Flexible Ground Suite - RF

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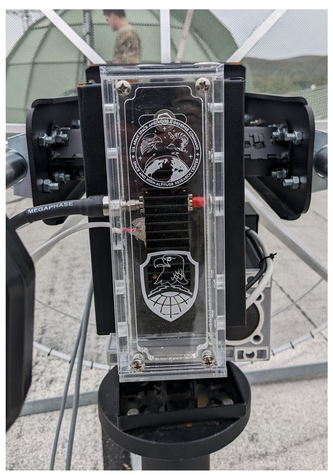
Purpose:

The increasing demand for tracking air and space assets has led to the inception of deployable systems for in-theater support. The goal of the Flexible Ground Suite is to meet this demand through the implementation of commercial off the shelf technology in support of Airspace and Space Situational Awareness Missions. This is accomplished by combining RF, EBS, and State Estimation and Processing. The objective of the RF element is to leverage software defined radio (SDR) in support of airspace and space object tracking.

Research Focus:

The goal of this past year's efforts has been to set the stage for future cadets to develop and integrate the SDR and antenna in tracking air and space objects. This was to be accomplished through extensive literature review and testing of the SDR in MATLAB Simulink, as well as the setup and integration of key hardware and software systems.

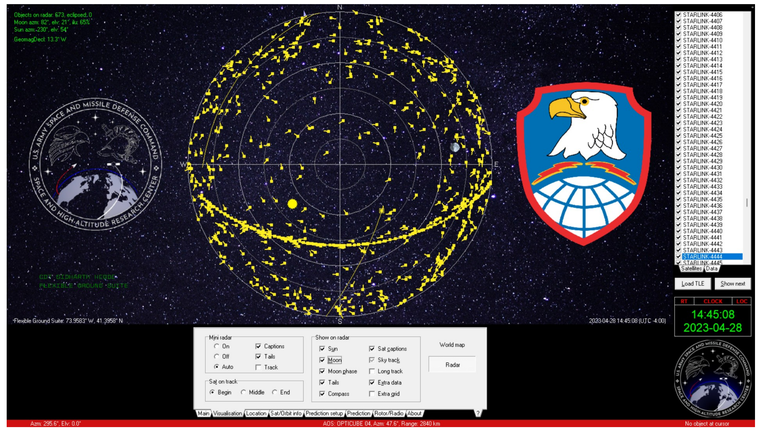


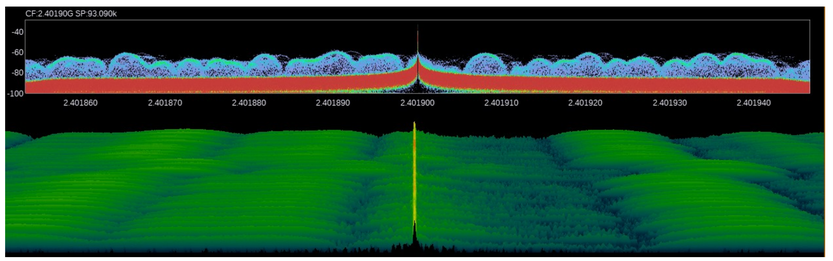
Methodology:

Using an Ettus Research USRP B210 SDR and MATLAB Simulink, a WiFi signals in the 2.4 GHz range were able to be visualized, preparing for the reception of satellite telemetry signals in the same frequency. This radio unit, controlled remotely, is wired via low attenuation cabling to a parabolic dish antenna and Low Noise Amplifier on the roof of Bartlett Hall. The antenna is mounted to a rotator unit, which sets it in motion.

Results:

The rotator controller is run by integrated software on an external machine. It allows for the prediction of the current position and future orbit of all declassified operational satellites. This data is converted into the desired azimuth and elevation from our location in real time, allowing the controller to steer the antenna to the optimal tracking position. The system can "lock onto" Geostationary, Medium Earth, and Low Orbit objects in space, allowing for seamless hardware integration for SDR.





Future Work:

As mentioned, this project set the stage for future cadets to continue research into optimizing and refining the system. Future research would include work on identifying satellites via telemetry signals, integrating deep learning or AI for object identification or classification, and beginning work on building and testing a deployable product.

It is expected that the simulation of space assets will be vastly improved, utilizing specific software systems such as the Systems Tool kit over basic orbit calculations. The rotator system, antenna, SDR, and other hardware systems are intended to be long-term resources for cadet endeavor in tracking satellites and other space systems.