

X-band Airborne Radar Description

This document describes the General Dynamics X-band airborne radar system for the purpose of obtaining an experimental FCC license for a test site location near Newport NY.

System Description and Operational Area

This radar system supports ground imaging research and development using traditional synthetic aperture radar techniques. The sensor is to be located on an aircraft flying at approximately 12,000 feet altitude. The aircraft will operate within a 50-mile radius of the Newport, New York Test Range located near N 43.148163, W 75.04514. The radar is to operate at this site for 1 week, twice per year, over a 3-year period.

Antennas

The radar antennas are on a rotational pedestal mounted on the aircraft allowing the antennas to view the ground. The rotational pedestal can point the antennas at depression angles between 0 and 90 degrees below the aircraft horizon. The pedestal can point the antennas within 20 degrees of the side of the aircraft. The radiated signal will reach the ground at elevation angles between 0 and 90 degrees. The horizontal angle that the signal will reach the ground is dependent on the orientation of the aircraft. The signal can reach the ground over all azimuth headings.

There are separate transmit and receive antennas located next to each other. The antennas are custom-designed. Transmit and receive antennas are identical. The gain of the antennas is 25 dBi at 9.5 GHz, and the antennas have a 13 degree half-power beamwidth in the horizontal plane and a 7 degree half-power beamwidth in the vertical plane. The antennas can operate in either vertical or horizontal polarization.

Waveform

The radar will use a pulsed linear-FM chirp or an arbitrary phase-modulated waveform. The waveform will be centered at 9.66 GHz and have a bandwidth of 680 MHz. Signals outside this bandwidth will be filtered and will be at least 50 dB below the desired signal. The waveform will have a maximum duty factor of 10%. The width of the waveform pulse will be approximately 20 microseconds and operate at a PRF of less than 10 kHz.

Transmit Power

The radar will transmit a waveform with a peak power of 4 kW. Factoring in the antenna gain, the peak ERP (effective radiated power; transmit power multiplied by antenna gain) is 1.26 MW (61 dBW). The radar will operate at a maximum of 10% duty factor, so the maximum average power emitted by the radar is 400 W, with an equivalent maximum average ERP of 126 kW (51 dBW).