Department of Mechanical and Aerospace Engineering

# IMPLEMENTATION OF SOFTWARE MICROSERVICES FOR THE DESIGN AND DEVELOPMENT OF A SATELLITE DETECTION AND MONITORING SYSTEM AS PROOF OF CONCEPT

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This report presents the development of the author's internship that took place in Groundspace, a start-up located in Montpellier, France. This project focuses on the implementation of software microservices into Satmon, an upcoming on-development product designed to provide assistance to satellite operators against interference problems resulting from the coexistence of multiple satellite constellations and assure operational regulations compliance.

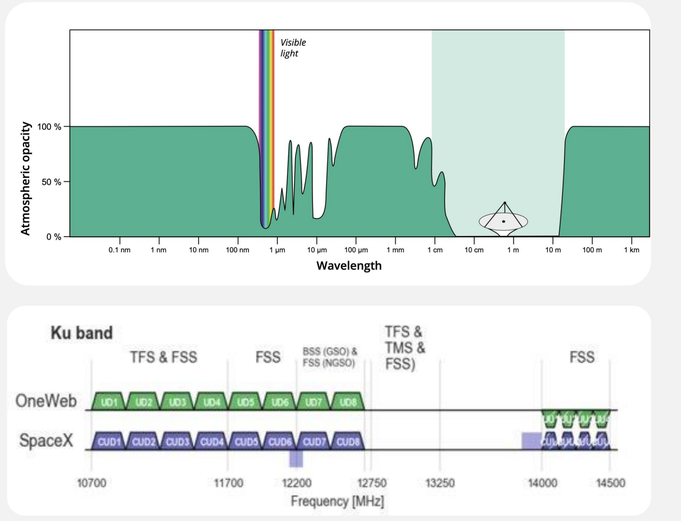


Figure 1. From top to bottom, *Available Radio Frequency Spectrum* and *Ku Band Distribution*

## Introduction

## Satmon: Proof of Concept

The exponential growth of high throughput LEO satellite constellations has led to many challenges, such as radio spectrum saturation and transmission loss. In response, Groundspace is developing Satmon, a software product designed to help satellite operators manage interference issues. The intern's contribution to this project involved developing microservices based on orbital mechanics and data science, focusing on the Sky Scan prototype.

## Objectives

- To implement and test prototype space signal acquisition systems
- To develop an algorithm to compute correlations between satellite orbits and received signal parameters
- To develop signal recognition algorithms
- To establish a centralized database of signal signatures

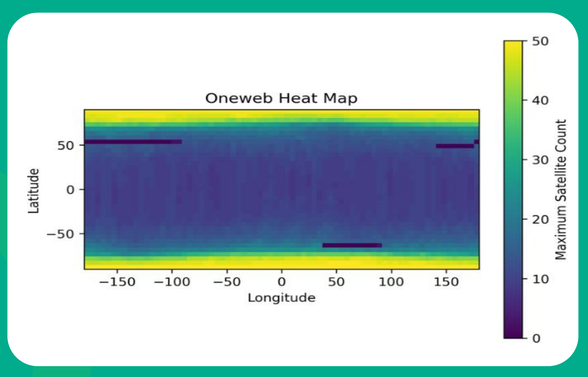


Figure 2. *Oneweb's Visibility Distribution Heat-map*

## Methodology

The applied methodology relied on the GitLab platform and VSCode editor, together with other tools such as Coder, Docker and Poetry. This enabled a collaborative workspace for task management, code review, and deployment. All microservices were developed in Python.

## Results

Four microservices were integrated as endpoints: Conjunction Prediction, Sun's Position, Solar Conjunction, and Sky Scan. For the Sky Scan prototype, the difference between the predicted and elapsed times was 7 ms, leading to hardware-software synchronization. Strong GEO satellites were spotted along the GEO arc, while LEO avoidance remains to be verified.

**More information about the project**

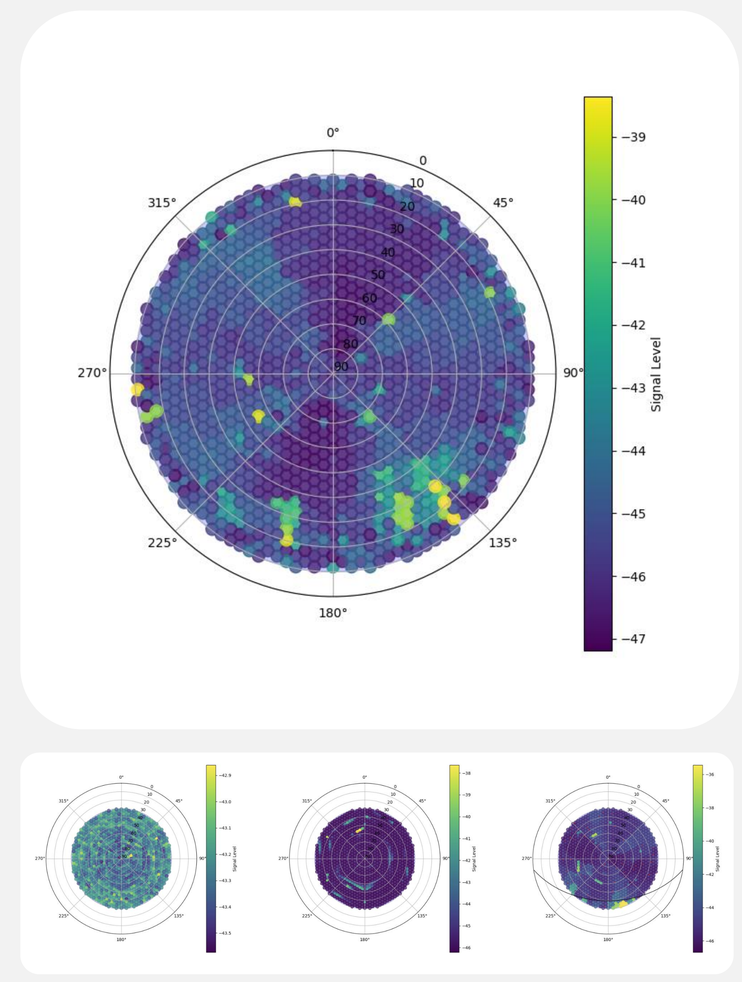


Figure 3. From top to bottom, *Sky Scan with Spotted Strong GEO Satellites* and *Sky Scan Evolution Results*

## Conclusions

- Four microservices and one prototype implementation were successfully developed according to the company's coding style and structure.
- Despite unscheduled inconveniences, the sky scan feature showed successful hardware-software synchronization and identification of strong GEO and some potential LEO satellites.
- Although the sky scan's execution time is restricted by factors such as steering speed, commands reception, and input type, it cannot take less than 10 minutes.
- A paper on the final implementation of the sky scan at the International Astronautical Congress 2025 in Sydney

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