Implementation of Federal Prize Authority: Fiscal Year 2013 Progress Report

A Report from the
Office of Science and Technology Policy

In Response to the America COMPETES Reauthorization Act of 2010 and the Requirements of Section 24 of the Stevenson-Wydler Technology Innovation Act of 1980

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Department, Agency, Office, and Division Abbreviations

AFRL	Air Force Research Laboratory (part of Air Force/DOD)
ARL	Army Research Laboratory (part of Army/DOD)
ASPR	Office of the Assistant Secretary for Preparedness and Response (part of HHS)
CDC	Centers for Disease Control and Prevention (part of HHS)
CMS	Centers for Medicare & Medicaid Services (part of HHS)
DARPA	Defense Advanced Research Projects Agency (part of DOD)
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DTRA	Defense Threats Reduction Agency (part of DOD)
EPA	Environmental Protection Agency
EERE	Office of Energy Efficiency and Renewable Energy (part of DOE)
FTC	Federal Trade Commission
GSA	General Services Administration
HHS	Department of Health and Human Services
HRSA	Health Resources and Services Administration (part of HHS)
HUD	Department of Housing and Urban Development
NASA	National Aeronautics and Space Administration
NCI	National Cancer Institute (part of NIH/HHS)
NCIPC	National Center for Injury Prevention and Control (part of CDC/HHS)
NEA	National Endowment for the Arts
NEH	National Endowment for the Humanities

Accessing this population efficiently and effectively enough to exercise the AVM tools on a mobility and drivetrain design for an amphibious vehicle in less than three months would not have been possible with standard authorities such as contracts, grants, or cooperative agreements."[110]

The DARPA FANG-1 Challenge was a successful demonstration of the AVM toolset, models, and collaboration platform for the compositional design and testing of an amphibious vehicle mobility and drivetrain system. DARPA reports that the challenge "attracted attention far beyond the participant pool and expanded the conversation around comprehensive systems design and manufacturing simulation." DARPA is pursuing a dual track of validating the predicted performance for the winning system, while continuing development of the AVM tools.

DARPA is building a full-scale test article to verify the software predictions made by the AVM tools based on the winning design from the FANG-1 Challenge. These real-world test and evaluation results will provide firm data points for assessing the accuracy of the software simulation tools.

The utilization of the AVM software tools during the FANG-1 Challenge also informed the continued development of the AVM tool chain and models. Metrics on model use and re-use, predictive capabilities of the META tools, utilization of the Vehicle FORGE platform, and experience in the utility of an open design challenge as a method for developing complex systems design are all feeding into the next set of research and development activities to improve and expand the AVM tool chain capabilities.

10.4.2. **Spectrum Challenge**

As the use of wireless technology proliferates, radios often compete with, interfere with, and disrupt the operations of other radios. DARPA seeks innovative approaches that ensure robust communications in such congested and contested environments in support of military operations. The goal of the DARPA Spectrum Challenge[111] is to develop and demonstrate electronic warfare strategies for guaranteeing successful wireless communication in the presence of coalitions of cognitive radios, which may have conflicting co-existence objectives. Cognitive radios identify, in real time, the most efficient frequencies to use in order to optimize use of available wireless spectrum. The techniques employed by the participants are expected to be representative of next-generation adaptive radio protocols that will be seen in future military and commercial communications systems.

Prize authority made it possible for DARPA to work with academic institutions, small businesses, and individuals, most of whom had never worked with DOD. The competition would not have been possible using standard authorities such as contracts, grants, or

[110] DARPA FANG Mobility/Drivetrain Challenge Fiscal Year 2013 Report, February 3, 2014
[111] http://www.darpa.mil/spectrumchallenge/

tools. "Team Huson's solution to the challenge will lead to an enhancement of DTRA's capability to diagnose and treat biothreats to the U.S. Armed Forces by giving DOD the ability to process and analyze biological sequence data rapidly in a realistic, moderate-to-low resource setting," said Dr. Christian Whitchurch, Devices Branch Manager for DTRA's Diagnostics, Detection and Disease Surveillance Division. The winning algorithm will be further assessed in FY 2014. In addition to distributing the pre-release version of the algorithm to DOD/DOE/DHS-supported laboratories, a Technology Transition Agreement is being coordinated with the Joint Project Manager Medical Countermeasure Systems office.

10.3.5. Mobile and Novel Chemical Warfare Agent Destruction and/or Neutralization Challenge

The Mobile and Novel Chemical Warfare Agent Destruction and/or Neutralization effort was an ideation challenge[108] to find new or novel ways to destroy or neutralize chemical agents. Twenty-nine initial ideas were submitted and ten were selected for awards from a $160,000 prize purse. Although DTRA determined that none of the submissions were mature enough for near-term operational needs, DTRA is evaluating ideas for potential additional analysis by DOD weapons of mass destruction elimination capability developers.

10.4. Defense Advanced Research Projects Agency

10.4.1. FANG Mobility/ Drivetrain Challenge

Initiated in 2010, the Adaptive Vehicle Make (AVM) portfolio of programs has conducted significant research in the area of design and verification flow for the "make" process of complex systems and the development of an integrated software tool suite that implements this new process. Early in 2013, AVM sponsored the FANG-1 Challenge[109] in an effort to run a focused test of the first release of these tools.

A total prize purse of $1,000,000 was offered to the team whose design submission best achieved established requirements for performance, lead time, and cost using the META design tools and the VehicleFORGE collaboration environment. The Ground Systems team – James Nees, Eric Nees, and Brian Eckerly – was awarded the $1,000,000 prize based on its final design submission, which received the highest score when measured against the established requirements for system performance and manufacturability.

The Defense Advanced Research Projects Agency (DARPA) reports that "prize authority made it possible to work with more than 1,000 individuals comprising more than 200 teams, many of whom had never worked directly with DOD. The target audience for participation included small automotive and technology enthusiasts, businesses, mechanics, academics, designers, manufacturers, vehicle designers within established industrial concerns, and hobbyists.

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[108] https://www.innocentive.com/ar/challenge/9932942

[109] http://www.darpa.mil/NewsEvents/Releases/2013/04/22.aspx

cooperative agreements. Incentive to participate in the Challenge, which required significant time and effort to implement operating strategies and test and tune the algorithms, was provided by $150,000 in prize funds.

The DARPA Spectrum Challenge called on participants to demonstrate radio protocols that can best utilize a given communication channel in the presence of other users and interfering signals. The need to provide robust communications in the presence of interfering signals is of great importance to military applications. The Spectrum Challenge is targeted at finding successful strategies for guaranteeing successful communication in the presence of other radios, each programmable and running its own spectrum etiquette protocols and that may have conflicting co-existence objectives.

The DARPA Spectrum Challenge was announced on December 13, 2012, in a web feature, posted on the DARPA homepage, and reported in national media and social media outlets. The registration period was open from January 9, 2013, to January 31, 2013, and 94 teams registered for the Challenge. The first qualification event required teams to complete a series of three technical hurdles that were designed such that each step required more effort and proficiency. Sixty-six teams completed the first hurdle, 59 completed the second, and 45 completed the third. The top 15 teams were selected to participate in the Preliminary Challenge Event, and the remaining teams competed for three additional spots.

The Preliminary Challenge Event took place at the Rutgers University Wireless Innovation Network Laboratory in North Brunswick, New Jersey, with live results viewed by the teams at the DARPA Conference Center in Arlington, Virginia. Teams compete head-to-head in a structured test environment, using identical radio hardware, to determine the most capable algorithms, as measured by how quickly a block of data can be transmitted from one radio to another. Awards were made to the best performing systems in two tournament scenarios:

- Competitive Scenario – Two teams attempt to simultaneously transmit a data file from one of their radios to the other. This tests their ability to design a radio that can best overcome interference.
- Cooperative Scenario – Three teams are grouped together with the objective that each team transmit a data file across their radio pair while causing minimal disruption to the other two teams. This tests their ability to design a radio that can operate in the presence of other radios while causing minimum disruption.

The Preliminary Challenge Event was held on September 11 and 12, 2013 with prizes of $25,000 awarded to the winners of the Competitive and Cooperative tournaments. The Competitive tournament was won by a team from Vanderbilt University, and the Cooperative tournament was won by a team from Northeastern University. The Final Challenge Event will be held March 19 and 20, 2014, with $100,000 awarded in prize money.