Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2019-1081

Topic # N172-119

Advanced Radio Frequency Link Analysis Tool

EMAG Technologies, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-265 F/A-18 Hornet/Super Hornet

Transition Target: NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION

TPOC:
(301)342-9174

Other transition opportunities: SPAWAR, NAVSEA, Air Force Research Laboratory at Wright-Patterson and Hanscom AFB, Combat Effectiveness and Vulnerability Analysis Branch, Sensors and Aerospace Systems directorates, Army Research Laboratory

Notes: EM.Cube and its various computational modules are used by a large number of users in the government, industry, and academia. The DoD users include NAVAIR, ARL, AMRDEC/RDECOM, AFRL Wright-Patterson. We have also established distributors in United Kingdom, Germany, India, Japan, etc.

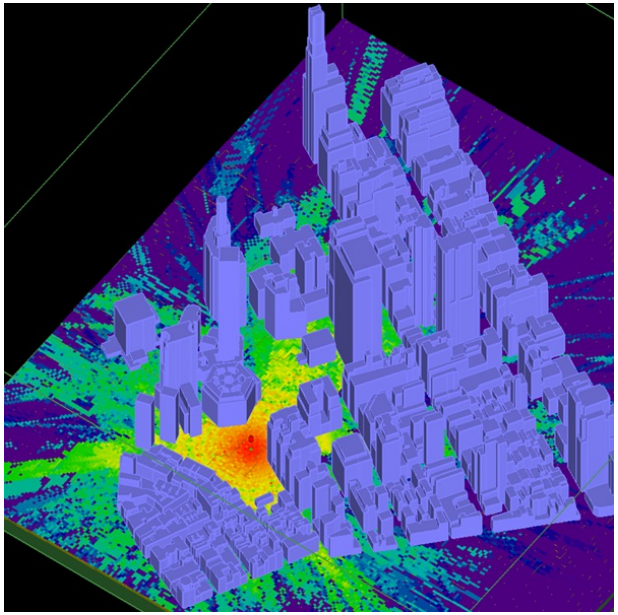

Image Courtesy of EMAG Technologies

WHAT

Operational Need and Improvement: High fidelity radio frequency (RF) link analysis requires in-situ antenna radiation patterns be utilized, which are most effectively determined with computational electromagnetic (CEM) antenna modeling. Electromagnetic propagation effects must be comprehensive including the effects of the atmosphere and terrain. Finally, high fidelity RF link analysis must include a three-dimensional spatial link availability analysis allowing for platforms to be at any position within a volume at any orientation (pitch, roll or yaw). There are existing software tools and packages available to assist in analyzing RF link performance, but they lack the capabilities listed above. There is a need for an advanced RF link analysis tool that interfaces with commercially available antenna modeling software providing comprehensive electromagnetic propagation effects and a three-dimensional availability analysis capability.

Specifications Required: The developed tool must have the following capabilities: (1) Ability to import simulated antenna patterns in American Standard Code for Information Interchange (ASCII) format from commercially available CEM modeling codes such as WIPL-D, SAVANT, FEKO, (2) Comprehensive RF propagation effects from very high frequency (VHF) to microwave bands simultaneously included as enabled by the user, (3) Advanced analysis capabilities, and (4) This tool must include the basic link analysis capabilities such as: requirements for analog and digital modulations including spread-spectrum modulation, standard error coding and code interleaving modeling, and calculations for antenna noise temperature, cascaded noise figure and propagation factor.

Technology Developed: A comprehensive RF link analysis tool for modeling air-to-air, air-to-ground, air-to-surface and air-to-satellite tactical communications in a multi-node, physical network environment. The tool will be equipped with a very fast, state-of-the-art, 3D polarimetric ray tracing solver, will interface with commercially available antenna modeling software and will provide comprehensive electromagnetic propagation effects as well as a three-dimensional space availability analysis necessary for evaluating the RF system performance.

Warfighter Value: The proposed software tool will allow wireless system designers to perform more accurate link budget analysis especially for aerial vehicular platforms in the presence of multipath and atmospheric effects.

WHEN

Contract Number: N68335-18-C-0753 **Ending on:** October 5, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
The preliminary software release with Polarimatrix Solver	Low	Installation and usage by NAVAIR	4	April 2019
Implementation of Atmospheric Effects	Med	Validation with published literature	4	August 2019
Second software release with atmospheric effects	Low	Installation and usage by NAVAIR	5	October 2019
Implementation of new waveforms	Med	Validation with published literature	6	December 2019
Third software release with new waveforms	Med	Installation and usage by NAVAIR	7	January 2020

HOW

Projected Business Model: EMAG Technologies Inc. develops and markets innovative software and hardware solutions for analysis, characterization and diagnosis of radio frequency (RF) and wireless systems and devices. Our integrated simulation software tools and non-invasive field measurement instruments together provide designers and test & evaluation engineers with unprecedented new insight into the inner workings and hidden complexities of high frequency devices and sensors, RF systems and massive wireless networks. This new technology will reside as a module within EM.Cube®, an industry-recognized simulation suite for electromagnetic modeling of RF system engineering problems. EM.Cube® features several distinct simulation engines that can solve a wide range of modeling problems such as electromagnetic radiation, scattering, wave propagation in various media, coupling, interference, signal integrity, field interactions with biological systems, etc.

Company Objectives: EMAG Technologies Inc. offers a number of products including EM.Cube simulation suite and NeoScan field measurement system. We plan to expand our marketing activities and grow our user base both inside the government and in the commercial market. The rapid growth of 5G wireless systems, internet of things (IoT), networks of autonomous sensors, etc. has created a great opportunity for accurate and reliable radio wave propagation modeling tools. Such tools can be use for design, deployment, assessment and optimization of massive networks.

Potential Commercial Applications: As with military platforms, there is a need to perform RF link analysis for commercial airborne and surface platforms. An advanced tool as defined above will have many commercial applications including the automotive and aerospace industries as new RF links are integrated such as cellular and satellites communications as well as satellite navigation.

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