

ASU Satellite Tracking Ground Station



Overview

Mission:

- Develop a satellite tracking ground station that supports UHF, S and X band frequencies
- Provide interface for scheduling ground station operations

Motivation:

- To support the communications for missions like...



Phoenix



LunaH-Map



LROC



LightSail

MarCO

Prox-1

AOSat

SWIMSat

...and more!

- To provide a platform for RF communication innovations technologies and participation in ground station operations

Challenges:

- Finding a cost effective hardware solution while maintaining the systems reliability, component redundancy, accuracy and functionality
- Safety requirements/procedures/documentation
- FCC Licensing

Antenna Location, ISTB4 Building

EAST

SOUTH

WEST

~5°



Student Development Participation

Student Participation with development:

- GNU radio script development
- Sensor circuit development

Using Raspberry Pi, Arduino and other similar components

Development support needed:

- 3D orientation circuit development (with .5 degree accuracy in azimuth and elevation)
- Temperature sensor circuit development

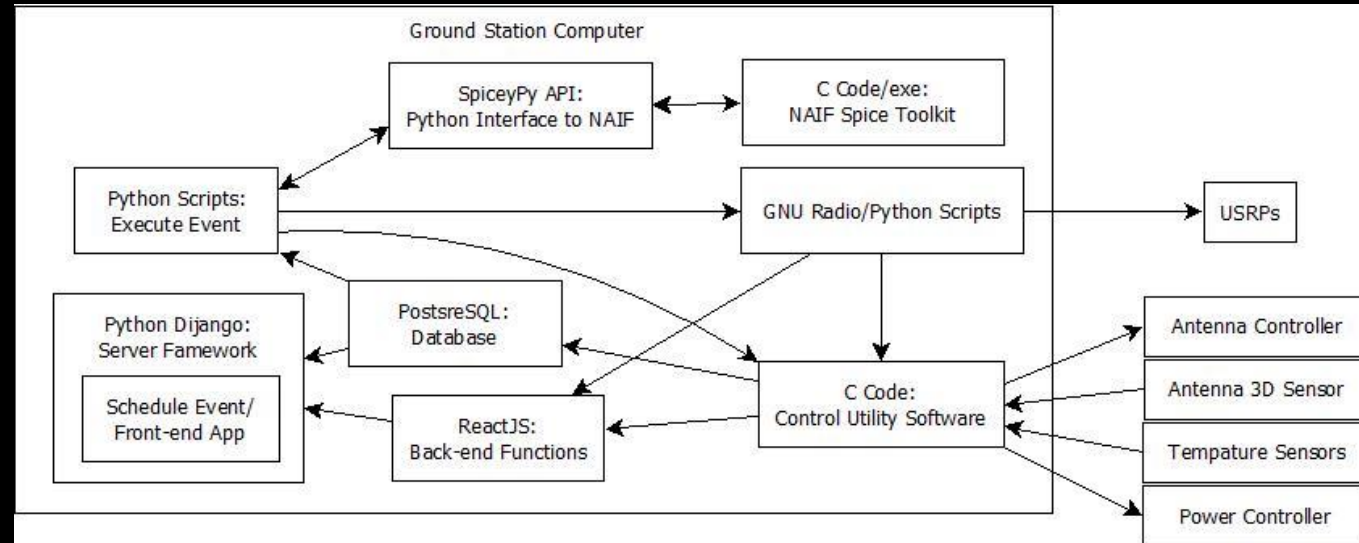
- Machine learning application development

Algorithms between astronomical events and/or other universities locations

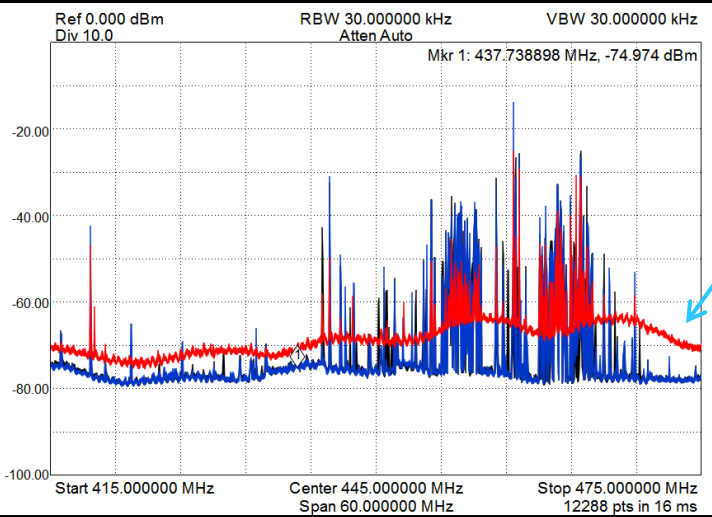
CSE485 Capstone Webapp:

Software Team developing the front end application for scheduling the ground station operation “events” for the system. This effort will include the following components to the system:

- Execute Event
- Database
- Schedule Event
- React JS Functions for supporting control utility



Frequency Band Selections



Performance will improve with better filtering and low-noise amplification techniques.

(coming soon!)

UHF: 430 - 450 MHz

S-Band: 2.2 - 2.45 GHz

C-Band: 7.145 - 7.235 GHz

X-Band: 8.4 - 8.5 GHz

C-Band:

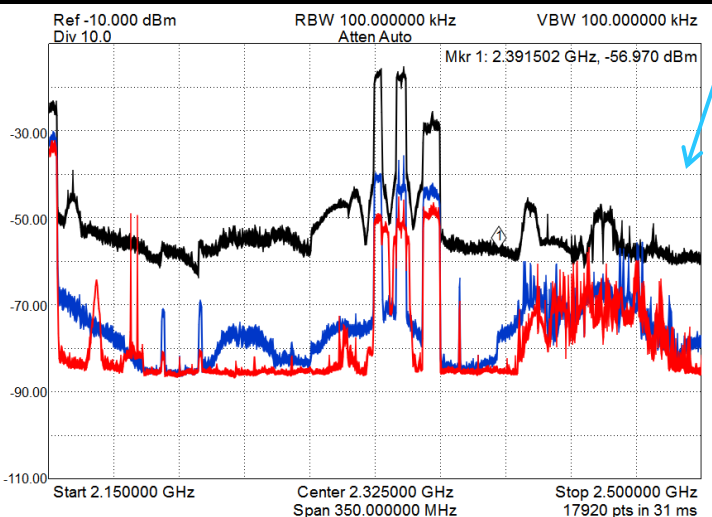
- 7.145 – 7.190 GHz: DSN Deep Space Uplink

- 7.190 – 7.235 GHz: DSN Near Earth Uplink

X-Band:

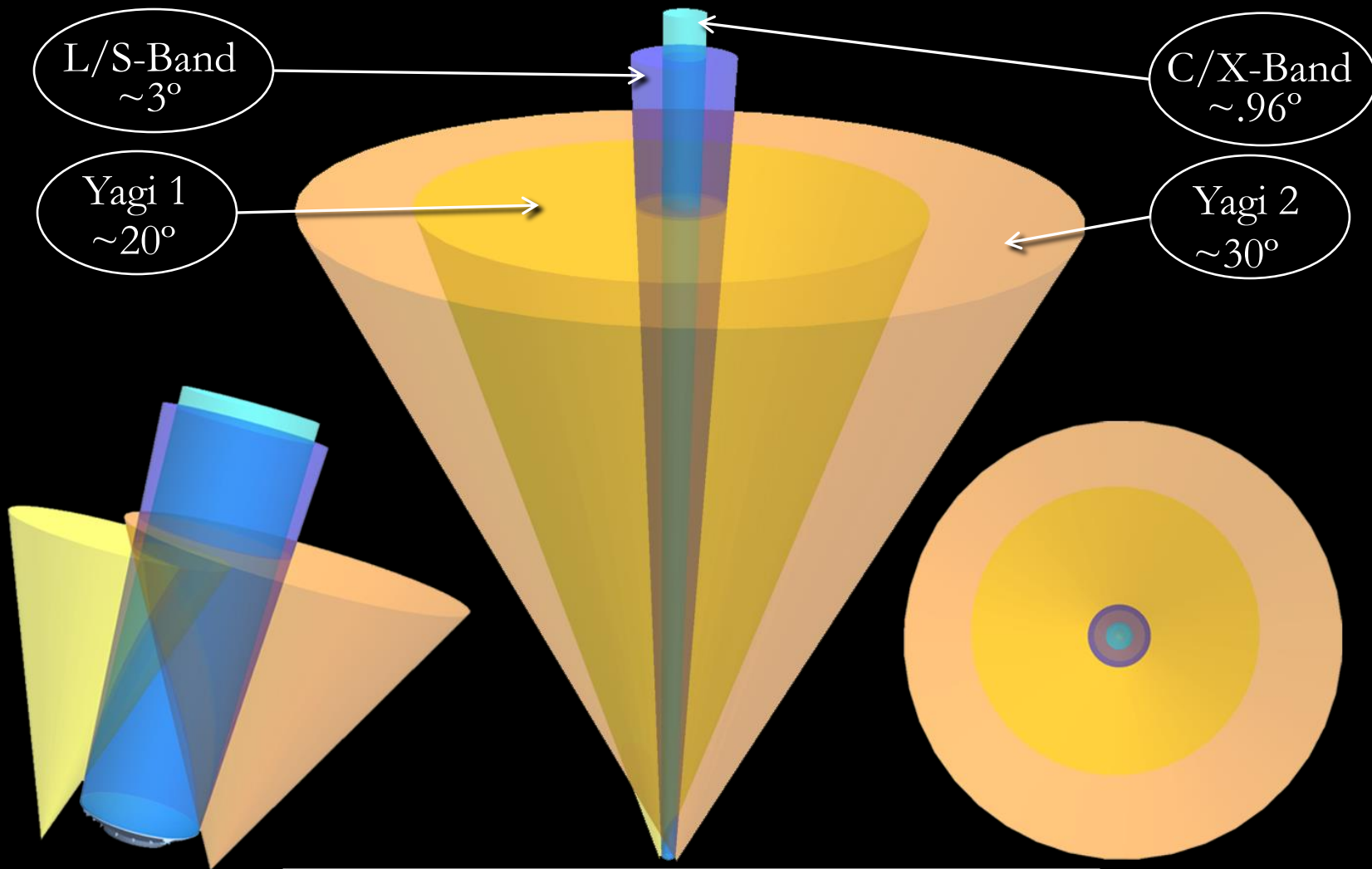
- 8.4 – 8.45 GHz: DSN Deep Space Downlink

- 8.45 – 8.5 GHz: DSN Near Earth Downlink

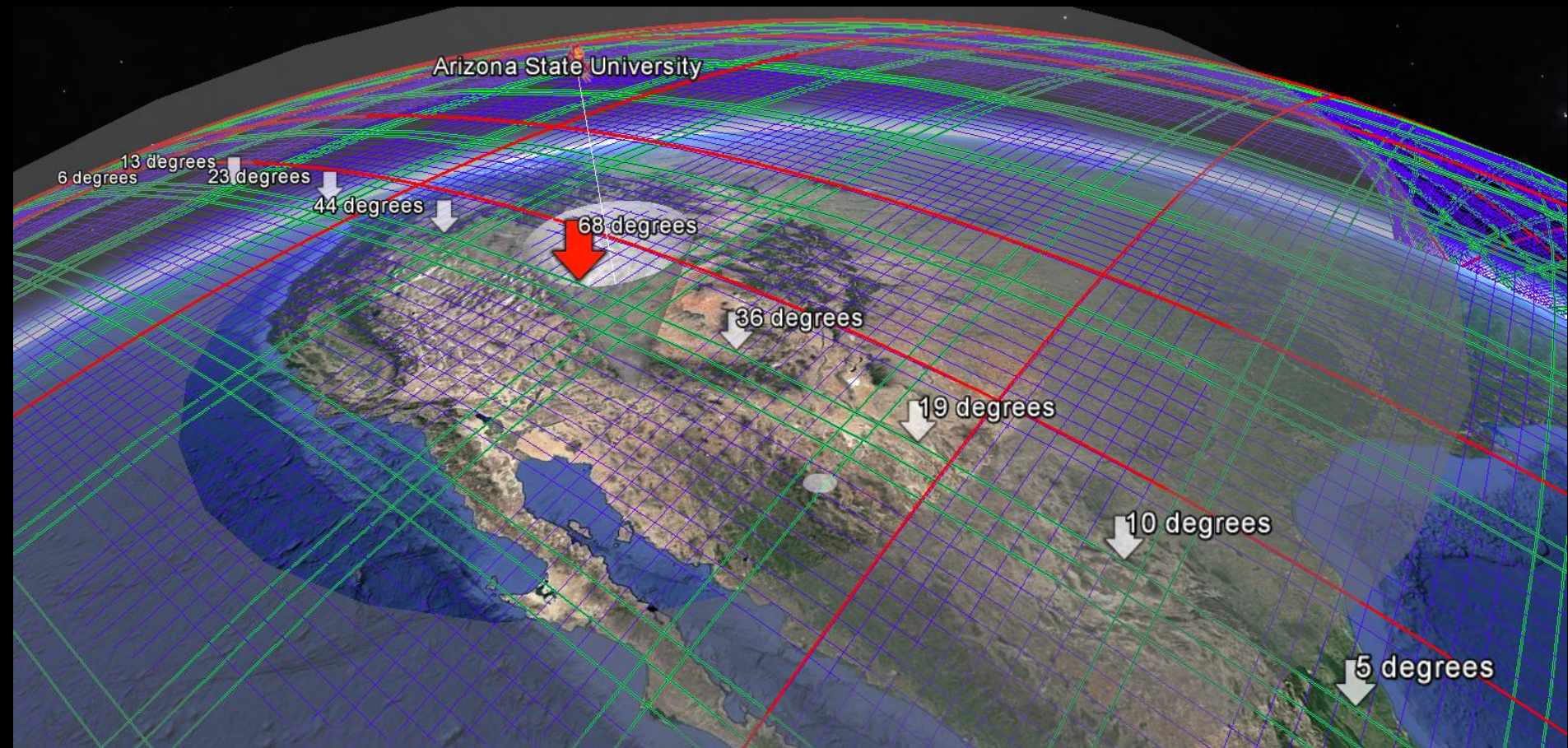


Band designation	Frequency range
HF	0.003 to 0.03 GHz
VHF	0.03 to 0.3 GHz
UHF	0.3 to 1 GHz
L	1 to 2 GHz
S	2 to 4 GHz
C	4 to 8 GHz
X	8 to 12 GHz
K _u	12 to 18 GHz
K	18 to 27 GHz
K _a	27 to 40 GHz
V	40 to 75 GHz
W	75 to 110 GHz
mm or G	110 to 300 GHz ^[note 1]

Antenna Beams



Phoenix Satellite Operation





NASA Space Grant Opportunity

Each year 40 - 50 ASU Undergraduates and 2 – 4 Graduates are selected to receive ASU/NASA Space Grant Internships and Fellowships. Paid Internships and Graduate Fellowships are available to exceptional ASU students in a variety of disciplines in science, engineering, technology, math (STEM), as well as fields in global change, media relations and education.

Mission:

Working to expand opportunities for ASU students to participate in NASA's aeronautics and space projects by supporting and enhancing science and engineering education, research and public outreach.

Goals for NASA Space Grant:

- To contribute to the nation's science enterprise by funding education, research and public engagement projects
- To increase the engagement of underrepresented minorities in all areas of Science, Technology, Engineering and Mathematics

Undergraduate Application:

- <https://nasa.asu.edu/2017-18-asunasa-undergraduate-scholarship-application>

Graduate Application:

- <https://nasa.asu.edu/2017-18-asunasa-graduate-scholarship-application>

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