

# United Nations/Brazil Symposium on Basic Space Technology

"Creating Novel Opportunities with Small Satellite Space Missions"

## AztechSat1 a model for cooperation in space development

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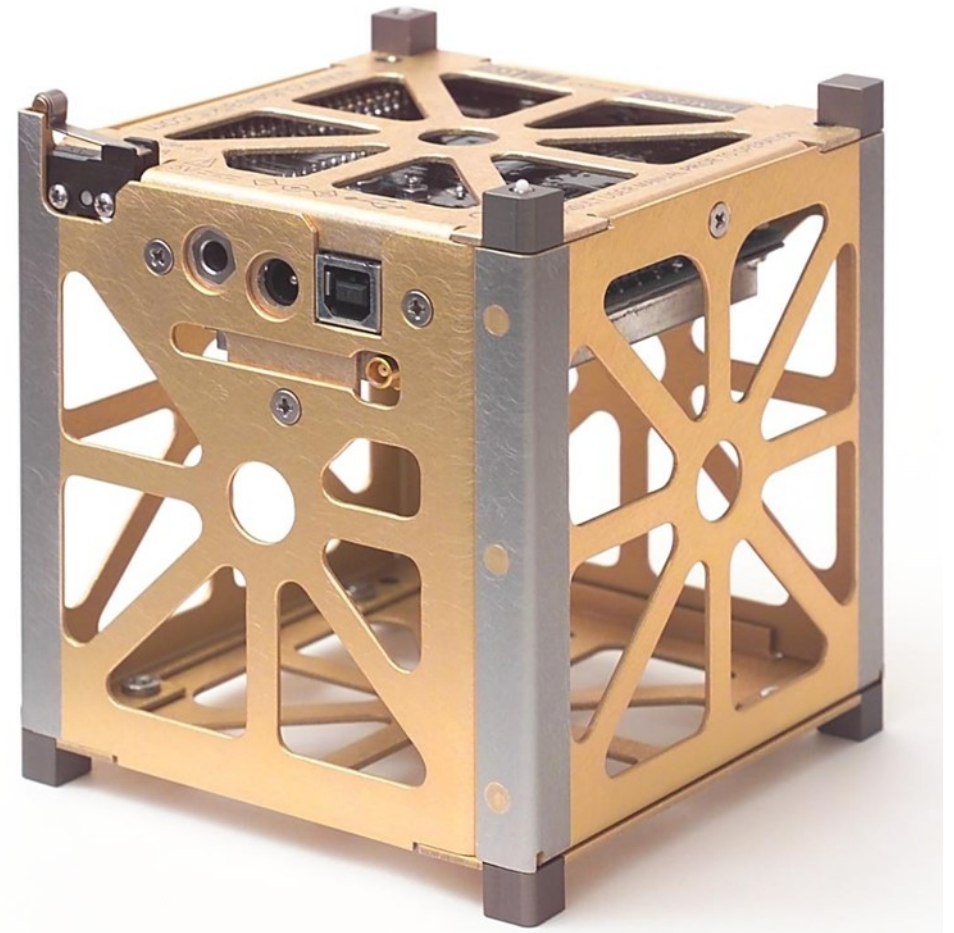


# Objective of the talk

Present a model of cooperation between the Mexican Space Agency, NASA and Mexican universities for capacity building in Mexico by constructing, testing, deploying an operating small satellites in a collaborative way

# Agenda

- Mexican Space Agency at a glance
- Origins of the AztechSat1 Project
- Mission and primary focus
- Stages of development
- Milestones of the Project
- AztechSat-1 team
- Model of cooperation
- Benefits
- Final thoughts



# Mexican Space Agency (AEM) at a glance

- Starts operations in 2013
- Small organization (62 employees)
- Focused on capacity building
  - Has developed many tools
    - Educational portal
    - Digital Magazine
    - Internships at NASA and other space agencies
    - etc
- Very good international relationships
  - Organized UNBSTI2014 in Ensenada, México
  - Organized IAC2016 in Guadalajara, México
  - Our Director General presides several international organizations
    - Chair at World Space Week
    - VP at IAA



# Origins of the AztechSat1 project

- A nonreimbursable Space Act Agreement between AEM and NASA
  - AEM will deliver a nanosatellite to NASA to test an issue *of interest for NASA*
  - NASA will provide technical advice, environmental tests and deployment of the satellite through the ISS
- On May 2017, AEM transferred the project development to a Mexican university. UPAEP committed to financing the project and
- Carry it out its development in its entirety with the participation of students and teachers.
- Funding came from UPAEP and a Mexican government fund (AEM-CONACYT space fund)

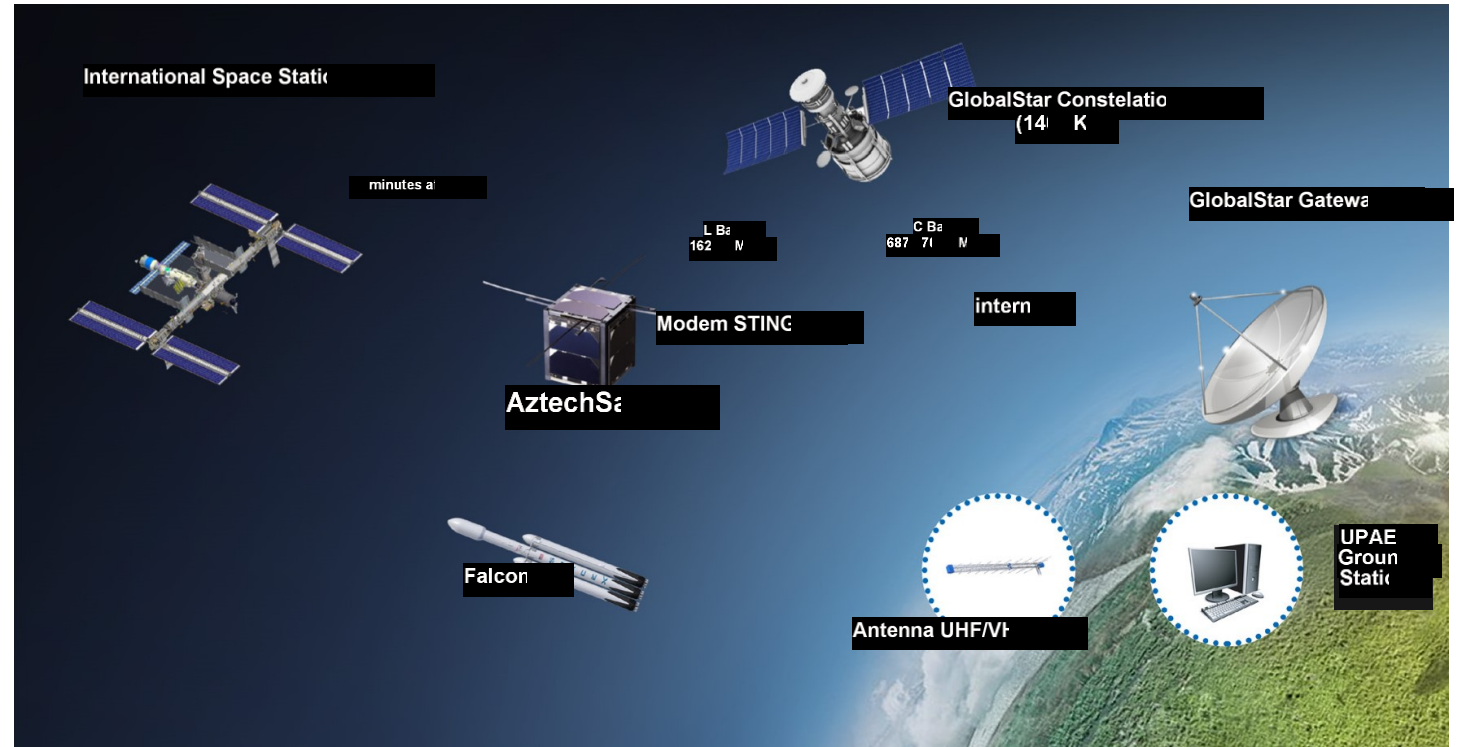




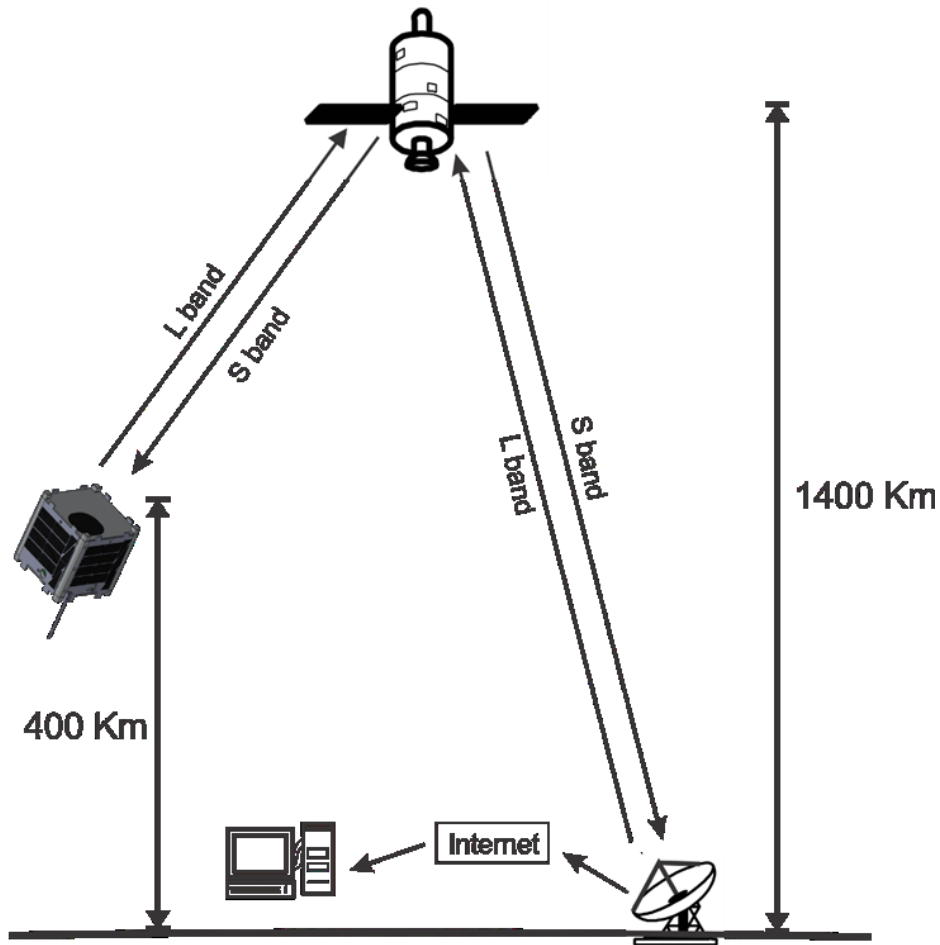
# Mission and primary focus

Develop a 1U flight certified CubeSat for deployment from the International Space Station.

Conduct intersatellite communication demonstrations between AztechSat1 and the GlobalStar Constellation.

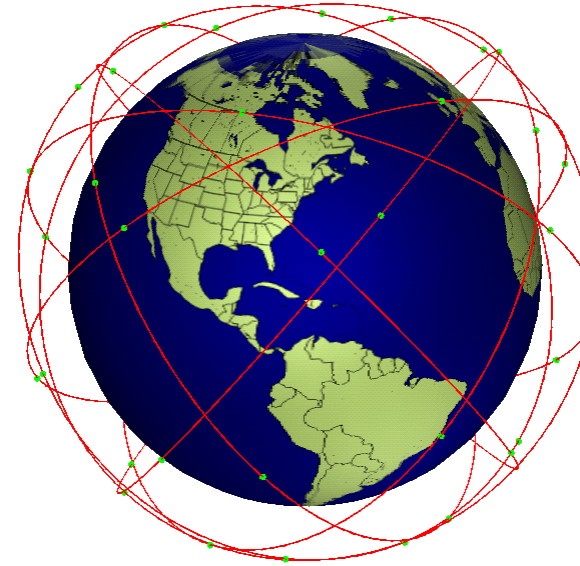


# Concept of operations



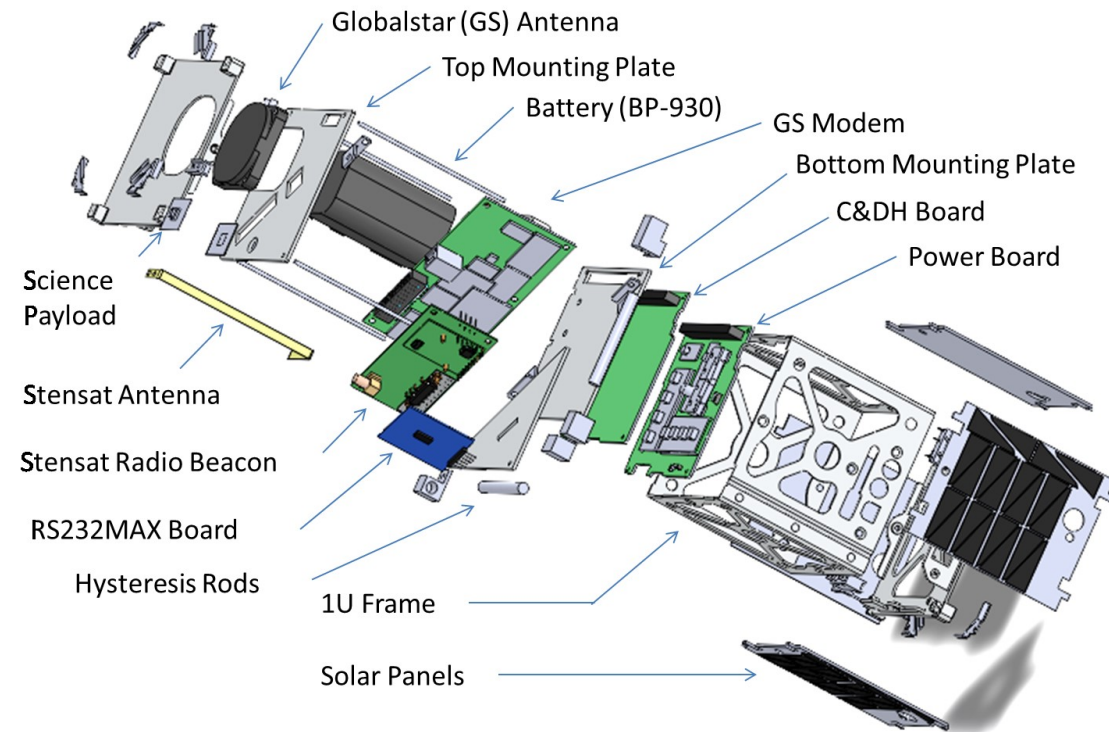
## GlobalStar Constellation Facts

Number of operational Satellites	32
Constellation Altitude	1,400 km
Inclination	52°
Orbital period	114 min



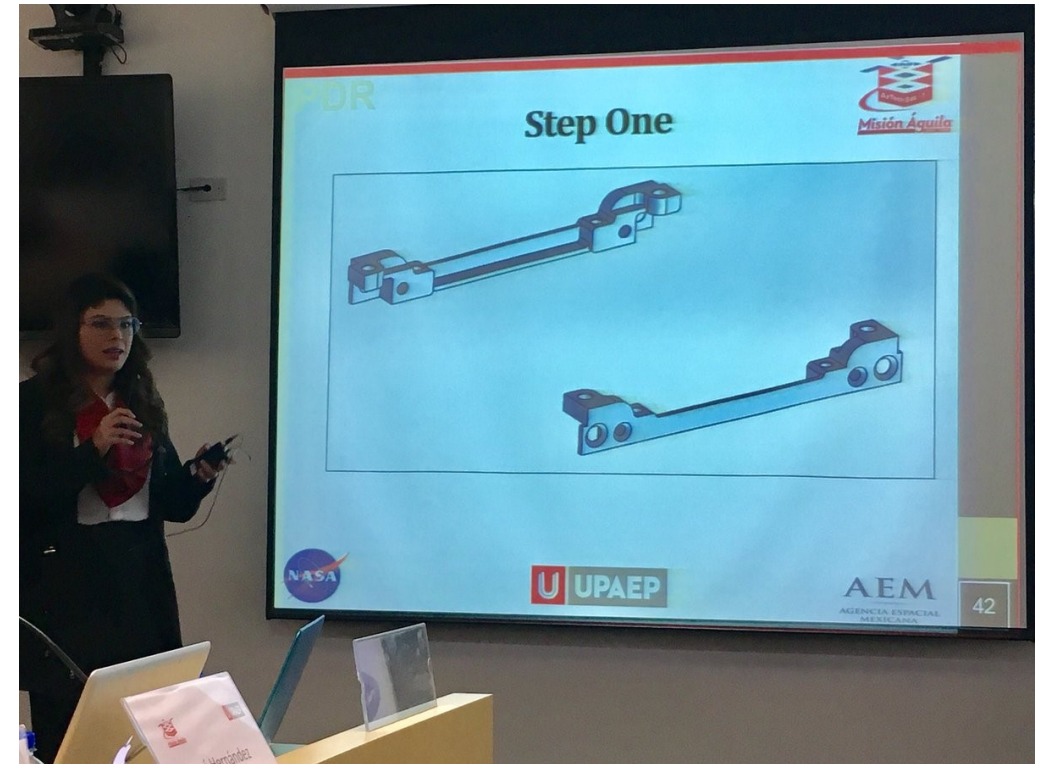
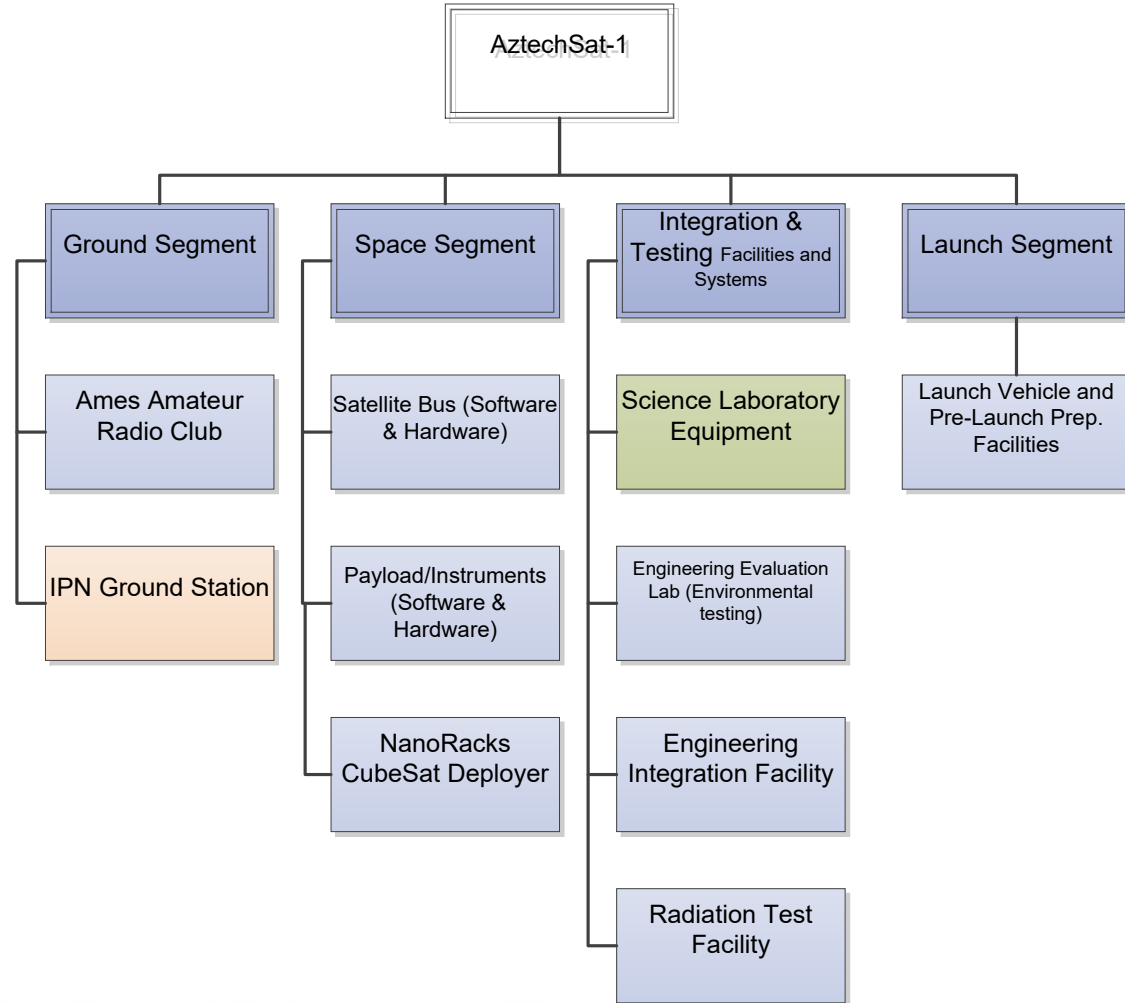
# Architecture

- AztechSat1 consists of 5 modules:
- Power
- On-board computer
- Communications in UHF and VHF
- Attitude control module
- Payload module to perform communication with the GlobalStar constellation.
- All of the above is housed in a 10x10x10 cm cubic structure according to the CubeSat standard.

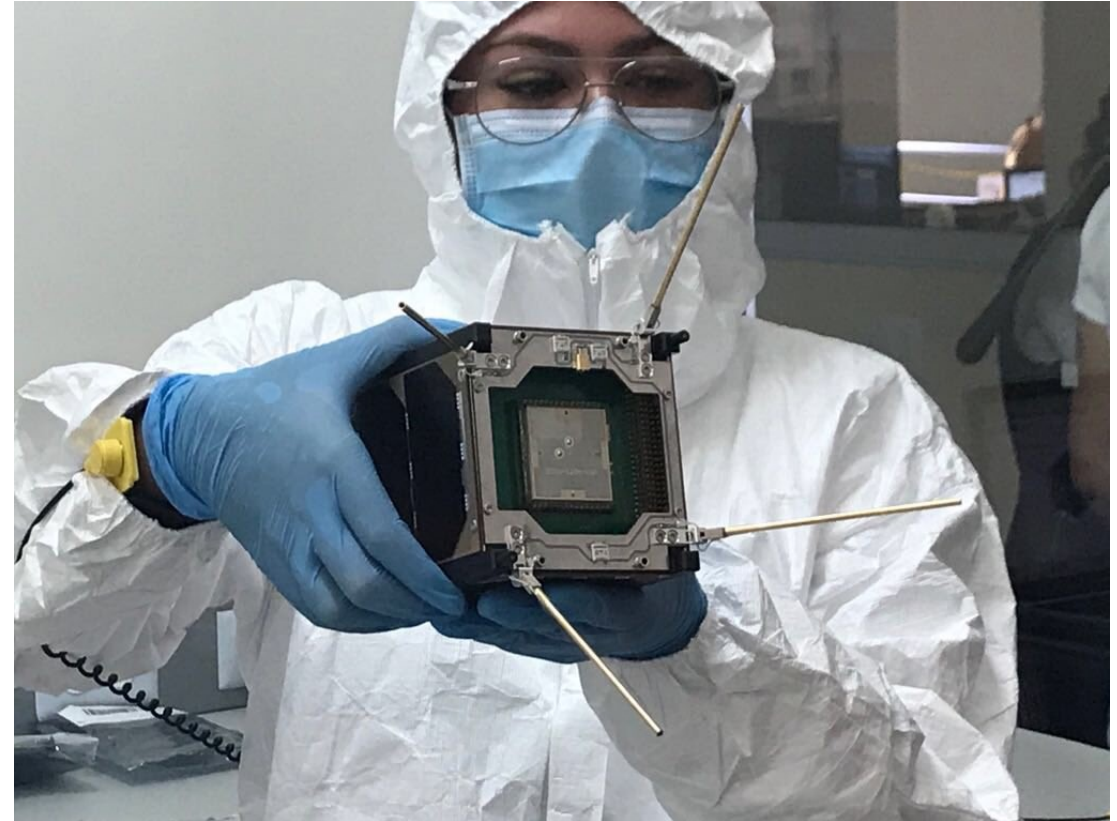
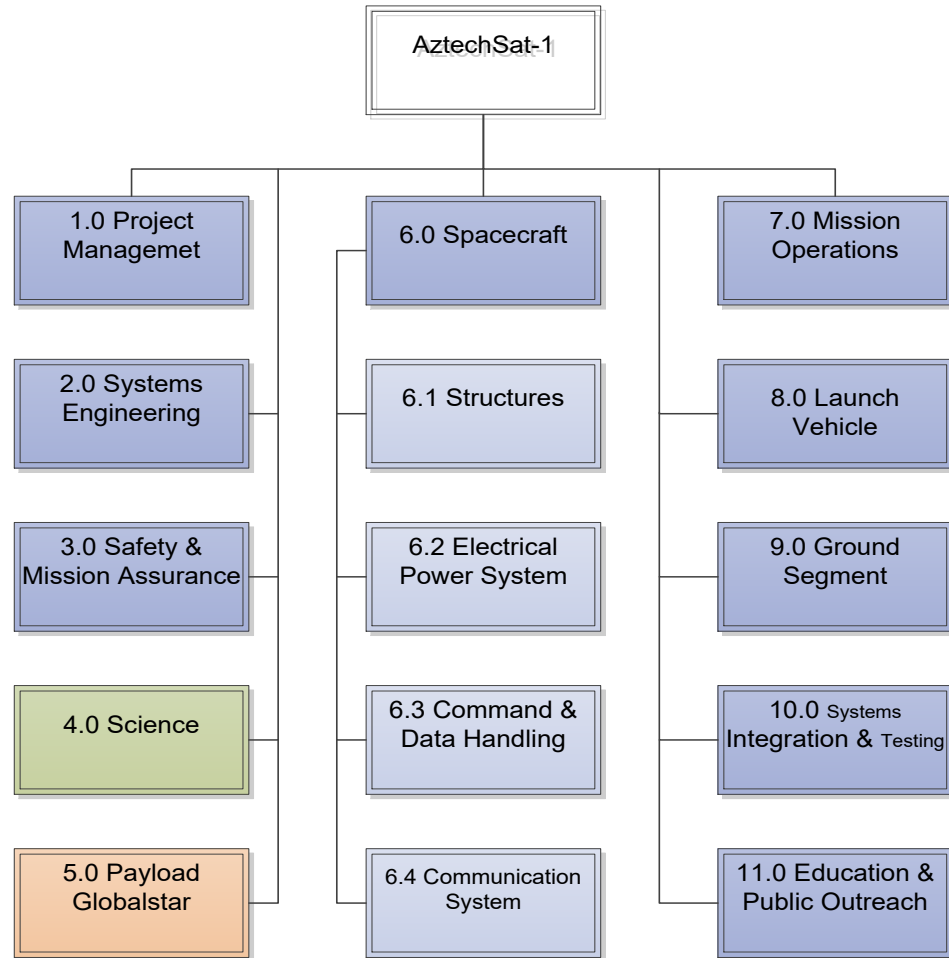




# Project breakdown structure

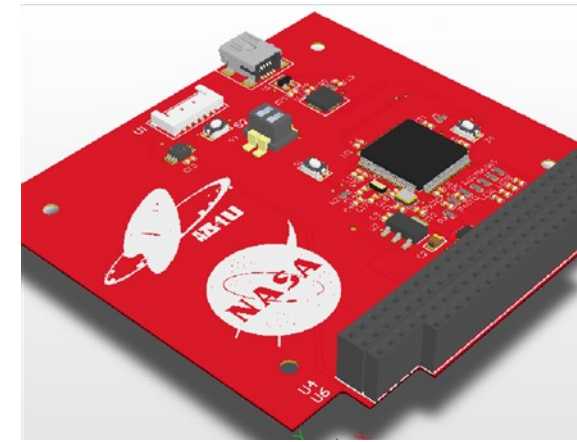


# Product breakdown structure



# All systems, besides the payload were bought of the shelf and flight proven

- This complies with NASA's philosophy of not reinventing the wheel
- Assures reliability and performance by minimizing risks
- Project participants are dedicated to develop the payload, integrating the satellite, documenting and developing software





# Model of collaboration

- Team of mentors from NASA and AEM closely supervises teams of students and professors from UPAEP
- Each UPAEP team has a definite responsibility
- Program management is UPAEP's responsibility
- Byweeking telephone meetings and continuous availability of mentors provide agile feedback when issues appear



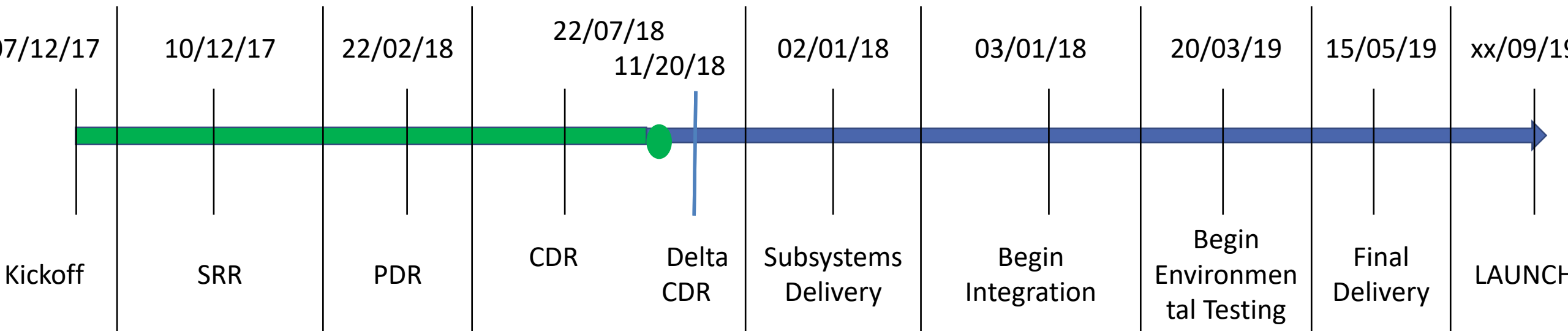
# Stages of the project

- Began its development on May 2017
- To date, the mentoring team, made up of specialists from the AEM and NASA, has validated the System Requirements Review (SRR), the Preliminary Design Review (PDR) and partially the Critical Design Review (CDR).
- It is estimated that the project will be completed by mid 2019. There is a launch manifesto for October 2019
- The duration of the mission is estimated to last a couple of months.





# AztechSat1 milestones



# AztechSat-1 team

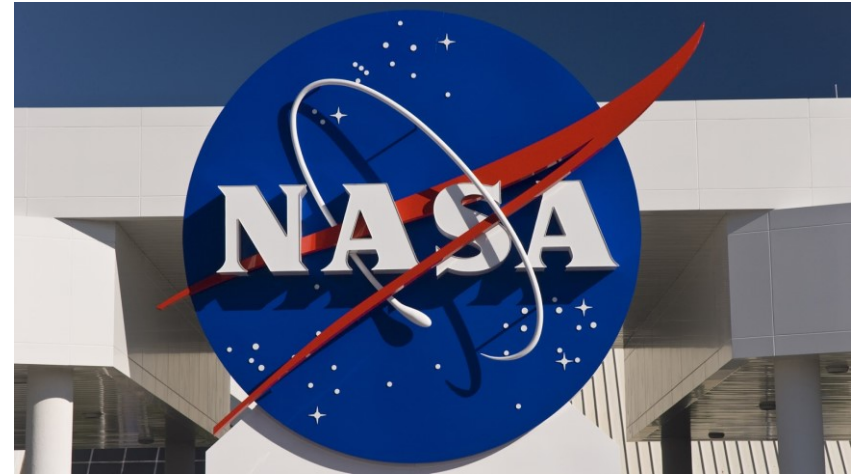
Comprised mostly of students (approximately 86 percent)

UPAEP students are actively engaged in all stages of the mission, from payload development to operations and regulatory issues



# Benefits (1/3)

- **To NASA**
  - Testing a technology that is of interest to NASA
- **To Mexico**
  - Access to a launch
  - Perform the environmental tests at no cost



# Benefits (2/3)

- Mentoring from NASA experts crucial to gain experience in the management of complex space projects using NASA's Space Engineering Systems methodology
- Experience gained by Mexico is not limited to technical issues (legal and regulatory aspects are very important and sometimes are neglected)

# Benefits (3/3)



- To UPAEP
  - Skilled professors and students in space technology
  - Outreach activities to inspire the next generation of space scientists and engineers

The whole project documentation will be available to share the experience with other universities



# Final thoughts

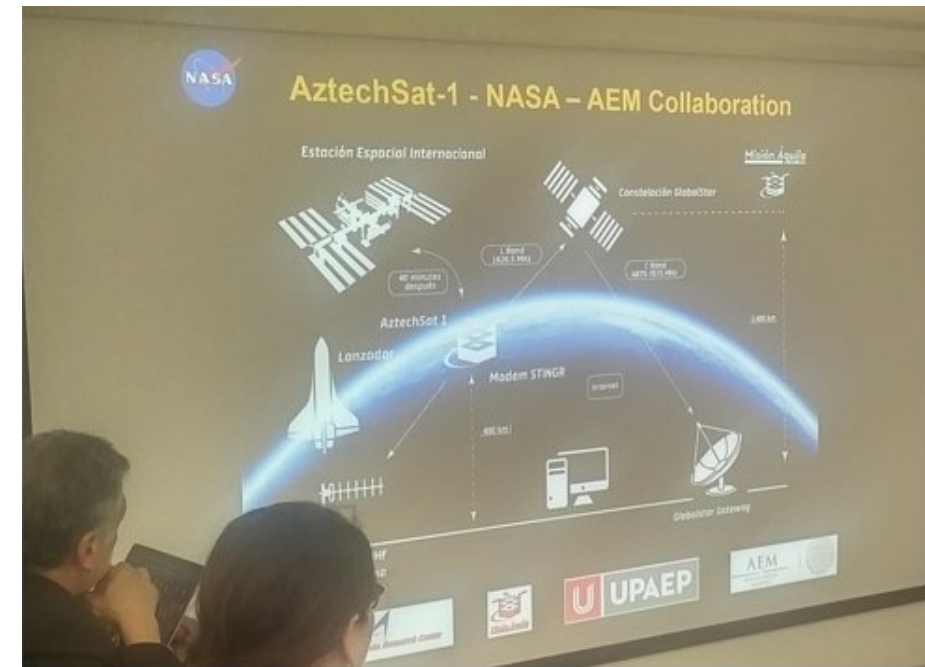
Once it is finished, AztechSat1 will provide invaluable experience to Mexico on how to tackle complex space projects

The *key ingredient* of the cooperation process was solving a problem that was of NASA's interest

AztechSat1 is the beginning of many projects to come between NASA, AEM and Mexican Universities

Currently AEM, NASA and two main Mexican universities are exploring the development of an Earth Observation Satellite, following the same model

The project provides a model of collaboration that other countries can apply



Thank you!

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