# Radar Development and Testing on Government Contract

RE: Antenna Registration Q4: Directional Antenna Information, Exhibit
File Number: 0213-EX-ST-2020
Confirmation Number: EL849442
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## Experiment Overview

Systems & Technology Research (STR) is developing leading technology in airborne SAR and GMTI RADAR systems for supporting government (DoD and other) uses. One of those development efforts is the SERVAL radar system.

In concurrence with the DARPA RadarNet program contract FA8750-18-C-0023, contracting agency is USAF, AFMC, Air Force Research Laboratory, 26 Electronic Parkway, Rome, NY. 13441-4514, STR is continuing development of the SERVAL radar system, and will require airborne testing of the system in the Eglin AFB area to support customer testing and demonstration utilizing the same equipment currently licensed under WK2XKB and WK2XJP.

The project will culminate in delivery of a radar sensor system, titled SERVAL (Software defined Efficient Radar Versatile, Affordable, Lightweight), which we seek to conduct flight tests in various key locations. STR is leading the efforts and will oversee testing and operation of the system.

To support this effort, we require multi-node data communications between two aircraft and two ground-based nodes. The aircraft will contain the radar systems, and telemetry and position data will be shared between the systems and the ground nodes using MANET data radios made by Trellisware, Inc.

We require a minimum of 10 MHz bandwidth centered at 2.39GHz, and AFTRCC coordination is in process to obtain a 10 MHz bandwidth centered at 2.39 GHz or other per AFTRCC authority.

This effort will be expected to begin in April 2020, and extend for up to 6 months .

For all computations we consider the highest desired bandwidth and ERP of the systems.

## Antenna Parameters:

We are asking to use several systems, each outfitted with antennas.

The two airborne systems will be outfitted with vertical polarized omni-directional azimuthal antennas. These are Haigh-Farr 6130-6 blade antennas, rated between 2.20 – 2.50 GHz. The antenna will be mounted to the bottom of the aircraft. The gains are approximately 0dBi in azimuth, and between -5 dBi and +5 dBi for

elevations between the horizon and the ground, with a peak of +5 dBi at a 20° depression angle between the horizon and ground. The datasheet with the corresponding antenna patterns for this antenna is attached.

There will be a ground-based receiver/transmitter outfitted with a sectoral antenna. This is to enable high data rate data communications between the airborne platforms that are between 10 - 40 km away from this antenna. The antenna selected is a Laird SA24-120-16-WB. It has a 120° azimuth and 9° elevation 3 dB beamwidth. It will be mounted to a temporary tripod/mast, of up to 6m (18 ft) in height, the objective being to get above any treeline obstructions and maintain line of sight to the aircraft. The boresight elevation angle from the horizon will be manually raised between 6.5° - 11.5° to support an aircraft flight envelope between 2.0° and 15.3° during testing. Any use near proximity to airports will comply with FAA and local airport regulations for proximity (and therefore height) to their facility.

Additionally, a second ground-based antenna will be utilized. It will use a vertically polarized, 360° omnidirectional azimuth whip halfwave dipole antenna, Trellisware TW-1161, with a 1 dBi maximum gain, between 675– 2600 MHz. The vertical beamwidth is 70° - 90° depending on frequency. It will be mounted to a temporary tripod/mast, of up to 6m (18 ft) in height, the objective being to get above any treeline obstructions and maintain line of sight to the other ground node. The data for this antenna is provided in the Trellisware DD-1494 appendix, page 11.

Connected to each antenna is a MANET data radio made by Trellisware, model TW-950. These are tunable radios, with a maximum transmit power of 2W. The modulation waveform is a CPM waveform. The Trellisware DD-1494 for this system is also submitted with this application.

## Power Parameters:

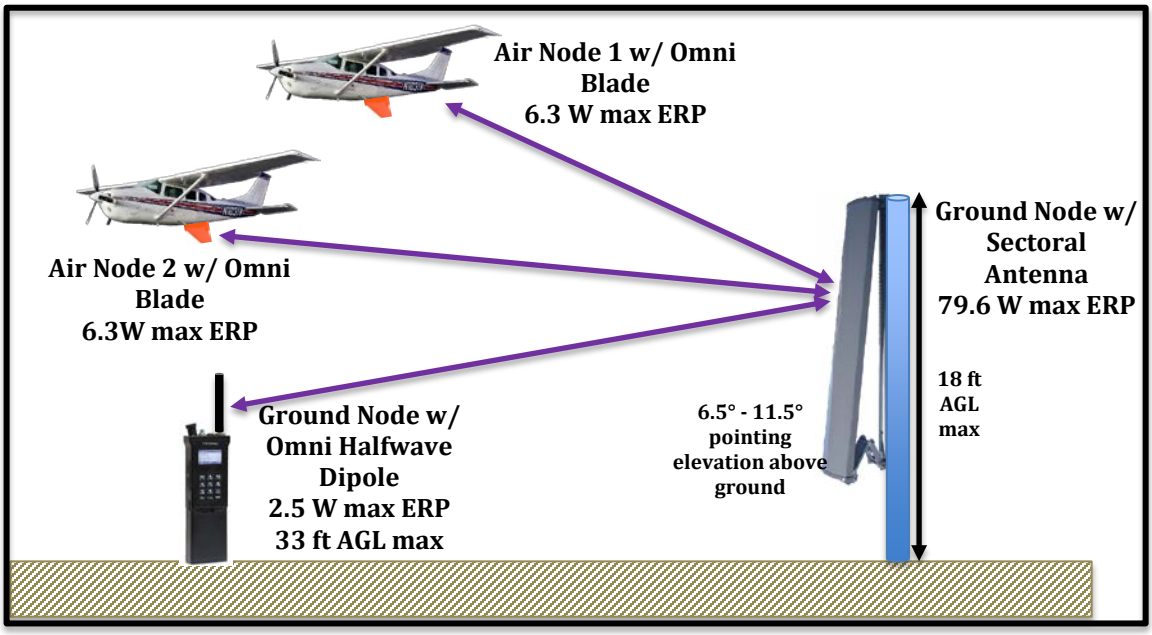
The MANET radio's peak transmit power is 2 Watts.

For the airborne antenna, the maximum transmit gain is 5 dB, therefore the peak ERP is 2 * 3.16 = 6.3W.

For the ground based node with sectoral antenna, the maximum transmit gain is 16 dB, or a factor of 39.8, therefore the peak ERP is 2 * 39.8 = 79.6 W.

For the ground based node with halfwave dipole antenna, the maximum transmit gain is 1 dB, or a factor of 1.26, therefore the peak ERP is 2 * 1.26 = 2.5 W.

## Operations / Flight Routes:

Flights are currently planned for the Boston, MA area primarily near Lawrence, MA (KWLM) but at times extending south to operations near Cape Cod CGAS (KFMH) and north to Portsmouth Intl (KPSM). These flight operations will occur not continuously, but rather as discrete test events during the execution of the contract.

A nominal flight altitude of 8500 ft MSL is planned, but could vary from 4500 ft to 9,000 ft MSL depending on weather conditions and VMC minimum requirements.