

North-East Terrain Mapping Radar (NETMapper)

A Three-frequency airborne radar system

System Description

The North-East Terrain Mapping Radar (NETMapper) is intended to measure the Earth's surface topography from an airborne (nominally a Cessna 206) platform. The system consists of three frequencies (L-, S- and Ka-band). The frequencies are chosen to coincide with other remote sensing instrumentation that operates at these same frequencies. Some of these instruments are for space borne satellites operated by NASA (e.g. see NASA's Surface Water and Surface Topography Mission, SWOT, and the NASA-India Synthetic Aperture Radar, NISAR). The goal of NETMapper is to map the topography, and differences in measured topography, made by the three systems. Differences in the topography measured by the systems will be related to terrain characteristics such as soil moisture, vegetation height and vegetation structure, snow cover, snow depth, snow density and the snow water equivalent (SWE). The measures are of interest to a variety of Earth and Environmental remote sensing disciplines. Measurements such as this do not exist anywhere else, and hence this experimental work can be considered state of the art, and a new step forward in using microwave systems for characterizing the environment.

Theory of Operation

The radar systems will operate using a single transmitter and two receivers, at each of the frequencies. The transmit signal will operate at a nominal pulse repetition frequency of 1 kHz. The pulses will be modulated by a linear FM chirp (description below). The radar systems will be mounted on a Cessna 206 aircraft operating out of Northampton Airport (42.327923°, -72.616005°) and stay to the East of the Connecticut river, within a 30 km radius centered on (42.44°, -72.45°). The altitude of the aircraft will be between 200 and 600 m above ground level (AGL).

Antenna Description

The antennas as shown have been fitted to an airplane (Cessna 206 door). Included in the attached exhibits are schematic drawings plus actual antennas (3.3 GHz and 35 GHz) antennas mounted on the door. The antenna width for the S-band antenna is 42 cm wide by 5 cm tall (aperture area) and 47 cm by 1 cm tall for the 35 GHz antennas. The L-band antennas have not yet been constructed, and may be combined with the S-band antennas. Only one transmit antenna is used each for each frequency. The gains of the antennas are: 8 dB (L-band), 13 dB (S-band) and 28 dB (Ka-band).

Modulation Description

The signals will be modulated with a linear FM chirp (low to high frequency). The chirps in this system have different bandwidths:

L-band 1215-1240 MHz: 25 MHz Chirp
L-band 1240-1300 MHz: 60 MHz Chirp
S-band 3150-3250 MHz: 100 MHz Chirp
Ka-band 34895-34995 MHz: 100 MHz Chirp

The chirp duration will be 1 millisecond long, with the chirp repeating every millisecond.