

# Programmable Ultra-Lightweight System Adaptable Radio

## Project Manager(s)/Lead(s)

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## Sponsoring Program(s)

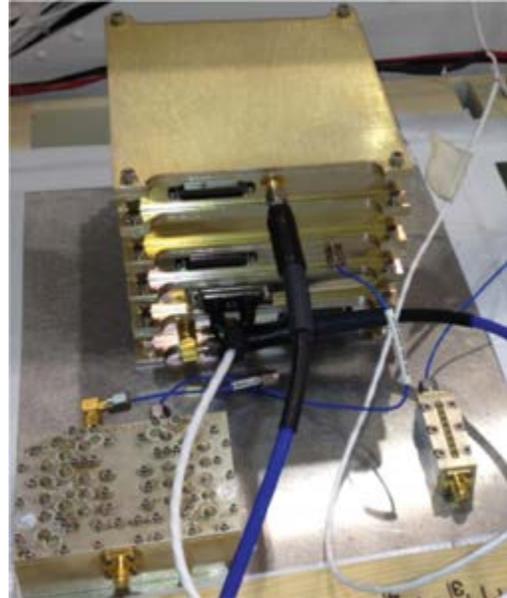
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Science and Technology Mission Directorate  
Game Changing Development

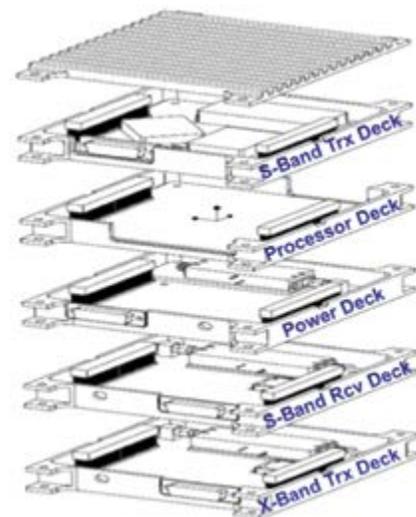
## Project Description

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The programmable ultra-lightweight system adaptable radio (PULSAR) is a NASA Marshall Space Flight Center transceiver designed for the CubeSat market, but has the potential for other markets. The PULSAR project aims to reduce size, weight, and power while increasing telemetry data rate. The current version of the PULSAR has a mass of 2.2 kg and a footprint of 10.8 cm<sup>2</sup>. The height depends on the specific configuration. The PULSAR S-Band Communications Subsystem is an S- and X-band transponder system comprised of a receiver/detector (receiver) element, a transmitter element(s), and related power distribution, command, control, and telemetry element for operation and information interfaces. It is capable of receiving commands, encoding and transmitting telemetry, as well as providing tracking data in a manner compatible with Earth-based ground stations, near Earth network, and deep space network station resources. The software-defined radio's (SDR's) data format characteristics can be defined and reconfigured during spaceflight or prior to launch. The PULSAR team continues to evolve the SDR to improve the performance and form factor to meet the requirements that the CubeSat market space requires. One of the unique features is that the actual radio design can change (somewhat), but not require any hardware modifications due to the use of field programmable gate arrays.



PULSAR unit.



PULSAR expanded view.

PULSAR 2.2A model radios have been delivered to NASA Johnson Space Center iPASS Lab and to NASA Stennis Research Center to support an engine test. In FY 2015, PULSAR will build and fly the 2.3 model PULSAR on a Peregrine sounding rocket as a payload. In preparation for this and as part of a typical development, the 2.3 model will undergo environmental testing: thermal/vacuum, electromagnetic interference, and vibration. After the 2.3 is refined, development is expected to continue into smaller form factors and X-band reception (not just transmit).



**PULSAR 2.2A as delivered for Stennis engine test support.**

### ***Anticipated Benefits***

The PULSAR radio has the benefit of providing a CubeSat radio at a high data rate and a cost that is significantly lower than any other commercially available S- and X-band frequencies.

### ***Potential Applications***

Possible potential applications include CubeSats, unmanned aerial vehicles, portable ground stations for Satellite communication.

### **Notable Accomplishments**

PULSAR has delivered two radios in calendar year 2014, designed the next evolution of the radio and is building it at this time, and has strong industry ties with GATR antennas, Miltec, and Orbital Telemetry.