NASA SBIR 2017 Phase I Solicitation

S1.02 Technologies for Active Microwave Remote Sensing

Lead Center: JPL

Participating Center(s): GSFC

Technology Area: TA8 Science Instruments, Observatories & Sensor Systems

NASA employs active microwave sensors for a wide range of remote sensing applications (for example, see http://www.nap.edu/catalog/11820.html). These sensors include low frequency (less than 10 MHz) radar sounders to G-band (160 GHz) radars for measuring precipitation and clouds, for planetary landing, upper atmospheric monitoring, surface water monitoring, soil moisture and global snow coverage, topography measurement and other Earth and planetary science applications. We are seeking proposals for the development of innovative technologies to support future radar missions and applications. The areas of interest for this call are listed below.

Deployable High-Frequency Antenna Technologies for CubeSats, NanoSats or SmallSats

Novel technologies are sought that enable X, Ku, Ka, W-band deployable antennas for small spacecraft, exceeding an effective deployed area of 3U or 30 cm x 30 cm. Techniques, hardware, electronics, materials, etc. are sought to advance the state of art in deployable high-frequency antennas for CubeSats, NanoSats or SmallSats.

Deployable Low-Frequency Antenna Technologies for CubeSats, Nano Sats or SmallSats

Novel technologies are sought that enable HF, VHF, UHF deployable, electrically large antennas (half-wavelength or greater) for small spacecraft. Techniques, hardware, electronics, materials, etc. are sought to advance the state of art in deployable low frequency antennas for CubeSats, NanoSats or SmallSats.

Efficient X-band High Power Amplifiers

Amplifiers for high power X-band radar remote sensing instruments are sought that push the state of art in efficiency, size and RF power. Solid state technologies, such as GaN are expected, but new developments in tube-based amplifiers (TWT, Pentode, etc.) are welcome. Technologies requiring high voltage power supplies (>>50V), should include challenges in power supply development.

Efficiency: >40% PAE

Output Power: >400W peak

Pulsed: ~30% duty cycle

Bandwidth: >50MHz

Deployable Cylindrical Parabolic Antenna including feed support structure

A singly-curved, offset fed parabolic antenna with feed structure to support a linear array feed (along the non-curved dimension) will be used to demonstrate advanced scanning cloud and precipitation radar operating at Ka- and W-band.

Frequency Range: 35 GHz, 94 GHz. Minimum Aperture Size: 1m x 2m (larger desirable)

Stowed Volume: 20cm x 20cm x 100 cm

Compact and modular backend radar subsystems for Cube/Small-Sats

Up/down converters: Ka, Ku, X, L to baseband

Receiver/ADCs: multichannel, >2GS/s, 12-bits or greater

Digital Processors: FPGA or GPU technologies on with performance on order of Xilinx V5, with significantly lower DC power consumption.

Synthesizers/AWGs: Stable signal sources, arbitrary waveform generators, required to generate standard radar waveforms.

VHF/P-band Dual-band Dual-Polarization Antenna Elements for Small Satellites or CubeSats

VHF/P-band Dual-band dual-polarization antenna elements for small satellites or cubesats are needed for signals-of-opportunity remote sensing. Specifications: 137 MHz and 255 MHz with ~10% bandwidth, dual polarization, stowable in <1U, deployable in zero gravity (1-G also desired), gain > 0 dBi. Combine into 2-element end-fire array.

Deployable Cylindrical Antennas

Deployable cylindrical parabolic antenna with up to a four square meter aperture. Performance up to 36 GHz desired.

Deployable W-band (94 GHz) antenna suitable for CubeSats and SmallSats

Aperture up to 1 square meter desired.

Reconfigurable Radar Processors

Radar processor capable of simultaneous or rapidly reconfigurable precipitation reflectivity and SAR measurements for multi-mode, multi-beam radars. Processor should be capable of high-altitude airborne operation with a path for spaceflight.