navsys
CORPORATION

Attachment to FCC Form 442 8/17/17
File Number: 0611-EX-CN-2017
Confirmation Number: EL151273

QUESTION 6: STATEMENT OF RESEARCH PROJECT

This is a 2-year Phase II Small Business Innovation Research (SBIR) Government contract with the Naval Air Warfare Center Weapons Division, with potential options/continuation to the contract:

Contract #: N68936-17-C-0019 (SOAP II)
NAVY POC: Jamie O'Malley, SBIR Contracting Specialist, Naval Air Warfare Center Weapons Div.
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The purpose of this contract is to develop and demonstrate a prototype System-of-Systems Open Architecture Assured Positioning Navigation and Timing (A-PNT) – [SOAP] solution which allows integration of inertial and other sensors with GPS aiding when available and also supports operation in a completely denied GPS environment using aiding from a Software Defined Radio (SDR) using Signals of Opportunity (SoOP), to provide a Global Military Positioning Service (GMPS).

NAVSYS will develop software and firmware for the commercial SDR in the SOAP Test-Bed to provide time of arrival (TOA) observations from space signals of opportunity (SoOP), using signals from GNSS satellites and augmentation services broadcast through commercial geostationary satellite transponders. Under this contract, NAVSYS will develop the processing to perform GMPS signal generation and tracking using the Intelsat C-band geostationary satellites. These geostationary satellites are used to lease transponders for VSAT data networking. Each transponder can support 2-way data rates of 38 MHz using a VSAT earth station which requires the use of a dish antenna to provide an earth station G/T of 30.3 dB/K. To deny access to GPS, it is only necessary to jam 48 MHz of L-band to cover the L1 and L2 frequencies. By leveraging the C-band services for broadcasting a GMPS signal, an enemy would have to deny access to 600 MHz of bandwidth making this a robust option for providing back-up PNT to GPS.

NAVSYS has been interfacing with Intelsat, and plans to use two 1.8m antennas at our facility in Colorado Springs to access Intelsat C-band satellites where 36MHz of Occasional User (OU) capacity is available. Since the OU pool is always changing, the list of C-band satellites in the Contiguous United States (CONUS) arc that could potentially be used is listed in the following table:

Intelsat C-Band Satellite Locations w/ 36 MHz OU Capacity

Satellite	Elevation (°)	Azimuth-True (°)	LNB Skew (°)
Galaxy 15 @ 133W	36.2	220.3	30.2
Galaxy 12 @ 129W	38.3	215.4	26.8
Galaxy 13 @ 127W	39.3	212.9	24.9
Galaxy 14 @ 125W	40.2	210.2	23.0
Galaxy 18 @ 123W	41.0	207.5	21.0
Galaxy 23 @ 121W	41.8	204.7	18.9
Galaxy 16 @ 99W	44.4	170.7	-7.2
Galaxy 19 @ 97W	44.0	167.6	-9.6
Galaxy 3C @ 95W	43.6	164.6	-11.9
Galaxy 25 @ 93.1W	43.2	161.7	-14.1
Galaxy 17 @ 91W	42.5	158.6	-16.5
Galaxy 28 @ 89W	41.9	155.7	-18.6
IS-21 @ 58W	24.1	120.6	-42.0
IS-34 @ 55.5W	22.3	118.4	-43.1
IS-23 @ 53W	20.5	116.3	-44.1

NAVSYS Location	*Latitude: 39.0492°*	*Longitude: -104.8552°*