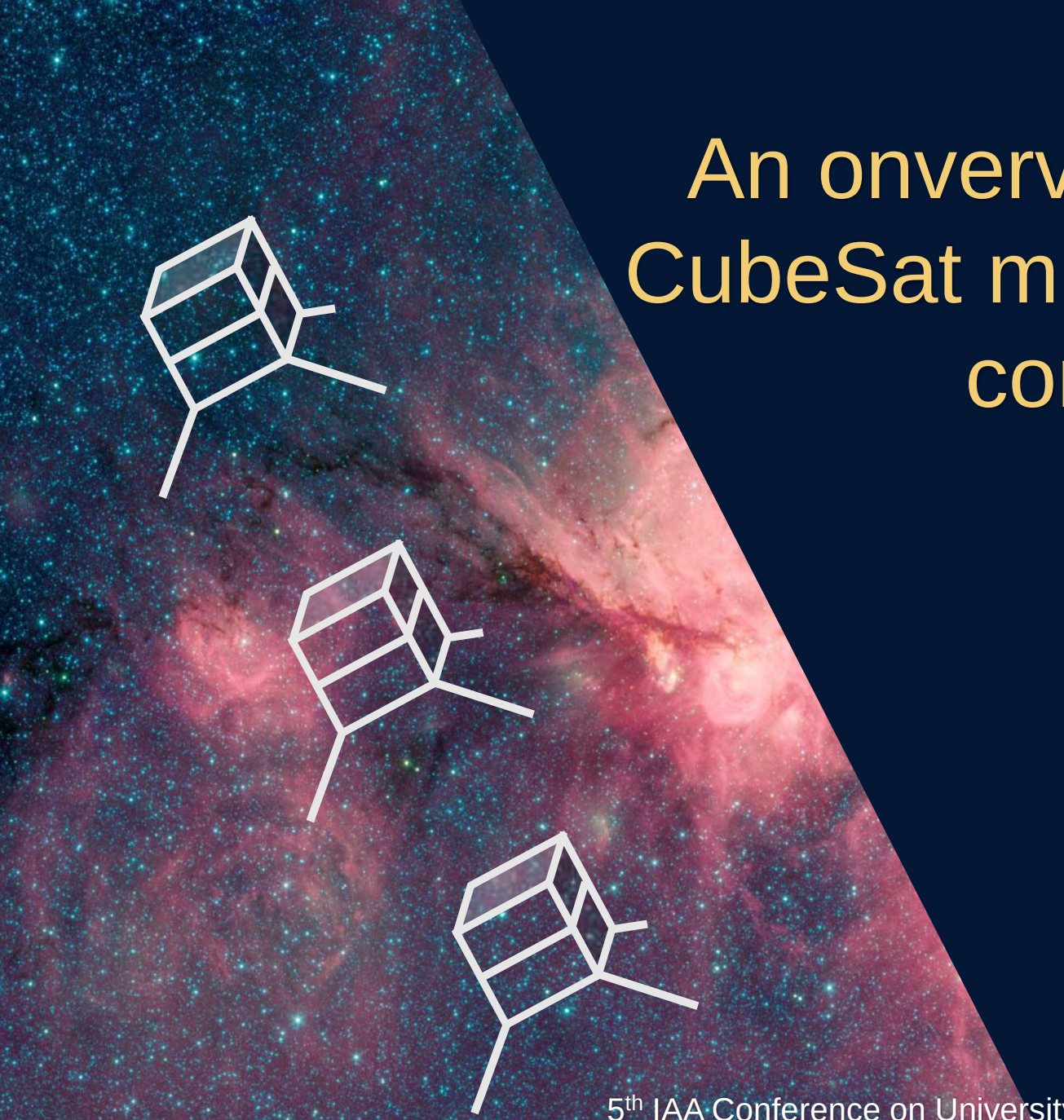

An onverview of the Alfa Crux CubeSat mission for narrowband communication

Leandro Ribeiro Reis – University of Brasilia
Renato Alves Borges – University of Brasilia
João Paulo Leite – University of Brasilia
Chantal Cappelletti – University of Nottingham
Simone Battistini – Sheffield Hallam University

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January 28-31, Rome, Italy, 2020.

How to meet data and voice communication demands in remote areas?

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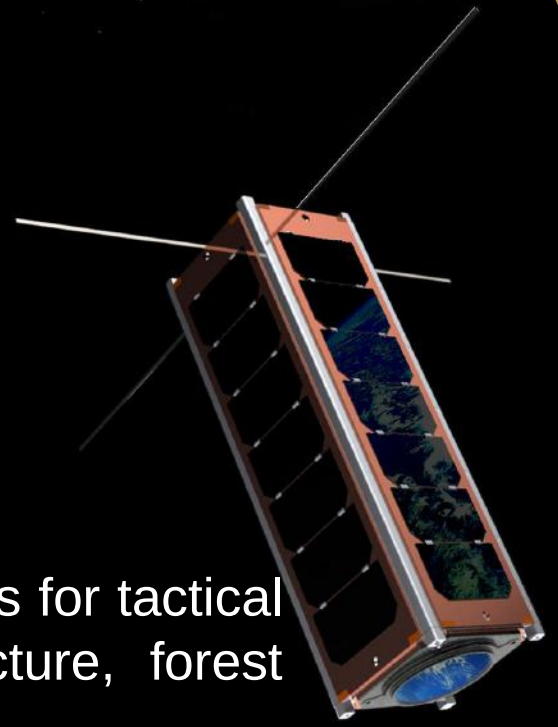
AlfaCrux 2021



The AlfaCrux nanosatellite mission is twofold:

1 - Provide mobile or fixed satellite narrowband communication links for tactical and strategic applications mainly in regions with low infrastructure, forest environments and countryside;

2 - Promote regional development through applied research focused on the NewSpace industry.

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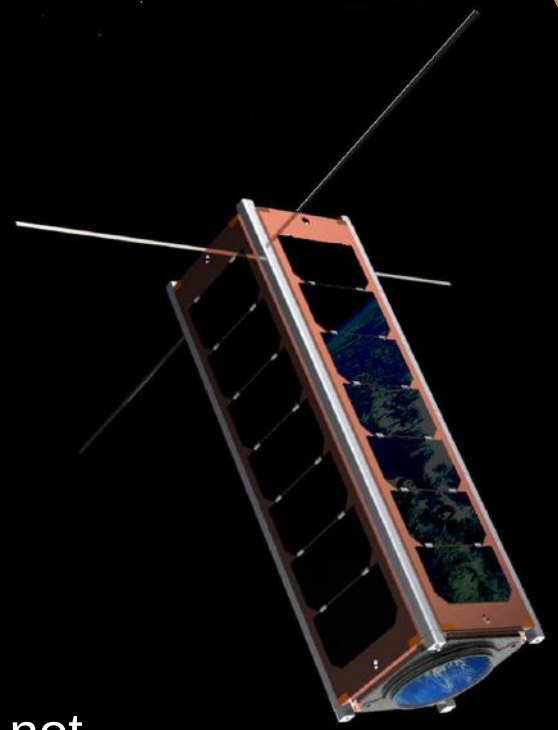
AlfaCrux System would meet the following characteristics:



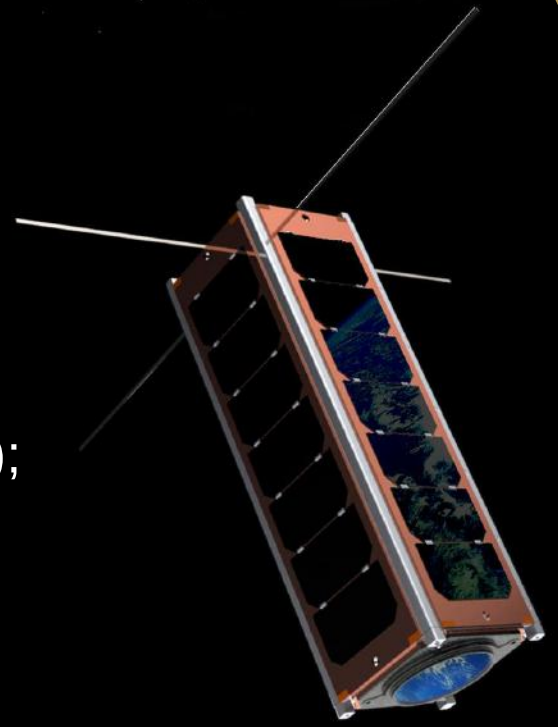
1. Small and lightweight terminals with low power consumption;
2. Reduced latency;
3. Interconnection with existing communication systems;
4. Satellite link on the move;
5. Communication link to cover hard to reach regions, where it is not possible to install ground infrastructure, such as the Brazilian Amazon;
6. Communication link for detached groups operating in isolation; and
7. Communications link to cover regions affected by disasters, natural or not, in which the local infrastructure was damaged.

Such solution would immediately bring the following advantages:

1. Improve the communication capacity in critical situations and tactical applications;
2. Lighter terminals compared to equipment used in SHF/EHF satellite communication systems;
3. Enable the use of the system in UN Peacekeeping Missions;
4. Mitigate the attenuation caused by rain, tree canopy foliage or elevated metal structures when compared to SHF/EHF solutions;
5. Cheaper terminals when compared to SHF/EHF equipment;
6. Greater mobility than SHF/EHF satellite systems due to their lower weight; and
7. Stimulate the national industry with a high degree of innovation.

The technical objectives to be addressed include:

1. Compatibility with radios available in the market (to be specified);
2. Voice and text messaging service;
3. Point-to-point communication (data relay framework);
4. Data storage and retransmission (store and forward);
5. Reception of ADS-B signals;
6. Ham radio repeater;
7. Spectrum monitoring.



The Alfa Crux 2021 system will consist of the following:

- A CubeSat (the α-Crux nSat) with omnidirectional antenna and software defined radio solution for payload and ground station;
- Its own control, tracking and command ground station;
- User segment solutions.

The α-Crux CubeSat

TTC communication system in the UHF band (437 MHz) and in the S band (2.1 GHz) based on:

- Omnidirectional antenna for communication with terminals on the ground. A possible option is the UHF Turnstyle antenna for 400 MHz communication band, 18.8 cm wavelength, remote control binary data rate and 9.6 Kbps telemetry;
- Patch antenna for S band (2.1 GHz) for high-speed transmission of 1-2 Mbps;
- Software-defined radio for data relay communication between tactical radios, data collection system, and command and control backup interface with the ground station, high frequency S-band communication system, reception of ADS-B signals and spectrum monitoring.

The α-Crux CubeSat

- On-board computer for control and management of satellite data (computer with on-board software development process).

- EPS power system, consisting of:

  -Control of storage, distribution and energy communication card;

  -Batteries for energy storage;

  -Solar panels for recharging batteries.

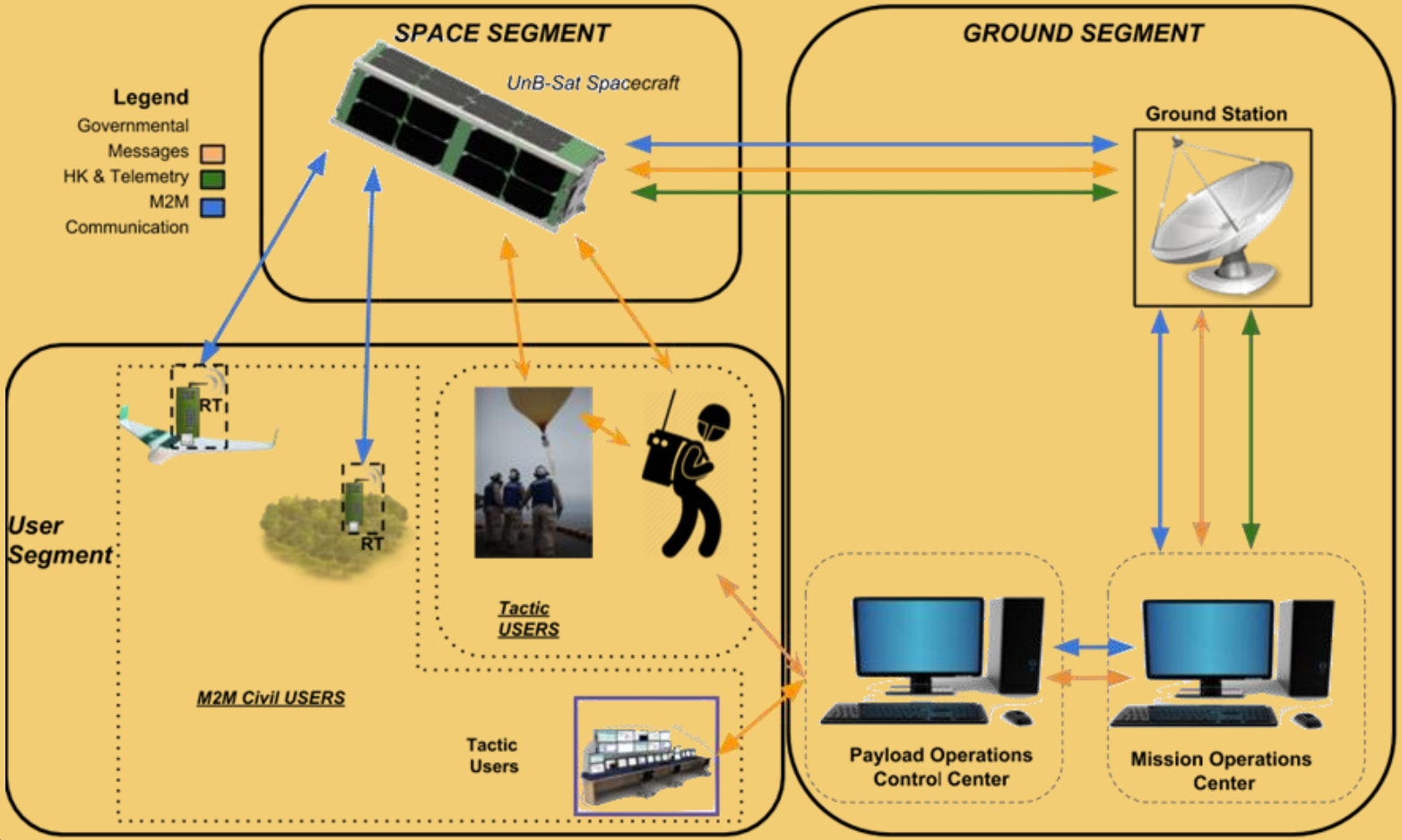
  - Power distribution network to the different satellite subsystems.

The α-Crux Orbit

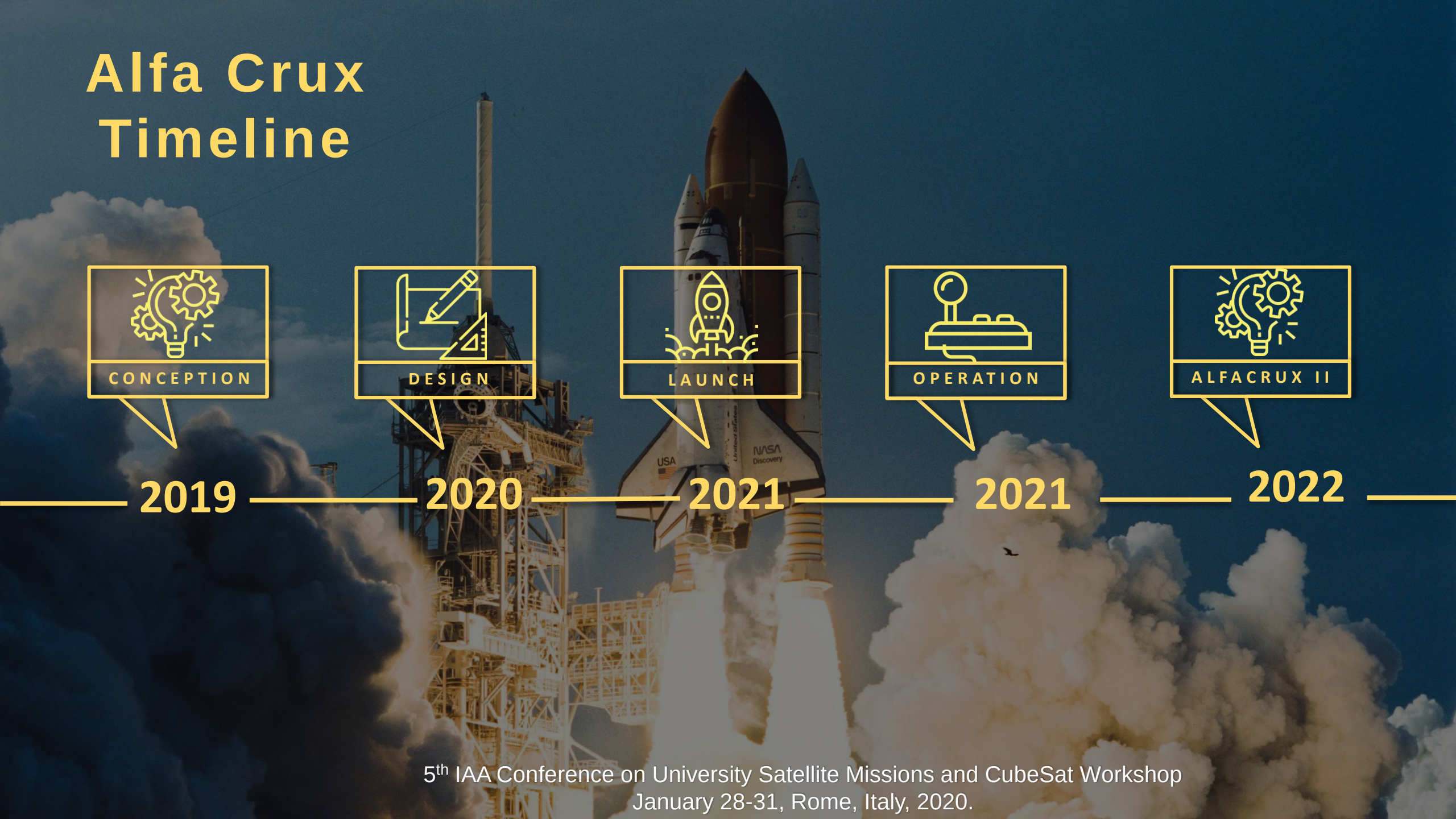
- The α-Crux CubeSat will be placed in a heliosynchronous low orbit at an altitude of approximately 500 km.
- The footprint of the satellite on the ground will have a radius of approximately 2500 km, equivalent to an area of 36 million km2.

Parameter	Value
Larger semi-axle	6878 Km (500 Km altitude)
Eccentricity	0
Slope	97°
Orbital Period	94,5 minutes

Operation Scenarios



Alfa Crux Timeline



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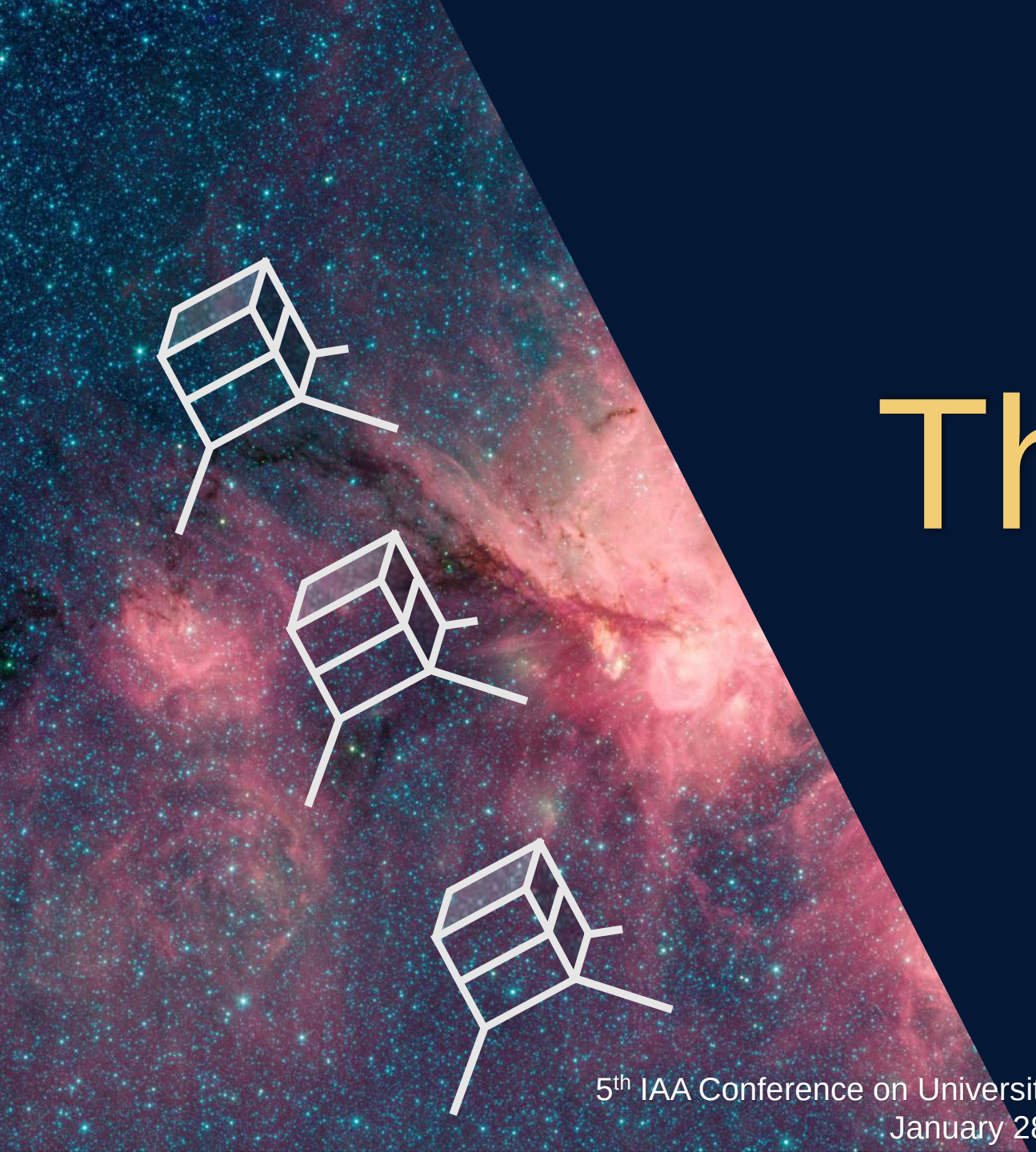

Thank you!

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