

The background of the slide is a composite image. The upper portion shows a night sky filled with stars and a vibrant aurora borealis (Northern Lights) in shades of green, yellow, and orange. The lower portion shows a dark, snowy, and rocky landscape. A large, semi-circular teal overlay covers the bottom half of the image, containing the text.

SOAR

Sub-orbital Amateur Radio



Introduction

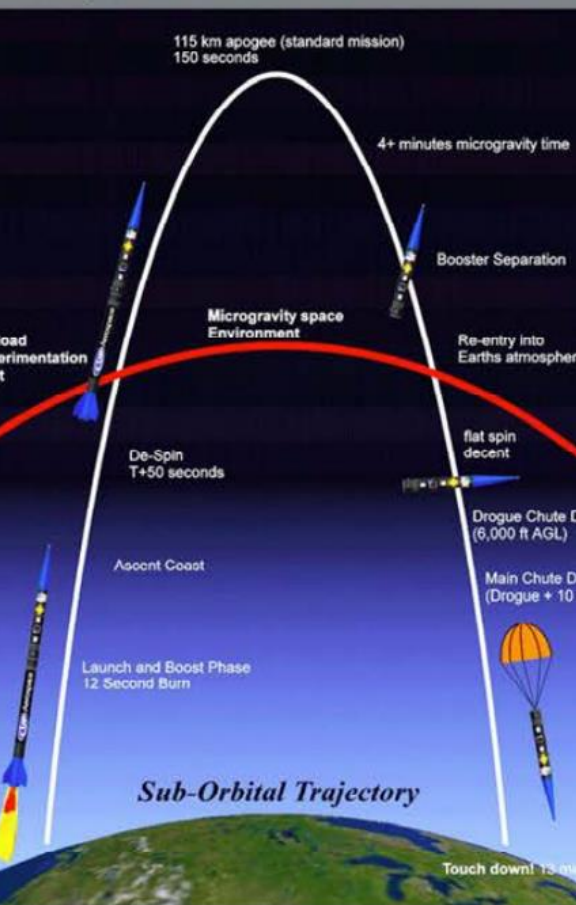
Sub-orbital rocket launches provide opportunities for space environment payload testing and experimentation at a fraction of the complexity and cost of typical Low Earth Orbit missions. The Sub-orbital Amateur Radio (SOAR) project's goals are to perform engineering and science experiments utilizing Amateur Radio, as well as increasing the Technology Readiness Level of Amateur Radio space flight systems.

This project is sponsored by the Open Research Institute.



Typical Mission: UP Aerospace SpaceLoft

SpaceLoft Mission Profile



Sub-orbital launches using vehicles such as UP Aerospace's SpaceLoft follow the mission profile shown at the left. Launch and boost phase lasts 12.5 seconds during which the payloads will experience axial loads up to 16 g and radial loads up to 18.5 g. The vehicle will coast for 42.5 seconds and then reduce its spin rate to a few degrees per second. At this point, the vehicle enters the microgravity space environment for just over 4 minutes, reaching an apogee of over 100 km. The vehicle re-enters the atmosphere, deploys drogue and main chutes, and touches down at approximately 13 minutes after launch.

SOAR

ASCENT

- Payload will experience both axial (direction of travel) and radial (due to vehicle spin stabilization) high acceleration loading
- Frequencies will be altered via doppler shift as well as component drift due to acceleration and temperature changes
- More difficult to track with directional ground station antennas due to the velocity of launch
- Shortest portion of the mission

SPACE

- Least dynamic environment of the mission
- Vehicle orientation may block antenna radiation (vehicle is slowly rotating)
- Best opportunity for longer range 3rd party reception

RE-ENTRY

- Very dynamic vehicle motions prior to drogue and main chute deployments
- Highest temperatures of the mission
- Additional opportunities for 3rd party reception

SOAR

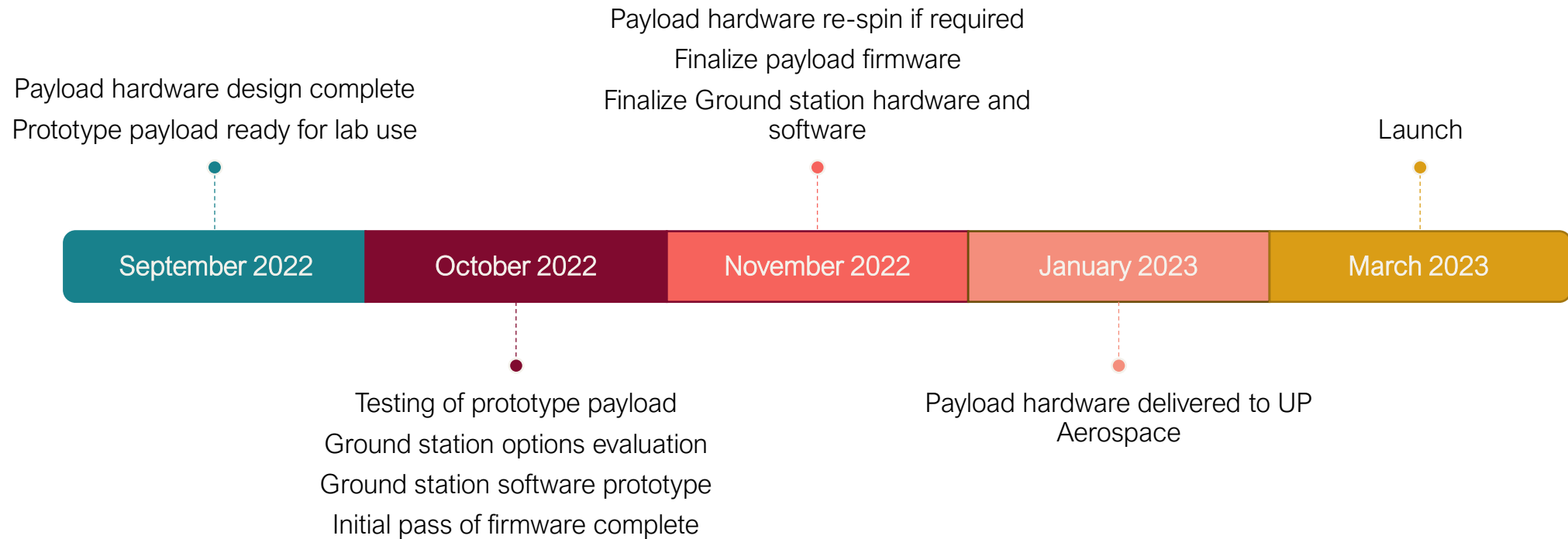
VEHICLE PAYLOAD

- A low-cost radio transceiver (Semtech SX1276) will be evaluated for use in space applications
- Modulation via LoRa, FSK, GFSK, MSK, OOK and FM voice modes are possible
- Test pattern data will be transmitted from the payload using different modes cycled in a predictable pattern

GROUND STATION

- A Software Defined Radio Receiver (e.g. AirSpy R2) will be used to record the radio spectrum required to demodulate the various transmitted modes (+/- doppler and some margin for drift)
- A single station with an azimuth/elevation tracking antenna, or multiple stations with fixed antennas covering the flight trajectory will be used (TBD)

SOAR Timeline



References

Open Research Institute

<https://www.openresearch.institute/>

UP Aerospace Inc.

<https://www.upaerospace.com/>

Semtech SX1276

<https://www.semtech.com/products/wireless-rf/lora-core/sx1276>



A vibrant image of the Aurora Borealis (Northern Lights) in shades of green and blue, set against a dark, starry night sky. The lights appear as flowing, ethereal curtains of light.

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<https://github.com/robojay/SOAR>