

Initialization

Testing conducted by CACI, Inc. would be performed within a one hundred (100) kilometer radius of the submission address. This radius will account for the various terrains and environments that will be of interest to RADA MHR RPS-42 radar systems with CACI's SkyTracker counter-small unmanned aircraft systems (C-sUAS). The following are the expected test procedures to be performed at 78 Echo Hill Lane in Washington, VA, 38°42'11.5"N 78°07'58.8"W, (Private property, test area usage coordinated with land owners at pre-determined site) on a RADA MHR RPS-42 radar system.

The pre-determined location will serve as the fixed radar station with a standalone generator for power and computer station for system monitoring and analysis. The fixed radar station is positioned in an open field, facing the test area. Radar face configurations will generally consist of four faces, providing 360 degrees of azimuth and elevation coverage.

Upon startup, the radar will be configured with the necessary parameters for the desired test. Operational frequency is set between 3.3 GHz and 3.4 GHz prior to testing and could be adjusted throughout this range during the test process to improve radar performance depending on signal noise and detection performance. This allows the operator to configure the radar system to detect a defined range/altitude and report detected targets depending on radar cross section (RCS), air speed, altitude, and flight characteristics. Detailed RF parameters can be adjusted to improve accuracy and resolution of RCS detections. By adjusting the radar beam patterns and characteristics, it is possible to focus the evaluated area to a specific region in the test area. This is done to minimize detection errors and improve tracking performance once the test target is detected.

During field tests and demonstrations, radar transmission patterns are calibrated to operate up to ranges of 3 to 6 Kilometers (1.86 to 3.72 Miles). Test targets are generally commercial drones piloted by a licensed UAV pilot, in accordance with FAA UAV flight procedures. Various size UAVs are utilized ranging from small commercial quadcopter to medium sized fixed wing hobby aircraft. The max AGL during test flights is 300 feet. We use an assortment of drones for testing. The drones we use transmit on either 430 MHz, 915 MHz, 1.3 GHz, 2.4 GHz or 5.8 GHz. The small RCS of these aircraft is ideal for evaluating experimental radar capabilities and demonstrating current tracking capabilities of the radar system.

Calibration

After initial startup and configuration, the radar system must undergo a calibration process to verify the system is operating properly. This involves flying the UAV throughout the test area in controlled patterns to verify position, altitude, heading, and airspeed of the aircraft. The position coordinates of the UAV can be cross referenced with the radar to ensure proper detection and classification of the UAV. Various flight patterns such as straight line, sweeping banked turns, pivot turns, and multi-point flight paths allow the radar operator to verify system performance and adjust the radar parameters to better detect the UAV while reducing false readings caused by trees, birds, and nearby obstacles. In some radar configurations, it is possible to distinguish between rotorcraft and non-rotorcraft objects. This provides a distinction between birds and other objects from fixed wing hobby aircraft and multi-copters. The calibration process can take between two to four hours after initial setup.

Testing

After the calibration process, the test process will involve multiple flights of the UAV over pre-defined flight paths during calibration. During the UAV flights, configurations and parameters of the radar are adjusted to optimize detection of the UAV and distinguish from other detections. Experimental configurations for the radar software and hardware can be tested during this time to detect the UAV on known flight paths. The system is continuously radiating to the test area during the time of the trial and will only be disabled during reconfiguration.

Unplanned maneuvers can be introduced to the flight path of the UAV to verify the traceability of the radar in new configurations. The data collected from the testing process is downloaded to the primary computer station for analysis. The recorded data consists of position, heading, altitude, RCS, and speed that can

be used to classify and analyze detections. By analyzing the data after testing, it is possible to verify the radar performance and determine parameters that need to be changed to optimize performance.

Development

The use and testing of the RADA MHR RPS-42 radar is for the long-term development of and integrated with CACI's SkyTracker C-sUAS. <http://www.caci.com/SkyTracker/>