequently applying for ESA workshops, with several of our current and past members already completing training in various ESA workshops. Furthermore, multiple student teams with a similar set of circumstances to ours have recently completed successful space missions. Many of these student teams are eager to share their knowledge, hence they have open-sourced (parts) of their designs and are readily answering questions. In fact, we very strongly encouraged to utilize flight-proven open-source designs wherever possible. This way, our engineering effort can be focused on solving problems unique to our mission and not on "re-inventing the wheel".

Since the majority of the components we are working with are low cost commercial off-the-shelf (COTS), we can afford making mistakes on the way, hence rapid prototyping. Our general approach to engineering is best characterized as *concurrent iterative engineering*, which is commonly referred to as the "***NewSpace***" approach. The merit of *NewSpace* lies in trading engineering certainty for time, potentially slashing the development time to a fraction of that of the "*Old Space*" engineering approach.

Although in principle every *Subteam* is responsible for the engineering of their respective sub-system, there is nevertheless a very heavy interdependency among the *Subteams*, hence a very tight bilateral cooperation between the *Subteams* is expected and exercised in order to succeed in *concurrent engineering*. This cooperation is usually facilitated by the **Subteam Leads** or the **Tech Lead**, and the Tech Lead is informed of the more significant arrangements.

Below every *Subteam* is described in its own dedicated section.

Attitude Determination & Control (*ADCS*)

ADCS is the subsystem of a satellite that determines where the satellite is pointing (attitude determination) and controls that orientation (attitude control). The ADCS ensure that the satellite is correctly oriented in space relative to the Earth, the Sun, a constellation or another specific target, using a combination of sensors to measure orientation and actuators to adjust it. ADCS is required for most space missions because many functions desired in satellites depend on attitude within an accuracy limit. For example:

- Communication: Directional antennas need to point toward the ground station to transmit and receive data efficiently.
- Power generation: To maximize power generation, the solar panel faces need to be turned orthogonal to the incoming solar rays.
- Payload operations: Cameras, scientific instruments, or sensors must point at specific targets (Earth, stars, or space phenomena).
- Stability: Without ADCS, a space vehicle may tumble uncontrollably due to disturbances such as Earth’s magnetic field, gravity gradients and solar radiation pressure.

A typical CubeSat ADCS uses a combination of sensors and actuators that work together. Below is a short summary of the ADCS solutions and components we are utilizing or may utilize in the future.

Sensors (for attitude determination):

- Magnetometers: Measure Earth’s magnetic field and help estimate satellite orientation.
- Sun sensors: Detect the direction of the Sun relative to the satellite.
- Gyroscopes: Measure angular velocity and help track rotation over short time periods.

Actuators (for attitude control):

- Reaction wheels: Small spinning wheels that change the satellite’s orientation by using the conservation of angular momentum. They allow precise pointing and smooth control.
- Magnetorquers: Electromagnetic rods that interact with Earth’s magnetic field to generate torque. They are mainly used for de-tumbling and reaction wheel de-saturation.

How they work together:

1) Sensors collect data about the satellite’s current orientation.
2) The onboard computer processes this data using estimation algorithms.
3) Control algorithms decide what torque to apply.
4) Reaction wheels provide fine pointing control.

5) Magnetorquers assist with coarse control and help unload excess momentum from the reaction wheels.

Tasks & Responsibilities	a) Design the attitude determination sensor configuration. b) Select the attitude determination sensor suite. c) Design and manufacture the magnetorquers. d) Design reaction wheel assemblies, or select from commercial options. e) Design ADCS algorithms. f) Test and evaluate the ADCS system in collaboration with the *PA Subteam*.
Roles	**Mechanical Engineers**, **Control Engineers, Physicists**

Structure & Thermal Management (*STM*)

The Structure & Thermal Management sub-team is in charge of designing and manufacturing the frame of the 3U CubeSat, using skills such as

- 3D CAD design,
- FEM,
- in-depth knowledge of various manufacturing processes.

The purpose of the CubeSat frame is not only to provide a mechanical scaffold structure to the CubeSat, but also to provide a hospitable environment for the rest of the subsystems contained within the frame. The frame will have to protect the rest of the subsystems from the prolonged extreme vibrations during launch and the harsh space conditions for two years afterwards. These space conditions include

- thermal vacuum cycling every orbit (eclipse ≈ 55 min and sunlit period ≈ 37 min on the likely SSO orbit),
- micrometeoroid bombardment,
- atomic oxygen bombardment,
- ionizing radiation exposure.

Beside the requirements posed by the environment, the structure must also comply with regulations such as the *ECSS* and the *Cal Poly CubeSat Design* Specification - to name the two most important ones.

This sub-team is divided into two groups: Structure and Thermals. Currently, the sub-team is focusing on an initial internal layout in CAD. We are working out the configuration of the subsystems that aims to be optimal, but at the very least ensures requirement compliance. Another major part of the designing phase is developing a deploying mechanism for solar panels which will be placed on the CubeSat. We are engineering specific release mechanisms to keep the panels folded flat against the frame during the launch phase and extend them after launch.

Those working on Thermals focus on the heat dissipation on the entirety of the CubeSat. Through the use of Finite Element Analysis (FEA), the CAD models of all subsystems are used to conduct simulations of how heat flows through the structure. Based on the results, control measures are issued to conduct heat away from hot-spots, supply net heat to cold-spots and to allow the subsystems to work within their designed temperature range.

The Structure and Thermal Management sub-team works in a very close coordination with the rest of the sub-teams to ensure that the requirements of all sub-teams are met, which sometimes involves facilitating the re-definition of conflicting requirements.

Tasks & Responsibilities	a) Design the configuration of the CubeSat subsystem arrangement. b) Design the deploying mechanisms such as deploying solar panels. c) Design thermal management system. d) Design environmental protection systems. e) Design the 3U CubeSat frame. f) Assemble the 3U CubeSat frame and structure. g) Optionally, also manufacture the frame (may be outsourced otherwise). h) Test the frame and structure in collaboration with the *PA Subteam*.
Roles	**Mechanical Engineers**, **Thermal Engineers, Material Scientists**

On-Board Computing (*OBC*)

The On-Board Computing team concerns itself with the software of the CubeSat, the internal communication between the OBC and other subsystems and the OBC hardware itself. The OBC is the central system that ties other subsystems together and is crucial to the success of the mission of the CubeSat. The OBC will run FreeRTOS, which is a real time operating system used to schedule all of the tasks. It is designed for embedded systems and has a small memory footprint, hence it is ideal for a CubeSat. This is the core of the system and will dictate the behaviour of everything.

As a member of the *OBC Subteam*, you will be working either on the software or on the OBC hardware, or possibly even on both. If you are working on the software, you will write the system code and program tasks such as retrieving sensor data or the code performing the algorithms requested by other subsystems such as ADCS. You will also have to test these task codes and debug any problems you come across. Some of the tasks will need to be tested on the actual hardware, which you will be setting up yourself. You will be responsible for finding appropriate libraries that can get the job done. You will also help develop and implement different protocols, such as what happens during deployment, after a reboot, when power is critically low and during a software update.

Another software responsibility is to cover all aspects of Fault Detection, Isolation, and Recovery, such as implementing a system wide and also task specific watchdogs, input validation, power cycling and bit-flip correction. The OBC team uses git with GitHub as a version control system. We work with pull requests and code reviews to ensure that all code is up to standard. The OBC will communicate with all other components through SPI connections. The code for the OBC will be written in C for FreeRTOS and C++ for other parts. PlatformIO will be used to handle dependency management and code compilation.

Engineering hardware for space use has a set of defining challenges. While in space, any electronic components are subject to radiation. This includes α, β, γ and heavy ion nuclei. The most important effects, and most noticeable, are the ones suffered by CMOS devices. Outcomes of radiation can be classified as displacement damage (exposure for longer periods of time causing changes in the semiconductor structure) or the more important single effect events. The latter can either cause soft errors (latching up a transistors, flipping a memory bit) or hard errors which consist of the permanent degradation of a MOSFET. When it comes to MCUs, soft errors can usually be handled by good software & hardware practices (redundancy or watchdogs), while hard errors can be fatal and the type of MCU should be carefully chosen in regards to reliability.

When choosing a hardware solution for the OBC there is a trade-off between reliability and cost. There are plenty of Cubesat OBC system that can be bought directly and have a certain degree of space qualification. This main issue with these solutions is the rather steep cost. Furthermore, another solution is to use commercial MCUs, which are usually used in either consumer products or the automotive industry. While the latter option may be more cheaper (by a few powers of 10), it does posses some issues in regards to how long it can realistically last.

Within Aster, a custom OBC system will be designed based around an automotive grade MCU which has been previously used in a space mission without issue. This design decision is mainly about striking the previously mentioned balance between cost and reliability. Tasks in regards to this part of the OBC design are as follows:

Tasks & Responsibilities	**SOFTWARE:** (a) Coding system code and tasks in C/C++. (b) Finding appropriate libraries, contribute to the standardization of libraries within the *OBC Subteam*. (c) Design Fault Detection, Isolation, and Recovery functionality. (d) Test your code both Software-in-the-Loop and Hardware-in-the-Loop, debug your code if any encountered. **HARDWARE:** a) Researching the MCU data-sheet. b) Developing a minimal setup circuit for the MCU. c) Interfacing with any external memory that may require to be added. d) Developing a full schematic of the OBC system. e) PCB design. f) PCB prototyping & assembly. g) Testing and evaluation.
Roles	**Electrical Engineers**, **Computer Scientists**

Electrical Power System (*EPS*)

"Power electronics is something that nobody wants to do but everybody needs"

Fundamentally power electronics is the application of electronic circuits in order to control and convert electrical power. In the case of the Cubesat project the need arises from the fact that on-board loads require stable DC supplies while energy is stored in batteries and harvested by solar panels (both which have voltage levels that vary).

Overall the task of the *EPS Subteam* is to design an electrical system which is able to:

- Harvest energy from the solar panels and store it in a battery bank.
- Ensure that the battery bank is in a good state.
- Use the stored energy to provide stable voltage rails for all on-board loads.
- Offer telemetry data in regards to how power is distributed to different loads.
- Isolate faults such that if one subsystem fails it does not compromise the whole mission.

The main challenges that such a system encounters are not within the power converters themselves, as they are usually contained entirely in an integrated circuit in the case of monolithic converters, but rather in creating a reliable enough design. Each power rail needs to be isolated and the system needs to handle a large number of failure modes, some in which the on board computer is not operational and thus there is no communication channel with the ground segment.

Within Aster we are developing an EPS system from the ground up, thus the work within the sub-team can be split as follows:

Tasks & Responsibilities	a) Researching hardware architectures. b) Circuit design. c) Circuit simulation. d) PCB design. e) PCB prototyping & assembly. f) Testing and evaluation.
Roles	**Electrical Engineers**

Telecommunications (*COMMS*)

NOTE: This is *Subteam* is still under creation. Setting up the *COMMS Subteam* is a very high priority. Join us!

As it is with any other satellite some for radio communication is required (there are satellites that only use optical communication however, that is usually reserved for specialized uses). The main tasks of the COMMS system is to establish a radio communications link between the satellite's OBC and the ground segment(s).

Within all of the electrical subsystems COMMS is the most interconnected with the other aspects of the Cubesat. For example planning out the antenna design has to be done in relation with how the frame is designed or the fact that the OBC software needs to be able to communicate with the RF transciever.

Tasks & Responsibilities	a) Designing the antenna(s) for the satellite. b) Creating a data budget (how much data needs to be handled/transmitted). c) Creating a link budget (how strong should the transmitted signal from orbit be to reach Earth, and vice versa). d) Choosing the type of modulation. e) Design of the satellite RF transciever. f) Programming of the ground segment SDR (software defined radio) transciever.
Roles	**Electrical Engineers, Antenna Engineers, RF Engineers, Computer Scientists, Physicists**

Mission Control (*MS*)

Mission control, otherwise known as flight operations, is an indispensable team of any space mission. Members participate in all stages of a mission’s life cycle ranging from the conceptual design, through to testing, operations, and end-of-life operations. Once the mission is in space the role of mission control is quite clear: track the spacecraft's health, trajectory, and send commands whenever it is required. However, this job would not be possible in a vacuum. Prior engagement in the mission design allows controllers to provide input with respect to the space environment, flight dynamics, tracking and more.

During the design phase, controllers are involved in flight dynamics assessments, orbital debris mitigation research, flight mode specification, among other tasks. Once a launch is confirmed the team rehearses launch and early operation (LEOP) operations to be comfortable operating the spacecraft. Operators work long shifts during this period as it requires 24/7 monitoring for up to weeks as satellites settle into their final orbits, deploy appendages, and verify systems are in working order. Afterwards, nominal operations begin, where the now ”satellite operators” carry the goals of the mission through to completion while monitoring for any anomalies.

The tasks and responsibilities of mission control is grouped into the following 3 groups.

Group I: Mission Design

The design group focuses on helping other *Subteams* design the satellite, from the perspective of operators and their duties. Concrete goals are laid down in a further section. Given the advanced knowledge design members have of the satellite and the mission goal, they are also apt for the operations section. More on operations is specified below in the possible goals for the mission control team starting this academic year, but there is a noticeable distinction between mission design and mission operations.

Group II: Operations

The operation teams focuses on the interpretation of down-linked telemetry and in sending commands up to the satellite. In as such, they are the members of the team actually ”flying” the spacecraft. Operators include subject matter experts in the electrical, thermal, orbital and attitude dynamics, payload, and communications subsystems. These operators monitor their respective subsystems (one reasonable choice for operators could be the leads of those *Subteams*) and report to a flight director responsible for the entire mission and calls the final shots. Before any actual telemetry is received from the satellite, operators train mission segments for all sorts of nominal and off-nominal situations. Scenarios devised by technical experts ensure satellite operators are able to identify and resolve issues as quickly as possible. Operators also rehearse LEOP procedures to understand how to properly manage their time, how to acquire signal, and broadly be ready for the real deal.

Group III: Interface

The work of mission control would not be possible without a good interface. This is the way engineers and controllers actually interact with the satellite and its telemetry, therefore it is essential that this is clearly specified. There exists commercial software for this case, and for some use cases Ansys STK can be used, particularly for graphical displays of orbit position and ground track and in mission planning. However this may be insufficient and alternatives may be expensive. Thus, it may be necessary to design a custom interface. This carries many advantages, particularly when integrating the ground station input-output protocols. To achieve this, one or several engineers knowledgeable in software development are required. Besides making software for mission data management, the *Interface team* should work to integrate the ground station project and work to expand the ground station network.

Tasks & Responsibilities	g) Researching hardware architectures. h) Circuit design. i) Circuit simulation. j) PCB design. k) PCB prototyping & assembly. l) Testing and evaluation.	
Roles	**Design**	**Flight Dynamics Engineer, Orbital Debris Researcher, Computer Engineer, Environment Researcher**
	Operation	**Flight Director, COMMS Officer, AOCS Officer, EPS Officer, Payload Officer, Thermal Officer**
	Interface	**Ground Station Engineer, Software Developer(s)**

Product Assurance (*PA*)

CURRENTLY UNDER PLANNING

PR Team Description

Tasks & Responsibilities	**Event Coordinator**	Fully organize events. This incudes finding a time that works for the majority, and a location (as well as ensuring we are allowed to use that space for the event!). Organizing catering if required, and ensuring special diets are taken into account. Taking pictures during the event to post on our social media later.
	Social Media Manager	Create weekly posts (as well as videos) for our Instagram and Linkedin and manage any messages we receive on those platforms.
	External Relations Coordinator	Reach out to companies to expand our network and find potential sponsors. You will be expected to log all of our connections, partnerships and any deals agreed to, as well as keeping up with the communication to these companies.
	Website Coordinator	Ensure all website information is up-to-date (team members, mission information and specifics, contact details). Edit the site when requested, collaborating with the designers to ensure our brand identity remains same.
	Designers	Design and produce any requested poster, graphic, sticker, merchandise and more. Be ready to collaborate with other designers and ensure the rest of the team is on the same page before anything is published/produced. Your job is also to keep our brand identity same across all platforms, informing those who incorrectly represent us.
Roles	**Event Coordinator, Social Media Manager, External Relations Coordinator, Website Coordinator, Designers**	

Aster in Space Membership Requirements

We expect 10-15 hours of work per week on average from regular Aster in Space members. The actual amount of hours worked on any given week fluctuates nevertheless. There only two mandatory meeting Aster in Space members are required to attend;

1. the weekly *General Members' Meetings*, or GMMs for short and
2. the sprint days of their respective *Subteam*.

These are the general requirements. Below you will find the specific requirements posted by every *Subteam*. Most *Subteams* split their requirements into two categories;

1. The skills that you must already have and
2. the skills you have to learn during your trial member period.

If you apply for a **Tech Team** position, be prepared to face a **rather steep learning curve** after you join Aster in Space! Space engineering has very specific ways of going about solving problems and TU/e does not (yet*) offer space engineering courses. Therefore, you will have to start learning domain-specific knowledge from the start.

In the first couple of months, you will spend quite a number of hours with reading through

a) ECSS Requirements[1],
b) ECSS Handbooks,
c) ESA/NASA regulations,
d) other space engineering handbooks.

This is to ensure that what you create is both functional and regulation compliant, with most ECSS, ESA and NASA regulations existing for a very good reason.

*We have been approached by multiple professors from TU/e who intend to start an *Advanced Aerospace Systems* Master's track, starting from 2027 September.

ADCS Engineer Requirements

Knowledge and skills required prior to joining

(a) Newtonian mechanics.

(b) Programming – Python, MATLAB, Simulink basics.

(c) CAD, preferably Siemens NX or Fusion 360.

(d) Basic Control Laws. Know the content of courses

- a) Signals and Systems,
- b) Dynamics and Control.

Knowledge and skills you will learn after joining

a) Quaternions.

b) More in depth simulation software, ANSYS in particular.

c) Kalman Filtering.

d) Knowledge about sensors: sun sensor, startracker, IMU, magnetometer.

e) Actuators: magnetorquer, reaction wheel.

f) Navigation systems.

STM Engineer Requirements

Application is open!

Currently, no requirements are published.

OBC Hardware Engineer Requirements

Knowledge and skills required prior to joining

a) Ability to plan designs.

b) Knowledge of PCB design.

c) Knowledge of the existence of at least these different types of protocols: I2C, SPI, UART, CAN.

d) Knowledge of the advantages/disadvantages of the protocols in a).

e) Knowledge about ADCs/DACs and an understanding of the characteristic parameters such as: resolution and dynamic range. Knowledge about ADCs is more important.

f) Knowledge about propagation time and what effects does it have on PCB traces (you need traces of equal length, that's why the squiggly lines on mother boards for example.)

g) Knowledge of what clock frequency & instructions per second are.

h) Knowledge of how you can usually choose the clock frequency when designing a board with an MCU (generally you choose the frequency of the crystal that you connect to the MCU).

OBC Software Engineer Requirements

Knowledge and skills required prior to joining

a) Basic programming skills and knowledge (2IP90).

b) Working with GIT, GitHub.

Knowledge and skills you will learn after joining

a) Working with platformIO.

b) Working with FreeRTOS.

c) Linux basics.

d) Operating a command line.

e) Programming in C.

f) Compiling, building and uploading code to a micro controller.

g) Understanding of task schedulers.

h) Making and using SPI connections.

i) Knowledge of embedded systems and basics of connecting components.

j) Knowing how to test and debug code.

k) Space standards for software.

l) Radiation protection.

m) Development cycle in a big team.

EPS Engineer Requirements

Knowledge and skills required prior to joining

a) Ability to plan designs.

b) Knowledge of PCB design.

c) Basic knowledge of control system.

d) Knowledge of feedback loops.

e) Basic knowledge of power electronics

1. DC/DC Converters (Bock/Boost).
2. MPPT Control.
3. What qualities should you look for when choosing a MOSFET for switching? (this one can be very important)
    - RDS_(on), resistance when the transistor is ON.
    - Gate capacitance.
    - Maximum VDS voltage.
    - Maximum VGS voltage.

COMMS Engineer Requirements

Knowledge and skills required prior to joining

a) Ability to plan designs.

b) Knowledge of PCB design.

c) Knowledge of basic RF principles

    1. Impedance matching.
    2. Antenna gain.
    3. S11 & S21 parameter analysis.
    4. SWR.
    5. Power amplification (amplifiers no loner have infinite impedance in RF they have 50 ohm impedance, the amplifier gain is the ration of the input power to the output power).
    6. Self resonance of passives.
    7. System building blocks (PA,LNA,PLL,Mixers).
    8. Knowledge of what a spectrum analyser of vector network analyser is.

d) Communication theory

    1. Analog modulation (AM and FM probably everyone knows).
    2. Digital modulation (OOK,FSK,PSK,ASK,QAM,QPSK,LoRA).
    3. Shannon limit theorem for a communication channel.

Mission Control Engineer Requirements

Knowledge and skills required prior to joining

a) Kepler's Laws of Motion

b) Knowledge of the 6 orbital parameters

c) Solar System physics

d) Programming (Python or MATLAB)

e) creative problem solving

f) work under pressure

g) vector calculus

h) Space environment (effects of radiation, gravity, micrometeoroids, atmospheric drag, atomic oxygen)

Knowledge and skills you will learn after joining

a) Determine the orbital parameters of a spacecraft after a maneuver.

b) Estimate the power budget of a spacecraft depending on orbit and mission parameters.

c) Create the requirements for a specific flight mode.

d) Simulate a mission.

PR Team Member Requirements

Knowledge and skills required prior to joining (mutually exclusive!)

a) Familiarity with some kind of design software (Adobe Suite, Canva).

b) Experience in creating social media posts/leading a company social media account.

c) Experience in website design.

Aster in Space Application & Selection Procedure

Phase I: Application

You begin your application at Aster in Space by emailing us your

a) CV,
b) Letter of Motivation,
c) Portfolio (if you have one),

at the info info@asterinspace.org address. In this email, also **do mark** which positions / *Subteams* interest you. The follow-up steps are dependent on your position / *Subteam* choices.

It is important that you note projects you have participated in on your CV (eg.: CanSat) and the specific skills you have that the Subteams are looking for. **It is even more important** that if you have hobby projects related to the position you apply for, **you do write a nice portfolio about** them, as **we prioritize the real-world engineering and project planning skills over academic achievements!**

Be honest in your letter of motivation. We have rejected applicants before due to inconsistencies between their stated motivation and their answers to interview questions. There are two life-long martial artists in the current board of Aster in Space, **we will** spot ulterior motivations and other acts of dishonesty, which we really do not appreciate as we are building a team of **reliable** members.

Phase II: Interview & Interview Exercise

If we deem that you are a suitable candidate based on your CV, Portfolio and Letter of Motivation, we will contact you shortly (usually the same week) and send you the *Interview Exercises* of the Subteams that you are interested in. These *Interview Exercises* are created such that:

a) They should take you ca. 10-15 hours to solve.
b) The required knowledge is slightly beyond what we require you to know. However, we do help you in your research by providing some additional information, and also access to our engineers for some specific problems.
c) The *Interview Exercises* are representative of the tasks that the Subteam is doing.

For each set of *Interview Exercise*, you get one week to solve them (unless special circumstances). For example, if you have applied for both the **COMMS Engineer** and **OBC Hardware Engineer** positions and we find you suitable for both positions, you will get the *Interview Exercises* of both Subteams and two weeks for solving both sets of exercises.

After you have submitted your *Interview Exercises*, it will be evaluated by the relevant **Subteam Lead,** relevant subject experts and the **Team Lead** or **Tech Lead** depending on whether you applied for a PR Team or a Tech Team position. If we deem that you did a good job, we will invite you for an interview with the aforementioned people. On this interview, we expect you to be familiar with the contents of this document and of the documents [2], [3], [4]. These documents are intended to ease you into the kind of space engineering that we are doing at Aster in Space.

Phase III: Trial member period

If you deem that you are a good fit to be an Aster in Space member after your interview, we will offer you a *Trial Member* position at the *Subteam* you have qualified for. If you have qualified for multiple *Subteams*, are also allowed to be a part-time *Trial Member* in multiple *Subteams*, or to start your trial membership in one *Subteam* and later switch your *Trial Membership* to another *Subteam*. Your trial membership will last <u>4 weeks</u>, during which time both you and Aster in Space can terminate your trial member period with immediate effect.

During your *Trial Member* period, you will be mentored by a member of your *Subteam* -most likely your *Subteam Lead*. Furthermore, you are <u>strongly encouraged to ask questions to any Aster in Space member and to discover Innovation Space and their vast amount of resources available for Aster in Space</u>.

Bibliography

[1]..*ECSS*, Noordwijk, The Netherlands. [Online]. Available: https://ecss.nl/

[2]…C. P. S. The CubeSat Program *et al.*, *CubeSat Design Specification*. 2022. [Online]. Available: https://static1.squarespace.com/static/5418c831e4b0fa4ecac1bacd/t/62193b7fc9e72e0053f00910/1645820809779/CDS+REV14_1+2022-02-09.pdf

[3]......R. D. Roberto, E. Brandolini, G. Sparvieri, and F. Graziani, “Best practices on adopting open-source and commercial low-cost devices in small satellites missions,” *Acta Astronaut.*, vol. 211, pp. 37–48, 2023, doi: https://doi.org/10.1016/j.actaastro.2023.06.001.

[4]..............C. Nieto-Peroy and M. R. Emami, “CubeSat mission: From design to operation,” *MDPI*. Multidisciplinary Digital Publishing Institute, Aug. 2019. [Online]. Available: https://www.mdpi.com/2076-3417/9/15/3110