Spatial, Temporal and Orientation Information in Contested Environments (STOIC) Program

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Research and Development Contract

The Global Positioning System (GPS) is the predominant means of obtaining PNT information for a majority of systems and applications, both military and civilian. However, GPS is vulnerable to interference due to its low signal strength. This combination of ubiquity and fragility has led many to conclude that sole reliance on GPS is untenable.

Military dependence on GPS has led to a variety of research & development (R&D) and program efforts to counter sources of interference. For example, use of phased array antennas, inertial sensors for dead reckoning during GPS degradation or outage and precision clocks have made great strides in achieving higher performance. However, these systems also accumulate significant error over time. R&D efforts have also evaluated non-traditional sensors for navigation, such as visual imaging and radio frequency (RF) signals of opportunity (SoOPs) sensors, but these also have limitations.

To address these limitations, DARPA initiated the Spatial, Temporal and Orientation Information in Contested Environments (STOIC) program to develop PNT systems that provide GPS-independent PNT with GPS-level timing and positioning performance. STOIC comprises three primary elements that when integrated have the potential to provide global PNT independent of GPS: 1) long-range robust reference signals, 2) ultra-stable tactical clocks, and 3) multifunctional systems that provide PNT information between cooperative users. When complete, the STOIC program will provide GPS-like and better PNT for contested environments where GPS performance is degraded or unavailable.

BBN is supporting DARPA under the STOIC effort and is utilizing experimental radios BBN built for DARPA under the ReACT program that cover the band 200 MHz to 18 GHz at bandwidths up to 40 MHz using any arbitrary waveform. Under STOIC, BBN is interested in determining the long term effects of the troposphere on relevant signals of interest, including those comparable to the Navy's Link 16 tactical data link. Better ranging performance is possible by incorporating the tropospheric delay as a parameter in the distributed navigation filter state space. Under this license, we would propose transmitting up to 1 W at a bandwidth of 30 MHz somewhere in the band at 880-940 MHz or 1400-1460 MHz. We'd like to operate in these band because RF at these frequencies would have comparable propagation to frequencies used by Link-16 which is one of the systems we're interested in enhancing with this capability. The 30 MHz of bandwidth is necessary to help complete the 12 km link @ 1W of power at this frequency. We would propose using Com-Power AH-118 double Ridge Guide broadband horn antennas that offer excellent performance over the frequency range of 700 MHz to 18 GHz. Polarization is Linear. (http://www.com-power.com/datasheets/AH-118.pdf). We would like to set up our experimental RF transceivers at each of the coordinates listed below and be able to transmit and receive at these locations over multiple days.

Sites:

Naval Observatory – (38 55 17 N / 77 04 01 W) (Radius 2km)
BBN Office – (38 53 41 N / 77 04 12 W) (Radius 2km)
Naval Research Lab – (38 49 30 N / 77 01 25 W) (Radius 2km)

St Louis Park, Minnesota (44 58 08 N, 93 21 14 W) (Radius 2km)
Plymouth, MN (44 59 45 N, 93 26 56 W), (Radius 2km)

Chesapeake Beach, MD – (38 39 28.2N / 76 31 46.8W) (Radius 3 km)
Tilghman Island's – (38 41 13.6 N / 76 20 35.2 W) (Radius 3 km)

Frequency Bands

880-940MHz
1400-1460MHz

Bandwidth

30MHz

Emissions Designator:

30M0J0N/30M0J1N

ERP

1W