

DARPA eXperimental Crowd-sourced Vehicle Challenge (XC2V)

Fiscal Year 2011 Report

April 19, 2012



Defense Advanced Research Projects Agency

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1 BACKGROUND

Section 2374a of United States Code, Title 10 authorizes the Secretary of Defense, acting through the Assistant Secretary of Defense for Research and Engineering (ASD R&E), and the Service Acquisition Executive of each military department, to conduct programs to award up to \$10 million in cash prizes to recognize outstanding achievements in basic, advanced, and applied research; technology development; and prototype developments that are potentially applicable to the military missions of the Department of Defense (DoD) (see Appendix A). ASD(R&E) delegated this authority to the Director of the Defense Advanced Research Projects Agency (DARPA) and authorized the conduct of the DARPA Adaptive Vehicle Make (AVM) Design Challenges totaling \$5.01million (see Appendix B). The only portion of that authorization executed to date is the Vehicle Crowd-sourcing Challenge (VCC), featuring a total of \$10,000 in cash prizes for the winning designs. This authorization was carried out under the renamed eXperimental Crowd-sourced Vehicle (XC2V) Challenge.

This document describes DARPA's FY 2011 activities under the delegated prize authority.

The DARPA XC2V Challenge was initiated on February 3, 2011 and lasted for four weeks. A total prize purse of \$10,000 was offered to the persons or teams providing the top three winning designs for an outer mold line and structural body panels using the frame of an existing all-terrain vehicle design. Victor Garcia, a vehicle designer for a large truck design and manufacturing company in the United States, received \$7,500 for his First Place design named *Flypmode*. In addition, his design was built by the contract performer Local Motors, Inc. as a prototype vehicle. Marc Senger was awarded \$1,500 for his Second Place design named *Kratos*. Style and Design Studio of France received \$1,000 for this Third Place design named *Sentinel*.

The XC2V project served as a pilot program for DARPA to learn how to successfully execute crowd sourced vehicle design. The lessons learned from this effort will be implemented for the conduct of the Fast Adaptable Next Generation Ground Vehicle (FANG) Challenge competitions to take place in CY2013 and CY2014, where DARPA will utilize a purpose-built design collaboration environment, named vehicleforge, to execute crowd-sourced design of an amphibious infantry fighting vehicle.

2 PROGRAM GOALS

Democratizing the design process, defined as expanding the pool of participants involved in a design project in order to tap a larger pool of innovation, is one of the key areas of improvement in the make process related to the design and manufacturing of complex engineering systems addressed by DARPA's AVM program. Crowd sourcing a system design, already proven as a workable solution in software development, is only now starting to gain traction as a method for developing physical systems. Crowd sourcing involves multiple designers of varied backgrounds collaborating on a joint design effort in a manner which allows for the creation of an integrated end product. DARPA intends to exercise crowd-sourced design on a large scale for the design of

an amphibious infantry fighting vehicle with the upcoming FANG Challenges in CY2013 and CY2014.

The XC2V Challenge was an exploratory attempt to employ crowdsourcing techniques to vehicle design as a building block approach to larger future efforts. The overall objective of the effort was the development of a crowd-sourced design (via a prize competition) for subsequent fabrication of vehicle body panels and wrap and their assembly onto the Local Motors, Inc. (LMI) Rally Fighter rolling chassis and drive train. The experience gained and lessons learned are to be implemented in the creation of the vehicleforge collaborative design environment and execution of the FANG Challenges.

DARPA managed the XC2V Challenge to meet these goals through the prize authority.

3 PRIZE AUTHORITY UTILIZATION

To execute the DARPA XC2V Challenge, an inducement scheme was required to incentivize participation of designers and enthusiasts in order to create and submit innovative vehicle designs that met the requirements of the challenge. Prize payments to individuals or teams creating the winning designs created the required incentive. Prize authority made it possible to work with thousands of individuals, most of whom had never worked with the DoD. The target audience for participation included race enthusiasts, small businesses, mechanics, academics, vehicle designers within established industrial concerns, international participants, and hobbyists. Accessing this population efficiently and effectively to produce a vehicle design in less than one month would not be possible with standard authorities such as contracts, grants, or cooperative agreements.

4 CASH PRIZES AWARDED

The XC2V Challenge concluded on March 3, 2011. The winner was announced and the prizes awarded on March 15, 2011.

Mr. Victor Garcia, a vehicle designer at a major truck design and manufacturing company in the US, was awarded \$7,500 for his First Place design named *Flypmode* (see Appendix C). Marc Senger, also from the US, was awarded \$1,500 for his Second Place design named *Kratos*. Style and Design Studio of France received \$1,000 for this Third Place design named *Sentinel*.

5 SOLICITATION AND EVALUATION METHODS

The DARPA XC2V Challenge was initiated on February 3, 2011. To enable rapid execution of the program, the challenge competition utilized the existing collaborative design utility operated by the executing performer Local Motors, Inc. The advantage of using the existing capability was the instant ability to tap into a design-oriented crowd of almost 20,000 community members.

Press releases by DARPA and Local Motors, as well as advertising on their website, were utilized to inform the existing community and new entrants of the forthcoming challenge competition. Local Motors registered a community size increase of nearly 3,000 during the month of the XC2V Challenge.

The desired “buzz” in the community and target audience was achieved. During the second day of the challenge alone, the competition webpage received 3,351 views with a significant number of direct links from networkworld.com, engadget.com, wired.com, darpa.mil, challenge.gov, crunchgear.com, fastcompany.com and science.dodlive.mil.

A total of 159 complete and final designs were submitted during the four-weeks of the design challenge. Of these, approximately 100 designs were deemed to be of “high caliber” by a cadre of operational military officers who served as DARPA advisors to Local Motors during the event. In an innovation itself, the evaluation of the designs was actually crowd sourced as well. The general public was invited to vote on the winning designs via announcements within the over 20,000 member Local Motors design community as well as press releases by DARPA. The top three winning designs were selected for prize awards.

6 RESOURCES USED

The DARPA XC2V Challenge was conducted over four weeks starting February 3, 2011. It utilized Local Motors, Inc. (a performers specifically selected to execute the challenge and following vehicle build), Government staff members, DARPA military interns, and support contractors to carry out the event. When feasible, existing travel plans were used to minimize travel costs.

Prize funds were drawn from the Program Elements (PE) and Projects as follows:

PE	Project	Title	FY11	Total
0602303E	IT-02	High Productivity, High-Performance Responsive Architectures	10,000	10,000
				\$10,000

7 TECHNOLOGY TRANSITION

The DARPA XC2V Challenge was a successful demonstration of the use of crowd sourcing for the design of a physical system to standard vehicle requirements and for a military mission, but in a time frame dramatically shorter than can be achieved through normal defense procurement today. DARPA is currently utilizing the experience of managing this crowd sourced vehicle design competition to develop the planned FANG Challenges in CY2013 and CY2014. In addition, lessons learned from the XC2V design effort are being directly applied to the creation of the vehicleforge online collaborative design environment, which will be the platform for the competitively designed amphibious infantry fighting vehicle sought by the FANG Challenge.

8 CONCLUSION

The DARPA XC2V Challenge achieved its goal of executing a pilot crowd sourced vehicle design competition. The event attracted a large pool of non-traditional participants and demonstrated a result that is far outside current DoD capabilities. XC2V was able to produce an innovative vehicle design in 4-weeks of a design challenge utilizing \$10,000 of prize money. An equivalent government procurement effort utilizing standard methods could have cost millions of dollars and required a program schedule measured in months or years of effort.

APPENDIX A

PRIZE AUTHORITY STATUTE

The prize authority statute, section 2374a of U.S. Code Title 10 was amended by Section 257 of the National Defense Authorization Act of 2006 and Section 212 of the National Defense Authorization Act of 2007 as follows:

§ 2374a. Prizes for advanced technology achievements

(a) Authority. The Secretary of Defense, acting through the Director of Defense Research and Engineering and the service acquisition executive for each military department, may carry out programs to award cash prizes in recognition of outstanding achievements in basic, advanced, and applied research, technology development, and prototype development that have the potential for application to the performance of the military missions of the Department of Defense.

(b) Competition requirements. Each program under subsection (a) shall use a competitive process for the selection of recipients of cash prizes. The process shall include the widely-advertised solicitation of submissions of research results, technology developments, and prototypes.

(c) Limitations.

(1) The total amount made available for award of cash prizes in a fiscal year may not exceed \$10,000,000.

(2) No prize competition may result in the award of more than \$1,000,000 in cash prizes without the approval of the Under Secretary of Defense for Acquisition, Technology, and Logistics.

(d) Relationship to other authority. A program under subsection (a) may be carried out in conjunction with or in addition to the exercise of any other authority of an official referred to in that subsection to acquire, support, or stimulate basic, advanced and applied research, technology development, or prototype projects.

(e) Annual report.—

“(1) In general.—Not later than March 1 of each year, the Secretary shall submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives a report on the activities carried out during the preceding fiscal year under the authority in subsection (a).

“(2) Information included.—The report for a fiscal year under this subsection shall include, for each program under subsection (a), the following:

“(A) A description of the proposed goals of the competitions established under the program, including the areas of research, technology development, or prototype development to be

promoted by such competitions and the relationship of such areas to the military missions of the Department of Defense.

“(B) An analysis of why the utilization of the authority in subsection (a) was the preferable method of achieving the goals described in subparagraph (A) as opposed to other authorities available to the Department, such as contracts, grants, and cooperative agreements.

“(C) The total amount of cash prizes awarded under the program, including a description of the manner in which the amounts of cash prizes awarded and claimed were allocated among the accounts of the Department for recording as obligations and expenditures.

“(D) The methods used for the solicitation and evaluation of submissions under the program, together with an assessment of the effectiveness of such methods.

“(E) A description of the resources, including personnel and funding, used in the execution of the program, together with a detailed description of the activities for which such resources were used and an accounting of how funding for execution was allocated among the accounts of the Department for recording as obligations and expenditures.

“(F) A description of any plans to transition the technologies or prototypes developed as a result of the program into an acquisition program of the Department.

(3) Suspension of the authority for failure to include information.—For each program under subsection (a), the authority to obligate or expend funds under that program is suspended as of the date specified in paragraph (1) if the Secretary does not, by that date, submit a report that includes, for that program, all the information required by paragraph (2). As of the date on which the Secretary does submit a report that includes, for that program, all the information required by paragraph (2), the suspension is lifted.

(f) Period of authority. The authority to award prizes under subsection (a) shall terminate at the end of September 30, 2013.

APPENDIX B

Adaptive Vehicle Make Design Challenges Prize Authority Memo



DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

ACTION MEMO

Ash - Good concept

FOR: UNDER SECRETARY OF DEFENSE (AT&L)

FROM: Director, Defense Research and Engineering *3N* DEC 08 2010

SUBJECT: Approval of Prize Awards for Defense Advanced Research Projects Agency (DARPA) Adaptive Vehicle Make (AVM) Design Challenges

- This request seeks authorization to offer prize awards for the DARPA AVM Challenges in total amount of \$5.01 million as detailed below. DARPA will coordinate with DDR&E staff to ensure the reporting requirements of the 10 U.S.C. § 2374a are met in regard to these competitions.
- The overall objective of the AVM Design Challenges is to exercise a new design and manufacturing approach that seeks to dramatically compress the development timeline for a complex military vehicle, shifting toward a make-before-buy development paradigm, and significantly broadening the innovation and participation pool in the design process. Five challenges are planned.
 1. The Vehicle Crowd-sourcing Challenge, planned to run in 2Q and 3Q FY11, is a small-scale pilot effort to identify the challenges of executing crowd-sourced vehicle design. The Challenge award is for the best design for the outer mold-line and structural body panels of a desert terrain vehicle. The winner of this Challenge will be awarded \$10,000.
 2. The Component Model Library Seed Challenge, planned to span 2QFY12 through 4QFY13, will focus on incentivizing contribution to the development of an open-source component model library that will facilitate the model-based design methods that underlie the AVM approach. This Challenge will consist of a series of one or more prize awards totaling \$1.0 million.
 3. The Infantry Fighting Vehicle Mobility and Drivetrain Design Challenge will occur in or around 4QFY12 and will award \$1.0 million to a winning design that, when subjected to model-based verification methods, maximizes an appropriate subset of metrics and attributes for the mobility and drivetrain subsystems of a next-generation infantry fighting vehicle.
 4. The Infantry Fighting Vehicle Chassis and Survivability Design Challenge will occur in or around 2QFY13 and will award \$1.0 million to a winning design that, when subjected to model-based verification methods, maximizes an appropriate subset of metrics and attributes for the chassis and survivability subsystems of a next-generation infantry fighting vehicle.

5. The Infantry Fighting Vehicle Total Platform Design Challenge will occur in or around 2QFY13 and will award \$2.0 million to a winning design that, when subjected to model-based verification methods, maximizes an appropriate subset of metrics and attributes for a complete next-generation infantry fighting vehicle.

RECOMMENDATION: USD(AT&L) delegate the authority and assign the responsibility of DDR&E to the DARPA Director to offer cash prizes not to exceed \$5.01 million for the AVM Design Challenges.

Approve:  _____ Disapprove: _____

PD. ACTION 2/27/10
COORDINATION: NONE

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APPENDIX C

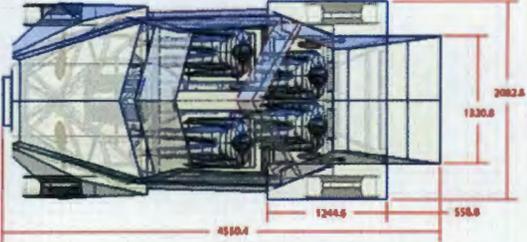
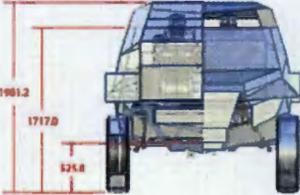
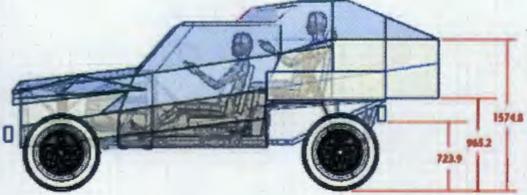
XC2V Winning Design – Flypmode by Victor Garcia

Experimental Crowd-derived Combat-support Vehicle



Local Motors Tubular Steel Space Frame Chassis

WHEELPOINTE'S specs	
Length	3150
Width	1705
Height	1760
Wheel Base	2523
Trac. Track	1366
Dr. Track	1705

Project Name: **FLYPMODE**
 Designer Name: Victor Garcia
 Notes: All Dimensions are in millimeters.

1:5 Scale Blueprint
 2cm Grid
 Document:
 270cm x 124cm

IMPORTANT: SCALE DRAWING.
 DO NOT CHANGE THE ARTBOARD SIZE OF THIS DOCUMENT

FLYPMODE  Design by Victor Garcia 



FLYPMODE  Design by Victor Garcia 