

Multi-Functional and Scalable Ka-band Active/Passive Digital Array Receiver

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Program: FY21 R&TD Strategic Initiative

Strategic Focus Area: Decadal Survey Instruments

Objective

The overall goal of this task is to develop an overall system architecture and advance key technology areas that allow JPL to move away from single purpose sensors and produce configurable digital arrays delivering multi-purpose capability required for future decadal survey observations.

Approach

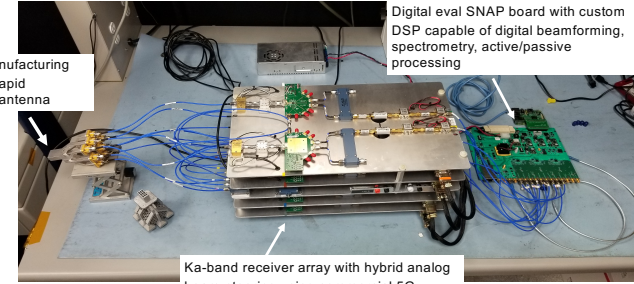
Develop a digitally configurable multi-function Ka-band receiver array for future cognizant satellite constellations.

Antenna Array Development: Scalable 3D printed antenna array ensuring scalability and configurability

Receiver Array Development: Leverage development in the commercial 5G world with in-house and off-the-shelf technology to develop a scalable and rapidly reproducible RF array, with ability to handle active and passive signals

Digital Beam-Forming Development: Hybrid beam-forming that leverages 5G analog modularity with scalable digital DSP design to expand to N-receivers – with spectrometry, active, and passive signal processing.

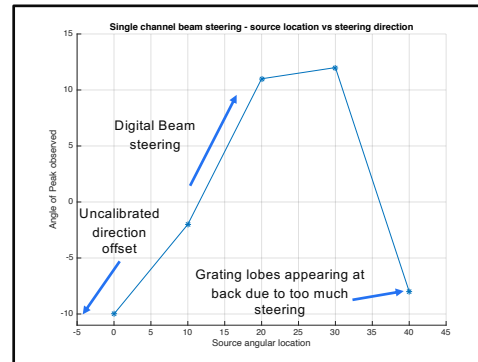
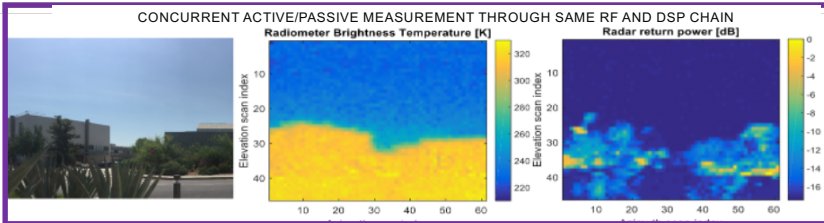
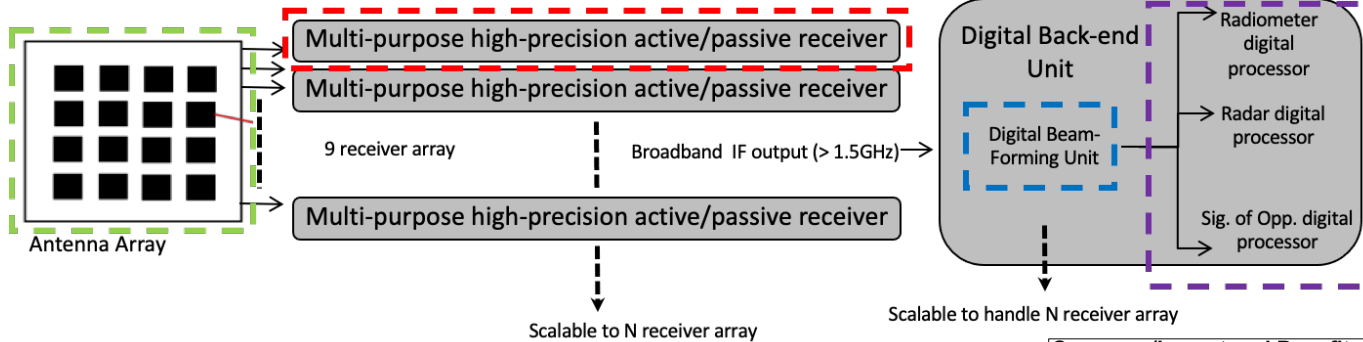
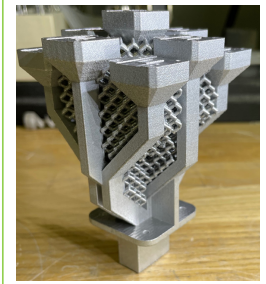
Additive manufacturing 3D printed rapid prototyping antenna



Digital eval SNAP board with custom DSP capable of digital beamforming, spectrometry, active/passive processing

Ka-band receiver array with hybrid analog beam-steering using commercial 5G technology

RAPID PROTOTYPING – 3D PRINTED SCALABLE ANTENNA



Summary/Impact and Benefits

The project successfully demonstrated a DSP system capable of multi-receiver beam-forming, over wide bandwidths, multiple output beams, with on-board spectrometry, an RF system capable of combining commercial 5G technology with custom RF design allowing compact and scalable systems that can ingest active and passive microwave receivers within a single design, and an antenna array system developed by the 3D manufacturing group allowing rapid prototyping and scalability.

We will be able to demonstrate a highly integrated and compact active/passive sensor that answers the decadal surveys call for **more with less**. Scalable and flexible backend digital array technology allows the instrument to be incorporated in "smart" constellation for storm identification and tracking. The **combined wideband RF/digital** array system supports concurrent radar, radiometer and signal of opportunity processing as required.