

## B. Prizes and Challenges under Other Authorities

This Appendix provides summaries of select prizes and challenges voluntarily submitted by agencies that were conducted in FY17 and FY18 under authorities other than COMPETES. Agency reporting on prizes and challenges under other authorities was optional, and therefore the activities presented here are representative rather than comprehensive. Please note that agency plans for the upcoming two fiscal years are notional and subject to the availability of funding.

### Table of Contents

B.1	Department of Defense (DOD) .....	B-3
B.1.1	DARPA Spectrum Collaboration Challenge (SC2) .....	B-3
B.1.2	CubeSat Challenge .....	B-5
B.1.3	Technology Challenges and Opportunities to SOF in 2027 .....	B-7
B.1.4	Urban 3D Challenge .....	B-8
B.2	Department of Health and Human Services (HHS) .....	B-9
B.2.1	Domestic Violence Awareness Month YouTube Challenge .....	B-9
B.2.2	Challenges in Computational Precision Medicine (CPM) 2018 .....	B-11
B.2.3	ICGC-TCGA DREAM Somatic Mutation Calling - RNACheck (SMC-RNA) .....	B-13
B.2.4	NCI-CPTAC DREAM Proteogenomics Challenge .....	B-14
B.2.5	PROSTATEx Challenge .....	B-16
B.3	Department of Homeland Security (DHS) .....	B-18
B.3.1	The U.S. Coast Guard Ready for Rescue Challenge .....	B-18
B.4	Department of State (State) .....	B-20
B.4.1	Diplomacy Lab .....	B-20
B.4.2	Almaty Mini Maker Faire—Pitching Challenge .....	B-21
B.4.3	Spelling Bee .....	B-22
B.4.4	World Tourism Day Quiz .....	B-23
B.4.5	Impact Video Competition .....	B-24
B.4.6	“150 Years of Cooperation and Friendship” Logo Contest .....	B-25
B.4.7	#MEthroughUSeyes .....	B-27
B.4.8	#OscarsME2018 .....	B-28
B.4.9	#USElections2016 - Official Trivia Contest Rules .....	B-29
B.4.10	GIFT O’CLOCK 2016 - #MEholidaysWithUS .....	B-30
B.4.11	Montenegrin Summer in the States #USalumniMNE .....	B-31
B.4.12	Tis the season 2017 - #MEholidaysWithUS .....	B-32
B.4.13	U.S. Embassy Podgorica: Give Away #1 .....	B-33
B.4.14	U.S. Embassy Podgorica: Give Away #2 .....	B-33
B.4.15	U.S. Embassy Podgorica: Give Away #3 .....	B-34
B.5	Department of Veterans Affairs (VA) .....	B-35
B.5.1	PseudoVet .....	B-35
B.5.2	VA Gun Safety Matters Challenge .....	B-36
B.5.3	Veterans Online Memorial Challenge .....	B-38
B.6	Environmental Protection Agency (EPA) .....	B-39
B.6.1	Smart City Air Challenge .....	B-39
B.6.2	Tox Test Challenge Stage II .....	B-41

B.6.3	Wildland Fire Sensors Challenge.....	B-42
B.7	National Aeronautics and Space Administration (NASA) .....	B-44
B.7.1	3D-Printed Habitat Challenge (Phases 2&3) .....	B-44
B.7.2	Breakthrough, Innovative, and Game-Changing (BIG) Idea Challenge .....	B-46
B.7.3	CineSpace Film Competition.....	B-48
B.7.4	Cube Quest Challenge .....	B-49
B.7.5	Future Engineers 3D Design Challenges .....	B-51
B.7.6	High Performance Fast Computing Architecture Challenge .....	B-53
B.7.7	High Performance Fast Computing Ideation Challenge.....	B-54
B.7.8	REALM User Interface Challenge .....	B-55
B.7.9	Human Exploration Rover Challenge .....	B-56
B.7.10	International Space Apps Challenge.....	B-59
B.7.11	RASC-AL Special Edition: Mars Ice Challenge .....	B-60
B.7.12	NASA Tournament Lab Micro-Purchase Challenges.....	B-62
B.7.13	Open MCT Notebook Challenge .....	B-64
B.7.14	Partnership Agreement Maker (PAM) Graphical User Interface (GUI) Updates .....	B-65
B.7.15	REALM Location Tracking Algorithm Challenge .....	B-66
B.7.16	Rice Business Plan Competition .....	B-67
B.7.17	Robonaut 2 Tool Localization Challenge .....	B-69
B.7.18	Robotic Mining Competition .....	B-70
B.7.19	Space Poop Challenge.....	B-72
B.7.20	Space Robotics Challenge .....	B-73
B.7.21	Student Launch Initiative .....	B-75
B.7.22	Swarmathon .....	B-76
B.7.23	Vascular Tissue Challenge .....	B-78
B.8	National Science Foundation (NSF) .....	B-80
B.8.1	The NSF 2026 Idea Machine.....	B-80
B.8.2	The Vizzies Challenge .....	B-83
B.9	Office of the Director of National Intelligence (ODNI) .....	B-84
B.9.1	3D Multi-View Stereo Challenge .....	B-84
B.9.2	Disguised Faces in the Wild Competition.....	B-86
B.9.3	Functional Map of the World (FMOW) Challenge .....	B-87
B.9.4	Fusion of Face Recognition Algorithms (FOFRA) .....	B-89
B.9.5	Geopolitical Forecasting Challenge .....	B-90
B.9.6	Mercury Challenge .....	B-92
B.9.7	MORGOTH’S CROWN (Modeling of Reflectance Given Only Transmission of High-Concentration Spectra for Chemical Recognition over Widely-Varying Environments) .	B-94
B.9.8	Nail-to-Nail (N2N) Fingerprint Challenge.....	B-96
B.9.9	OpenCLIR (Open Crosslingual Information Retrieval).....	B-97
B.9.10	The ODNI-OUUSD(I) Xamine Challenge: Machine Verification of Collected Information ..	B-98
B.9.11	The ODNI-OUUSD(I) Xpress Challenge: Machine Generation of Analytic Products .....	B-100
B.9.12	The ODNI-OUUSD(I) Xtend Challenge: Machine Evaluation of Analytic Products .....	B-102
B.9.13	UG2 Prize Challenge .....	B-103
B.10	United States Agency for International Development (USAID) .....	B-105
B.10.1	EduApp4Syria Prize Competition.....	B-105

B.10.2 Book Boost: Access for All Challenge .....	B-108
B.10.3 Data-Driven Farming Prize .....	B-110
B.10.4 Fall Armyworm Tech Prize.....	B-113
B.10.5 Global Lighting and Energy Access Partnership (Global LEAP) Off-Grid Refrigerator Competition.....	B-116
B.10.6 No Lost Generation Prize Competition .....	B-118
B.10.7 Tracking and Tracing Books Prize Competition .....	B-119
B.10.8 WomenConnect Challenge .....	B-122

## **B.1 Department of Defense (DOD)**

### **B.1.1 DARPA Spectrum Collaboration Challenge (SC2)<sup>1</sup>**

*Lead Sponsoring Agency:* Defense Advanced Research Projects Agency (DARPA)

*Authority:* 10 USC 2374a

*Status:* This competition was underway in both FY17 and FY18, but has not concluded.

*Competition Goals:* The DARPA Spectrum Collaboration Challenge (SC2) is the first of its kind collaborative machine learning competition to overcome scarcity in the radio frequency (RF) spectrum. Today, spectrum is managed by dividing it into rigid, exclusively licensed bands. This human-driven process is not adaptive to the dynamics of supply and demand, and thus cannot exploit the full potential capacity of the spectrum. In SC2, competitors will reimagine a new, more efficient wireless paradigm in which radio networks autonomously collaborate to dynamically determine how the spectrum should be used moment to moment. The team whose radio design most reliably achieves successful communication in the presence of other competing radios could win as much as \$3,500,000.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* The objectives of the Spectrum Collaboration Challenge warrant a prize competition format for a number of reasons. First and foremost, the “collaboration” aspect of the competition requires a sizeable field of unaffiliated performers creating a heterogeneous solution set. Further, it is unclear which approach will yield the most effective solution to the problem. The allure of prize money incentivizes teams with diverse backgrounds from academia, industry and independent entrepreneurs to develop creative, varied solutions to the problem. The government is then able to evaluate across the solution set and determine the best approach at a low investment threshold. Finally, SC2 seeks to create a community focused on developing autonomous spectrum management solutions. The current advances in artificial intelligence and machine learning as applied to software radio design create what DARPA believes is a critical inflection point in autonomous management of the wireless spectrum.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$18.75 million and the total amount awarded was \$7.5 million to date. In Phase I, a total of ten \$750,000 prizes were awarded to the top ten performing teams at SC2’s Preliminary Event #1 in December 2017. In Phase II,

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<sup>1</sup> The website for the DARPA Spectrum Collaboration Challenge (SC2) can be viewed at [www.SpectrumCollaborationChallenge.com](http://www.SpectrumCollaborationChallenge.com).

a total of six \$750,000 prizes were awarded to successful teams at SC2's Preliminary Event #2 in December 2018 and four \$375,000 prizes were awarded to successful teams that passed an extended evaluation in January 2019. In Phase III, three awards will be awarded to successful teams at SC2's Championship Event in October 2019 (1st place: \$2 million; second place: \$1 million; third place: \$750,000), a total of \$3.75 million.

*Solicitation of Submissions:* SC2 was advertised through various means. Prior to launching the challenge, the program manager visited various universities and industry locations in the wireless research community soliciting interest and feedback in the competition. The challenge was officially launched through a DARPA press release and publishing of the SC2 website. The proposal track was additionally advertised through a Broad Agency Announcement (BAA) posted to FedBizOpps. A Competitor's Information Day was hosted at DARPA on August 10, 2016. Open track teams are able to enter at the beginning of each of the three phases of the competition by successfully completing technical entrance hurdles. These hurdles evaluate a team's ability to develop software defined radios and demonstrate applicable machine learning techniques.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Other - FedBizOpps.gov

*Participation Requirements:* The target solver audience is a cross section of wireless researchers from academia, industry, and independent entrepreneurs. Successful teams will have a strong background in both software defined radio design and artificial intelligence/machine learning techniques. The competition is open to any entity that can provide a US Taxpayer ID number to receive prizes. As such, teams from around the world are currently competing, representing major universities, DoD, commercial contractors, and independent inventors.

*Evaluation of Submissions:* For entrance to the competition, Open track teams are evaluated based on their successful performance in a series of hurdles, which evaluate teams' ability to develop software defined radios and demonstrate applicable machine learning techniques. Proposal track teams were evaluated based on the merits of their technical approach by a selection board consisting of DARPA program managers, AFRL, and NSF subject matter experts. A valuable lesson learned in establishing a capable competitor field was the use of entrance hurdles to deter and deny technically immature teams. This is essential since the competitor field all share access to a limited government-provided Colosseum resource (a RF emulator testbed that forms the backbone of the competition). To evaluate performance in prize award competition events (Preliminary Event #1, #2, and the SC2 Championship Event), teams submit their software defined radio code to DARPA for testing in Colosseum. Each team's radio software is tested in a series of emulated RF scenarios in the presence of multiple other team radio solutions. Teams are judged on their ability to achieve performance thresholds in collaboration with other teams.

*Results:* Phase I began July 19, 2016. Proposal track submissions were due September 2, 2016 and open track submissions were due December 2, 2016. Phase I winners were announced December 13, 2017. Phase II began January 1, 2018 and submissions were due April 30, 2018. Phase II winners were announced December 13, 2018 and January 24, 2019. Phase III submissions were due January 11, 2019.

Phase I had 152 participants across 26 open track teams and six proposal track teams. A total of ten prizes were awarded in Phase I. Phase II had 134 participants across 15 open track teams (including one new team) and four proposal track teams. Ten prizes were awarded in Phase II. Phase III had 109 participants across 912 open track teams (no new teams entered) and three proposal track teams. Phase III will have three prizes.

*Budget and Resources:* One FTE program manager was assigned to SC2 over FY17 and FY18. DARPA utilizes third party support vendors to perform various tasks for conducting SC2, including hardware procurement/maintenance, software development, RF scenario development, scoring, integrity, visualization, production, and logistics. In FY17, third party vendors were obligated \$12.6 million, but expended \$11.5 million. In FY18, third party vendors were obligated \$5.9 million, but expended \$4.1 million.

*Partnerships:* DARPA contracted with MIT Lincoln Labs to provide expertise in RF scenario design and scoring methodologies. Their considerable knowledge base in these two areas provided valuable inputs to the initial architecture of the competition. DARPA has also entered in a Cooperative Research and Development Agreement (CRADA) with Groupe Spécial Mobile Association (GSMA), to host the SC2 Championship Event at their annual Mobile World Congress Los Angeles conference in October 2019. This relationship with GSMA, a non-Federal partner, provides key synergy in capturing an interested, educated audience of the commercial wireless industry, government policy experts, and DoD entities for the culminating the SC2 Championship Event.

*Advancement of Agency Mission:* DoD operations increasingly rely on unfettered access to the spectrum in order to carry out their primary mission. Managing the spectrum is a tedious, laborious, and error-prone process. A spectrum manager must take into account the needs of their radio systems, the needs of allied and NATO force radio systems, and existing host nation infrastructure. This delicate planning can easily be disrupted by the rapid change in needs for spectrum services (both ours and allies'), changes in RF conditions, and variability of types of radios which need access based on changing mission needs. Due to inefficiencies in this process, currently available planning tools are unable to effectively allocate spectrum. Resulting SC2 radio technology will increase the efficiency and ability of communications networks to perform electromagnetic maneuver by allowing radio networks to autonomously and collaboratively perform tactical spectrum decision-making at the edge, faster than today's human planning cycle.

*Solution Types:* Software and apps; Technology demonstration and hardware; Scientific

*Plan for Upcoming 2 FYs:* DARPA has seen immense success with the Grand Challenges hosted by the Agency since the initial Grand Challenge for autonomous ground vehicles in 2004. Currently, DARPA is running three separate prize challenge competitions, cross-cutting various research areas such as responsive small satellite launch, subterranean navigation, and of course SC2's autonomous spectrum management. For SC2, the next two fiscal years cover the final two prize events, Preliminary Event #2 in December 2018 and the SC2 Championship Event in October 2019.

### **B.1.2 CubeSat Challenge<sup>2</sup>**

*Lead Sponsoring Agency:* United States Special Operations Command (USSOCOM)

*Authority:* 10 USC 2374a

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* USSOCOM is pursuing a development effort to determine the operational utility of using CubeSats and SmallSats to directly support special forces in austere and denied areas. The intent is to solicit operationally relevant and technically feasible payload concepts for USSOCOM CubeSats and SmallSats. Example areas that are relevant to USSOCOM missions include: advanced

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<sup>2</sup> The website for the CubeSat Challenge can be viewed at <https://herox.com/cubesat-challenge>.

communications (including full orbit C2 and data exfiltration); electro-optical infrared sensing and imaging; propulsion systems capable of modifying or maintaining orbits; on-orbit data processing; multi-function payloads; tagging, tracking, and locating capabilities; next-generation CubeSat and sensor technologies.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research

*Justification for Using Prizes and Challenges:* Traditional development conducted over the past several years has not resulted in payloads which can provide satisfactory solutions for these problems. USSOCOM was seeking to find solutions by leveraging commercial and academic sources through the prize challenge solver ecosystem.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$35,000. Under the 3U Satellite Category four \$5,000 prizes were awarded, and under the 6U Satellite Category two \$5,000 prizes and one \$5,000 People's Choice Award were awarded.

*Solicitation of Submissions:* Through an interagency agreement between USSOCOM and the National Aeronautics and Space Administration (NASA), USSOCOM employed NASA to solicit prize challenge providers to conduct this challenge. HeroX was selected as the best option to conduct this challenge. All parties used social media to advertise the challenge. This information was also provided to Challenge.gov for posting on their site. USSOCOM found that all of these methods were satisfactory in getting the word out to the general public based on the number of responses and registrants.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* All public submissions were accepted for this challenge.

*Evaluation of Submissions:* Submissions were evaluated using a panel of subject matter experts selected from USSOCOM and other agencies who have extensive knowledge in the field of satellite communication technologies. NASA and HeroX provided the judging panelists with an automated evaluation product that automatically tabulated the score submissions.

*Results:* Of the 35 entries submitted by 18 participants between August 15 and October 18, 2017, seven prizes were awarded to six winners.

*Budget and Resources:* USSOCOM provided \$88,303.97 in funding by using FY17 Research Development Test and Evaluation Funds. \$35,000 was awarded to six challengers through the HeroX prize challenge platform. Administrative costs of \$41,907 were incurred by HeroX for their efforts in administering this challenge; and \$11,396.97 was incurred by NASA via their existing prize challenge contract for their administrative costs.

*Partnerships:* N/A

*Advancement of Agency Mission:* Current over-the-horizon audio and video data exfiltration capabilities do not provide the consistent access, coverage, throughput, and flexibility required by U.S. forces. Therefore, USSOCOM executed a development and demonstration effort to determine the operational utility of using CubeSats to directly support U.S. forces in austere and denied areas. USSOCOM was seeking unique solutions to developing/delivering operationally relevant and technically feasible cubesat payload for missions such as advanced communications; tagging, tracking, and locating capabilities; and on-orbit data processing. The intent was to determine to what extent low-cost, tactically controlled small satellites can support over the horizon data exfiltration requirements.



*Solution Types:* Creative (design & multimedia); Ideas; Scientific

*Plan for Upcoming 2 FYs:* N/A

### **B.1.3 Technology Challenges and Opportunities to SOF in 2027<sup>3</sup>**

*Lead Sponsoring Agency:* USSOCOM

*Authority:* 10 USC 2374a

*Status:* This competition was completed in FY17.

*Competition Goals:* USSOCOM was interested in understanding what global challenges or opportunities lay ahead for Special Operations Forces ten years into the future.

*Goal Types:* Find and highlight innovative ideas

*Justification for Using Prizes and Challenges:* The pace of technology change is arguably not slowing down and the proliferation of emerging technology-based capabilities to the global population is continuing to cause global effects. Previous efforts to understand the future Special Operation Forces (SOF) environment based on technological advances have taken many forms. The one glaring omission has been reaching out to a non-Department of Defense (DoD) community for their thoughts and perceptions. Through this challenge, USSOCOM aimed to look at the future in a non-traditional way.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$25,000 and the total amount awarded was \$22,000. Non-monetary incentives included a personal letter from the Special Operations Forces, Acquisition, Technology, and Logistics, Science and Technology (SOF AT&L-ST) Director and a USSOCOM Coin.

*Solicitation of Submissions:* Submissions were solicited on the InnoCentive web site and the challenge was also announced on the “Challenge.gov” website.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release

*Participation Requirements:* All public submissions were welcome.

*Evaluation of Submissions:* Submissions were evaluated by four individuals from SOF and reviewed by the Director, SOF AT&L-ST.

*Results:* Of the 108 entries submitted between July 21 and August 10, 2017, 18 prizes (ten \$1,000 prizes, and eight \$1,500 prizes) were awarded to ten winners.

*Budget and Resources:* USSOCOM provided \$25,000 for this challenge using FY17 Research Development Test and Evaluation funds. \$22,000.00 was awarded in prizes through the InnoCentive platform and \$3,000 was returned to USSOCOM.

*Partnerships:* N/A

*Advancement of Agency Mission:* USSOCOM is interested in the impacts of technological innovation in civilian society around the globe. The challenge sought perspectives on how people see the world in 2027 and the critical impacts it might pose for Special Operations Forces by asking the following questions: What new or evolved technology will have the greatest impact, either as a challenge or as an opportunity, for Special Operation Forces in 2027? How is daily life for humans around the world going

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<sup>3</sup> The website for the Technology Challenges and Opportunities to SOF in 2027 can be viewed at [www.innocentive.com](http://www.innocentive.com).

to differ from today? What innovations will industry invent, which will shape society ten years from now? How will technologies become disruptive by themselves or converged with other technologies? What are the economic, social, and military effects created by this technological evolution?

*Solution Types:* Ideas

*Plan for Upcoming 2 FYs:* A challenge will be used to support USSOCOM's Innovation Foundry (IF) #3 in the second quarter of FY19. USSOCOM will be contracting the challenge through the Capital Factory in Austin, Texas, who will also be hosting the event. The Capital Factory already conducts prize challenges within its ecosystem, and USSOCOM wants to focus on its ecosystem for the next IF. The same pattern for prize awards will be followed: \$1,000 for a white paper and \$1,500 for participation in person at the IF event.

#### **B.1.4 Urban 3D Challenge<sup>4</sup>**

*Lead Sponsoring Agency:* USSOCOM

*Authority:* 10 USC 2374a

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* USSOCOM is seeking an algorithm that provides reliable, automatic detection and delineation of building footprint outlines based solely on USSOCOM-provided 3D Digital Surface Model (DSM) and Red, Green, Blue (RGB) orthorectified imagery products. Specifically, USSOCOM sought concepts that: (1) are relevant to USSOCOM missions; (2) provide positive operational impact, efficacy, and utility; (3) advance the state of the art for automated detection and delineation of building footprint outlines from specified source data; (4) improve the quality of the data products of the SOFPREP workflow pipeline; and (5) can be integrated into the existing data processing workflow pipeline.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* Extraction of building footprint outlines from satellite imagery is one of the first and most challenging steps in producing realistic textured 3D scene models to support the Special Operations Forces tactical mission set. While automated algorithms continue to improve, significant manual effort is still required to correct mistakes and ensure acceptable quality. Newly available near-global 3D DSM products along with conventional RGB orthorectified image products offer a wealth of information to enable more reliable automated building footprint extraction which, in turn, is expected to further enable an automated pipeline for 3D scene model production to support SOF missions. USSOCOM was seeking to find solutions by leveraging commercial and academic sources through the prize challenge community.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$34,500. Prizes were awarded as follows: first place \$10,000, second place, \$8,000, third place \$6,000, fourth place \$5,000, fifth place \$4,000, sixth and seventh places \$500, and two additional prizes of \$250 each.

*Solicitation of Submissions:* Through an Interagency Agreement between USSOCOM and NASA, USSOCOM employed NASA to solicit prize challenge providers to conduct this challenge. Topcoder was selected as the best option to conduct this challenge. TopCoder created a marketing campaign which included a direct email campaign that ran for 30 days, where they developed a database of 1,564 contacts based on demographics of individuals and organizations who would be likely, and qualified,

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<sup>4</sup> The website for the Urban 3D Challenge can be viewed at <http://crowdsourcing.topcoder.com/Urban3D>.



to participate in the challenge. In addition to the direct target email, they also reached out to their 5,225 subscribers via a monthly newsletter. In addition to the email campaign, a social media campaign ran for 30 days that directed persons to the Topcoder registration page. This challenge was also posted on the Challenge.gov site.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* All public submissions were welcome.

*Evaluation of Submissions:* Finalists were selected by USSOCOM based on quantitative scores provided by TopCoder in coordination with USSOCOM technical subject matter experts. Evaluators worked independently to review the submissions and used a standard scoring methodology derived from baseline quantitative metrics. The results were then tallied and reviewed by TopCoder and USSOCOM before making the final award recommendations.

*Results:* Of the 790 entries submitted by 217 participants between October 9 and December 4, 2017, eight prizes were awarded to nine winners.

*Budget and Resources:* USSOCOM provided \$134,804 in funding using FY17 RDT&E Funds. Of this, \$72,936 was incurred by Topcoder for administering the challenge, \$35,000 was awarded to nine challengers through the Topcoder prize challenge platform, \$11,500 was provided to judging panelists for their participation in evaluating submissions, \$10,608.95 was incurred by NASA for their administrative costs, and \$5,000 was expended in supplemental advertising.

*Partnerships:* N/A

*Advancement of Agency Mission:* USSOCOM was seeking an algorithm that provides reliable, automatic detection and delineation of building footprint outlines based solely on USSOCOM-provided 3D Digital Surface Model and Red, Green, Blue orthorectified imagery products.

*Solution Types:* Software and apps; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* USSOCOM plans to work with other software coders to experiment with the development of promising machine learning algorithms into emerging software capabilities. Experiments show great potential for improving the detection and delineation of building footprint outlines. USSOCOM may conduct another prize challenge, but this is yet to be determined.

## **B.2 Department of Health and Human Services (HHS)**

### **B.2.1 Domestic Violence Awareness Month YouTube Challenge**

*Lead Sponsoring Agency:* Administration on Children, Youth and Families (ACYF), Family and Youth Services Bureau (FYSB), Division of Family Violence

*Authority:* 15 U.S.C. § 3719 and 42 U.S.C. § 10401(a)(1)

*Status:* This competition was completed in FY17.

*Competition Goals:* FYSB envisions a future in which all of our nation's youth, individuals, and families, no matter what challenges they may face, can live healthy, productive, violence-free lives. The Challenge goal was to learn more about, and bring attention to, new, emerging, and effective methods that go beyond traditional services, programs, and supports that communities are using with this special population. The Challenge was conducted in an effort to stimulate innovation and raise

awareness of the services and supports for children and youth exposed to domestic violence and their abused parents. In this Challenge, FYSB asked the public to submit videos featuring their most innovative means of helping to improve safety, promote healing, and build the resilience of children and youth exposed to domestic violence and their abused parents. The Challenge sought innovative, creative, and inclusive practices, policies, programs, safe spaces, activities, and strategies to meet this end.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Inform and educate the public; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* This YouTube Challenge was the first of its kind at FYSB. The Challenge was a pilot project to see if a challenge is an effective mechanism for reaching FYSB grantees and gathering information on innovation and promise. If competitions or challenges are found to be effective, this project may lead to larger challenges that create life-saving or life-changing benefits for victims of domestic violence and other populations that are served by Family Violence Program in the Family & Youth Services Bureau (ACF) programs. This Challenge also helped FYSB build our knowledge and skills in running competitions, which will be helpful for future and larger scale competitions.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$10,000. First, second, and third place winners were awarded \$5,000, \$3,000, and \$2,000, respectively

*Solicitation of Submissions:* N/A

*Solicitation Types:* Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Submissions were required to be (1) one to three minutes in length; (2) in a compatible YouTube format with the proper codecs: WebM files, MPEG4, 3GPP, MOV, AVI, MPEGPS, WMV, FLV with suggested aspect of 16:9; and (3) aligned with the vision of FYSB. Entrants must (1) post their video submission to their favorite video sharing site and send the link to their video entry on the Domestic Violence YouTube Challenge listed on [www.challenge.gov/domestic-violence-video-challenge](http://www.challenge.gov/domestic-violence-video-challenge) by the deadline; (2) highlight one or more new, innovative, emerging, and effective approaches, practices, policies, programs, safe spaces, activities, strategies, and any other ways that help to improve safety, promote healing, and build resilience of children exposed to domestic violence and their abused parents; and (3) include a written transcript for the video for closed captioning purposes.

*Evaluation of Submissions:* Evaluation criteria included weighted ratings of the following elements: (1) the video content highlighted one or more new, innovative, emerging, and effective approaches, practices, policies, programs, safe spaces, activities, strategies, and any other ways that help to improve safety, promote healing, and build the resilience of children exposed to domestic violence and their abused parents; (2) the video aligned with FYSB's vision; (3) the video content increased awareness of domestic violence issues; (4) the video content was educational, imparts knowledge, or deepens understanding of supports for children, youth, and parents; (5) the video content was innovative; (6) the video content was creative.

*Results:* Of the 26 entries submitted between October 12 and November 2, 2016, three prizes were awarded.

*Budget and Resources:* Prize money was awarded from the ACF. Administrative support provided by the Budget Office, Division of Grants Policy, ACF leadership at all levels, Office of the General Counsel, Office of Communications, among others, was critical to get the challenge started, published on the Federal

Register, and awarded. The Challenge utilized 0.05 FTE in FY17 and used FY16 funding obligations to finish the Challenge.

*Partnerships:* N/A

*Advancement of Agency Mission:* The prize competition advanced our agency’s mission in our goals to inform and educate the public; engage new people and communities; learn about and share innovative ways the community is supporting this population.

*Solution Types:* Ideas

*Plan for Upcoming 2 FYs:* There are no future plans for this Challenge at the time of reporting.

## **B.2.2 Challenges in Computational Precision Medicine (CPM) 2018<sup>5</sup>**

*Lead Sponsoring Agency:* National Institutes of Health (NIH), National Cancer Institute (NCI)

*Authority:* NCI considers the use of challenges and prize competitions within its statutory authority as a means to fulfill the Institute’s purpose.

*Status:* This competition was launched in FY18, and is underway.

*Competition Goals:* The overall goal of CPM challenges is to promote development of medical image analysis algorithms for clinical decision support in diagnosis and staging of various cancers. In CPM 2018 these include (1) pancreatic cancer survival prediction: predict pancreatic cancer survival from computed tomography (CT) and clinical data from Memorial Sloan Kettering Cancer Center (MSKCC); (2) 18F-FDG PET radiomics risk stratifiers in head and neck cancer: predict local tumor control following radiation treatment of oropharynx cancer using an ensemble of radiomics and clinical data from MD Anderson Cancer Center (MDACC); (3) combined radiology and pathology classification: evaluate performance of automated classification algorithms that use a combination of imaging and digital pathology data from brain tumor collection of the Cancer Genome Atlas; (4) digital pathology segmentation of nuclei in images: evaluate performance of algorithms for segmentation of nuclei in digital pathology images of low- and high-grade glioma (brain tumor).

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* The use of incentivized challenge competitions allows agencies to cast a wide net to find innovative solutions through crowd- sourcing and open science. Furthermore, participants in a challenge agree to benchmark performance of their software tools against a common reference dataset. Such approaches are not typically provided through traditional grant mechanisms. NCI determined that the monetary prize is often secondary to the community’s interest to participate in an activity where they can find access to high quality data and the opportunity to benchmark their tools compared to other participants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* CPM offered non-cash prizes only. Three winners received a certificate of merit, the opportunity to give an oral presentation at the International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2018 annual

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<sup>5</sup> The websites for the Challenges in Computational Precision Medicine (CPM) 2018 are accessible at <https://wiki.cancerimagingarchive.net/pages/viewpage.action?pageId=37224869> and <http://miccai.cloudapp.net/competitions/>.

conference, and the opportunity to be a co-author on a scientific manuscript on one of CPM 2018 challenges.

*Solicitation of Submissions:* CPM challenges were announced through MICCAI 2018 webpage on satellite events and emailed through several professional listservs. MICCAI has been running medical imaging challenges for over ten years and CPM has been offered regularly since 2014. As a result, NCI has had a growing number of international participants in CPM challenges over the years. Furthermore, given the emerging trends in data science, machine learning and artificial intelligence (AI), NCI expects participation in future will only increase. One factor that is of prime importance in offering a challenge in conjunction with the annual meeting of a scientific society is the timing of the opening and closing of the challenge and announcement of the winners who need enough time to plan their travel to the meeting.

*Solicitation Types:* Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Special challenge session at MICCAI annual meeting to highlight the challenge and facilitate presentations by the winners

*Participation Requirements:* N/A

*Evaluation of Submissions:* Submissions were evaluated against the ground truth and summarized as an index. The ground truth is always provided by clinical experts who are familiar with the disease and the data.

*Results:* NCI received 217 submissions for pancreatic cancer survival prediction; 65 submissions in 18F-FDG PET radiomics risk stratifiers in head and neck cancer; 223 submissions in combined radiology and pathology classification; and 314 submissions in digital pathology segmentation of nuclei in images. These submissions were received between June 12, 2018 and August 16, 2018, and 12 prizes were offered.

*Budget and Resources:* The NCI Program Director devoted 10% time to lead the development of the CPM challenges design and implementation, including an associated workshop. Outside collaborators from academia contributed data and managed individual challenges within the CPM offering. Datasets available through The Cancer Imaging Archive (TCIA), MSKCC, and MDACC were used in training and test phases of the CPM 2018 challenge. An existing challenge platform was used for submission of results and ranking of participants based on a set of evaluation metrics. The challenge platform was utilized under a blanket contract between the platform operator and NCI Center for Biomedical Informatics and Information Technology.

*Partnerships:* As mentioned, NCI partnered with various organizations which provided shared interest and expertise in development, advertisement, and completion of the Challenge. These partners included MICCAI 2018, Harvard University, MSKCC, MDACC, Stony Brook Cancer Center, and the University of Pennsylvania.

*Advancement of Agency Mission:* The NCI mission includes dissemination of information on cancer detection, diagnosis, and treatment, and support for innovative solutions to the cancer problem. CPM challenges, performed in collaboration with non-profit entities such as scientific societies and universities leverage existing shared datasets to drive algorithmic excellence and incentivize development of innovative analytic software methods in cancer detection, diagnosis, and staging.

*Solution Types:* Software and apps; Ideas; Analytics, visualizations, algorithms; Scientific

*Plan for Upcoming 2 FYs:* A great amount of high quality cancer data (imaging, pathology, genomics, proteomics, and clinical) are generated through NCI-funded grants and cooperative agreements. Often these constitute what is referred to as big data. Solvers in the community, who are typically graduate students or research fellows with innovative ideas usually lack access to such data. Challenges provide a great way to develop tasks related to existing data that are aimed to bring innovative approaches, such as AI, to solve long standing problems, or facilitate more accurate solutions toward clinical decision support. NCI plans to utilize new datasets (imaging and other types) to launch new challenges in 2019 and 2020. These include challenges related to pancreatic and brain cancers, two of the deadliest cancers.

### **B.2.3 ICGC-TCGA DREAM Somatic Mutation Calling - RNACHallenge (SMC-RNA)<sup>6</sup>**

*Lead Sponsoring Agency:* NIH, NCI

*Authority:* NCI considers the use of challenges & prize competitions within its statutory authority as a means to fulfill the Institute's purpose.

*Status:* This competition was completed in FY17.

*Competition Goals:* The International Cancer Genome Consortium-The Cancer Genome Atlas (ICGC-TCGA) Dialogue for Reverse Engineering Assessments and Methods (DREAM) Somatic Mutation Calling - RNA Challenge (SMC-RNA) is an international effort to improve standard methods for identifying cancer-associated rearrangements in RNA sequencing (RNA-seq) data. NCI held the ICGC-TCGA DREAM Somatic Mutation Calling RNA Challenge (SMC-RNA), a community-based collaborative competition of researchers from across the world. The goal was to rigorously assess the accuracy of methods to perform two key tasks in cancer RNA-Seq data analysis: the quantification of known isoforms and detecting novel fusion transcripts. NCI generated synthetic RNA-Seq data and introduced a phase during which teams make predictions on real human-tumors. The SMC-RNA Challenge will analyze a couple of dozen samples created to have known alterations representing different tumor types, allowing confidence that the winning methods will be generalizable across the broad range of human cancers.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities

*Justification for Using Prizes and Challenges:* This was a unique way to get new participants to not only create new, better algorithms to solve an issue with RNA sequencing, but also utilize the NCI Cloud Pilots off of which the Challenge was run. The NCI Cloud Pilots are designed to explore innovative methods for accessing and computing on large genomic data. They aim to bring data and analysis together on a single platform by creating a set of data repositories with co-located computational capacity and an application programming interface (API) that provides secure data access. In this model, applications are brought to the data, rather than bringing the data to the applications. The goals of Cloud Pilots are to democratize access to NCI-generated genomic and related data and to create a cost-effective way to provide computational support to the cancer research community.

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<sup>6</sup> The website for the ICGC-TCGA DREAM Somatic Mutation Calling - RNA Challenge (SMC-RNA) can be viewed at <https://www.synapse.org/#!/Synapse:syn2813589/wiki/401435>.

*Cash Prize Purses and/or Non-Cash Prize Awards:* There were no cash prizes for this Challenge. All participants were invited as consortium co-authors on challenge marker papers and winners will receive speaking invitations at the next DREAM conference or Sage Congress.

*Solicitation of Submissions:* The Challenge was advertised through NCI email groups and regularly scheduled meetings to contractors and grantees, specifically those scientists involved in the TCGA project (as this Challenge used TCGA data) were targeted. In addition, the Challenge was advertised on the DREAM Challenge site. The contractors funded to do this work also advertised the Challenge when they gave presentations at scientific meetings.

*Solicitation Types:* Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* Submissions were ranked based on scoring metrics for each sub-challenge. In the Quantify Known Isoforms sub-challenge, the scoring metric was the Spearman and Pearson correlations calculated on the relative and true quantity of simulated isoforms or isoform spike-ins. In the Discover Gene Fusions Truth sub-challenge, the scoring metric was the sensitivity, precision and F1-score calculated for each simulated or spike-in tumor when applicable.

*Results:* 11 entries were submitted between June 29, 2016 and May 12, 2017.

*Budget and Resources:* Two contracts were awarded to Oregon Health Sciences University and Ontario Institute for Cancer Research for approximately \$100,000 each to facilitate the Challenge by setting up the Challenge, the website, the rules, the test datasets, and to evaluate the results of the participants entries. A single Federal staff member oversaw the Challenge at about 5% FTE.

*Partnerships:* The partnership with the two contractors to run the Challenge was successful. The two contractors both had prior experience with running DREAM Challenges and this was critical in making the Challenge a success.

*Advancement of Agency Mission:* There is limited international efforts aimed at providing an unbiased and long-lived benchmarking of RNA-Seq Analysis Methods. This Challenge will help inform the standard approaches adopted across the cancer-research community due to the involvement of the organizers and participants in ICGC, TCGA and the Global Alliance for Genomics and Health projects.

*Solution Types:* Software and apps; Scientific

*Plan for Upcoming 2 FYs:* N/A

#### **B.2.4 NCI-CPTAC DREAM Proteogenomics Challenge<sup>7</sup>**

*Lead Sponsoring Agency:* NIH, NCI

*Authority:* NCI considers the use of challenges & prize competitions within its statutory authority as a means to fulfill the Institute's purpose.

*Status:* This competition was launched in FY17 and completed in FY18.

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<sup>7</sup> The websites for the NCI-CPTAC DREAM Proteogenomics Challenge are accessible at <https://www.synapse.org/#!/Synapse:syn8228304/wiki/413428> and [https://proteomics.cancer.gov/news\\_and\\_announcements/best-performers-announced-nci-cptac-dream-proteogenomics-computational](https://proteomics.cancer.gov/news_and_announcements/best-performers-announced-nci-cptac-dream-proteogenomics-computational).



*Competition Goals:* Characterization and analyses of alterations in the proteome has the promise to shed light on cancer development and may improve development of both biomarkers and therapeutics. Measuring the proteome is very challenging, but recent rapid technology developments in mass spectrometry are enabling deep proteomics analysis. Multiple initiatives have been launched to take advantage of this development to characterize the proteome of tumors, such as the Clinical Proteomic Tumor Analysis Consortium (CPTAC). This challenge used public and novel proteogenomic data generated by the CPTAC to try to answer fundamental questions about how different levels of biological signal relate to one another. In particular, the Challenge focused on understanding: (1) Can one impute missing values in proteomics data given observed proteins?; (2) Can one predict abundance of any given protein from mRNA and genetic data?; and (3) Can one predict the phosphoproteomic data, using proteomic, mRNA and genetic data?

*Goal Types:* Solve a specific problem; Advance scientific research; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* The use of incentivized challenge competitions allows agencies to cast a wide net to find innovative solutions through crowd-sourcing and open science. Furthermore, participants in a challenge agree to benchmark performance of their software tools against a common reference dataset. Such approaches are not typically provided through traditional grant mechanisms. NCI determines that the monetary prize is often secondary to the community's interest to participate in an activity where they can find access to high quality data and the opportunity to benchmark their tools compared to other participants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$25,000 and the total amount awarded was \$25,000. NVIDIA Foundation provided the cash prize. Additionally, Nature Publishing supported submission of overview paper and insights that emerge from the Challenge.

*Solicitation of Submissions:* NCI solicited submissions through emails and speaking presentations at scientific meetings.

*Solicitation Types:* Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* Submissions were evaluated and peer reviewed based on the algorithmic performance comparing training data to test data sets.

*Results:* 504 participants were involved in submissions between June 26 and November 20, 2017. Three prizes were awarded to researchers from the University of Michigan and Korea University.

*Budget and Resources:* NCI staff worked closely with our scientific partners and a Challenge contractor to develop the scientific scope and requirements of the Challenge. NCI provided \$250,000 in FY18 funding to manage the organization and logistics of the new Challenge.

*Partnerships:* The Defense Advanced Research Projects Agency (DARPA) contributed its SIMPLEX suite of scientific discovery tools. The NVIDIA Foundation provided the cash prize. NCI also partnered with Google, IBM, DREAM Challenges, and Nature Publishing.

*Advancement of Agency Mission:* NCI leads, conducts, and supports cancer research across the nation to advance scientific knowledge and help all people live longer, healthier lives. This crowdsourced Challenge highlighted the use of computational tools in cancer research to extract new information from the cancer proteome and to understand the association between the genome, transcriptome, and

proteome in tumors to better efforts that improve cancer prevention, detection, diagnosis, and survivorship.

*Solution Types:* Software and apps; Analytics, visualizations, algorithms; Scientific

*Plan for Upcoming 2 FYs:* N/A

### **B.2.5 PROSTATEx Challenge<sup>8</sup>**

*Lead Sponsoring Agency:* NIH, NCI

*Authority:* NCI considers the use of challenges and prize competitions within its statutory authority as a means to fulfill the Institute's purpose.

*Status:* This competition was completed in FY17.

*Competition Goals:* The overall goal of the two PROSTATEx challenges (termed PROSTATEx I and II) was to promote development of medical image analysis algorithms for clinical decision support in diagnosis and staging of prostate cancer. The goal of PROSTATEx I was to determine the presence of cancer in each subject based in quantitative image analysis of multi-parametric magnetic resonance imaging (MRI) data. The goal of PROSTATEx II was to use multi-parametric MRI data to determine Gleason Grade Group in prostate cancer.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* The use of incentivized challenge competitions allows agencies to cast a wide net to find innovative solutions through crowd-sourcing and open science. Furthermore, participants in a challenge agree to benchmark performance of their software tools against a common reference dataset. Such approaches are not typically provided through traditional grant mechanisms. NCI determined that the monetary prize is often secondary to the community's interest to participate in an activity where they can find access to high quality data and the opportunity to benchmark their tools compared to other participants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* PROSTATEx challenges offered non-cash prizes only. The top two teams received waived registration fees to attend SPIE 2017 or American Association of Physicists in Medicine (AAPM) 2017 annual conferences to present results. Both registration fee waivers were provided by the SPIE and AAPM.

*Solicitation of Submissions:* NCI collaborated with SPIE and AAPM to announce the challenges through their communication channels, including their respective websites, press release, and listserv emails to society members. These methods were effective to get a critical mass of participants involved with each challenge. However, this was only the second time offering prize competitions for SPIE, and the first time for AAPM. Both societies are planning to offer challenges in the coming years. Given the general emerging interest in data science, machine learning, and artificial intelligence (AI), we expect that participation in the future will increase. One factor that is of prime importance in offering a challenge, in conjunction with the annual meeting of a scientific society, is the timing of the opening and closing

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<sup>8</sup> The websites for the PROSTATEx Challenge are accessible at <https://www.aapm.org/GrandChallenge/PROSTATEx-2/default.asp> and <http://spiechallenges.cloudapp.net/competitions/7>.

of the challenge and announcement of the winners, who need enough time to plan their travel to the meeting.

*Solicitation Types:* Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Special sessions at scientific meetings (SPIE Medical Imaging and AAPM) to highlight the challenge and facilitate presentations by the winners

*Participation Requirements:* N/A

*Evaluation of Submissions:* Submissions were evaluated through against the ground truth and summarized as an index. The ground truth was provided by clinical experts who are familiar with the disease and the data.

*Results:* Entries for PROSTATEx I were submitted between November 21, 2016 and January 15, 2017. Entries for PROSTATEx II were submitted between May 15 and June 23, 2017.

*Budget and Resources:* The NCI Program Director devoted 5% time to guide the development of the Challenge design and implementation. Outside collaborators from academia contributed similar services. Datasets available through the Cancer Imaging Archive (CIA) were used in training and test phases of the Challenge. An existing challenge platform was used for submission of results and ranking of participants based on a set of evaluation metrics. The challenge platform was utilized under a blanket contract between the platform operator and NCI Center for Biomedical Informatics and Information Technology.

*Partnerships:* NCI partnered with the Food and Drug Administration, SPIE, AAPM, Harvard University, University of Michigan, and Radboud University to develop, advertise, and complete the Challenge. The estimated values of the waived registration fees provided by AAPM and SPIE is estimated at \$300-1,000 per person.

*Advancement of Agency Mission:* The NCI mission includes dissemination of information on cancer detection, diagnosis, and treatment, and support for innovative solutions to the cancer problem. PROSTATEx challenges, performed in collaboration with non-profit entities (scientific societies and universities) leverages existing shared datasets to drive algorithmic excellence and incentivize development of innovative analytic software methods in cancer detection, diagnosis, and staging, using such datasets.

*Solution Types:* Software and apps; Ideas; Analytics, visualizations, algorithms; Scientific

*Plan for Upcoming 2 FYs:* A great amount of high quality cancer data (imaging, pathology, genomics, proteomics, and clinical) are generated through NCI-funded grants and cooperative agreements. Often these constitute what is referred to as big data. Solvers in the community, who are typically graduate students or research fellows with innovative ideas usually lack access to such data. Challenges provide a great way to develop tasks related to existing data that are aimed to bring innovative approaches, such as AI, to solve long standing problems, or facilitate more accurate solutions toward clinical decision support. NCI plans to utilize new datasets (imaging and other types) to launch new challenges in 2019 and 2020. These include challenges related to pancreatic and brain cancers, two of the deadliest cancers.

### **B.3 Department of Homeland Security (DHS)**

#### **B.3.1 The U.S. Coast Guard Ready for Rescue Challenge<sup>9</sup>**

*Lead Sponsoring Agency:* United States Coast Guard, Research and Development Center

*Authority:* Procurement Authority

*Status:* This competition was launched in FY18.

*Competition Goals:* The United States Coast Guard's Research and Development Center (USCG RDC) in conjunction with the DHS Science and Technology Directorate (DHS S&T) is seeking new solution based concepts that help make it easier to find and rescue people lost in the water. The best concepts will be effective, affordable, and hold the potential for wide adoption by recreational mariners. The competition will involve four phases: (I) Identify possible solutions; (II) Incentivize the development of working prototypes; (III) Assess the efficacy of the working prototypes to enable USCG search and rescue operations; (IV) Provide additional non-monetary support to encourage commercialization of the solutions.

*Goal Types:* Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public

*Justification for Using Prizes and Challenges:* The USCG is seeking a wide breadth of potential solutions and prototypes for testing in FY19. A wide variety of potential technologies and approaches will provide the best opportunity for success and eventual adoption of an improved inherent person-in-the-water (PIW) detectability standard. Using other authorities will result in a limited pool of solutions and likely be more expensive to produce and acquire by public boaters and mariners. Prizes and challenges also affords the opportunity for an innovator to have access to government and private sector mentors, limited user evaluation of their prototype, and assistance in commercializing their concept.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse available for offer is \$255,000, to be awarded across three phases. The purse for Phase I is \$25,000 (five awards at \$5000 each), the purse for Phase II is \$120,000 (up to seven awards), and the Purse for Phase III is \$110,000 (up to five awards). Non-monetary incentives include the ability to work with USCG RDC maritime subject matter experts and boating industry mentors in the development of ideas into products. The DHS Science & Technology Directorate is helping to develop a path for Phase III winners to work with an accelerator or business to further develop and commercialize their prototype. Funding for Phase I is provided by DHS S&T R&D funds while funding for Phases II and III is provided by USCG RDC R&D funds.

*Solicitation of Submissions:* Phase I solicited the submission of ideas that have a high expectation for commercialization, affordability, and adoption by the boating and maritime community. Phase II will require selected Phase I winners and honorable mentions to present their concept and pathway for prototype development to a review panel. Successful participants will be provided incremental prize award milestones to assist in the development of their prototype. Phase II participants will be invited to participate in a Phase III challenge that evaluates their prototype with USCG search and rescue assets. Phase III participants will compete for a bonus prize purse of \$110,000.

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<sup>9</sup> The website for The U.S. Coast Guard Ready for Rescue Challenge can be viewed at [www.ReadyforRescuechallenge.com](http://www.ReadyforRescuechallenge.com).

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Conference promotional activities, outreach with accelerator networks

*Participation Requirements:* The contest seeks the following skill sets: Public Safety, Maritime Safety, Recreational Sports, Consumer Goods and Materials, Wearables, Textiles, Smart Technologies, and Internet of Things.

*Evaluation of Submissions:* Submissions will be assessed by a diverse panel of judges from the government and the private sector against five criteria: (1) Effectiveness. The extent to which the solution demonstrates potential to improve detectability of PIW by search and rescue teams using existing Coast Guard search methods. Improved detectability is measured by the degree to which a reduced search time and/or success rate of search and rescue missions may be increased by the proposed solution. (2) Accessibility. The potential to be purchased and/or utilized by a broad set of recreational mariners (boaters, kayakers, Jet Ski, paddle craft, etc.). There are minimal companion purchases and is cost-effective from the consumer perspective (potential to be sold at a low, mass-market price point in the range of \$25 to \$35 if manufactured at scale). (3) User experience. The likelihood that the proposed solution would be utilized by recreational mariners on the water (boaters, kayakers, jet ski, paddle craft, etc.). The extent to which the solution addresses common barriers to use that limit existing solutions, such as comfort, convenience, or awareness. (4) Feasibility. The extent to which the proposed solution is viable and can be reasonably developed into a prototype within a nine-month period, with the potential to be manufactured at scale. (5) Team. The extent to which the entrant's team demonstrates the appropriate level of experience, commitment, and ability to move from concept to prototype. If entrant is an individual, the level of experience, commitment, and ability to prototype to include access to non-team member assets and capabilities.

*Results:* The competition is ongoing with entries for Phase I submitted by participants between September 5 and October 15, 2018.

*Budget and Resources:* In FY17, agency personnel supporting challenge included .25 FTEs. In FY18, agency personnel supporting the program included 0.6 FTE (DHS Prize Office and General Counsel: 0.1 FTE; USCG RDC: 0.5 FTEs). Greater clarity is needed to distinguish whether this amount includes the prize money total from Phase I or not.

*Partnerships:* In addition to partnering with the DHS Science and Technology Directorate, the competition sought judges and mentors from the private sector to include marine safety equipment manufacturers, distributors, designers, etc. The estimated value of partner contributions is \$175,000.

*Advancement of Agency Mission:* One of the most challenging aspects of maritime search and rescue is finding a person in the water (PIW) because a PIW is often indistinguishable from the surrounding environment. In order to find people in the water more effectively and save more lives, a PIW's inherent detectability must be increased. Examples include color/light for conspicuity, electronic/heat signatures, form factors, and personal floatation devices. Effective PIW detectability enhancements must be suitable for use with USCG sensors and methods. There have been incremental improvements to USCG rescue methods over time as technology advanced. Recently the USCG has upgraded sensors on aviation and surface assets; however, PIW detectability standards have lagged. The desired outcome of this challenge is effective concepts that increase conspicuity of a PIW and will likely be used by the public. A successful design, prototype and execution will make possible transition to market that will be low cost and easily adapted by the boating public. Results of this challenge may become part of an improved inherent PIW detectability standard.

*Solution Types:* Ideas; Technology demonstration and hardware; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* In FY19, three competitions are in planning and one in early stage exploration for execution in 2019. Crosscutting mission areas include: chemical-biological defense, opioid detection in bulk mail, search and rescue, and emergency preparedness. Planned competitions include the development or enhancement of a new technology, opportunities for entrepreneurs to develop and market new technologies, and an educational game to better prepare the public. Additional cross-cutting areas include first responder technologies. In FY20, cross-cutting areas that may be considered by DHS include: critical infrastructure technologies, first responder technologies, cyber defense applications, chemical-biological detection technologies, algorithms, sensors, and screening technologies.

## **B.4 Department of State (State)**

### **B.4.1 Diplomacy Lab<sup>10</sup>**

*Lead Sponsoring Agency:* State, Secretary's Office of Global Partnerships (S/GP)

*Authority:* State Department Basic Authorities Act of 1956

*Status:* This competition was underway in both FY17 and FY18, but has not concluded.

*Competition Goals:* Students participating in Diplomacy Lab explore real-world challenges identified by DOS and work under the guidance of faculty members who are authorities in their fields. This initiative allows students to contribute directly to the policymaking process while helping State tap into an underutilized reservoir of intellectual capital. Teams that develop exceptional results and ideas are recognized for their work and may be invited to brief senior State officials on their findings.

*Goal Types:* Improve government service delivery; Engage new people and communities

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* This Challenge provided university partners with real-world experience and State with free research and recruiting opportunities.

*Solicitation of Submissions:* State provided participating universities with a list of proposed projects. Partner universities then identify faculty members to lead teams of students in Diplomacy Lab projects. Over the course of a semester, professors guide students in developing a final work product that accomplishes the goals outlined by State. Students have opportunities throughout the semester to discuss their research with State officials. Diplomacy Lab member institutions may bid on project proposals developed by State six months prior to each semester during the bidding window. Each university is encouraged to submit bids for its top four priority projects. It is also highly recommended that each university choose four alternate projects with an individual proposal in the event a particular project is over-subscribed

*Solicitation Types:* Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Diplomacy Lab is open to students and faculty at vetted and approved partner universities in the United States.

*Evaluation of Submissions:* N/A

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<sup>10</sup> The website for the Diplomacy Lab can be viewed at [www.diplomacylab.org](http://www.diplomacylab.org).



*Results:* N/A

*Budget and Resources:* This Challenge utilized one FTE in both FY17 and FY18.

*Partnerships:* Partner universities are vetted and approved according to 2 FAM 970. Partner universities provide research to projects proposed by State offices and embassies worldwide. Non-Federal partners have included College of William and Mary, Florida International University, Georgetown University, Georgia Institute of Technology, Gettysburg College, Hunter College, Indiana University Bloomington, Indiana University – Purdue University Indianapolis, John Jay College of Criminal Justice, Miami University, Missouri University of Science and Technology, Montana State University, Stevens Institute of Technology, Stockton University, Syracuse University, Tufts University, University of California San Diego, University of Oklahoma, University of Kansas, University of New Mexico, University of Notre Dame, University of Pittsburgh, University of Tennessee, University of Virginia, University of Washington, Virginia Tech, Wilbur Wright College, Yale University, Oberlin College, and Columbia University.

*Advancement of Agency Mission:* Diplomacy Lab is designed to address two priorities: (1) State's determination to engage the American people in the work of diplomacy; and (2) the imperative to broaden State's research base in response to a proliferation of complex global challenges.

*Solution Types:* Ideas; Other - Research

*Plan for Upcoming 2 FYs:* Diplomacy Lab will continue to operate as it has during the past two fiscal years, with an aim to grow its partner network to expand the geographic and academic diversity of research provided.

#### **B.4.2 Almaty Mini Maker Faire—Pitching Challenge<sup>11</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Astana

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The goal of the competition was to identify ideas and projects with the potential to change social life related to science, technology, engineering and mathematics (STEM) education and ecological problems.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were awarded to allow the winners to continue to work on the projects following the conclusion of the competition.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$6,000. The prize came from the grant that was given to the local non-governmental organization.

*Solicitation of Submissions:* The competition was announced on social media and monitored by an Information Assistant who collected all of the submitted applications. The judges selected the

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<sup>11</sup> The website for the Almaty Mini Maker Faire – Pitching Challenge can be viewed at <https://www.facebook.com/AlmatyMiniMakerFaire/photos/a.337478493324638/352379608501193/?type=3&theater>.

participants who would present their works during the Maker Faire, and those selected gave a presentation at the end of the event.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Teams were required to pre-register for the competition by submitting a proposal, plan, and one minute video explaining the project.

*Evaluation of Submissions:* On the day of the event, selected participants presented their projects in front of a panel of five judges and answered any follow-up questions.

*Results:* Of the 12 participants who presented their solutions, three participants were each awarded a \$2,000 prize.

*Budget and Resources:* Over five days, several people from the Public Affairs team worked to ensure the execution of the competition.

*Partnerships:* N/A

*Advancement of Agency Mission:* Almaty Mini Maker Faire promotes do-it-yourself activities, technology, innovation, science, and STEM education, specifically focusing on how individuals can use technology to solve social problems.

*Solution Types:* Software and apps; Creative (design & multimedia); Ideas; Technology demonstration and hardware; Scientific

*Plan for Upcoming 2 FYs:* The Almaty Mini Maker faire was well attended by both participants and the media. The competition proved to be an effective means to incite discussion around novel solutions by relating social issues to STEM topics and encouraging physical solutions to real problems. This type of event will be repeated during the next 2 fiscal years.

### **B.4.3 Spelling Bee<sup>12</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Astana

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The purpose of this Challenge is to invite students to come to the Spelling Bee competition and support each country. Active fans would have been awarded.

*Goal Types:* Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* Because the event was organized on a Saturday and before that it was a public holiday, therefore we wanted to attract more people to come and support and learn more about AmericanSpace's services.

*Cash Prize Purses and/or Non-Cash Prize Awards:* Winners were awarded T-shirts.

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<sup>12</sup> The website for the Spelling Bee can be viewed at <https://www.facebook.com/almaty.usconsulate/photos/a.316951578330291/2337570952935000/?type=3&theater>.

*Solicitation of Submissions:* N/A

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* N/A

*Evaluation of Submissions:* Evaluation was through observation of participants who came to support the Spelling Bee competition and how active they were.

*Results:* Of the 20 participants, five prizes were awarded to five winners.

*Budget and Resources:* This Challenge utilized three to four hours of time of one FTE and \$15 in funding.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge intended to advance State’s mission through promotion of the English language.

*Solution Types:* Creative (design & multimedia); Ideas

*Plan for Upcoming 2 FYs:* The event was very successful and well-attended by students and was covered by media. This project will be continued in the future as it also covers other Central Asian countries.

#### **B.4.4 World Tourism Day Quiz<sup>13</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Astana

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The prize competition was launched on World Tourism Day to promote and inspire tourism in the United States. Through Facebook, the participants were asked to identify which city or state a person would need to travel to in order to enjoy something special (e.g., “the best beef bbq” or “the highest mountain peak in America”). The competition also sought to promote and applaud the use of English language; the competition was administered in English and required some light research to find the answers to the quiz questions.

*Goal Types:* Inform and educate the public; Engage new people and communities; Stimulate a market; Other - Promote tourism in the United States of America

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* Non-monetary incentives included a United States Consulate General (USCG) Almaty branded notebook, bookmark, and pen. Three sets of prizes were awarded.

*Solicitation of Submissions:* The quiz was announced on the USCG Almaty Facebook Page.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Participants needed to access and read the USCG Almaty Facebook page.

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<sup>13</sup> The website for the World Tourism Day Quiz can be viewed at <https://www.facebook.com/almaty.usconsulate/photos/a.316951578330291/2704438682914890/?type=3&theater>.

*Evaluation of Submissions:* The first five people to answer all four quiz questions correctly were identified as the winners. The winners were notified to pick up their prizes the next day at the American Space.

*Results:* Of the seven entries submitted between September 27 and September 28, 2018, five winners were selected.

*Budget and Resources:* Funding for FY18 totaled \$15 to supply the prize package. In addition, 0.5 FTE employees, one American Eligible Family Member employee and one Locally Employed staff member, supported the planning and launching stages of the competition.

*Partnerships:* N/A

*Advancement of Agency Mission:* Promoting and advancing the English language is a priority for both the U.S. Embassy Astana and the government of Kazakhstan. Through tourism, the competition provides an opportunity to expose our young, social media audience to American values and perspectives.

*Solution Types:* N/A

*Plan for Upcoming 2 FYs:* Over the next two fiscal years, the U.S. Embassy Astana will continue to promote the English language, Western ideas and values, and tourism between the United States and Almaty.

#### **B.4.5 Impact Video Competition**

*Lead Sponsoring Agency:* U.S. Embassy Lilongwe

*Authority:* Foreign Assistance Act

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* USAID aims to clearly and effectively demonstrate the impact of its development programs. Through this contest, contestants submitted one to two-page pitches attempting to show how their programs had a positive impact on Malawi. Entries were judged largely upon their ability to show quantitative evidence of their impact. For the winners, USAID hired a professional video production team to make a short film about their project and its impact. USAID and the partners will both retain copies of these videos for communications/marketing purposes respectively.

*Goal Types:* Find and highlight innovative ideas; Inform and educate the public

*Justification for Using Prizes and Challenges:* While partners submit regular reports to USAID, sometimes these only include standard, required indicators which do not adequately capture impact. Through this competition, partners were incentivized to take a deeper look at their programs and show evidence of substantial impact at a broad level based on quantitative evidence. This way, partners did the investigation on their own. By doing so, USAID saved the costs of awarding a new contract to determine this information.

*Cash Prize Purses and/or Non-Cash Prize Awards:* A video was produced for each of the three winning entries. The videos described their USAID and President's Emergency Plan for AIDS Relief (PEPFAR) funded projects in Malawi. USAID uses the videos to communicate the effectiveness of its programming and to convey ideas and information to the American and global public around issues related to foreign policy, such as HIV, deforestation, and economic growth).<sup>14</sup>

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<sup>14</sup> The costs for the videos were: GH-C/2012/201 \$32,417 – disbursed, DV/2015/2016 \$32,417 – in requisition

*Solicitation of Submissions:* Announcement at a partners meeting; subsequent email to partners

*Solicitation Types:* Email (e.g., listservs); Day-long event(s) prior to the competition

*Participation Requirements:* Organizations had to be current USAID/Malawi partners implementing development projects to participate in this Challenge. To win, organizations had to show that their program made a positive impact on U.S. Government foreign policy goals.

*Evaluation of Submissions:* Evaluators were internal to USAID. Evaluation criteria included evidence of quantitative impact, sustainability, and the degree to which the story was compelling based on making a difference in the lives of Malawians and achieving the goals of the U.S. Government in Malawi. It worked well because USAID applied the same criteria across all submissions.

*Results:* Of the 30 entries submitted by 30 organizations between October 30, 2017 and December 8, 2017, three prizes were awarded.

*Budget and Resources:* Staff time was utilized to organize, judge, and communicate regarding the contest. This Challenge had travel costs for USAID staff to ground truth claims of impact and accompany the film company during filming. Staff time was used to work with the video production company to develop films in advance of filming (storyboarding etc.), and to review production company editing and final film production. This Challenge utilized approximately 1 FTE throughout FY17 and FY18 and about \$63,000 in FY18 funding.

*Partnerships:* Partners, on a voluntary basis, submitted a one to two-page pitch for their story. Once USAID selected the winners, those partners used staff time to work with USAID staff to hone the story. Partners worked with USAID and film production company staff to produce the video. Non-Federal partners included Pact, Inc.; Tetra Tech; Baylor University; and Johns Hopkins University. Partner contributions are estimated at \$2,000 and travel costs.

*Advancement of Agency Mission:* This Challenge advances agency mission by showing how USAID programs are fulfilling U.S. foreign policy goals.

*Solution Types:* Creative (design & multimedia)

*Plan for Upcoming 2 FYs:* The mission may hold another contest in subsequent years, with similar anticipated costs, but those plans are not confirmed at the time of reporting.

#### **B.4.6 “150 Years of Cooperation and Friendship” Logo Contest<sup>15</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Montevideo, Public Affairs

*Authority:* Fulbright-Hays Act

*Status:* This competition was completed in FY17.

*Competition Goals:* This Challenge intended to obtain an official logo to be used in all official communications during 2017 for the 150<sup>th</sup> anniversary of diplomatic relations between the U.S. and Uruguay, and encourage the community to engage with the celebrations and gain new followers as well.

*Goal Types:* Solve a specific problem; Engage new people and communities

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<sup>15</sup> The website for the “150 Years of Cooperation and Friendship” Logo Contest can be viewed at <https://uy.usembassy.gov/es/logo150>.

*Justification for Using Prizes and Challenges:* The Prize was offered to engage with a wider audience and to have as many logos as possible and professionally done, as the selected logo was going to be used in all official Embassy communications.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was a Nikon Coolpix AW130 and Sandisk 16GB memory card, valued at \$271. Non-monetary incentives included having the winning logo be used in all official communications during 2017, a certificate signed by the Ambassador, and getting mentioned and participating in the 150<sup>th</sup> anniversary celebrations.

*Solicitation of Submissions:* Participants were asked to send their designs to the Embassy Webmaster email account.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs)

*Participation Requirements:* Challenge requirements included: (1) the Challenge was only open to Uruguayan citizens; (2) there was no age limit; (3) more than one design by participant was accepted; (4) logos must be done by participants and no property rights could be violated during the creative process; (5) participants agree to give the U.S. Embassy in Montevideo full authorization to use the context, platform, and product.

*Evaluation of Submissions:* After the closing date, all logos were printed and displayed in a conference room where Embassy staff was invited to vote for their preferred submission. The voting process ended with five finalists that were presented to the front office. The final decision was made considering not only the logo itself, but the different applications for which it was needed, including size, proportions, and use in both full-color and black-and-white applications.

*Results:* Of the 182 entries submitted by 134 participants between February 27, 2017 and March 16, 2017, one prize was awarded to one winner.

*Budget and Resources:* Budget and resources were utilized to create contest regulations and graphics, promotion on social media, posting on the website and procurement of the waterproof digital camera. Additionally, budget and resources included collecting all submitted logos, presenting them to the jury, carrying out the selection, and announcing the winning logo and designer. Costs included three hours of time on behalf of the webmaster \$59.47; three hours for the audiovisual tech assistant \$35.56; camera supplier (i.e., vendor) \$271.00; Facebook promotion \$100.00. The Challenge also utilized \$371 in FY17 funding and six FTEs.

*Partnerships:* N/A

*Advancement of Agency Mission:* DOS celebrated the long history of friendship and cooperation between the United States and Uruguay by inviting the members of the Uruguayan public to design a logo to recognize the 150-year anniversary of bilateral relations between both countries. This initiative was intended to improve the Mission's image and popularity within the local community. Within the Mission, all employees, both American and local staff, were encouraged to work together to pick the winning logo as an activity which contributes to the development of a better working environment.

*Solution Types:* Creative (design & multimedia); Ideas

*Plan for Upcoming 2 FYs:* N/A



#### **B.4.7 #MEthroughUSeyes<sup>16</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The contest objective was to show how American citizens spend their time in Montenegro and what are the most beautiful places in Montenegro according to people from the USA, thus showcasing that appreciating nature is a shared value.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* Non-monetary incentives included 10 branded bags containing U.S. Embassy's branded materials.

*Solicitation of Submissions:* Participants were asked to post their own picture of Montenegro landmarks on the Embassy's social media properties.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 13 years old on the date of entry into the contest. Contestants must have been U.S. citizens or lawful permanent residents.

*Evaluation of Submissions:* At the end of the submission period, the Public Affairs team evaluated the photos and selected favorites.

*Results:* Of the 120 entries submitted by 50 participants between May 5, 2017 and May 25, 2017, 10 prizes were awarded to 10 winners.

*Budget and Resources:* The prize was a branded bag containing U.S. Embassy branded materials, including a t-shirt, an umbrella, a notebook, a pen, a pin, and a mug with American symbols. Best photos were exhibited at the American Corner - Podgorica. One staff member worked on the contest organization, execution and promotion for a total of five work days in FY18.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance U.S.-Montenegro partnership and highlighted the Montenegrin public support of the United States and its values and policies.

*Solution Types:* Other - Sharing a photo

*Plan for Upcoming 2 FYs:* N/A

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<sup>16</sup> The website for the #MEthroughUSeyes (U.S. Embassy Podgorica) can be viewed at [https://www.facebook.com/notes/us-embassy-podgorica/methroughuseyes/10154665107302705/?\\_\\_tn\\_\\_=HH-R](https://www.facebook.com/notes/us-embassy-podgorica/methroughuseyes/10154665107302705/?__tn__=HH-R).

#### **B.4.8 #OscarsME2018<sup>17</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* Embassy Podgorica used the Academy Awards to engage and expand its social media following with the goal of increasing support for U.S. values.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* Winners received an invitation to the U.S. Embassy reception celebrating American film and the Academy Awards with Ambassador Uyehara.

*Solicitation of Submissions:* Participants were asked to fill in a Google form by following a link from Embassy social media properties.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 18 years old on the date of entry into the contest. Contestants must have been residents of Montenegro and not U.S. citizens or lawful permanent residents.

*Evaluation of Submissions:* Winners were randomly selected at the end of the polling period.

*Results:* Of the 400 entries submitted by 250 participants between February 5, 2018 and February 26, 2018, five prizes were awarded to five winners.

*Budget and Resources:* One staff member worked on the contest organization, execution and promotion for a total of five work days in FY18. This Challenge required no additional financial resources.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public's support of the United States and its values and policies. This program focused on educating the Montenegrin public about cultural events in the United States and related American values.

*Solution Types:* Other - Participating in a quiz

*Plan for Upcoming 2 FYs:* N/A

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<sup>17</sup> The website for the #OscarsME2018 (U.S. Embassy Podgorica) can be viewed at [https://www.facebook.com/notes/us-embassy-podgorica/oscarsme2018-official-game-rules/10155456275822705/?\\_\\_tn\\_\\_=HH-R](https://www.facebook.com/notes/us-embassy-podgorica/oscarsme2018-official-game-rules/10155456275822705/?__tn__=HH-R).

**B.4.9 #USElections2016 - Official Trivia Contest Rules<sup>18</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was completed in FY17.

*Competition Goals:* As U.S. Presidential Elections were getting closer, DOS wanted to engage with social media followers and share knowledge about election rules, procedures, and trivia. DOS aimed to promote good democratic practices and explain to followers the historic developments that led to these practices. Sharing U.S. election stories and experiences would not only familiarize the audience with the U.S. electoral system, but let them think about what is similar in their country and what could be improved. The overall objective was not only to raise awareness about the 2016 elections, but to promote the value and the power of young people's participation in process of choosing state representatives and decision makers.

*Goal Types:* Inform and educate the public

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* Winners received invitations to the Election Breakfast event and met with the Ambassador.

*Solicitation of Submissions:* Participants were asked to fill in a Google form, and link answers to the Embassy social media properties.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 16 years old on the date of entry into the contest. Contestants must have been residents of Montenegro and not U.S. citizens or lawful permanent residents.

*Evaluation of Submissions:* One winner was selected at random every day during the contest.

*Results:* Of the 450 entries submitted by 450 participants between October 21, 2016 and October 31, 2016, 10 prizes were awarded to 10 winners.

*Budget and Resources:* One staff member worked on the contest organization, execution and promotion for total of 5 work days in FY17. This Challenge required no additional financial resources.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public's support of the United States and its values and policies. This program focused on educating the Montenegrin public about the electoral process in the United States.

*Solution Types:* N/A

*Plan for Upcoming 2 FYs:* N/A

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<sup>18</sup> The website for the #USElections2016 - Official Trivia Contest Rules (U.S. Embassy Podgorica) can be viewed at <https://www.facebook.com/notes/us-embassy-podgorica/selections2016-official-trivia-contest-rules/10154069651817705/>.

#### **B.4.10 GIFT O’CLOCK 2016 - #MEholidaysWithUS<sup>19</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was completed in FY17.

*Competition Goals:* The goal of this contest was to expand the reach of the Embassy’s social media following by showcasing American holiday traditions.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were used as an incentive to encourage participation and contribute to the goal of expanding social media following.

*Cash Prize Purses and/or Non-Cash Prize Awards:* Each winner was awarded a branded bag containing U.S. Embassy’s branded materials, including a t-shirt, umbrella, notebook, pen, pin, and mug with American symbols.

*Solicitation of Submissions:* Participants were asked to post a picture of their holiday decorations on the Embassy’s social media properties.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 13 years old on the date of entry into the contest. Contestants must have been residents of Montenegro and not U.S. citizens or lawful permanent residents.

*Evaluation of Submissions:* One winner was selected randomly every day during the contest.

*Results:* Of the 30 entries submitted by 50 participants between December 12 and December 22, 2016, 10 prizes were awarded to 10 winners.

*Budget and Resources:* One staff member worked on the contest organization, execution and promotion for a total of five work days in FY17.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public’s support of the United States and its values and policies.

*Solution Types:* Other - Sharing a photo

*Plan for Upcoming 2 FYs:* N/A

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<sup>19</sup> The website for the GIFT O’CLOCK 2016 - #MEholidaysWithUS (U.S. Embassy Podgorica) can be viewed at [https://www.facebook.com/notes/us-embassy-podgorica/gift-oclock-2016-meholidayswithus/10154214370007705/?\\_\\_tn\\_\\_=HH-R](https://www.facebook.com/notes/us-embassy-podgorica/gift-oclock-2016-meholidayswithus/10154214370007705/?__tn__=HH-R).

#### **B.4.11 Montenegrin Summer in the States #USalumniMNE<sup>20</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was underway in FY18.

*Competition Goals:* This contest aims to strengthen people-to-people ties between the United States and Montenegro and provide a forum for current and past Montenegrin participants in the Summer Work Travel program to share their experiences through photographs.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* N/A

*Cash Prize Purses and/or Non-Cash Prize Awards:* Each winner will be awarded with a branded bag containing U.S. Embassy’s branded materials, including a t-shirt, umbrella, notebook, pen, pin, and mug with American symbols, and an invitation to an Embassy reception. Thirteen branded bags containing U.S. Embassy branded materials and 13 invitations were awarded.

*Solicitation of Submissions:* Participants were asked to post a picture of their experiences in the United States on the Embassy’s social media pages.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 18 years old on the date of entry into the contest. Contestants must have been Montenegrin citizens or lawful permanent residents.

*Evaluation of Submissions:* At the end of the submission period, the Public Affairs team selected the best photos. Authors of the winning photos were contacted via direct message.

*Results:* Of the 231 entries submitted by 70 participants between August 1 and September 10, 2018, 13 prizes were awarded to 13 winners.

*Budget and Resources:* Beyond the prizes, this Challenge required no additional financial resources. One staff member worked on the contest organization, execution, and promotion for a total of five work days

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public’s support of the United States, and its values, and policies.

*Solution Types:* Other - Sharing a photo

*Plan for Upcoming 2 FYs:* N/A

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<sup>20</sup> The website for the Montenegrin Summer in the States #USalumniMNE (U.S. Embassy Podgorica) can be viewed at [https://www.facebook.com/notes/us-embassy-podgorica/montenegrin-summer-in-the-states-usalumnimne/10155898786427705/?\\_\\_tn\\_\\_=HH-R](https://www.facebook.com/notes/us-embassy-podgorica/montenegrin-summer-in-the-states-usalumnimne/10155898786427705/?__tn__=HH-R).

#### **B.4.12 Tis the season 2017 - #MEholidaysWithUS<sup>21</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The goal of this contest was to expand the reach of the Embassy’s social media and showcase American holiday traditions.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were used as an incentive to encourage participation and contribute to the goal of expanding social media following.

*Cash Prize Purses and/or Non-Cash Prize Awards:* Each winner was awarded a branded bag containing U.S. Embassy’s branded materials, including a t-shirt, umbrella, notebook, pen, pin, and mug with American symbols. Five branded bags containing U.S. Embassy’s branded materials were awarded.

*Solicitation of Submissions:* Participants were asked to post a picture of their holiday decorations on the Embassy’s social media properties.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Contestants must have been at least 13 years old on the date of entry into the contest. Contestants must have been residents of Montenegro and not U.S. citizens or lawful permanent residents.

*Evaluation of Submissions:* Public Affairs evaluated the submissions internally and selected winners.

*Results:* Of the 45 entries submitted by 50 participants between December 13 and December 26, 2017, five prizes were awarded to five winners.

*Budget and Resources:* Beyond the prizes, this Challenge required no additional financial resources. One staff member worked on the contest organization, execution, and promotion for a total of five work days in FY18.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public’s support of the United States, and its values and policies.

*Solution Types:* Other - Sharing a photo

*Plan for Upcoming 2 FYs:* N/A

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<sup>21</sup> The website for the Tis the season 2017 - #MEholidaysWithUS (U.S. Embassy Podgorica) can be viewed at <https://www.facebook.com/montenegro.usembassy/posts/10155979179929712>.



#### **B.4.13 U.S. Embassy Podgorica: Give Away #1<sup>22</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The contest objective was to share symbols of the United States across social networks and increase the number of followers of the Embassy's Instagram account.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were used as an incentive to encourage participation and contribute to the goal of expanding social media following.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The winner was awarded a branded bag containing U.S. Embassy's branded materials including a t-shirt, notebook, pen, pin, and mug with American symbols.

*Solicitation of Submissions:* Participants were invited to tag a friend.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Participation was open to citizens of Montenegro of all ages, who reside in Montenegro. Each user could enter only one comment to qualify.

*Evaluation of Submissions:* The winner was selected by a raffle.

*Results:* Of the 68 entries submitted by 120 participants between July 30 and August 1, 2018, one prize were awarded to one winner.

*Budget and Resources:* Beyond the prize, this Challenge required no additional financial resources. One staff member worked on the contest organization, execution, and promotion for a total of two work days in FY18.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public's support of the United States, and its values and policies.

*Solution Types:* Other - Tagging a friend

*Plan for Upcoming 2 FYs:* N/A

#### **B.4.14 U.S. Embassy Podgorica: Give Away #2<sup>23</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

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<sup>22</sup> The website for the U.S. Embassy Podgorica: Give Away #1 can be viewed at [https://www.instagram.com/p/Bl2YWNThMbA/?utm\\_source=ig\\_web\\_copy\\_link](https://www.instagram.com/p/Bl2YWNThMbA/?utm_source=ig_web_copy_link).

<sup>23</sup> The website for the U.S. Embassy Podgorica: Give Away #2 can be viewed at [https://www.instagram.com/p/Bm0p\\_6XhX5P/?utm\\_source=ig\\_web\\_copy\\_link](https://www.instagram.com/p/Bm0p_6XhX5P/?utm_source=ig_web_copy_link).

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The objective of the contest was to increase the Embassy's social media following, particular on its new Instagram account.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were used as an incentive to encourage participation and contribute to the goal of expanding social media following.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The winner was awarded a branded bag containing U.S. Embassy's branded materials.

*Solicitation of Submissions:* Participants were invited to tag a friend.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* Participation was open to citizens of Montenegro of all ages, who reside in Montenegro. Each user might have entered only one comment to qualify.

*Evaluation of Submissions:* The winner was selected by a raffle.

*Results:* Of the 64 entries submitted by 89 participants between August 23 and August 25, 2018, one prize were awarded to one winner.

*Budget and Resources:* Beyond the prize, this Challenge required no additional financial resources. One staff member worked on the contest organization, execution, and promotion for a total of two work days in FY18.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public's support of the United States, and its values and policies.

*Solution Types:* Other - Tagging a friend

*Plan for Upcoming 2 FYs:* N/A

#### **B.4.15 U.S. Embassy Podgorica: Give Away #3<sup>24</sup>**

*Lead Sponsoring Agency:* U.S. Embassy Podgorica

*Authority:* The United States Information and Education and Exchange Act of 1948, as amended (P.L. 80-402; 22 U.S.C. § 1431 et seq.), a.k.a. the Smith-Mundt Act

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The contest objective was to share symbols of the United States across the social networks and increase the number of followers of the Embassy's Instagram account.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Prizes were used as an incentive to encourage participation and contribute to the goal of expanding social media following.

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<sup>24</sup> The website for the U.S. Embassy Podgorica: Give Away #3 can be viewed at [https://www.instagram.com/p/Bo1il9HBB\\_V/?utm\\_source=ig\\_web\\_copy\\_link](https://www.instagram.com/p/Bo1il9HBB_V/?utm_source=ig_web_copy_link).

*Cash Prize Purses and/or Non-Cash Prize Awards:* A winner was awarded with a branded bag and a pair of U.S. Embassy's branded headphones.

*Solicitation of Submissions:* Participants were invited to tag a friend.

*Solicitation Types:* Social media (e.g., Twitter, Facebook)

*Participation Requirements:* The Challenge was open to citizens of Montenegro of all ages, who reside in Montenegro. Each user was restricted to one entry.

*Evaluation of Submissions:* The winner was selected by a raffle.

*Results:* Of the 36 entries submitted by 50 participants between October 12 and October 17, 2018, one prize were awarded to one winner.

*Budget and Resources:* Beyond the prize, this Challenge required no additional financial resources. One staff member worked on the contest organization, execution, and promotion for a total of two work days in FY18.

*Partnerships:* N/A

*Advancement of Agency Mission:* The contest served to advance the Montenegrin public's support of the United States, and its values and policies.

*Solution Types:* Other - Tagging a friend

*Plan for Upcoming 2 FYs:* N/A

## **B.5 Department of Veterans Affairs (VA)**

### **B.5.1 PseudoVet<sup>25</sup>**

*Lead Sponsoring Agency:* VA

*Authority:* Space Act/Procurement Authority

*Status:* This competition was launched in FY17 and FY18, and was completed in FY18.

*Competition Goals:* Through this challenge, the VA sought the development of PseudoVet 1.0, a publically available, automated patient data fabrication engine that provides a set of active synthetic patients for healthcare software development and application testing. The target was to generate and perform continuous updates of mock provider, clinic, and scheduling entries to a subset of as many as 10,000 fabricated patients representing various clinical diagnoses based on template data.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* The VA was interested in crowd-sourcing the development of PseudoVet for a variety of reasons including the desire to broaden participation by Veterans in the gig economy to solve pressing problems for the VA. In this way we ensured development of a product for Veterans by Veterans. Few mechanisms aside from Prize competitions allow for this type of sourcing from citizens with talent and great ideas.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$95,000 and the total amount awarded was \$167,000. Non-monetary incentives included recognition via TopCoder and VA.

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<sup>25</sup> The website for the PseudoVet can be viewed at <https://www.topcoder.com/PseudoVet>.

*Solicitation of Submissions:* Solicitation was conducted by TopCoder on their platform. This solicitation specifically targeted the TopCoder community of solvers. Although VA pushed other solvers to the TopCoder platform, the agency relied heavily on this vendor's existing community. A more aggressive communications push by VA would have likely led to a greater diversity of solvers beyond just the TopCoder community.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release

*Participation Requirements:* The target solver base for this challenge was those possessing deep development expertise. This challenge was highly complex and narrow in the type of solver skillset that would be required. Because of this, the VA did not limit eligibility exclusively to United States citizens.

*Evaluation of Submissions:* The overall project was split into several individual challenges. Submissions were evaluated on a number of factors including: code quality, performance, requirements met, and documentation.

*Results:* Of the 542 entries submitted between August 8, 2017 and February 1, 2018, 75 prizes were awarded.

*Budget and Resources:* The VA contracted with TopCoder to administer this prize competition and to disburse funds to winners. The total budget was \$500,000. The National Aeronautics and Space Administration (NASA) received an approximate 8% servicing fee through the interagency agreement. The remaining \$442,152 was budgeted as follows over both fiscal years: \$167,000 for prizes and \$277,152 for administration costs to TopCoder. In FY17, the funding total was \$177,152, and 0.25 FTEs were used. In FY18, the funding total was \$267,000, and 0.25 FTEs were used.

*Partnerships:* N/A

*Advancement of Agency Mission:* Electronic health record systems sometimes require realistic patient data in order to facilitate development, testing, and training. While it is possible to obfuscate patient data from production systems, this is risky and involves a large effort to ensure no real patient data are accidentally exposed. The alternative is to secure the environments as production, but this often needlessly complicates development, testing, and training. Pseudovet was developed to create realistic, but fake patient data. This data can be used in non-production environments to facilitate development, testing, and training. If one of these systems were to be exploited or improperly accessed, the data contained would have no impact on real individuals.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.5.2 VA Gun Safety Matters Challenge<sup>26</sup>**

*Lead Sponsoring Agency:* VA

*Authority:* Space Act/Procurement Authority

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* NineSigma, representing the U.S. Department of Veterans Affairs, sought novel and effective approaches that offer enhanced gun safety mechanisms to prevent suicide, injury, and

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<sup>26</sup> The website for the VA Gun Safety Matters Challenge can be viewed at <https://ninesights.ninesigma.com/web/gunsafety-Matters>.

accidents. Specifically, the VA sought cost-effective options for a tangible device or system to be used voluntarily by a veteran or trusted friend or family member. The device or system was required to allow for 100% voluntary control (implementation, suspension, decommissioning) by the veteran. The goal was to provide safe firearm storage within or outside the home. Approaches were sought that addressed emotional distress or crisis, especially for those individuals who may not have a secondary support system such as family members or friends nearby, or who do not have the means for storing their guns safely.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Suicide prevention has been a top priority for years. Resources have been allocated to research, clinical intervention, and innovation. Much is known now about suicide decedents and the fact that the majority of veterans dying by suicide use a gun/firearm to do so needed to be addressed. The VA was interested in trying a new approach of crowd-sourcing to addressing some of the challenges facing the agency.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$60,000. The first place award was \$30,000, the second place award was \$20,000, and the third place award was \$10,000. Non-monetary incentives included access to VA resources, such as subject matter experts, for any potential follow-on design and development; recognition across VA media streams to highlight the winning concepts/design; and a communications push via NineSigma media streams.

*Solicitation of Submissions:* Largely, the internet and social media were used to solicit submissions. The company contracted to administer the challenge, Ninesigma, Inc., also used email to solicit submissions. Overall, the judges anticipated more than the 40 submissions received, so one lesson learned is to request a more robust marketing plan in the future.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Webinar

*Participation Requirements:* Companies of all sizes, consultants, venture capitalists, entrepreneurs, or inventors were invited to respond to this request. Citizens or permanent residents of the US and its territories were eligible to participate. Responses were solicited via the online response form and included the following: (1) A description of the proposed approach, including a discussion of any technical aspects that enable an effective prevention mechanism for the use of a gun in a suicide attempt; (2) Any data or evidence to show or support the effectiveness of the approach in its current capability; (3) Availability of samples, prototypes, or demonstration of proposed technology; (4) Supporting data to show fit to stated criteria for the approach; and (5) Experience of the submitter or submission team in the proposed technology field.

*Evaluation of Submissions:* A team of subject matter experts across the Department of Veterans Affairs was compiled. Among the panel of judges, who reviewed the submissions and rated each based on a series of questions directly from the challenge criteria, were both civilian and veteran employees. In the future, one lesson learned is to provide a timeline to the judges so that they know what to expect. Winners were selected after compiling the scores of all judges.

*Results:* Of the 40 entries submitted between September 19, 2017 and January 8, 2018, three prizes were awarded.

*Budget and Resources:* A total of \$135,000 was spent on this open innovation prize challenge. Three Department of Veterans Affairs subject matter experts worked together along with NASA staff in the entire process. There was no specific FTE allocated to this project, but in both FY17 and FY18 0.1 FTEs were used.

*Partnerships:* N/A

*Advancement of Agency Mission:* Suicide prevention has been among the top priorities for the Department of Veterans Affairs for several years. An average of twenty veterans die by suicide each day. In 2014, roughly 67% of all Veteran deaths by suicide were the result of firearm injuries. Statistics for that year also show that about 65% of all veterans who die by suicide are age 50 or older. Compared to their age-matched civilian peers, both male and female veterans have an increased risk for suicide. Research suggests that most suicidal crises pass within minutes to hours, and that building in time and space between a suicidal impulse and access to a gun reduces suicide deaths. In response, the VA Challenge Team was given the authority to seek solutions through an Innovation Challenge. The Gun Safety Challenge invited proposals for solutions that offer new options for enhanced safe gun storage to prevent suicide, injury, and accidents.

*Solution Types:* Software and apps; Creative (design & multimedia); Ideas; Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* The VA Office of Mental Health and Suicide Prevention may pursue prize competition(s) again although there is no specific plan to at this time.

### **B.5.3 Veterans Online Memorial Challenge**

*Lead Sponsoring Agency:* VA

*Authority:* Space Act/Procurement Authority

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* The online memorial will enable remembering, celebrating, and commemorating those buried at VA national cemeteries. This capability will allow remote participation in the grieving process, and extended celebration of veterans' lives, and can also serve a social memorialization function for students, researchers, and genealogists.

*Goal Types:* Improve government service delivery; Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* The purpose of this website is to provide an enhanced memorialization experience using user/public-driven content. Tapping the public to develop a tool that is both used and curated by the public seemed like a logical approach. Additionally, several of the micro-competition rounds of this challenge specifically engaged veteran solvers. As a result, this form of crowd-sourcing created an incentive structure that enabled meaningful contribution by veterans to develop a solution for veterans and their loved ones.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$197,373 and the total amount awarded was \$169,043. Non-monetary incentives included recognition in the TopCoder newsletter.

*Solicitation of Submissions:* The VA relied primarily on HeroX and TopCoder to generate communications out to their robust solver communities. VA also released a blog post about the challenge and pushed information via the agency's innovation social media streams.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Press release

*Participation Requirements:* For the HeroX ideation challenge, the VA was seeking ideas to help frame the ideal online memorialization platform and experience. Participation and eligibility was according to HeroX platform rules and guidance. For the TopCoder-assisted challenges, the VA also relied on the existing eligibility, rules, and requirements.



*Evaluation of Submissions:* The VA team performed incremental reviews of wireframes, user interfaces, and final prototypes. VA reviewers conducted reviews and selections of winners across the stages of the challenge.

*Results:* Of the 76 entries submitted by 563 participants between September 27, 2017 and June 30, 2018, prizes were awarded to 22 winners.

*Budget and Resources:* The overall budget was \$500,000. Of this, the NASA Center of Excellence for Collaborative Innovation received a service fee of approximately 8% (\$40,000). The amount awarded as prizes to winners was \$169,043. The administration cost for this challenge was \$290,000 to the prize vendor, TopCoder. This prize competition lasted approximately nine months from beginning (planning) to close-out and required approximately 1.25 FTEs over the life-cycle of the challenge.

*Partnerships:* N/A

*Advancement of Agency Mission:* Currently, 77 of VA National Cemetery Administration's (NCA) national cemeteries are closed to burial, and that number will increase over time. NCA, in its commitment to memorialize Veterans in perpetuity, seeks to make available the stories of service and sacrifice of Veterans of all periods.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

## **B.6 Environmental Protection Agency (EPA)**

### **B.6.1 Smart City Air Challenge**

*Lead Sponsoring Agency:* EPA

*Authority:* Clean Air Act Amendments, Section 103

*Status:* This competition was launched in FY17 and is underway in FY18.

*Competition Goals:* EPA needs to be ready to deal with the tremendous amount of data that will be produced from inexpensive air quality sensors. The main purpose of the Challenge is to learn how communities will manage large volumes of environmental data, yield a set of best practices for doing so, and encourage communities to share their practices with each other. A secondary purpose is to help people be more aware of air quality levels in their community.

*Goal Types:* Find and highlight innovative ideas; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* Inexpensive sensors are not ready for regulatory use, but they are developing rapidly. EPA needs to be ready to deal with the tremendous amount of data they will provide. EPA can learn how communities manage the data from collecting it, to storing it, to making it available to the public. The Challenge provided EPA with real-world lessons about data management that could not have been learned using other approaches.

*Cash Prize Purses and/or Non-Cash Prize Awards:* Of a total prize purse of \$100,000, \$80,000 has been awarded.

*Solicitation of Submissions:* EPA used a website to describe the Challenge and posted frequent updates there. EPA reached out to potential applicants using social media, email, and webinars. Social media were particularly effective, especially EPA's social media accounts, which were picked up by influential

parties. Email and listservs were effective at engaging existing communities of interest. Webinars were useful in providing details and answering questions in real time about the challenge itself and about communities that had implemented similar projects. Finally, EPA reached out to journals and encouraged them to describe the Challenge to their readers.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Webinars

*Participation Requirements:* The target audience was communities that could deploy hundreds of air quality sensors. Any group could enter as long as it included a U.S. local governmental party as a partner and all members of the team were over 15 years old. EPA defined community as anything from neighborhoods to counties to tribes. Applicants were not allowed to be a Federal entity or Federal employee acting within the scope of their employment. Employees of EPA, and/or any other individual or entity associated with the development, evaluation, or administration of the Challenge as well as members of such persons' immediate families (spouses, children, siblings, parents), and persons living in the same household as such persons, whether or not related, were not eligible to participate in the Challenge. Constraints included (1) the ability to deploy 250 to 500 sensors in a community; (2) community involvement in purchasing and using the sensors; (3) identification of partners and project sustainability; and (4) transparency in terms of making the data open and describing the data management plans.

*Evaluation of Submissions:* EPA evaluated the submissions based on four criteria: data management, data use, sensor procurement and deployment, and project sustainability. The Challenge used judges who were knowledgeable in the fields of data management and air quality measurement. Judges included subject matter experts from the Office of Air and Radiation, the Office of Environmental Information, and the Office of Research and Development. Submissions were screened to determine if they met the constraints. If so, judges evaluated them based on the four criteria. Judges were trained so they could evaluate the submissions in a similar fashion on a scale of 1 to 10 for each criterion. The fifteen judges were divided into three groups of five judges that had a similar mix of types of expertise. Each group of judges evaluated five submissions. Then all of the judges reviewed the highest rated submissions. Finally the judges conferred and agreed about the best two submissions and the four honorable mentions.

*Results:* Of the 22 entries submitted by over 100 participants between August 30 and October 28, 2016, two winners plus four honorable mentions were awarded.

*Budget and Resources:* Third-party vendors provided assistance with communications materials and planning the judging process. EPA staff tracked their activities and coordinated with the EPA project officer. In FY17, the competition was allocated \$15,000 and 0.2 FTE; in FY18, no additional funding and only 0.05 FTE was used. Cash prize funds were provided in FY16 using a Miscellaneous Obligation Document (MOD). The funds were contributed by EPA's Office of Air and Radiation and EPA's Office of Environmental Information in the amount of \$50,000 each. Such funds can be distributed once the MOD has been approved and do not have restrictions for distribution during a specific fiscal year.

*Partnerships:* N/A

*Advancement of Agency Mission:* The mission of EPA is to protect human health and the environment. The prize competition advanced the mission by learning how communities collect and use air quality data to understand local environmental conditions. This information will be used by individuals or agencies to protect themselves or the environment.

*Solution Types:* Other - Project plans

*Plan for Upcoming 2 FYs:* EPA plans to use what is learned how to help manage data that is collected and used at the local level.

### **B.6.2 Tox Test Challenge Stage II<sup>27</sup>**

*Lead Sponsoring Agency:* EPA

*Authority:* Toxic Substances Control Act (TSCA)

*Status:* This competition was completed in FY17.

*Competition Goals:* Scientists from EPA, the National Center for Advancing Translational Sciences (NCATS), and the National Institute of Environmental Health Sciences' (NIEHS) National Toxicology Program (NTP) are using high speed, automated screening technologies called high-throughput screening (HTS) assays to rapidly test whether thousands of commonly used chemicals may affect human health. However, since current HTS assays do not fully incorporate chemical metabolism, they can miss chemicals that are metabolized to a more toxic form. In January 2016, EPA launched stage I of the Transform Toxicity Testing Challenge along with their partners, NCATS and the NIEHS NTP. The Transform Toxicity Challenge asked teams to develop prototypes that retrofit existing HTS assays to incorporate processes that reflect how chemicals are broken down and metabolized by the body. After selecting semi-finalists in May 2017, the EPA and its partners selected the Transform Toxicity Challenge Stage II winners.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities; Build capacity; Stimulate a market

*Justification for Using Prizes and Challenges:* The prize/challenge approach enabled the agency to reach scientists from multiple disciplines that may offer new and creative strategies to address the problem. The prize approach provided the agency with the opportunity to review multiple solutions and only make the award if one of the solutions met the criteria.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$500,000, distributed in \$100,000 awards to five winners. Non-monetary incentives included rigorous prototype testing, evaluation, and feedback on technology performance. Participants also received recognition and publicity and took part in peer networking.

*Solicitation of Submissions:* Solicitation strategies for the Challenge included tweets from the EPA twitter account, emails to relevant listservs, and official EPA press releases. Partner organizations also promoted the Challenge using similar strategies.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* A panel of five judges was convened to evaluate the prototypes against the requirements identified in the challenge. Rigorous testing was conducted. The judging panel made recommendations to EPA management who made the final selection.

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<sup>27</sup> The website for the Tox Test Challenge Stage II can be viewed at <https://www.challenge.gov/challenge/transform-tox-testing-challenge-stage-2/>.

*Results:* Of the nine entries submitted by nine participants between January 30 and August 31, 2017 for phase two of this Challenge, five prizes were awarded to five winners.

*Budget and Resources:* Resources from EPA and partner organizations included scientists and technical staff as well as communication and administrative support. Contractor support was used to develop and host a website and provide communication support. In FY17, the challenge budget was \$500,000 and required less than one FTE.

*Partnerships:* Federal partners included the NIH NCATS, and NIH's NTP within the NIEHS.

*Advancement of Agency Mission:* EPA's mission is to protect human health and to safeguard the natural environment. This Challenge helps to advance the agency's mission by accelerating the market and incentivizing the development of technology and algorithms that will help to more accurately and effectively screen chemicals for toxicity.

*Solution Types:* Technology demonstration and hardware; Scientific

*Plan for Upcoming 2 FYs:* Plans for next steps are in discussion.

### **B.6.3 Wildland Fire Sensors Challenge<sup>28</sup>**

*Lead Sponsoring Agency:* EPA

*Authority:* Clean Air Act, Section 103, 42 USC 7403

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* This Challenge addresses the need to advance air measurement technology used in wildland fire situations to provide more accurate information about smoke levels to state and local organizations so that citizens and first responders can minimize their exposure. The technical goal was to make air measurement technology in wildland fire situations easier to deploy, suitable for use in high concentration events, durable to withstand difficult field conditions, and able to report data continuously and wirelessly. Desired measurements were to include fine particles (PM<sub>2.5</sub>), ozone, carbon monoxide, and carbon dioxide.

*Goal Types:* Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* A challenge/prize approach enabled us to reach technology developers from around the world and from disciplines who normally would not be focused on EPA research opportunities but could bring creative new approaches to the problem. In addition, the prize approach would create more excitement and visibility and be less bureaucratic than traditional contracting or grant mechanisms. Involvement of six Federal agencies also signaled that this is a priority for technology development. Using technologies that are already in development, a challenge had the potential to provide a wide range of solutions more cost effectively than was likely in-house or through a contract. A prize approach also provided an easy way to collaborate with multiple Federal agencies, now and in the future. Lastly, a competition provided a reasonably low-risk process because the agency only had to award prize funds if the challenge succeeded.

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<sup>28</sup> The website for the Wildland Fire Sensors Challenge can be viewed at <https://www.challenge.gov/challenge/wildland-fire-sensors-challenge/> & <https://www.epa.gov/air-research/winners-wildland-fire-sensors-challenge-develop-air-monitoring-system-prototypes>.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$60,000, with \$35,000 awarded to the first prize winner and \$25,000 awarded to the second prize winner. Non-monetary incentives included rigorous testing, evaluation and feedback on technology performance. Winners were announced at a conference where they could receive recognition from peers, the public, and media.

*Solicitation of Submissions:* A contractor was retained to share the Challenge with the international solver community. The Challenge announcement was posted on Challenge.gov. Federal partners amplified the announcement through social media, webinars, newsletters, list serves, flyers, announcements at professional meetings, etc.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Informational webinars

*Participation Requirements:* The target solver audience included engineers, technology developers, sensor developers, environmental scientists, computer scientists, telemetry experts, etc.

*Evaluation of Submissions:* For the first stage, EPA technical staff reviewed the written submissions and identified those that addressed the challenge criteria. These were asked to submit prototypes. Not all did so. To evaluate the submissions that were received, EPA technical staff worked with technical colleagues in other agencies to agree on testing procedures. Rigorous technology testing was carried out at EPA and U.S. Forest Service laboratories. Using the agreed-upon criteria, an interagency judging panel, with participation from a non-Federal partner, Tall Timbers Research Station, reviewed the results of the testing, met by conference call, received a briefing on the results and evaluated the data based on the requirements in the Challenge. They made recommendations for challenge winners and an honorable mention. Finally, senior managers within EPA's Office of Research and Development reviewed the recommendations and made the final decisions.

*Results:* Twenty-seven preliminary submissions were received by November 22, 2017, and ten prototypes by January 5, 2018. Two prizes and one honorable mention prizes were awarded.

*Budget and Resources:* In FY17, \$16,000 was provided for contractor support for communication and outreach and \$25,000 was allocated for the award. In FY18, \$35,000 was spent for the award. Less than one FTE was used in FY17, but 1.5 FTE was needed in FY18. Communications and administrative support involved preparing the communications plan, written materials, FAQs, press release, and social media for both the launch and announcement of the winners as well as development of a video to describe the challenge and the winners. Federal partners collaborated on the challenge design, technical review, testing, and judging involved review of written submissions, conducting laboratory testing of prototypes, and a multi-agency panel that met to review all of the results and develop recommendations for awards.

*Partnerships:* Federal Partners included the U.S. Forest Service, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, Centers for Disease Control and Prevention, and National Park Service. The non-Federal partner was Tall Timbers Research Station. Partners provided technical expertise in challenge development and judging and monetary support for laboratory testing. In-kind support was provided for use of testing facilities and staff time for testing, marketing, outreach, and communications. The estimated value of partner contributions amounted to \$30,000 in direct contributions and \$30,000 in in-kind support.

*Advancement of Agency Mission:* EPA's mission is to protect human health and to safeguard the natural environment. Wildland fires are increasing in intensity and duration. Communities are exposed to

dangerous levels of air pollutants from smoke for weeks at a time. The very young, the elderly, those with respiratory or cardiovascular health conditions are particularly at risk. To enable communities to reduce dangerous smoke exposures, they need near real-time information about smoke conditions. With information about where smoke and pollutant concentrations are highest, people can plan their daily activities to avoid the worst exposures and protect their health as much as possible. This Challenge helped advance EPA's mission to protect public health by developing the technologies needed to address this new, longer lasting environmental health threat.

*Solution Types:* Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* N/A

## **B.7 National Aeronautics and Space Administration (NASA)**

### **B.7.1 3D-Printed Habitat Challenge (Phases 2&3)<sup>29</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20144

*Status:* This competition was launched in FY17 and is currently underway in FY18.

*Competition Goals:* The 3D-Printed Habitat Challenge seeks to develop housing solutions for extended duration missions on planetary surfaces (particularly on Mars) using advanced additive construction technology. This technology will use indigenous materials, mission recyclables, and the capabilities of 3D-printing to achieve efficient and sustainable building materials and construction. These developments will be applicable both to the fulfillment of the Mars mission and to the creation of cheaper and more sustainable housing solutions on Earth.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* 3D-printing technology is maturing quickly, and there are inventors and entrepreneurs who are investing money to develop systems that can construct large structures the size of a house for potential profit or service in an emergency situation. The purpose of this competition is to see how NASA can push the technology and harness it for space exploration. A prize competition brings in experts from outside the space industry and ideas that are outside-the-box to engage the public in space exploration activities.

*Cash Prize Purses and/or Non-Cash Prize Awards:* In FY17, the total prize purse offered was \$1,100,000 and the total amount awarded was \$701,000. For Phase 2 level 1, \$100,000 was available, and a total of \$100,000 was awarded to two teams; for Phase 2 level 2, \$500,000 was available, and a total of \$201,000 was awarded to four teams; and for Phase 2 level 3, \$500,000 was available, and a total of \$400,000 was awarded to two teams. In FY18, \$100,000 was available for Phase 3 level 1 and a total of \$100,000 was awarded to five teams. For Phase 3 level 2, \$400,000 is available, and a total of \$120,000 was awarded to three teams. Phase 3 continues into FY19 with additional prize purse available.

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<sup>29</sup> The website for the 3D-Printed Habitat Challenge (Phases 2&3) can be viewed at <https://www.bradley.edu/challenge/>.



*Solicitation of Submissions:* Public announcement of the Challenge was made on the FedBizOps website. For Phase 2, the Challenge was announced at Maker Faire in New York. Phase 3 was opened at the Building Information Modeling (BIM) Forum Conference in Dallas, Texas, in November 2017. Centennial Challenges has exhibited the Challenge at the American Concrete Institute (ACI) Conventions in Detroit and Los Angeles and also at the World of Concrete in Dallas. A website that is produced by Bradley University specifically for administering the Challenge is promoted in many correspondences and public press releases. The NASA Centennial Challenges Program and NASA Solve social media accounts (Facebook, Twitter, and Instagram) are used to bring attention to activities or videos to attract competitors and for general awareness.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* The target solver audience is inventors, entrepreneurs, designers, architects, makers, and the construction industry. All U.S. citizens and foreign nationals are welcome to participate in the Challenge except for four countries currently on the designated country list that support terrorism. Only U.S. citizens are eligible to win prize money.

*Evaluation of Submissions:* A lead judge was selected from one of the sponsors to bring expertise from the construction industry. In selecting judges, experts with a good mix of experience with both space and terrestrial projects were sought. The submissions were evaluated strictly according to rules and rubrics established prior to the competition's start. Wherever possible, objective guidelines were established to help judges make evaluations.

*Results:* For Phase 2, entries from seven teams were received for level 1, seven for level 2, and three for level 3 by October 06, 2017; total participation for Phase 2 was ~100 people. Two prizes were awarded for level 1 on March 31, 2017; six prizes were awarded for level 2 on May 31, 2017; and two prizes were awarded for level 3 on August 25, 2017. For Phase 3, which will conclude in May 2019, entries from 18 teams were received for level 1 and three for level 2 by November 07, 2017; total participation was 178 people. Five prizes were awarded for level 1 on May 16, 2018 and three prizes were awarded for level 2 on July 11, 2018.

*Budget and Resources:* Funding for the 3D-Printed Habitat Challenge in both FY17 and FY18 was \$319,000. In FY17 and FY18, 1.4 FTEs<sup>30</sup> were needed for the competition to provide subject matter experts from NASA who participated in the development of the rules, judging, and guidance of the allied organization (Bradley University) to direct the competition toward the correct technology that can make an impact for space exploration. Procurement and travel funds were utilized to help promote the competition to the communities that were most capable of advancing the technology and to conduct workshops to plan for the Challenge and invigorate challenge teams.

*Partnerships:* Bradley University is the allied organization conducting the 3D-Printed Habitat Challenge with support from sponsors Caterpillar, Bechtel, and Brick & Mortar Ventures. Bradley University executes the competition and ensures that the outcomes meet the overall goals of NASA and the Centennial Challenges Program. Caterpillar, as a major sponsor of the Challenge, facilitates all coordination activities of the Challenge and provides facilities for the major head-to-head competition at the Edwards Facility near Peoria, Illinois. Construction Engineering Research Lab (CERL) of the U.S. Army Corps of Engineers has provided expert guidance under a Memorandum of Agreement for rules

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<sup>30</sup> 1.2 FTEs were from the Marshall Space Flight Center and 0.2 FTEs were from the Kennedy Space Center.

development and judging. The total value of Bradley University & sponsors (Caterpillar, Bechtel, and Brick & Mortar Ventures) contribution for 2017 was \$747,000 and approximately \$1,000,000 for 2018.

*Advancement of Agency Mission:* Advancements in 3D-Printing (i.e., additive manufacturing) will provide benefits to future NASA missions and may enable new mission scenarios. Using indigenous and recyclable material on a lunar or Mars mission will reduce overall payload requirements and reduce the risk for astronauts, making space exploration missions possible.

*Solution Types:* Creative (design & multimedia); Ideas; Technology demonstration and hardware; Scientific; Other - Space Exploration

*Plan for Upcoming 2 FYs:* The 3D-Printed Habitat Challenge Phase 3 is planned to run thru May 2019. The final level of the competition will be the autonomous 1:3 Sub-Scale Habitat at the Caterpillar Edwards Facility where eight teams will be invited to compete. NASA will evaluate whether to open a Phase 4 that would involve construction of the full-scale habitat.

### **B.7.2 Breakthrough, Innovative, and Game-Changing (BIG) Idea Challenge<sup>31</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* The BIG Idea Challenge provides for the free flow of information, ideas, and concepts between NASA's Game Changing Development (GCD) program and the university research, education, and industry communities, and achieves the following secondary objectives: (1) opportunities to inexpensively tap university talent on important challenges facing GCD with potential to more quickly advance technology readiness levels; (2) potentially introduce concepts into future NASA research and program planning; (3) provide opportunity for NASA GCD engineers to interact with faculty and students as well as explore workforce pipeline opportunities; (4) provide a real-world challenge for the aerospace industry and other stakeholders that results in the development of a highly talented future workforce pool; (5) demonstrate and leverage university-NASA GCD-industry cooperation; and, (6) provide students with the opportunity to develop highly transferable skills in collaboration, communication, and critical thinking, as well as the opportunity to engage in teamwork activities, which are relevant and highly desired skills for future NASA GCDP employees.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Engage new people and communities; Build capacity; Other - Educational outreach and engagement

*Justification for Using Prizes and Challenges:* This initiative uses a challenge/competition format but does not award monetary prizes. For a STEM education outreach effort, this format is useful because this initiative is designed to align with academic studies in multi-disciplines related to NASA's mission and to foster exciting innovation and sharing of ideas from the best and the brightest students in the United States. By design, this program ties in with academic calendars and lends itself to become focal projects in senior capstone courses, student clubs, and graduate student studies within university environments.

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<sup>31</sup> The website for the Breakthrough, Innovative, and Game-Changing (BIG) Idea Challenge can be viewed at <http://bigidea.nianet.org>.

*Cash Prize Purses and/or Non-Cash Prize Awards:* No prize money is offered as part of this Challenge. Non-monetary incentives include opportunity to work on real-world, NASA-based research; expert feedback from judges; public recognition; tour of a NASA facility; opportunity to present in front of subject-matter expert judges; NASA internship opportunities offered to winning team to further advance promising designs.

*Solicitation of Submissions:* The FY17 and FY18 BIG Idea Challenges were promoted using a robust email campaign targeting ~3,000 faculty with specified interest in aerospace engineering. Emails targeted directly to university professors have proven to be very effective, and we see a significant correlation between website visits and email distributions. The Challenge was also announced through NASA's Education Express and Science Wow! to ~31,000 subscribers and ~90,000 NASA Education Twitter Followers. The Challenge was posted on the NASA Solve website and on the Institute for Broadening Participation's Pathways to Science page. Additionally, an informational flyer was created and distributed to the National Institute of Aerospace's (NIA) network of previous participants in other challenges to explain the challenge details and constraints. Press releases were issued by NASA for both the FY17 and FY18 Challenges. A website for the challenge is maintained and updated for each year's challenge.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release

*Participation Requirements:* The BIG Idea Challenge is open to teams of three to five undergraduate and graduate students studying in fields applicable to human space exploration (i.e., aerospace, electrical, and mechanical engineering; and life, physical, and computer sciences). Eligibility is limited to students from accredited universities in the United States. Foreign universities are not eligible to participate in the BIG Idea Challenge.

*Evaluation of Submissions:* Participating teams for the FY17 and FY18 BIG Idea Challenges were selected as finalists by a panel of judges using an evaluation rubric. Judges for the FY17 challenge were all from NASA while the FY18 challenge was a hybrid of government and external (industry) reviewers. In FY17, the criteria were: (1) feasibility of proposed concept or idea, including low system mass, design simplicity, and ground testability (40 percent); (2) innovative, unique and/or synergistic advanced concepts, modularity, and concept of operations for robotic assembly, module deployment and replacement, and extensibility (30 percent); (3) systems analysis of requirements, including identification of challenges and issues including Technical Readiness Level of mission-enabling technologies (20 percent); (4) evidence of credible and implementable project plan (5 percent); and (5) concept is supported by original engineering and analysis (5 percent). In FY18, the criteria were: (1) feasibility of proposed design, including low system mass, design simplicity, Mars environmental resiliency, and Earth ground testability (40 percent); (2) innovation of proposed ConOps for unattended installation/deployment and sustained, long-term power generation in the Martian environment (30 percent); (3) adequacy of proposed engineering analysis to support structural design and power output predictions (20 percent); (4) ability to fabricate an affordable proof-of-concept experimental prototype that addresses the key design and operational challenges (10 percent)

*Results:* In FY17, 29 submissions were received from five teams. In FY18, 16 submissions were received from five teams. Winners were announced on November 30, 2016 and November 30, 2017, respectively.

*Budget and Resources:* The administrative cost for the BIG Idea Challenge activity was \$110,980 in FY17 and \$125,316 in FY18. These costs were for NIA program management and other direct costs including but not limited to university stipends provided to participating universities through their respective Office of Sponsored Programs to enable the teams to participate in the culminating NASA Forum/Design Review. Additional costs for FY17 included \$80,000 for NASA internships awarded through the Challenge

(\$70,000 for internships and \$10,000 for materials to build BIG Idea prototypes). Additional costs for FY18 included \$70,000 for NASA internships (\$60,000 for internships and \$10,000 for materials to build BIG idea prototypes).

*Partnerships:* Through a cooperative agreement with NASA Langley Research Center, the NIA provides day-to-day administration of the BIG Idea Challenge for NASA. Their certified program managers, program coordinators, and meeting planners provided a robust marketing plan, extensive contact lists, in-kind challenge website hosting, graphics support, submission management, and event planning for the culminating Forum. Involving industry (Space Systems Loral) on the judging panel added value to the competition and opened additional avenues for future internships/jobs for the students.

*Advancement of Agency Mission:* The BIG Idea Challenge engages the university community with NASA's GCD program efforts to rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future NASA missions. It links academic institutes with the NASA Space Technology Mission Directorate, in which the GCD program resides, and multidisciplinary university teams are asked to provide innovative solutions to current GCD projects. Each year, the program theme is developed by one of GCD's Principal Technologists (PT) and is fashioned in a way that allows the academic community to be an active, productive, and contributing part of the PT's work at NASA.

*Solution Types:* Ideas; Analytics, visualizations, algorithms; Scientific

*Plan for Upcoming 2 FYs:* The FY19 BIG Idea theme currently seeks ideas from the academic community for the design and operation of a Mars Greenhouse that will complement the Mars Ice Home. Supplying reliable and effective food production systems on Mars will reduce the need to transport food from Earth and also promote crew health on long surface missions. A design review of the top five finalist teams will be conducted during the BIG Idea Forum in April 2019 at NASA Langley Research Center and features a robust panel of judges from NASA and industry.

### **B.7.3 CineSpace Film Competition<sup>32</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This FY17 competition is complete, and the FY18 competition is underway.

*Competition Goals:* The International Space Station (ISS) External Integration Office created a unique film competition inspired by the past, current, and future efforts of the United States and its global partners to expand human knowledge through the exploration of space. NASA and the Houston Cinema Arts Society (HCAS) offered filmmakers around the world a chance to share their works inspired by and using actual NASA imagery. The films of the finalists and winners were screened at the Houston Cinema Arts Festival in November of 2017 and 2018.

*Goal Types:* Inform and educate the public

*Justification for Using Prizes and Challenges:* Crowd-based challenges using a prize have been proven extremely effective for film development for use by NASA.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$26,000. Non-monetary incentives included showing of the winning films during the HCAS Film Festival in Houston.

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<sup>32</sup> The website for the CineSpace Film Competition can be viewed at <https://tongal.com/l/55fz9wra0awp>.

*Solicitation of Submissions:* Tongal, the NASA Tournament Lab (NTL) vendor managing the Challenge, solicited submissions from its existing member community and the public through blog features, emails, and social media campaigns. Tongal promoted the Challenge heavily at the start and during the final month while maintaining consistent awareness throughout the campaign. Tongal reached out to its community and other film communities by posting to relevant websites and newsletter blasts.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Outreach by the vendor to existing platform members

*Participation Requirements:* Submissions from any restricted country list were not eligible to receive the award.

*Evaluation of Submissions:* Judging was completed by the NASA/HCAS team.

*Results:* In FY17, 689 entries were submitted by 646 participants. Five winners were announced November 11, 2017. In FY18, 242 entries were submitted by 222 participants. Five winners were announced November 13, 2018.

*Budget and Resources:* The full challenge budget (\$56,000 in FY17 and \$50,000 in FY18) was funded by the NASA ISS External Integration Office. The funds were disbursed to the vendor via the NASA Open Innovation Services contract. The vendor conducted the Challenge and awarded the prize money. Funds included prizes, vendor project management resources, and platform fees. NASA FTE/work year equivalent (WYE) resources (0.01 FTE and 0.02 WYE in both FY17 and FY18) supported challenge coordination activities including development of the Task Order Request for Proposal and award processes as well as oversight of challenge execution .

*Partnerships:* The HCAS participated in the evaluation of the submissions for selection as winners and provided the venue for showcasing the winning films.

*Advancement of Agency Mission:* This film competition supports NASA’s mission to expand human knowledge through the exploration of space as well as highlighting the significant amount of imagery available to the public from NASA’s repository.

*Solution Types:* Creative (design & multimedia)

*Plan for Upcoming 2 FYs:* There is a plan to conduct this challenge for the next fiscal year.

#### **B.7.4 Cube Quest Challenge<sup>33</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20144

*Status:* This competition was underway in both FY17 and FY18, but has not concluded.

*Competition Goals:* NASA’s Space Technology Mission Directorate (STMD)/Centennial Challenges program administers the Cube Quest Challenge to incentivize the advancement of CubeSat and nanosatellite capabilities to stimulate the small spacecraft market needed for conducting unique and more affordable science and explorations missions in deep space. The goal of the Challenge is to develop CubeSat technologies and missions with advanced capabilities needed for deep space

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<sup>33</sup> The website for the Cube Quest Challenge can be viewed at <https://www.nasa.gov/cubequest/details>.



operations and then to demonstrate their performance at the Moon (“Lunar Derby”) or beyond (“Deep Space Derby”).

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* The objective of the Challenge is to reward citizen inventors who successfully advance the CubeSat technologies needed for operations at the Moon and beyond, particularly long-distance communications, navigation beyond earth, and long-term survival. Our goal is to advance technologies and private industry for spacecraft whose small size and light weight will help NASA to explore and conduct science in deep space in novel, more affordable ways.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$5,000,000. A set of eight challenge goals were set for the in-space competition that takes place after a competitor achieves lunar orbit (“Lunar Derby”) or a range of four million kilometers from Earth (“Deep Space Derby”). The total of all eight challenge goals comprises a prize purse of \$4.5M. During a series of Ground Tournaments (GTs), \$460,000 was awarded (GT-1: five prizes of \$20,000 each were awarded in September 2015; GT-2: five prizes of \$30,000 each were awarded in March 2016; GT-3: five prizes of \$30,000 each were awarded in October 2016; and GT-4: three prizes of \$20,000 each were awarded in June 2017). As a non-monetary incentive, each of the three winners of GT-4 were offered the opportunity to launch a 6U CubeSat via the Space Launch System as a secondary payload on NASA’s EM-1 mission.

*Solicitation of Submissions:* Public announcement of the Challenge was announced in FedBizOps and to a small satellite mailing list maintained by the STMD Small Spacecraft Technology Program. An organizing summit, open public event was conducted with the purpose of announcing the Challenge and disseminating rules and answering questions. It was attended by more than 120 members of the interested public.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Live video streaming

*Participation Requirements:* The team leader had to be (i) a citizen or permanent resident of the United States, or (ii) an entity that is incorporated in and maintains a primary place of business in the United States. A competitor team was comprised of one or more team members. A team member could be an individual or an entity. If a team member was an individual, the individual had to be a citizen or permanent resident of the United States. If the team member was an entity, the entity must be a U.S. entity (i.e., incorporated in and maintains a primary place of business in the United States). Foreign nationals could only participate as either owners, employees, or students of an otherwise eligible U.S. entity. No team member could be a citizen of a country on the NASA Export Control Program list of designated countries. A Federal entity or Federal employee could not participate in the Challenge if acting within the scope of their employment. An entity employee, or entity, contracted by the US. Government and physically located at a federally owned facility could not participate if acting within the scope of the contract.

*Evaluation of Submissions:* A panel of five judges was convened for each of the GT events. The judging panel comprised of three NASA subject matter experts, one expert from academia, and one expert retired from small spacecraft industry. Prior to each GT, judging instructions were updated and re-published. The goals and standards were raised as expectations for CubeSat design maturity increased at each successive milestone. Judges used a written set of detailed instructions for evaluating and scoring submittals according to a scaling system specified in the instructions. The scoring instructions



were publicly available to competitors before each judged event. Judges also provided written, post-judging feedback summaries to teams after each judged event, for use by the teams to consider improvements before the next event.

*Results:* Thirteen teams submitted 13 entries for GT-1, ten entries for GT-2, seven entries for GT-3, and five entries for GT-4.

*Budget and Resources:* The Challenge is part of NASA’s Centennial Challenges Program, which is part of NASA’s STMD. Challenge development, oversight, and prize purse were funded by NASA’s STMD. The FY17 FTE and procurement budget (\$942,000 and three FTEs) was used for administration of the Challenge, enforcement of rules, and execution of GT-3 and GT-4. It included a prize award event at Ames Research Center including rental of facility for GT-4. The FY18 FTE and procurement budget (\$761,000 and three FTEs) was used for administration of the Challenge, enforcement and updates of the rules, and preparations for the upcoming in-space competition scheduled for FY20-FY21.

*Partnerships:* N/A

*Advancement of Agency Mission:* Advancements in small spacecraft capabilities will provide benefits to future missions and may enable new mission scenarios, including future investigations of the Moon and near-Earth asteroids. If capabilities associated with larger spacecraft can be achieved in the smaller platform of CubeSats, a dramatic improvement in the affordability of space missions will result, greatly increasing science and research possibilities.

*Solution Types:* Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* The Challenge continues in FY19 and FY20 with the in-space competition phase. In FY20, the top three CubeSat designs are scheduled to launch on NASA’s EM-1 mission. From the Moon or beyond, the CubeSat operating teams will compete for prizes by accomplishing any of a set of eight in-space competition goals. Other teams may choose to compete by obtaining their own launch to reach the Moon or beyond to compete in the in-space competition. The competition will end exactly 365 days after EM-1 launch (regardless of whether or when a team may have obtained their own launch), and prizes will be awarded after all accomplishments are judged at that time.

### **B.7.5 Future Engineers 3D Design Challenges<sup>34</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20113(e)

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* Through a series of Future Engineers 3D Space Challenges, students focused on solving real-world space exploration problems and submitted model designs for 3D printable objects for use by astronauts in space. In the Mars Medical Challenge, students were challenged to design an object that could be used by an astronaut to maintain physical health on a 3-year mission to Mars. Students submitted a digital 3D model intended to be 3D printed and used for a wide range of medical needs including diagnostic, preventative, first-aid, emergency, surgical, and/or dental purposes. In the Two for the Crew Challenge, students were challenged to create a tool that combines the functions of two objects currently used by crew aboard the International Space Station. Students invented multi-

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<sup>34</sup> The website for the Future Engineers 3D Design Challenges can be viewed at <https://www.futureengineers.org/>.

use tools and customized equipment, including solutions used for maintenance, medical, trash management, and securing and storing items in microgravity.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Inform and educate the public

*Justification for Using Prizes and Challenges:* A challenge run through an agreement made with the American Society of Mechanical Engineers under the National Aeronautics and Space Act (a Space Act Agreement) provided NASA the opportunity to engage in a no-cost partnership arrangement to obtain solutions and to engage a broad range of student ideas from ages 5-19, thereby gaining out-of-discipline perspectives and a broad spectrum of possible solutions to NASA problems.

*Cash Prize Purses and/or Non-Cash Prize Awards:* No cash prizes were offered. For the Two for the Crew Challenge, the teen winner had their design printed on the Made In Space 3D printer on the International Space Station (ISS) and got a trip to Washington D.C. for a VIP space experience, including participating in an ISS Downlink at the Smithsonian Air and Space Museum. The junior winner was awarded a trip to Washington D.C. for a VIP space experience, including participating in an ISS Downlink at the Smithsonian Air and Space Museum. Four finalists in each age group were awarded a Makerbot Replicator Mini+ donated to their school, library, or education organization. Sixteen semi-finalists in each age group were awarded a 3D printing-in-space prize pack. For the Mars Medical Challenge, the winner in each age group was awarded a trip to Houston, Texas and a tour of the NASA Johnson Space Center to learn about human exploration, space medicine, and the Journey to Mars. Four finalists in each age group were awarded a MakerBot Replicator Mini+ printer donated to their school, library or education organizations and a set of Giant Microbes plush cells. Sixteen semi-finalists in each age group were awarded a Mars-themed prize pack

*Solicitation of Submissions:* The challenges were launched on the Future Engineers platform, an online education platform that hosts national innovation challenge for K-12 students. They have been extremely successful in engaging students and, as a result of the collaboration, received a Small Business Innovation Research award from the Department of Education to expand the platform to the in-school setting.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* The 3D Space Challenge was open to eligible persons between the ages of 5-19 residing in the United States.

*Evaluation of Submissions:* The competition is comprised of an open entry submission phase with two categories: junior engineers (ages 5-12) and teen engineers (ages 13-19). Submissions were initially judged to determine ten semifinalists and then culminated in a second round of judging to select four finalists followed by an interview round to select one winner in each age group. Submissions were judged using the following criteria: innovation and creativity of the solution (40%); quality of the 3D modeled geometry, and compliance with design guidelines (20%); usefulness of the design in a space environment (20%); ability to communicate the design through the text description, and finalist interview (20%).

*Results:* The Mars Medical Challenge received 745 entries. A total of thirty prizes including semi-finalists, finalists, and winners were awarded. The Two for the Crew Challenge received 565 entries. A total of thirty-one prizes including semi-finalists, finalists, and winners were awarded.

*Budget and Resources:* NASA resources in both FY17 and FY18 were 0.25 FTE each.

*Partnerships:* The Challenge was conducted through a nonreimbursable agreement under the National Aeronautics and Space Act (the Space Act Agreement) with the American Society of Mechanical Engineers Foundation, which implemented the Challenge through the Future Engineers platform. The value of partner contributions was \$400,000 in each fiscal year.

*Advancement of Agency Mission:* These challenges provide an opportunity for students to focus on real-world space exploration challenges and prepare our next generation of space explorers who will take the first step on Mars. The challenges also provide NASA with an opportunity to tap into the creativity and innovation of a new pool of solvers to obtain potential new designs for future space missions.

*Solution Types:* Creative (design & multimedia); Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* Continuation of challenges through a no-cost contract.

### **B.7.6 High Performance Fast Computing Architecture Challenge**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was cancelled in FY17.

*Competition Goals:* NASA's Aeronautics Research Mission Directorate (ARMD) sought an architectural analysis of the current processing configuration for the FUN3D software with recommendations on improving performance.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* The agency firmly supports the use of prize challenges to solve difficult problems and engage a broader community in agency activities.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$35,000. The total amount awarded was \$0 because the Challenge was cancelled.

*Solicitation of Submissions:* As with all NASA Tournament Lab challenges, NASA worked with its vendor, Topcoder, to mobilize an international community specific to the Challenge, based on the curated community already existing for the particular vendor platform. For this Challenge, NASA chose to release its own web feature on the nasa.gov public website. Cancellation of the Challenge was also posted as a web feature.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - NASA web feature

*Participation Requirements:* Participation was limited to U.S. citizens only.

*Evaluation of Submissions:* N/A

*Results:* More than 1,800 people applied to receive a copy of the code base from both the ideation and architecture challenges. A total of 335 entries were submitted between May 03, 2017 and September 30, 2017, when the Challenge was cancelled.

*Budget and Resources:* The full challenge budget was funded by NASA's ARMD. The funds were awarded to the crowdsourcing vendor TopCoder via the NASA Open Innovation Services (NOIS) contract. The awarded vendor received \$107,000 of the originally awarded \$141,500 for their effort in challenge design and launch prior to cancellation. NASA FTE/WYE resources (0.8 FTE and 0.1 WYE) supported the Challenge coordination activities needed prior to and up to the release of a NOIS task order as well as significant efforts involved in cancelling the Challenge.

*Partnerships:* N/A

*Advancement of Agency Mission:* This challenge was intended to support NASA's aims to improve the performance and efficiency of aeronautical systems. NASA was seeking ideas for innovative architecture enhancements for the NASA FUN3D software while providing readily achievable benefits to the current ARMD program with minimal additional capital investment. However, the extremely high number of applicants, more than 1,800, coupled with the difficulty in satisfying the extensive vetting requirements to control the public distribution of the software made it unlikely the Challenge owner would achieve the Challenge's original objectives in a timely manner. NASA looked at several alternatives to keep the challenge design intact like significantly extending the challenge performance period, and offering a much smaller portion of the code. None were considered viable options.

*Solution Types:* Software and apps; Ideas

*Plan for Upcoming 2 FYs:* N/A

### **B.7.7 High Performance Fast Computing Ideation Challenge**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was cancelled in FY17.

*Competition Goals:* NASA's Aeronautics Research Mission Directorate (ARMD) sought ideas to improve the performance of its existing FUN3D Computational Fluid Dynamics software to maximize innovation and decrease software execution time while providing readily achievable benefits to the current ARMD program.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* The agency firmly supports the use of prize challenges to solve difficult problems and engage a broader community in agency activities.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$20,000. The total amount awarded was \$0 because the Challenge was cancelled.

*Solicitation of Submissions:* As with all NASA Tournament Lab challenges, NASA worked with its vendor, HeroX, to mobilize an international community specific to the Challenge, based on the curated community already existing for the particular vendor platform. For this Challenge, NASA chose to release its own web feature about the Challenge on the nasa.gov public website. Cancellation of the Challenge was also posted as a web feature.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - NASA web feature

*Participation Requirements:* Participation was limited to U.S. citizens only.

*Evaluation of Submissions:* N/A

*Results:* More than 1,800 people applied to receive a copy of the code base from both the ideation and architecture challenges. A total of 4,808 entries were submitted between May 03, 2017 and June 16, 2017, when the Challenge was canceled.

*Budget and Resources:* The full challenge budget was funded by NASA's ARMD. The funds were awarded to the crowdsourcing vendor HeroX via the NASA Open Innovation Services (NOIS) contract. The vendor received \$26,600 of the originally awarded \$49,500 for their effort in challenge design and launch prior

to cancelation. NASA FTE/WYE resources (0.8 FTE and 0.1 WYE) supported the challenge coordination activities needed prior to and up to the release of a NOIS task order as well as significant efforts involved in cancelling the Challenge.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge was intended to support NASA's aims to improve the performance and efficiency of aeronautical systems. However, the extremely high number of applicants, more than 1,800, coupled with the difficulty in satisfying the extensive vetting requirements to control the public distribution of the software made it unlikely the challenge owner would achieve the challenge's original objectives in a timely manner. NASA looked at several alternatives to keep the challenge design intact like significantly extending the challenge performance period, and offering a much smaller portion of the code. None were considered viable options.

*Solution Types:* Software and apps; Ideas

*Plan for Upcoming 2 FYs:* N/A

### **B.7.8 REALM User Interface Challenge<sup>35</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in FY17.

*Competition Goals:* Radio-Frequency Identification (RFID)-Enabled Autonomous Logistics Management (REALM) is a system onboard the International Space Station (ISS) that uses RFID tags to locate and track various tools and inventory. The goal of this Challenge was to develop a software user interface for a complex event processing system using REALM to locate, track, and manage ISS inventory and tools as they are moved around the ISS. The solution for this Challenge was required to address all system user scenarios for the REALM system and the user application requirements.

*Goal Types:* Solve a specific problem

*Justification for Using Prizes and Challenges:* NASA's Advanced Exploration Systems Logistics Reduction/RFID Auto Logistics Management Project needed a novel and cost-effective approach to harvest user interface designs that ensure a positive user experience for the ISS astronauts and mission controllers. The prize approach provided access to myriad solutions and met cost and schedule constraints.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$11,025. Topcoder, the vendor, also offered participants the chance to gain Topcoder points toward attendance at its annual TopCoder Open event. The Open is Topcoder's annual online and onsite tournament to celebrate and reward their community.

*Solicitation of Submissions:* As with all NASA Tournament Lab challenges, NASA works with its vendor to mobilize an international community specific to the Challenge, often based on the curated community already existing for the vendor platform. NASA used the NASA Solve website ([www.nasa.gov/solve](http://www.nasa.gov/solve)), which lists NASA's participatory opportunities, to market this Challenge.

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<sup>35</sup> The website for the REALM User Interface Challenge can be viewed at <https://www.topcoder.com/challenge-details/30055215/?type=design>.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Other - Outreach to vendor platform members; Other - NASA Solve website ([www.nasa.gov/solve](http://www.nasa.gov/solve))

*Participation Requirements:* Winners were vetted to ensure they were not on any restricted country list and are, therefore, eligible to receive the award.

*Evaluation of Submissions:* The user interface application submissions were evaluated against a number of technical and functional requirements including the ability to enable an on-demand search of the complex event processing (CEP) system to determine an item's location; ability to edit CEP scenarios of interest; ability to interface to a Unity 3D representation of the instrumented ISS modules to display location and location trajectories of item(s) queried; and enables on-demand searches for either a single or multiple items.

*Results:* Of the 51 entries submitted by 129 participants between September 16, 2016 and December 02, 2016, nine prizes were awarded to nine winners.

*Budget and Resources:* The full challenge budget was funded by NASA's Human Exploration and Operations Mission Directorate (Advanced Exploration Systems division). A total of \$32,900 was awarded to the crowdsourcing vendor Topcoder via the NASA Open Innovation Services (NOIS) contract to execute the Challenge and fund the challenge purse. The awarded vendor conducted the Challenge and awarded the prize money per the task order. Fund allocations included prizes, vendor project management resources, and platform fees. NASA FTE/WYE resources (0.03 FTE and 0.1 WYE) supported the challenge coordination activities including the task order request for proposal development and award processes as well as oversight of challenge execution per the task order.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge supports NASA's mission to work with industry to improve America's aerospace technologies through the application of crowdsourcing as an innovative and cost-effective acquisition tool for solutions to specific operational needs. In this case, the solution contributed to the system that helps locate and manage the thousands of items and tools located on the ISS and helps to save the crew's time locating critical items and resulting in valuable cost savings for the agency. The Topcoder community successfully designed a set of application wireframes (i.e., user interface prototypes) that met the technical and functional requirements defined in the task order. The user interface code was completed and delivered to NASA's GitHub software repository at: <https://github.com/NASA-Tournament-Lab/NTL-REALM-User-Interface>.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.7.9 Human Exploration Rover Challenge<sup>36</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20113(e)

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* The Human Exploration Rover Challenge sought to (1) solicit ideas that stimulate innovation in a manner that has potential to advance NASA's mission through collaboration with educational institutions and students; (2) contribute to solving tough problems related to NASA's

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<sup>36</sup> The website for the Human Exploration Rover Challenge can be viewed at [NASA.gov/roverchallenge](http://NASA.gov/roverchallenge).



mission using challenges and prize competitions; (3) present high school and college students with a hands-on engineering design challenge that meets the foundation principles of NASA human exploration missions; (4) provide a team-based engineering project that emphasizes problem solving and the use of engineering systems and design processes; (5) meet the grades 9-12 national education standards and the college fields of study standards of science, technology, engineering, and mathematics (STEM).

*Goal Types:* Find and highlight innovative ideas; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* The nature of the activity and the age and experience level of this audience is not well suited to contracts, grants, and cooperative agreements. The teams engage in the Challenge to compete for corporate-sponsored prizes and bragging rights.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$12,400 in 2017 and \$12,900 in 2018. The total amount awarded was \$12,400 in 2017 and \$12,900 in 2018. Non-monetary incentives included participation and winner plaques and certificates. Cash prizes were provided by corporate sponsors through the U.S. Space & Rocket Center Education Foundation. Non-cash prizes (i.e., plaques, trophies, banners, certificates) were provided by sponsors as well.

*Solicitation of Submissions:* The Marshall Space Flight Center Public and Employee Communications media team produced and assisted with media advisories, news releases, web features, interviews, and stories for the center's Marshall Star newsletter. In 2018, they focused on Facebook and Periscope. In only one day of competition, they received 192,212 views, just shy of 2017's two day total of 204,190. In 2017, the Ustream broadcast was viewed 29,390 times.

Coverage by 686 news stories received 59,596,488 views. The broadcast on Facebook Live was viewed 157,597 times with 4,953 engagements. The broadcast on Periscope (Twitter) was viewed 34,615 times with 72 engagements. Fifteen posts on the Rover Facebook page reached 376,004 and received 1,498 engagements. Twenty-three tweets on the Rover Twitter account reached 2,818,614 and received 547 engagements.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* The competition targeted high school and college/university students. Each rover had to be the work of a student team from a high school or accredited institution of higher learning. The school or institution could enter up to two teams. A group of high schools could also collaborate in building a rover entry. An entity that promotes education, such as a museum, science center, planetarium, or youth-serving organization, could also enter up to two rover teams in each division. Teams could consist of up to six students.

*Evaluation of Submissions:* In 2017, winning teams were determined based on run time and accumulated penalties. In 2018, teams had six minutes of 'oxygen' to complete as many obstacles and tasks as possible. One minute of 'reserve oxygen' was added, if necessary, for teams to journey back to home base. However, no additional points could be earned after six minutes or during the use of 'reserve oxygen.' Teams returning to the home base within six minutes received bonus points. Teams arriving after seven minutes were not eligible for competition prizes. Participants could bypass many of the obstacles and tasks, but after six minutes they had to bypass all of them. Obstacles and tasks were assigned points based on difficulty. Teams were encouraged to implement a strategy based on

the time remaining and the choices of obstacles or tasks to undertake. Additionally, points were given for meeting pre- and post-challenge requirements.

*Results:* There were six hundred participants and 31 awarded prizes in both FY17 and FY18. In 2018, over 500 students comprising 88 teams from 22 states and Puerto Rico, along with nine international teams from Bangladesh, Bolivia, Brazil, Colombia, Germany, India, Lithuania, Mexico and Peru participated in the Challenge. Some prizes were awarded to both the winning high school and college teams. Other prizes were for a single category winner (i.e., either high school or college team).

*Budget and Resources:* NASA's Human Exploration and Operations Mission Directorate provided funding for FTEs and WYEs (\$196,000 and 0.4 FTE in both FY17 and FY18), web services, and logistics. Sponsor funding supported prizes.

*Partnerships:* The Challenge has evolved into a large community event. Partnerships have been formed with the Chamber of Commerce, the Huntsville/Madison County Convention and Visitor's Bureau, and the U. S. Space & Rocket Center. Corporate sponsors mainly provide monetary contributions. These include the Boeing Company, Lockheed Martin, Jacobs, Polaris, the American Institute of Aeronautics and Astronautics, Orbital ATK, Aerojet Rocketdyne, Davidson Technologies, Science Applications International Corporation, Teledyne Brown Engineering, Corporate Office Properties Trust, and the Tennessee Valley Chapter of the Systems Safety Society, Inc. Other corporate sponsors, such as Northrop Grumman Corporation and the National Space Club, contribute through in-kind support of trophies/plaques, tents, banners, and volunteers. The estimated value of partner contributions was \$91,000 in 2017 and \$94,700 in 2018.

*Advancement of Agency Mission:* This Challenge met multiple NASA Office of Education 2017 performance goals. The Challenge (1) assured that students participating in NASA higher education investments were representative of the diversity of the Nation. Of the more than 600 students who participated in the Human Exploration Rover Challenge, 197 were Hispanic, 71 were Black or African America, 10 were American Indian/Alaska Native, and 130 were Asian. Nine teams were from minority-serving institutions. The Challenge (2) continued to provide opportunities for learners to engage in STEM education through NASA-unique content provided to informal education institutions designed to inspire and educate the public. The Challenge, which was open to the public and was widely promoted in the media, was held at the U. S. Space & Rocket Center, an Alabama state flagship museum and Smithsonian affiliate. And lastly, the Challenge (3) continued to provide opportunities for learners to participate in STEM education engagement activities that capitalize on NASA-unique assets and content.

*Solution Types:* Creative (design & multimedia); Ideas; Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* In 2018, in an effort to better align with NASA's mission, the competition moved away from being a timed race format to one driven by accomplishing mission objective tasks limited by a six-minute supply of 'oxygen' with a one-minute reserve. The new format forced teams to make real-time decisions about which tasks to attempt and which to leave behind. Because the new requirements were substantially different from the past 24 years of the competition, no additional changes are planned for the next two years.

**B.7.10 International Space Apps Challenge<sup>37</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20113(e)

*Status:* This FY17 competition is complete, and the FY18 competition is underway.

*Competition Goals:* The goal of the International Space Apps Challenge is to inspire communities of talented volunteers to use NASA data to solve some of the most exciting problems in space science and technology, to foster engagement in STEM topics with emphasis on Earth and space science and exploration, and to help improve the quality of life on Earth.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* Space Apps is a free and open hackathon, and in the hackathon ecosystem, prizes are the prevailing award for participation.

*Cash Prize Purses and/or Non-Cash Prize Awards:* There was no cash award prize offered for this Challenge. Non-monetary incentives included recognition of winning solutions and an invitation for winners to attend a launch event or tour of Kennedy Space Center at their own expense.

*Solicitation of Submissions:* Space Apps is advertised through the [spaceappschallenge.org](http://spaceappschallenge.org) website, and through social media, using #SpaceApps and @SpaceApps. Submissions occur at the end of hackathon weekend, via the [spaceappschallenge.org](http://spaceappschallenge.org) website.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Anyone is welcome to register and participate in the Challenge. Participation is fully voluntary. Children under the age of 13 should be registered and accompanied at all times by a parent or legal guardian.

*Evaluation of Submissions:* Submissions were evaluated by NASA civil servants and NASA contractors only.

*Results:* More than 2000 entries were submitted by more than 25,000 participants.

*Budget and Resources:* Funding (\$850,000 and 3.25 FTEs in FY17; \$975,000 and 5.25 FTEs in FY18) supports contract staff who manage the event and website, create materials for use at local events, and serve as the interface with participants worldwide.

*Partnerships:* Local host organizations and their sponsors in several dozen locations around the world provided facilities and publicity for Space Apps in their respective locations.

*Advancement of Agency Mission:* Space Apps advances the Agency's mission to drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

*Solution Types:* Software and apps; Creative (design & multimedia); Ideas; Technology demonstration and hardware; Analytics, visualizations, algorithms; Scientific

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<sup>37</sup> The website for the International Space Apps Challenge can be viewed at [Spaceappschallenge.org](http://Spaceappschallenge.org).

*Plan for Upcoming 2 FYs:* Space Apps in FY19 and FY20 will be closely aligned with and similar to Space Apps in FY17 and FY18. Based on past experience, the number of participants is expected to grow.

#### **B.7.11 RASC-AL Special Edition: Mars Ice Challenge<sup>38</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* To provide students with the opportunity to design and build prototypes that can extract water from simulated Martian subsurface ice testing environments. Currently the NASA in situ resource utilization (ISRU) community has focused on extracting water from hydrated Mars regolith, but recent discoveries of what are thought to be large ice deposits just under the surface on Mars have mission planners re-thinking how a sustained human presence on Mars could be enabled by a water rich environment. This Challenge is intended to cultivate innovative thinking from university students on a task that NASA has spent very little resources on, yet may be the true enabler of Earth independence on Mars.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* This initiative does not use monetary prizes but does use a challenge/competition format. This format is useful because this initiative is intended to align with academic studies in multi-disciplines related to NASA's mission for undergraduate and graduate students, and to foster exciting innovation and sharing of ideas from the best and the brightest students in the United States with NASA, the university community, and the space exploration industry. NASA technical and research programs directly benefit by tapping new approaches to space exploration, and students benefit by applying their academic knowledge to real-world problems and active engagement with NASA, industry experts and their peers.

*Cash Prize Purses and/or Non-Cash Prize Awards:* There was no cash award prize offered for this Challenge. Non-monetary incentives included the opportunity to work on real-world, ISRU research for NASA that is among the first of its kind; expert feedback from subject matter experts; public recognition; tour of a NASA facility; opportunity to demonstrate technology in front of NASA and industry experts; developing capabilities, skills and hands-on experience. The most promising designs may result in invitations to present research at a technical conference. Subject to the availability of funds, such invitations may include an accompanying stipend to further advance development of the concept and to offset the cost of traveling to the event.

*Solicitation of Submissions:* The 2018 RASC-AL Special Edition: Mars Ice Challenge Competition was announced and promoted through both NASA and the National Institute of Aerospace's (NIA) Communications Teams (including NASA's Education Express and Science Wow!) and through direct email to over 3,000 engineering faculty throughout the country. Additionally, emails and phone calls were made to engineering professors and robotics clubs at universities across the country to promote the Mars Ice Challenge. A Facebook group and Twitter account were also utilized to draw interest from

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<sup>38</sup> The website for the RASC-AL Special Edition: Mars Ice Challenge can be viewed at <http://specialedition.rascal.nianet.org>.

students. Feature stories on the nasa.gov website also called for project plan proposals each year. A website for the challenge is maintained and updated by the NIA.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* The RASC-AL Special Edition: Mars Ice Challenge is open to full-time undergraduate and graduate student teams and faculty advisors at accredited U.S. universities. Teams may include senior capstone courses, robotics clubs, multi-university teams, multi-disciplinary teams, etc. Multi-disciplinary teams are encouraged.

*Evaluation of Submissions:* The Mars Ice Challenge steering (and judging) committee is comprised of NASA and industry experts who evaluate all submission deliverables using rubrics for project plan proposals, mid-project reviews, and on-site technology demonstrations. Mars Ice Challenge projects are evaluated and judged based on adherence to the system prototype design constraints and requirements and the following criteria. For the onsite competition, 50% of the team's score was related to water extraction, and the remaining 50% was related to the technical paper and poster presentation, with points deducted from the total score for exceeding the volume, mass, current, or Newton limits, failure to provide a weight-on-bit data logger, misalignment of system with the technical paper, or excessive dirt thrown outside of their designated area. Paramount to the Challenge is how well the teams can describe their water extraction system's path-to-flight (i.e., what modifications their system would need to operate on Mars). The path-to-flight portions of the technical papers and poster presentations received the bulk of the points available in the scoring matrix.

*Results:* Twenty-eight entries were submitted in FY17 by 8 teams consisting of 109 individuals. Eighteen entries were submitted in FY18 by 10 teams consisting of 154 individuals.

*Budget and Resources:* Funding for the FY17 Challenge was \$284,999 and 0.1 FTE. Funding for the FY18 Challenge was \$285,500 and 0.15 FTE. These costs were for NIA program management and other direct costs including but not limited to testing materials and technology development participation stipends provided to participating universities through their respective Offices of Sponsored Programs.

*Partnerships:* NASA partners with the NIA, who provides day-to-day administration of the Challenge. They have extensive expertise in managing successful higher education STEM competitions for NASA and are well equipped with certified program managers that provide a well-rounded experience for participants. They provide a robust marketing plan, extensive contact lists, in-kind challenge website hosting, graphics support, submission management, simulated test bed creation, and event planning for the culminating technology demonstrations/Forum at NASA's Langley Research Center. Industry partners also brought their unique expertise to this Challenge and incorporating industry involvement on the steering committee added value to the overall competition and enabled students to interact with the foremost experts in this field. In FY17 and FY18, an expert from Honeybee Robotics served an integral member of the Challenge steering committee (with estimated value of \$2500 in both FY17 and FY18). In FY17, an expert from SpaceX also participated in the Challenge and collected participant resumes for consideration of internships and jobs at SpaceX.

*Advancement of Agency Mission:* The Challenge provides university undergraduate and graduate engineering students the opportunity to assist NASA achieve its strategic goal of extending humanity's reach into space. The Challenge fuels innovation for aerospace systems, analogs, and technology prototyping at the nation's best collegiate institutions. The Challenge enlists teams of students to focus on ISRU technology demonstrations for harvesting water from subsurface ice, a focus for NASA over the next few decades. The Challenge also leverages interaction to explore workforce pipeline opportunities



and attract a highly skilled, competent, and diverse workforce. MIC contributes to NASA's goals to enhance STEM experience of undergraduate students and provide graduate-trained STEM professionals with basic and applied research expertise.

*Solution Types:* Ideas; Technology demonstration and hardware; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* Maintaining its relevance to the agency's shifted focus to return Americans to the Moon, the FY19 challenge has evolved into the Moon to Mars Ice & Prospecting Challenge, which will provide university-level engineering students with the opportunity to design and build prototype hardware that can not only extract water, but can also assess subsurface density profiles relevant to both lunar and Martian ISRU. The purpose of updating the challenge in FY19 is to explore and demonstrate methods to identify different layers using system telemetry, and ultimately extract water from ice deposits that could be found in lunar or Martian ice deposits. In FY20, NASA and NIA plan to continue adding evolutionary, incremental elements to the challenge so that university-based student teams/participants can continue making significant, relevant contributions to advancing ISRU research and technology.

### **B.7.12 NASA Tournament Lab Micro-Purchase Challenges**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* This was a collection of challenges with small purses executed through the NASA Tournament Lab that sought to achieve goals such as developing graphics, videos, or animations to communicate a space project's utility or function; developing portions of a course or curriculum for training software developers on how to use a particular computer code needed for a space project; and developing models, solutions, or designs to solve a variety of problems involving radiation shielding, spacecraft thermal protection systems, robotic cameras, and lunar and Martian sample return.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* These challenges utilized prizes as a way to incentivize members of large crowdsourcing communities to deliver their most creative ideas and designs. This method has been consistently shown to be successful in finding novel, high-quality concepts, designs, and creative products in a cost effective and schedule efficient way. These 25 challenges cost just over \$50,000 total (averaging only \$2000 per challenge) and yet resulted in savings of an estimated \$100,000.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$44,800 (over multiple challenges) and the total amount awarded was \$44,000 (over multiple challenges).

*Solicitation of Submissions:* These challenges were executed under the government's micro-purchase program, which allows for the direct purchase of a product up to \$3,500 in FY17 and \$10,000 in FY18. The solicitation of submissions was executed by the vendor as part of the transaction. Some of the challenges were advertised on the NASA Solve website ([www.nasa.gov/solve](http://www.nasa.gov/solve)).

*Solicitation Types:* Other - Communications provided by the vendor; Other - NASA Solve website

*Participation Requirements:* NASA did not levy any specialized participation requirements. Each vendor maintains participation requirements in their user terms and conditions that ensured participation aligned with applicable laws such as banned country participants.



*Evaluation of Submissions:* For completed challenges, the end products were reviewed and approved by each of the NASA technical teams to ensure all requirements were met.

*Results:* Of the 1,514 (across all 25 challenges) entries submitted by 809 participants, 35 prizes were awarded.

*Budget and Resources:* All challenge budgets were fully funded by NASA's Human Exploration and Operations Mission Directorate. The funds were paid to the crowdsourcing vendor via the government micro-purchase program and vendors conducted the challenges and awarded the prize money. In FY17, \$5,290 and 0.1 FTEs were spent; in FY18, \$46,707 and 0.2 FTEs were spent. Freelancer.com and GrabCAD.com were paid for a variety of delivered media ranging from training materials to videos. Budgets for individual challenges were (1) Delay/Distruption Tolerant Networking (DTN) Interplanetary Overlay Network (ION) Training course sample challenge: \$574; (2) DTN imagery or animation challenge: \$574; (3) Origami/Folding Radiation Shielding Concepts Challenge: \$1,060; (4) Origami/Folding Radiation Shielding Models Challenge: \$1,060; (5) Astrobbee Robotic Arm Design Architecture Study Challenge Series (14 challenges): \$25,000; (6) REALM Project Overview Animated Video Storyboard Challenge: \$573; (7) REALM Project Overview Animated Video Challenge: \$3,030; (8) 3D Model Development for Human Rated Spacecraft Thermal Protection System (TPS) 3D Printing Process Challenge: \$3,500; (9) Model Animation for Human Rated Spacecraft Thermal Protection System (TPS) 3D Printing Process Animation Challenge: \$6,000; (10) Sample Return Regolith Sorter Design Challenge: \$10,000; (11) Autonomous Systems Operations-ISS-TEA Project Graphic: \$317; and (12) In-Space Manufacturing Refabricator Mission Patch/Graphic Challenge: \$310.

*Partnerships:* N/A

*Advancement of Agency Mission:* These challenges contributed to key projects at NASA: (1) developing the communications protocols required for deep space exploration at distances that incur significant light-time delays in communications; (2) enhancing mission operations for current ISS missions and future missions by building an automated inventory tracking system; (3) developing radiation shielding concepts and designs to protect humans in deep space exploration (one of the current key unsolved risks for deep space exploration); (4) developing autonomous systems necessary for human management of complex systems in deep space where time delayed communications constrain ground interactions; (5) developing new production processes for thermal protection systems required for human exploration due to high speed entries required upon return; (6) developing sample return sorting mechanisms so that robotic surface exploration and scientific return can be enhanced; and (7) developing recycling and in space manufacturing methods that enable more efficient and resilient human space exploration in deep space.

*Solution Types:* Software and apps; Creative (design & multimedia); Ideas

*Plan for Upcoming 2 FYs:* The NASA Tournament Lab Micro-Purchase Challenges are a mechanism that most NASA projects can afford without special funding requests and therefore it is anticipated that their use will grow in the future.

**B.7.13 Open MCT Notebook Challenge<sup>39</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* This Challenge was launched to add a new user-creatable Notebook plugin component for the Mission Control Technology (MCT) software framework. A Notebook is a container for multiple Notebook entries, which are comprised of a timestamp, text, and optionally one or more embedded links to other objects in Open MCT. Embedded links themselves can optionally include a snapshot image capture of their linked object's view state at a given point in time. For example, a user might be viewing a plot of a telemetry element that tracks temperature for a system in a rocket. They might see an anomalous temperature spike in the plot, and would be able to immediately create a new Notebook entry describing what they saw that also includes a visual image capture of the plot.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* Competitive crowd-based software development methods have proven effective for efficient generation of quality software especially when Government resources are limited.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$12,900. Non-monetary incentives included points from the vendor, TopCoder, toward attendance at the yearly prestigious TopCoder Open, an annual online and onsite tournament to celebrate and reward the TopCoder community.

*Solicitation of Submissions:* As with all NASA Tournament Lab challenges, NASA worked with its vendor to mobilize an international community specific to the Challenge, based on the curated community already existing for the vendor platform. NASA used the NASA Solve website ([www.nasa.gov/solve](http://www.nasa.gov/solve)), which lists NASA's participatory opportunities, to market this Challenge. This Challenge was broken up into six distinct competitions and marketed directly to Topcoder members via challenge listing and Topcoder's development newsletter.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Other - Outreach by TopCoder to its platform members; Other - NASA Solve website ([www.nasa.gov/solve](http://www.nasa.gov/solve))

*Participation Requirements:* Winners are vetted to ensure they are not on any restricted country list and are, therefore, eligible to receive the award.

*Evaluation of Submissions:* The NASA MCT team evaluated the products developed and selected by the TopCoder community to ensure a quality implementation of the requirements as provided in the NOIS contract task order statement of work.

*Results:* Of the 35 entries submitted by 87 participants between September 28, 2017 and November 13, 2017, 3 prizes were awarded to 3 winners.

*Budget and Resources:* The full challenge budget was funded by NASA's Human Exploration and Operations Mission Directorate. The funds (\$34,952 in FY17) were awarded to the crowdsourcing vendor TopCoder via the NOIS contract. The awarded vendor conducted the Challenge and awarded the

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<sup>39</sup> The website for the Open MCT Notebook Challenge can be viewed at <https://www.topcoder.com/challenges/#&query=MCT&tracks=datasci&tracks=design&tracks=develop>.

challenge purse per the task order. NASA FTE/WYE resources (0.01 FTE in FY17 and FY18; 0.014 WYE in FY17 and 0.01 WYE in FY18) supported the challenge coordination activities including the task order request for proposal development and award processes as well as oversight of challenge execution per the task order.

*Partnerships:* N/A

*Advancement of Agency Mission:* This challenge supports NASA's mission to work with industry to improve America's aerospace technologies through the application of crowdsourcing as an innovative and cost-effective acquisition tool for solutions to specific operational needs.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

#### **B.7.14 Partnership Agreement Maker (PAM) Graphical User Interface (GUI) Updates<sup>40</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in FY17.

*Competition Goals:* Develop a new user interface for NASA's Partnership Agreement Maker (PAM) that is intuitive, user-friendly, and will render well on mobile devices. PAM is NASA's online tool for the development, execution, and storage of all agreement types, whether with other domestic or foreign government agencies, non-governmental organizations, or commercial entities. The design should have reused existing functionality, not changed existing code, and improved the user experience for completing a workflow.

*Goal Types:* Improve government service delivery; Solve a specific problem

*Justification for Using Prizes and Challenges:* The NASA Partnerships Office is extending its approaches to acquisition.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$15,684. Non-monetary incentives included points from the vendor, TopCoder, toward attendance at the prestigious TopCoder Open, an annual online and onsite tournament to celebrate and reward the TopCoder community.

*Solicitation of Submissions:* The limited marketing approach for this challenge consisted of alerts to TopCoder members through weekly newsletters and RSS feeds/social media.

*Solicitation Types:* Other - TopCoder development newsletters; Other - RSS feeds/social media

*Participation Requirements:* As with all NASA Tournament Lab challenges, NASA worked with the vendor to mobilize an international community specific to the Challenge, based on the curated community already existing for the vendor platform. Winners were vetted to ensure they were not on any restricted country list and were, therefore, eligible to receive the award.

*Evaluation of Submissions:* Three representatives (two technical and one managerial) from the NASA Partnerships Office evaluated submissions throughout the design and build phases and made award

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<sup>40</sup> The website for the Partnership Agreement Maker (PAM) Graphical User Interface (GUI) Updates can be viewed at <https://www.topcoder.com/challenge-details/30055736/?type=design>.

determinations based on aesthetic and functional capabilities that would support the defined system requirements. Success criteria include adherence to defined technical requirements for system integration and interoperability with the existing system code base and architecture, as well as select design enhancements to the graphic interface to improve the overall user experience.

*Results:* Of the 60 entries submitted by 194 participants between November 21, 2016 and April 03, 2017, 12 prizes were awarded to 12 winners.

*Budget and Resources:* The full challenge budget was funded by NASA’s Mission Support Directorate. The funds were awarded to the crowdsourcing vendor via the NOIS contract. The awarded vendor conducted the Challenge and awarded the prize money per the task order. Fund allocations included prizes, vendor project management resources, and platform fees. NASA FTE/WYE resources used in FY17 (\$34,990, 0.14 FTE, and 0.01 WYE) supported the challenge coordination activities including the task order request for proposal development and award processes as well as oversight of challenge execution per the task order.

*Partnerships:* N/A

*Advancement of Agency Mission:* The Challenge introduced a new approach for service acquisition to the NASA Partnerships Office and provided a refreshed user interface for a critical Agency-wide routing system, thereby supporting NASA’s mission to improve America’s aerospace technologies.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

#### **B.7.15 REALM Location Tracking Algorithm Challenge<sup>41</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was launched in FY18, and is underway.

*Competition Goals:* The Radio-Frequency Identification (RFID) Enabled Autonomous Logistics Management (REALM) project seeks to build a machine learning based algorithm to help find, identify, and track cargo on the International Space Station (ISS). Tracking items in space habitats can be more challenging than it might at first seem. The environment is predominantly closed, with the exception of the jettisoning of trash or the delivery of new cargo or return of some items by visiting vehicles. However, there are a number of factors that complicate tracking, including crews that change out in six-month intervals, laboratory space that doubles as living space, cargo transfer bags that are nearly identical in appearance, and limited stowage space.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* Expert communities such as those found on TopCoder have been shown repeatedly to respond to prize-based challenges to complete tasks such as developing high-performing algorithms based on machine-learning data science.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$26,500. TopCoder provides gamified incentives such as point scores and badges to its members who participate.

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<sup>41</sup> The website for the REALM Location Tracking Algorithm Challenge can be viewed at <http://www.topcoder.com>.

*Solicitation of Submissions:* This project was executed under the NOIS multi-vendor indefinite delivery, indefinite quantity (IDIQ) contract. TopCoder was selected as the NOIS contract vendor for this task order based on a NOIS solicitation within the NOIS contract. TopCoder executed the task order to develop and execute the Challenge, which included outreach to its members and the wider public about participation in the Challenge. Additionally, this Challenge was posted on Challenge.gov and on the NASA Solve ([www.nasa.gov/solve](http://www.nasa.gov/solve)) website.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs)

*Participation Requirements:* NASA did not levy any specialized participation requirements. TopCoder maintains participation requirements in their user terms and conditions that ensured participation aligned with applicable laws such as banned country participants.

*Evaluation of Submissions:* This Challenge is in its early stages, and the evaluation plan is still in development.

*Results:* No prizes have been awarded at this stage of the Challenge.

*Budget and Resources:* The funding for this project was provided by the NASA Human Explorations Operations Missions Directorate (HEOMD)/Advance Exploration Systems (AES) division's Logistics Reduction (LR)/REALM Project. The total budget for the NOIS task order to TopCoder under the fixed price contract was \$89,700. Of those funds, \$26,500 was budgeted for the prize pool. This Challenge is still in progress.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge contributes to NASA's mission for human space exploration. Specifically, an improved cargo location tracking algorithm would save significant crew time and effort operating in a zero-gravity environment with rotating crews.

*Solution Types:* Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

#### **B.7.16 Rice Business Plan Competition<sup>42</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* The Rice Business Plan Competition is an event that matches startup companies with potential funding sponsors. NASA/Johnson Space Center provides a small amount of prize funding which allows participation in the process and access to the proposals from the best teams. The support NASA provided for this competition was intended to encourage the development of commercial technologies that can address physical challenges of spaceflight, which also have benefits on Earth. It aimed to engage faculty and students in addressing key space flight challenges in the areas of life sciences, engineering, and commercial space. It also sought to identify technology innovations which may assist NASA in achieving its mission and objectives.

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<sup>42</sup> The website for the Rice Business Plan Competition can be viewed at <https://rbpc.rice.edu>.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* This competition enabled NASA to learn about emerging technologies that the agency may not otherwise have known existed.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$20,000 in FY17 and \$50,000 in FY18. Non-monetary incentives included recognition by NASA Johnson Space Center.

*Solicitation of Submissions:* Rice University solicited globally for applications to their overall Business Plan Competition.

*Solicitation Types:* Other - Rice University outreach

*Participation Requirements:* Only U.S. teams are eligible for the NASA award.

*Evaluation of Submissions:* NASA established a scoring method and then evaluated the business plan teams and their technologies to select a winner.

*Results:* Of the more than 400 submissions (1 per team) received in FY17 between November 1, 2016 and March 15, 2017, 42 teams were selected to compete. One prize was awarded to one winner. Of the more than 750 submissions (1 per team) received in FY18 between November 1, 2017 and March 15, 2018, 42 teams were selected to compete. One prize was awarded to one winner.

*Budget and Resources:* In FY17, the grant budget was funded by NASA Johnson Space Center's Human Health and Performance Directorate. In FY18, the Chief Technologist in the Exploration Integration and Science Directorate put in place a new three-year grant and collected funding from different organizations within the Johnson Space Center. In FY17, \$20,000 was allocated for the prize and \$7,500 was provided to Rice University through a grant for management and administration of the competition; in FY18, \$50,000 was allocated for the prize and \$7,500 went to Rice University. NASA FTE (0.03 in both FY17 and FY18) supported competition activities including preparing the grant agreement with Rice University, managing logistics of the competition, and ensuring a multi-disciplinary team was available to judge the competition for the NASA Earth/Space Human Health and Performance Innovation Prize.

*Partnerships:* N/A

*Advancement of Agency Mission:* The Rice Business Plan Competition is an event that matches startup companies with potential funding sponsors. The support NASA provided for this competition was intended to encourage the development of commercial technologies that can address physical challenges of spaceflight, which also have benefits on Earth. It aimed to engage faculty and students in addressing key space flight challenges in the area of life sciences, engineering, and commercial space. It also sought to identify technology innovations which may assist NASA in achieving its mission and objectives. Even when the proposals did not align with NASA's needs, they can provide a rare opportunity to see fresh ideas from startup companies at a point when NASA might still have the opportunity to influence their direction.

*Solution Types:* Ideas; Technology demonstration and hardware; Business plans

*Plan for Upcoming 2 FYs:* The final year for the Human Health and Performance grant was 2017. NASA has established a three-year grant with Rice University to continue participating in the Rice Business Plan Competition through 2020.



**B.7.17 Robonaut 2 Tool Localization Challenge<sup>43</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in FY17.

*Competition Goals:* The Challenge was launched to develop a general vision algorithm for Robonaut 2 (R2), NASA's dexterous humanoid robot, to improve the robot's ability to manipulate objects. The R2 team was looking to find vision algorithms that would be effective with noisy stereo vision data for localizing a specific point on a variety of tools. The Challenge was comprised of three separate algorithm contests run on the vendor, TopCoder, platform.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* Crowd-based challenges incentivized with a monetary purse have proven extremely effective for algorithm development, particularly when a team is resource limited.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$19,250. For the first contest, the following prizes were awarded: \$5,000 for first place, \$2,500 for second place, \$1,500 for third place, and \$750 for fourth place. For the second contest the following prizes were awarded: \$4,000 for first place, \$2,750 for second place, \$1,750 for third place, and \$1,000 for fourth place. The winner of the optimization round won a NASA swag bag and a one-hour talk and coffee with the Harvard Crowd Innovation Lab team. The winners also received points from TopCoder toward attendance at the yearly TopCoder Open, an annual online and onsite tournament to celebrate and reward the TopCoder community.

*Solicitation of Submissions:* As with all NASA Tournament Lab challenges, NASA worked with its vendor to mobilize an international community specific to the Challenge, based on the curated community already existing for the particular vendor platform. In addition to soliciting submissions from its existing member community, TopCoder ran a blog feature, newsletter promotion, and forum promotion, as well as direct email campaigns and support for a NASA press release.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Outreach by vendor TopCoder to its platform's members

*Participation Requirements:* Winners were vetted to ensure they were not on any restricted country list and were, therefore, eligible to receive the award.

*Evaluation of Submissions:* NASA and Harvard worked with TopCoder to establish scoring methods and then worked to verify the resulting algorithms to determine their relative performance and select winners. In order to win a prize, the submitter had to achieve a score in the top five, according to system test results. Within seven days from the announcement of the challenge winners, winning candidates had to submit a complete report at least two pages long outlining their final algorithm, explaining the logic behind and steps to its approach, and describing how to install any required libraries to run it.

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<sup>43</sup> The website for the Robonaut 2 Tool Localization Challenge can be viewed at <https://community.topcoder.com/longcontest/?module=ViewProblemStatement&rd=16672&compid=51137>.

*Results:* Of the 222 entries submitted by 1,912 participants between February 23, 2016 and March 08, 2016 for Algorithm Contest 1 and October 05, 2017 and October 19, 2017 for Algorithm Contest 2, nine prizes were awarded to nine winners in the Optimization Algorithm Final Contest on October 26, 2017.

*Budget and Resources:* The full challenge budget (\$59,500 for challenge execution and prize purse) was funded by NASA’s Human Exploration and Operations Mission Directorate. In addition, 0.014 FTEs were allocated to support the Challenge. The funds were awarded to the crowdsourcing vendor TopCoder via the NOIS contract. The awarded vendor conducted the Challenge and awarded the prize money per the task order.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge supports NASA’s mission to work with industry to improve America’s aerospace technologies. It provided the R2 team with several algorithmic approaches to this difficult problem of detecting points on a three-dimensional tool and recognizing that tool. Given the low cost of this challenge and the serial contests involved, the team was able to gain insight into some very effective approaches to building this algorithm.

*Solution Types:* Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

#### **B.7.18 Robotic Mining Competition<sup>44</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20113(e)

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* This competition is for university-level students to design and build a mining robot that can traverse simulated chaotic lunar/Martian terrain, excavate the regolith and ice simulant (gravel), and deposit it into a collector bin to simulate an off-world mining mission. The complexities of the challenge include the abrasive characteristics of the regolith, weight and size limitations of the mining robot, and the ability to tele-operate it from a remote Mission Control Center. Teams also submit a systems engineering paper explaining their design philosophy, engage in K-12 Outreach in their communities, and give a project presentation to judges at Kennedy Space Center.

*Goal Types:* Solve a specific problem; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Teams provide their best students, faculty advisors, robots, equipment, supplies, transportation, etc. to come to the competition at the Kennedy Space Center. Prizes inspire and motivate students to compete.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered in both FY17 and FY18 was \$17,000 and the total amount awarded in both FY17 and FY18 was \$17,000. Three trophies were awarded in FY18 for the Judges’ Innovation Award, the Solar System Exploration Research Virtual Institute (SSERVI) Regolith Mechanics Award, and Efficient Use of Communications Power Award. Non-monetary incentives included NASA bragging rights: schools and students got to say “We ran our robot at NASA’s Robotic Mining Competition” or “We successfully wrote a NASA peer-reviewed Systems

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<sup>44</sup> The website for the Robotic Mining Competition can be viewed at <https://www.nasa.gov/offices/education/centers/kennedy/technology/nasarmc.html>.

Engineering Paper” or “We took home the Robotic Mining Competition’s ‘Joe Kosmo Award for Excellence’.”

*Solicitation of Submissions:* The competition registration date was announced on the NASA RMC website, on social media (Facebook and Twitter), and in announcements sent to all the teams that competed the previous year.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs)

*Participation Requirements:* Teams from post-high school vocational/technical schools, colleges, and universities located in the United States, its Commonwealths, territories, and possessions were eligible to register for the competition (no more than one team per university campus was allowed). A team consisted of current faculty/staff members of the college or university and at least two undergraduate students. Students had to be enrolled during the current or previous school semester and submit transcripts demonstrating good academic standing. The number of team members was at the discretion of the school but had to be sufficient to successfully design, build, and operate their mining robot.

*Evaluation of Submissions:* Both the first and second round of systems engineering papers judging was done by engineers from across NASA. Presentations and demonstrations during the week of the mining competition were judged by engineers from across NASA. Both the first and second rounds of the outreach report was judged by communications and education personnel from across NASA. Points during the on-site mining competition were awarded based on numerous factors including but not limited to the amount of regolith returned. This event was judged by engineers from across NASA. Points from all categories were tallied for the grand prize, The Joe Kosmo Award for Excellence.

*Results:* Of the 48 entries (740 individuals) submitted for the FY17 competition, 22 prizes were awarded to 12 different teams. Of the 46 entries (810 individuals) submitted for the FY18 competition, 23 prizes were awarded to 11 different teams.

*Budget and Resources:* NASA’s Human Exploration and Operations Mission Directorate provided 1.0 FTE and \$361,750 in FY17, and 1.0 FTE and \$362,325 in FY18. This funding supported contractor labor as well as preparations, materials, supplies, and the NASA-funded awards for the competition.

*Partnerships:* Non-Federal partners in FY17 (Honeybee, Harris, Caterpillar, Moon Express, Igus, and Lockheed Martin) contributed \$38,540. Non-Federal partners in FY18 (Honeybee, Harris, Caterpillar, Moon Express, and Boeing) contributed \$41,500.

*Advancement of Agency Mission:* NASA directly benefits from the competition by encouraging the development of innovative robotic excavation concepts. These concepts may result in unique solutions applicable to an actual excavation device and/or payload on an in-situ resource utilization (ISRU) mission. Advances in off-world mining have the potential to significantly contribute to our nation’s space vision and NASA space exploration operations.

*Solution Types:* Software and apps; Technology demonstration and hardware; Scientific

*Plan for Upcoming 2 FYs:* In FY19, the objectives of the competition will remain the same; however, the playing field will have significant changes. Teams will be required to submit 60 mechanical data points about the robots. In FY20, the competition will incorporate a gravity offloading device to better simulate lunar and Martian gravity. In FY21, the competition will incorporate a 3-D printing component to keep the competition current and on task with new technology research needs.

**B.7.19 Space Poop Challenge<sup>45</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 31 USC § 6301, et seq.

*Status:* This competition was completed in FY17.

*Competition Goals:* The goal was to find viable concepts and designs for a urine and fecal management system for use in landing and entry space suits over a continuous duration of 144 hours in the event of a cabin depressurization or alternate contingency scenario. Currently space suits are worn for launch and entry activities and in-space activities to protect the crew from any unforeseen circumstances that the space environment can cause. An astronaut might find himself or herself in this suit for up to 10 hours at a time nominally for launch or landing, or up to 6 days if something catastrophic happens while in space. The current fecal-management solution is equipping the astronauts with diapers. However, the diaper is a low-tech and very temporary solution. Most significantly, it does not provide a healthy or protective option longer than one day.

*Goal Types:* Solve a specific problem; Develop technology

*Justification for Using Prizes and Challenges:* A crowdsourced competition provided the greatest possibility of identifying innovative solutions with the limited available budget.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$30,000. Non-monetary incentives included official letters of recognition being sent to the top 25 submissions along with a Crew Survival Systems patch and NASA Tournament Lab stickers.

*Solicitation of Submissions:* As is the case for all NASA Tournament Lab challenges, NASA worked with a vendor to mobilize an international community specific to the Challenge based on the curated community already existing for the vendor's platform. The vendor solicited submissions from its existing member community and the public through blog features, emails, social media campaigns.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Outreach by challenge vendor

*Participation Requirements:* Winners are vetted to ensure they are not on any restricted country list and are, therefore, eligible to receive the award.

*Evaluation of Submissions:* Initial screening evaluation of the more than 5,000 submissions was done by HeroX based on the stated evaluation criteria. Eighty-four submissions were provided to a NASA evaluation panel. This panel recommended a list of finalists that included the top 25 submissions along with the list of recommended first, second, and third place submissions.

*Results:* Of the 5,170 entries submitted by 20,129 participants between October 11, 2016 and December 20, 2016, 3 prizes were awarded to 3 winners.

*Budget and Resources:* The full challenge budget (\$58,000) was funded by NASA's Human Exploration Operations Mission Directorate. The funds were awarded to the crowdsourcing vendor HeroX via the NOIS contract. The awarded vendor conducted the Challenge and awarded the challenge purse per the task order. NASA FTE/WYE resources (0.025 FTE and 0.002 WYE) supported the Challenge coordination activities including the task order request for proposal development and award processes as well as oversight of Challenge execution per the Task Order.

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<sup>45</sup> The website for the Space Poop Challenge can be viewed at <https://herox.com/SpacePoop>.

*Partnerships:* N/A

*Advancement of Agency Mission:* This Challenge supports NASA's mission to work with industry to improve America's aerospace technologies through the application of crowdsourcing as an innovative and cost-effective acquisition tool for solutions to specific operational needs. This Challenge resulted in the submission of many novel and interesting ideas for dealing with human waste in a space suit environment over an extended time period. The three winners provided some unique solutions including an airlock and internal suit manipulation tool that was based on laparoscopic surgical techniques and tools. This approach allows for the removal of waste material, entry of wipes and underwear, and manipulation required for cleaning in the space suit. Another concept included a design for self-inflating air pumps to help dry the skin that used emergency air bagging technology to save power and complexity while providing high rate airflow. The winning submission also included a compact wiping mechanism that provided a novel approach to skin cleaning and infection prevention.

*Solution Types:* Other - Design

*Plan for Upcoming 2 FYs:* N/A

### **B.7.20 Space Robotics Challenge<sup>46</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20144

*Status:* This competition was completed in FY17.

*Competition Goals:* The goal of the Space Robotics Challenge (SRC) was to foster innovations in technology to advance robotic autonomy in manipulation and perception in humanoid robots to help astronauts on the journey to Mars and other deep-space destinations. Autonomy is critical for space flight missions to Mars and beyond due to the time it takes to send and receive commands from Earth. As missions grow longer and more complex, robots could be used as precursor explorers, helpers in space, and caretakers of assets left behind. There are also potential Earth applications for autonomous capabilities, including disaster relief and clean-up and/or maintenance of areas with conditions hazardous to humans.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* The competition gave access to the complex NASA R5 robot, providing multiple entities with access to advance the technology for both space and Earth applications. Also, partnering on the competition with Space Center Houston gave NASA the opportunity to engage and inspire the broader public, including K-12 and educators.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$900,000 and the total amount awarded was \$570,000. As non-monetary incentives, the top four teams were awarded a code implementation partnership with an R5 Host Team for at least two weeks.

*Solicitation of Submissions:* Soliciting competitors was conducted mainly by NineSigma from their database of solvers. Potential competitors were engaged via direct email and a customized newsletter. Social media efforts were coordinated between NASA, Space Center Houston, and NineSigma. Postings

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<sup>46</sup> The websites for the Space Robotics Challenge are accessible at [NASA.gov/spacebot](https://www.nasa.gov/spacebot) and [www.spaceroboticschallenge.com](https://www.spaceroboticschallenge.com).

were made on LinkedIn, Twitter, and Facebook. Feedback from competitors was that social media was the main attractor. Two webinars were executed in order to engage the public. Four videos were made to promote the Challenge on social media, the first of which was used to tease the release of the Challenge, and the remaining three to further explain the goals of the Challenge and the current state of technology.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Anyone could participate in the SRC as long as they were not a citizen of a country on the NASA Export Control Program List. Only U.S. citizens or permanent residents were eligible to win a cash prize; non-U.S. citizens were allowed to participate and be recognized as winners. Teams with foreign participation were only eligible to receive cash awards from NASA if the overall composition of the team was at least 51% U.S. citizens and entity team members were incorporated in and maintained a primary place of business in the U.S. or were full-time students at an accredited U.S. institution, had a valid student visa, and submitted a signed foreign participation acknowledgement form.

*Evaluation of Submissions:* Since the competition was completed in a simulation environment, a large portion of the scoring was based on an established algorithm. For the qualification round, the scoring from the algorithm was reviewed by the Open Source Robotics Foundation (OSRF) and validated by the NASA Centennial Challenges program team. For the Virtual Competition Round, once the teams completed their runs, their log files were generated and uploaded. OSRF then executed a double-blind peer review process for each team and each round (i.e., each team was only known to the reviewers by a randomly designated number) and created a summary of how each team performed. Two additional people at OSRF then approved these summaries or offered refinement. The outcome of this verification process was the metric score and time. The videos of the simulations were then passed to the judging panel for subjective scoring. The expert judges did not see the teams' computed scores in order to remove any bias.

*Results:* A total of 405 teams (754 people) registered to participate, 92 teams (290 people) were selected to compete in the qualifying round, and 20 teams (100 people) reached the final round. Each of the 20 teams in the final round received \$15,000; the first place team received \$125,000, the second place team received \$100,000, the third place team received \$50,000, and the fourth place team received \$25,000.

*Budget and Resources:* One FTE and funding in the amount of \$306,000 in FY17 provided by the NASA Space Technology Mission Directorate/Centennial Challenges Program were used to support the vendor, OSRF, to develop and execute the simulation environment for the challenge tasks; workforce to develop and execute the Challenge; travel to the challenge meetings and events; and for the subject matter expert and NASA project team at Johnson Space Center.

*Partnerships:* Non-Federal partners included Space Center Houston (allied organization), NineSigma Inc. (challenge sponsor), Florida Institute of Human and Machine Cognition – R5 Software, Open Source Robotics Foundation Inc., and Gazebo Design and Support. Space Center Houston contributed \$985,202, and NineSigma Inc. contributed \$362,627.

*Advancement of Agency Mission:* The SRC aligns the needs of NASA's Space Technology Mission Directorate and Human Exploration and Operations Mission Directorate.

*Solution Types:* Software and apps; Analytics, visualizations, algorithms



*Plan for Upcoming 2 FYs:* Phase 2 of the SRC is currently in development. The goal of phase 2 will be to advance autonomous surface mobility for NASA exploration robotic systems. This new phase will push the technology even further by striving for fully autonomous operations.

### **B.7.21 Student Launch Initiative<sup>47</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20113€

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* The NASA Student Launch Initiative (SLI) is a research-based, competitive, experiential exploration activity intended to provide relevant, cost-effective research and development of rocket propulsion and ground support systems. SLI connects learners, educators, and communities in NASA-unique opportunities that align with STEM Challenges under the NASA Office of Education's STEM Engagement. The activity reaches a broad audience of middle schools, high schools, colleges and universities across the nation through an eight-month commitment to design, construct, and fly payloads and vehicle components. Teams launch the experiments on high-power rockets and share the research results, which could be used in future design and development of NASA projects.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Student Launch has been conducted for more than 15 years. The challenge/competition allows NASA to reach a different demographic than usually reached with grants and contracts. It also allows participants to propose more easily because there is no grant or contract paperwork.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$9,500 in both FY17 and FY18 and was contributed by partners. The total amount awarded was \$9,500 in both FY17 and FY18. Non-monetary incentives included trophies.

*Solicitation of Submissions:* The request for proposal was announced on the Student Launch website. Former teams and any interested teams were emailed. NASA posted a press release and announced the opportunity on social media.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* For universities and colleges, the opportunity to propose was open to all. For middle schools and high schools, proposal opportunity was open to the top 25 performing teams from the Team America Rocketry Challenge and the top three teams from Rockets4Schools.

*Evaluation of Submissions:* Submitted proposals were scored by a panel of NASA Marshall Space Flight Center (MSFC) subject matter experts using a rubric.

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<sup>47</sup> The website for the Student Launch Initiative can be viewed at <https://www.nasa.gov/audience/forstudents/studentlaunch/home/index.html>.

*Results:* For 2017, 68 entries (810 participants) were submitted between August 15, 2016 and April 24, 2017. For 2018, 75 entries (879 participants) were submitted between August 21, 2017 and April 27, 2018. In both 2017 and 2018, 19 prizes (3 cash awards; 16 trophies) were awarded.

*Budget and Resources:* In both FY17 and FY18, \$377,000 went to personnel (FTE and contract support) for challenge design, proposal review, four design reviews throughout the eight-month process, launch week activities, safety review and monitoring, website development, social media and press releases, and interaction with teams and appropriate NASA entities (Office of Education, Human Exploration and Operations Mission Directorate, Center management). A total of \$102,000 went to contracts for launch services (National Association of Rocketry), launch week services (meeting rooms, emergency vehicle support, port-o-lets and other necessities), transportation for teams to NASA's Marshall Space Flight Center, and to launch field. \$15,000 was budgeted for materials and \$55,000 was used for stipends for team mentors. Mentors were required to have level 2 high powered rocketry certification and to travel to launch and were responsible for rocket for safety purposes.

*Partnerships:* Partners provided prize money, trophies, and items that the Federal Government does not provide, including an awards banquet and stipends to the team. In both years, Orbital ATK provided \$5,000 sent directly to the first place winner and \$4,669 in trophies (i.e., prize trophies for winners and a participation trophy for each team). The Huntsville Chapter of the National Space Club provided \$2,500 to the second place overall winner; \$2,000 to the high school/middle school winner (delivered through NASA MSFC contractor, Aetos); \$183.71 for trophies; and \$16.29 in contractor overhead fees.

*Advancement of Agency Mission:* SLI provides relevant, cost-effective research and development of rocket propulsion and ground support systems. Additionally, SLI connects learners, educators, and communities in NASA-unique opportunities that align with STEM Challenges under the NASA Office of Education's STEM Engagement.

*Solution Types:* Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* Plan to continue the Challenge for FY19 and FY20, using NASA's Space Launch System as the research emphasis.

### **B.7.22 Swarmathon<sup>48</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* FAR

*Status:* This competition was completed in both FY17 and FY18.

*Competition Goals:* The NASA Swarmathon is a challenge to develop cooperative robotics to revolutionize space exploration. Students from minority serving institutions (MSIs) are challenged to develop search algorithms for robotic swarms. Swarmathon participation is designed to improve students' skills in robotics and computer science, and further advance technology for future NASA space exploration missions. The NASA Swarmathon project used small, robotic vehicles called Swarmies to challenge programming skills of students at select minority-serving institutions. Swarmies were equipped with a Wi-Fi antenna, GPS, webcam, and sensors developed to search for resources. There was a physical competition (with sets of three robots) and a virtual competition. Virtual teams had their code run in a simulation environment. Physical teams had their code installed on Swarmie

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<sup>48</sup> The website for the Swarmathon can be viewed at <http://nasaswarmathon.com/>.

robots which were run at the physical competition at NASA Kennedy Space Center in April. The physical layout and format were reproduced in a simulated environment for the virtual competition.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* Prize competitions reach far more students and institutions than could be reached through direct pay mechanisms. Instead of one funded school and their results, over 30 provided proof of concept algorithms for search methods. Competitions allow students and faculty to engage with NASA research and training in a way that gives them flexibility for the amount of time they spend on the project. Prize awards provide an incentive for students to expand their learning, gain valuable hands-on experience, and utilize their skills to solve a real-world problem.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded in FY17 was \$15,000 and \$17,000 in FY18. Non-monetary incentives included trophies.

*Solicitation of Submissions:* One of the goals of the NASA Swarmathon was to recruit a sizeable and diverse pool of applicants from MSIs across the United States and its territories. The project sought diversity in the form of MSI types, geographic distribution, and school sizes. To support the goal of making every computer science department at every MSI aware of this opportunity, the following marketing efforts were undertaken: constant updates of the [nasaswamathon.com](http://nasaswamathon.com) website; postcard mailers to computer science faculty at MSIs; publication in NASA Education Express electronic newsletter; dissemination through Penn Center for MSIs; recruitment webinar; and promotion through social media.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Reviewers evaluated each application using a rubric based on seven different criteria and awarded a score ranging from one to four for each criterion. The criteria were as follows: (1) faculty technical qualifications; (2) faculty teaching experience; (3) goals and objectives to accomplish project; (4) description of student engagement; (5) description of plan to deadlines and milestones; (6) number of students engaged; (7) other strengths. All the faculty team mentors established various methods to convene students and provide them with the instruction necessary to prepare for the NASA Swarmathon. These methods included offering advanced topics courses for credit, offering special topic courses for credit, working with campus clubs and societies, and hosting weekly or monthly meetings.

*Evaluation of Submissions:* Student teams were challenged to develop search algorithms for robotic swarms. These algorithms were written in Robot Operating System (ROS) with Java and C++ and submitted about four weeks before the actual competition. These search algorithms were run on ‘house’ Swarmies on the week of competition. The objective was to find resources in the form of cubes with software tags on them. Judges monitored the software and the robots during their runs, which were 20-40 minutes long. Winning teams were those that obtained and returned the most resources to the home collection nest. Each team was also required to submit a five page technical report that described the algorithms and approaches they developed using pseudo-code, equations, flow charts, figures, or descriptions. These reports were judged for most innovative and functional solutions.

*Results:* In FY17, 34 university teams (400 students) and 30 high school teams (300 students) participated. In FY18, 30 university teams (360 students) and 20 high school (200 students) participated. In FY17, 27 prizes were awarded to 19 different teams; in FY18, 28 prizes went to 19 different teams.

*Budget and Resources:* Funding was provided through a grant from the NASA Minority University Research Program within the NASA Office of Education (now Office of STEM Engagement) to the University of New Mexico (UNM), as a cooperative agreement. Expenses were paid by UNM through the grant. In both FY17 and FY18, 1.0 FTE and \$824,000 were used to support the competition

*Partnerships:* The NASA Swarmathon was funded from NASA Office of Education, through a cooperative agreement grant. This project was overseen by a management team consisting of the grant principle investigator at the UNM computer science department and NASA Kennedy Space Center. The estimated value of partner contributions was \$25,000 in both FY17 and FY18.

*Advancement of Agency Mission:* In situ resource utilization of water or ice to provide hydrogen and oxygen for fuel, breathing, and drinking and other resources in support of human missions to the Moon and Mars is a stated goal of NASA. Being able to send robots to gather these resources rather than sending tons of fuel, oxygen, and water required to support extended missions makes them not just cheaper but, in many cases, feasible. To make robots a realistic option for supporting human missions we have to understand how to organize teams of lightweight robots so they can find and collect resources efficiently. This competition has set hundreds of students, who would not normally have access to a robotics environment, on career paths as roboticists, computer programmers, and engineers.

*Solution Types:* Software and apps; Creative (design & multimedia); Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* For FY19, Swarmathon will utilize the current Swarmies. For FY20, Swarmathon plans to utilize for its new robots a ground version of the Pop-Up Flat Folding Explorer Robot (PUFFER), a robot concept being developed by the Jet Propulsion Laboratory (JPL) through NASA funding. A letter of interest has been provided to Swarmathon from the JPL PUFFER development leads. The JPL PUFFER team is interested in making the hardware and autonomy available to more institutions through potentially open-sourcing its design, firmware, and software. NASA Swarmathon provides a framework for JPL's objective by utilizing the PUFFER design in the Swarmathon autonomous competition. JPL would benefit by getting the PUFFER into the academic community to help JPL solve technology challenges. The goals for Swarmathon will be to evolve the competition search arenas over the years to increase the challenge level and thereby provide usable software for JPL testing.

### **B.7.23 Vascular Tissue Challenge<sup>49</sup>**

*Lead Sponsoring Agency:* NASA

*Authority:* 51 USC § 20144

*Status:* This competition was launched in FY17 and is underway in FY18.

*Competition Goals:* The goal of the Vascular Tissue Challenge (VTC) is to break through one of the critical obstacles in developing medically useful 3D-engineered heart, lung, kidney, liver, and pancreas tissues for pharmaceutical research, organ bandages, and ultimately organ transplants on Earth or in space. Specifically, the VTC goal is to inspire the successful creation of thick (1 cm x 1 cm) human vascularized organ tissue in an engineered environment while maintaining the function of the tissues similar to those

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<sup>49</sup> The websites for the Vascular Tissue Challenge are accessible at [https://www.nasa.gov/directorates/spacetech/centennial\\_challenges/vascular\\_tissue.html](https://www.nasa.gov/directorates/spacetech/centennial_challenges/vascular_tissue.html) and <https://neworgan.org/vtc-prize.php>.

within the human body through a 30-day survival period. Teams must demonstrate three successful trials with at least a 75% trial success rate to win an award. Current state of the art is 2 mm for tissue size with no vascular system or a vascular system where tissues do not behave as they do in the body. No one has achieved the combination of increase in size with a vascular system that functions as organ tissues do in the body. Because there are data indicating that engineered tissues can grow larger and more medically relevant in space, the Center for the Advancement of Science in Space (CASIS) also offers the opportunity to fly winning strategies on the ISS.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Stimulate a market; Other - Provide lifesaving medical advances

*Justification for Using Prizes and Challenges:* In the context of the VTC, prizes are accelerants that inspire focus, new innovators, and non-traditional collaborations to solve a problem of exceptional difficulty that has escaped resolution with conventional practices. Prizes enable new and highly innovative approaches, including those that conservative organizations consider to be too risky.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$500,000. Non-monetary incentives included the opportunity to fly the winning entry to the ISS.

*Solicitation of Submissions:* Solicitation mechanisms included a White House kickoff event; website announcements from multiple organizations (NASA Centennial Challenges, NASA Solve, the Methuselah Foundation, and the New Organ Alliance); presence at professional conferences, workshops, and symposia; advertisement through NASA and Methuselah Foundation webinars, videos, and other public outreach mechanisms; and word of mouth recruiting through the growing VTC scientific network. In addition, because of its profound importance to medicine, both the National Science Foundation and Veterans Administration contributed resources and personnel, and the National Institutes of Health participated in the workshops. These agencies' networks have also been used to solicit submissions.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Day-long event(s) prior to the competition; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - White House kickoff event; Other - NIH and NSF networks

*Participation Requirements:* Participation is open to teams from organizations incorporated in the United States. Team leads must be U.S. citizens or permanent residents.

*Evaluation of Submissions:* An expert judging panel was recruited, and criteria and decisions are informed by a large group of subject matter experts and oversight committee members who can provide additional support for judging the adequacy of a submission.

*Results:* Twelve teams have indicated intention to participate since June 13, 2016. Closing date is September 30, 2019.

*Budget and Resources:* The VTC is part of NASA's Centennial Challenges Program, which is part of NASA's Space Technology Mission Directorate. The challenge development and oversight and prize purse are funded by NASA's Space Technology Mission Directorate. The VTC budgets (\$270,000 in FY17 and \$400,000 in FY18, not including prize purse) and civil servant resources (1.2 FTE in both FY17 and FY18) are used primarily for workshops where experts from multiple disciplines are assembled to work with the competitors to identify key obstacles and how to overcome them. A secondary investment is in the preparation of workshop reports and its development into publications, which began in FY18 and will be completed in FY19.

*Partnerships:* Non-Federal partners include the Methuselah Foundation, the New Organ Alliance, and CASIS. The Methuselah Foundation is the implementing partner in the VTC and has been outstanding in raising companion funds for judges and teams to travel to workshops, symposia, and conferences as well as to advertise the competition and recruit judges and other subject matter experts. The Methuselah Foundation also recruited National Science Foundation and Veterans Administration support. In addition, CASIS is offering to fly prize winners' investigations on the ISS.<sup>50</sup> CASIS was selected by NASA in 2011 to be the sole manager of the ISS National Laboratory. The estimated value of partner contributions in FY18 is \$102,000, which includes \$60,000 for management and implementation and \$26,000 for workshops and other events.

*Advancement of Agency Mission:* NASA's objective for this Challenge is to produce technologies capable of creating viable, thick (>1 cm) metabolic tissues that can be used to advance research on human physiology, fundamental space biology, and medicine on both the Earth and the ISS. VTC is responsive to a mandate in the 1958 Space Act (as amended), the foundational legal document governing NASA: "Congress declares that the general welfare of the United States requires that the unique competence of the <National Aeronautics and Space> Administration in science and engineering systems be directed to assisting in bioengineering research, development, and demonstration programs designed to alleviate and minimize the effects of disability."

*Solution Types:* Technology demonstration and hardware; Analytics, visualizations, algorithms; Scientific; Other - Science and Technology Breakthrough in medically important 3D tissue engineering

*Plan for Upcoming 2 FYs:* The VTC ends September 30, 2019. Over the next year, because of the humanitarian potential and the unique insights obtained via the workshops, the VTC team, both paid and volunteer, plan to write articles that capture the state of the art of 3D tissue engineering, describe critical research issues and recommendations, and articulate the role of spaceflight in potentially overcoming the significant gravitational issues constraining successful development of tissues large enough to be medically useful. Two more workshops are planned, one in January 2019 and another as a closeout workshop in September 2019. A closeout report will be prepared.

## **B.8 National Science Foundation (NSF)**

### **B.8.1 The NSF 2026 Idea Machine<sup>51</sup>**

*Lead Sponsoring Agency:* NSF

*Authority:* NSF Act of 1950, as amended

*Status:* This competition was launched in FY18, and is underway.

*Competition Goals:* The goal of the NSF 2026 Idea Machine is to engage a broad swath of stakeholders in the science, technology, engineering, and mathematics (STEM) and STEM education research

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<sup>50</sup> Prior space research has shown that growing certain tissues in microgravity yields larger and often superior tissues to those grown under the best conditions on Earth. However, the vascularization of those tissues has still not been satisfactorily achieved, and without it, the tissues are of limited utility for developing solutions to medical problems on Earth or in space. Once vascularized tissues are successfully developed, space flight might offer an important tool for further breakthroughs.

<sup>51</sup> The website for The NSF 2026 Idea Machine can be viewed at [https://www.nsf.gov/news/special\\_reports/nsf2026ideamachine/index.jsp](https://www.nsf.gov/news/special_reports/nsf2026ideamachine/index.jsp).



enterprise to identify grand challenges for future, long-term investment by NSF (i.e., to identify the next set of big ideas). The competition will help set the U.S. agenda for fundamental research in science and engineering by asking entrants to suggest the pressing research questions that need to be answered in the coming decade, the next set of big ideas for future investment by NSF in anticipation of the Nation's 250th anniversary in 2026 and beyond. It is an opportunity for researchers, the public, and other interested stakeholders to contribute to NSF's mission to support basic research and enable new discoveries that drive the U.S. economy, enhance national security, and advance knowledge to sustain the country's global leadership in science and engineering.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Engage new people and communities

*Justification for Using Prizes and Challenges:* A prize competition was chosen in order to maximize excitement, engage the public, and incentivize participation by a wide range of potential contestants, including thinkers inside and outside the academic and industrial research communities. The NSF 2026 Idea Machine prize competition is based on the premise that scientific creativity and innovation have no bounds. Its premise is that everyone in the science and engineering community, from high school students to emeritus professors, as well as anyone who loves science in the general public have ideas about the future and what might be possible. NSF wants to harness those rich imaginations through an ideation prize competition that extends the agency's tradition of reaching out to the community to find fresh, new ideas that have the potential to benefit science and society.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$164,000 (to be awarded summer 2019). Non-monetary incentives included public recognition (posting entries on website), thank-you letters from NSF leadership, and acknowledgment of honorable mentions at winner recognition event. Grand prize winners (up to four individuals or teams comprised of up to five individuals) will receive travel support to attend the recognition event in summer of 2019 in the Washington, D.C. area.

*Solicitation of Submissions:* The NSF 2026 Idea Machine was announced at meetings of the National Science Board, other NSF events (e.g., NSF Days), and scientific disciplinary organization meetings attended by NSF staff. A toolkit of materials for outreach available to NSF staff members included postcards, posters, sample social media posts, sample emails, and slide presentations. The NSF 2026 website went live prior to launch of the competition, and announcements went out over all NSF social media platforms. The competition was announced via email to current and former principal investigators, representatives of scientific organizations, NSF directorate advisory committees, non-profit organizations, industry groups, independent research institutes and centers, heads of science and engineering research departments at universities, and STEM high-school teachers. The launch of the competition was also announced by press release, the NSF Director's Newsletter, and on social media platforms.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Paid advertising

*Participation Requirements:* All contestants (including individual entrants and all team members) must be at least 14 years of age by September 1, 2018, and be U.S. citizens or permanent residents, or residing legally in the U.S. on September 1, 2018. Only one entry per individual or team is permitted. A contestant may submit an entry as an individual or as a member of a team, but not both. A contestant may only be on at most one team. Entries may be submitted by individuals or by teams comprised of up to five individuals, one of whom must be designated as the team leader. Restrictions apply to people working at NSF, Idea Machine judges, and Federal contractors.

*Evaluation of Submissions:* Entries will be screened by NSF staff for responsiveness to the competition call and consistency with the competition rules. Entries that meet the initial screening criteria will be judged by NSF staff who will select approximately 30 for the next phase of the competition. Those entrants continuing to the second phase will be invited to make video submissions. The second phase entries will be judged by a Blue-Ribbon panel of external experts in two stages. The Blue-Ribbon panel will make recommendations to NSF. The final selection of winning entries will be at the discretion of NSF and will include consideration of additional factors such as the Foundation's current and planned investments, the unique suitability of NSF to lead research activities on the proposed big idea, risk/reward balance of investing in the idea, readiness of the relevant research communities to take on the idea, and the scope and scale of the idea.

*Results:* The competition is still active and results have not yet been determined. The competition opened for submission on August 31, 2018 and closes on September 30, 2019. The competition has received 801 entries.

*Budget and Resources:* The NSF 2026 Idea Machine is led by the Office of Integrative Activities (OIA) and is managed by a working group representing all the directorates and four offices within NSF. For FY18, one FTE and \$311,000 have been allocated. The Office of Legislative and Public Affairs supports inreach and outreach (creating graphics and materials, developing and maintaining the Idea Machine website, and announcing the competition via social media platforms, email updates, press releases, leadership blogs and speeches, etc.). Post Modern Company (subcontract to SKILD) was contracted to build, operate, and maintain an online platform that facilitates the submission of entries (text and video), collection of public comments, and judging of competition entries. The contractor is also providing technical support to contestants and marketing the competition, and will distribute cash prizes for winning entries. The contract price was valued at \$303,000 (including funds for cash prizes) in FY18. The NSF 2026 Idea Machine is being advertised throughout the entry submission window via on-line leaderboard ads in Science, Science New, and Science Advances (all products of the American Association for the Advancement of Science). The cost for advertisement was \$8,000 in FY18. In FY19, OIA will support a one-day virtual meeting and a three-day in-person meeting of the Blue-Ribbon panel at NSF. The estimated cost for this is \$33,000.

*Partnerships:* N/A

*Advancement of Agency Mission:* Thematic initiatives informed by the NSF 2026 Idea Machine will advance NSF's mission to "promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense." The NSF 2026 Idea Machine exemplifies a new way of eliciting the most forward-looking ideas and enabling a broad consensus with respect to major initiatives that require and deserve support over the next decade to sustain America's global leadership in science and engineering.

*Solution Types:* Ideas; Scientific

*Plan for Upcoming 2 FYs:* This is the pilot year for the NSF 2026 Idea Machine, and depending on the response and quality of entries, it will continue in FY19 and FY20 as an annual competition. Several NSF programs that ran challenge competitions during FY17-FY18 are considering hosting new competitions to build on prior successes.

**B.8.2 The Vizzies Challenge<sup>52</sup>**

*Lead Sponsoring Agency:* NSF

*Authority:* NSF Act of 1950, as amended

*Status:* This FY17 competition is complete, and the FY18 competition is underway.

*Competition Goals:* In the Vizzies Challenge, NSF asks participants to submit creative, science visualizations that promote understanding of scientific and engineering research. As the need to increase science literacy grows more urgent, visualizations can provide immediate and influential connections between scientists and other citizens. Utilizing these visualizations may be the best hope for nurturing popular interest, as well as helping scientists explain complex problems, while also demonstrating to the public the illustrative aspects of science and engineering. This national contest intends to recognize outstanding achievement by academic scientists, engineers, and the public in the use of visual media to promote understanding of research results.

*Goal Types:* Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* Traditional methods such as the grants-approval process would be ill-suited to recognizing the outstanding performance and creation of participants' visual media. Running the Vizzies as a prize competition allows NSF to engage the general public in an interactive manner, and it allows us to partner with outside organizations to more fully realize the reach and potential of the Challenge.

*Cash Prize Purses and/or Non-Cash Prize Awards:* In FY17, the total prize purse offered and awarded was \$11,250. Experts' Choice winners were awarded \$2,000 for each category and People's Choice winners were awarded \$250 in each category. In FY18, the total prize purse was \$11,500. Up to five Experts' Choice will receive \$2,000 and up to three People's Choice will receive \$500. Non-monetary incentives include featuring winning entries on PopSci.com and on NSF.gov.

*Solicitation of Submissions:* Entries were solicited via email listservs, social media (facebook/twitter/Instagram/etc.) and social media advertisements, postcards distributed at various events, sessions/talks at various events.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Eligibility requirements stipulated that team leads must be U.S. citizens, nationals or permanent residents; all entrants must be 18 years or older; entries must convey science, technology, engineering, and/or mathematics principles; and entries must not advertise or promote a commercial product visually or orally.

*Evaluation of Submissions:* Vizzies judging is completed in three phases. In each phase, judges evaluated visual impact (50%), effective communication (30%), and freshness and originality (20%). For the first and second rounds, judges were primarily program officers, science assistants, and American Association for the Advancement of Science Fellows at NSF. For the third round of judging, experts in scientific visualization, art, publishing, and media evaluated entries. As part of the third round, members of the public were also invited to vote on their favorite entry.

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<sup>52</sup> The website for The Vizzies Challenge can be viewed at [NSF.gov/vizzies](https://www.nsf.gov/vizzies).

*Results:* A total of 372 entries were submitted between January 15, 2018 and April 18, 2018. Ten prizes were awarded in 2017 and eight prizes will be awarded in 2018, one prize was later retracted.

*Budget and Resources:* One FTE (in both FY17 and FY18) was responsible for managing the Vizzies competition. This included answering inquiries, working with contractors on setup, editing and working with other office members to update the website, as well as managing the application, submission, and evaluation processes. In FY17, \$35,000 for the competition was disbursed through a contract with PostModern to entry platform company WizeHive. In FY18, \$40,000 was disbursed through PostModern to entry platform company Skild. An additional \$3,000 left over from a previous competition NSF had run with Skild was transferred to the Vizzies account.

*Partnerships:* Popular Science magazine provided social media support and advertising for the competition. Additionally, the magazine has published the winners in its online edition, and will do so again for the 2018 winners. The value of this contribution is estimated at \$10,000-\$30,000.

*Advancement of Agency Mission:* The mission of the National Science Foundation is to fund fundamental and basic research in science and engineering across all fields of study. The Vizzies Challenge helps us to advance that mission by increasing awareness of the agency and our work. The Vizzies Challenge has historically been a valuable asset for interacting with non-traditional audiences, since the competition is open to all US citizens, nationals, and permanent residents, not just academic researchers. By combining an expert panel and a popular choice aspect to the Challenge, the public can engage with NSF in a new and novel way.

*Solution Types:* Software and apps; Creative (design & multimedia); Technology demonstration and hardware; Analytics, visualizations, algorithms; Scientific

*Plan for Upcoming 2 FYs:* N/A

## **B.9 Office of the Director of National Intelligence (ODNI)**

### **B.9.1 3D Multi-View Stereo Challenge<sup>53</sup>**

*Lead Sponsoring Agency:* Intelligence Advanced Research Projects Activity (IARPA)

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was completed in FY17 and prizes were distributed in FY18.

*Competition Goals:* There were several goals for the Multi-View Stereo Challenge. The main goal was to encourage the development of an algorithm better than the current state of the art. The winning algorithm would then be provided as an open source baseline for generating 3D point clouds for others to use and try to improve, and the top algorithm, along with the competition data, would be hosted online indefinitely to encourage further algorithm development. Thus, this challenge will allow individuals outside the IC in the computer vision community to develop algorithms for satellite imagery.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research

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<sup>53</sup> The website for the 3D Multi-View Stereo Challenge can be viewed at <https://www.iarpa.gov/index.php/working-with-iarpa/prize-challenges/785-multi-view-stereo-3d-challenge>

problems of interest to the Intelligence Community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$100,000. \$84,000 of the prize purse was paid out in FY17 and the remainder was distributed in FY18. Prize awards in the Explorer Challenge break down as follows: First Place - \$5,000, Second Place - \$4,000, Third Place - \$3,000, Fourth Place - \$2,000, Fifth Place - \$1,000, Best Feedback - \$1,000. Prize awards in the Master Challenge break down as follows: First Place - \$20,000, Second Place - \$16,000, Third Place - \$11,000, Fourth Place - \$7,000, Fifth Place - \$5,000, Bonus Opportunities - \$12,000, Open Source Award (x3) \$5,000. Non-monetary incentives included the opportunity for winners to present their solutions at a government and industry workshop on the challenge.

*Solicitation of Submissions:* A presentation was made at the Conference on Computer Vision and Pattern Recognition to solicit feedback and participation. Additionally, members from academia, the computer vision field, and other computer vision entities were targeted for participation. The challenge attracted a wide audience of competitors from various fields, as well as participation from within the Topcoder community.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition

*Participation Requirements:* The target audience for this challenge was data scientists, computer vision programmers, and others interested in the realm of data satellite imagery. Solvers 18 and over were eligible, including those from around the globe, with the exception of those who reside in Iran, Cuba, North Korea, Crimea Region of Ukraine, Sudan, or Syria. In addition, those who are on the Specially Designated Nationals list promulgated and amended, from time to time, by the United States Department of the Treasury were ineligible.

*Evaluation of Submissions:* For this data science competition, there was a data set released with training data and test data for solvers to work with. They created their algorithms and submitted results to a holdback data set that calculated a provisional leaderboard that alerted people to progress over the duration of the challenge. At the end of the challenge, the algorithms were run against a final data set the solvers had not seen or interacted with. This final score and review of their code resulted in the winning solution being selected. Solvers were also asked to document their algorithms and code for final evaluation to ensure that the code was understandable and doing what was intended in the challenge. There was an introductory Explorer Challenge Phase and an advanced Master Challenge Phase to the competition.

*Results:* Between July and October 2016, the Explorer Challenge drew 686 registrants with 16 active competitors and the Master Challenge drew 369 participants with 24 active competitors. Thirteen prizes were awarded to 10 winners.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* This IARPA public prize challenge has resulted in immediate major outcomes of benefit to the intelligence community and also the public community of remote sensing researchers. Three Open Source solutions were made public via the challenge and posted on the challenge website. Results of the prize challenge indicate the best performing research solutions are

based on the Satellite Stereo Pipeline (S2P), the RPC Stereo Processor, and the NASA Ames Stereo Pipeline (ASP). As a result of prize incentives from the challenge, multi-view stereo solutions based on S2P and ASP are being open sourced. All source imagery, ground truth LIDAR, and metric analysis software for the prize challenge has been publicly released as a commercial satellite benchmark to support the research community. This data is made available at <http://www.jhuapl.edu/satellite-benchmark.html>. The best research solutions from the challenge are based on variations of the Semi-Global Matching dynamic programming algorithm first published by Hirschmuller in 2008. This establishes a baseline for further research.

*Solution Types:* Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

### **B.9.2 Disguised Faces in the Wild Competition**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* The goal of the Disguised Faces in the Wild Competition was to advance the performance of face recognition on disguised or obfuscated faces. With recent advancements in deep learning, the capabilities of automatic face recognition have been significantly increased. However, face recognition in an unconstrained environment with non-cooperative users is still a research challenge, pertinent for users such as law enforcement agencies. While several covariates such as pose, expression, illumination, aging, and low resolution have received significant attention, “disguise” is still considered an arduous covariate of face recognition.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Other - Benchmark state of the art

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$25,500. Six prizes were awarded: first (\$6,000) and second (\$2,500) place in Overall Recognition Accuracy, Impersonation Recognition, and Obfuscation Recognition. Non-monetary incentives included the opportunity to present at the 2018 Institute of Electrical and Electronics Engineers (IEEE) Computer Vision and Pattern Recognition Conference.

*Solicitation of Submissions:* The prize challenge was advertised through [challenge.gov](http://challenge.gov) and <http://iab-rubric.org/DFW/dfw.html> with all rules and participation instructions. Organizations signed a participation agreement with Indraprastha Institute of Information Technology (IIIT)-Delhi and submitted executable software to them for evaluation. The target audience for this challenge were academic and industry researchers in face recognition.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)



*Participation Requirements:* N/A

*Evaluation of Submissions:* IIIT-Delhi evaluated the performance of submitted algorithms by conducting standardized biometric tests involving a sequestered test and evaluation dataset. Metrics and evaluation conditions were published in the prize challenge rules ahead of time.

*Results:* Of the 12 entries submitted between January 20 and May 1, 2018, six prizes were awarded to two winners.

*Budget and Resources:* N/A

*Partnerships:* Non-Federal partners included the University of Maryland, IBM, and IIIT-Delhi.

*Advancement of Agency Mission:* Face recognition is used in many U.S. Government missions, including counter terrorism, criminal justice, and national security. This prize challenge allowed IARPA to engage the wider academic and commercial research communities developing face recognition software to stimulate advances in unconstrained face recognition as well as to benchmark the state of the art of existing solutions.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.9.3 Functional Map of the World (FMOW) Challenge<sup>54</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* Recent advances in computing capabilities have led to deep learning algorithms and great advances in computer vision and machine learning. The goal of the Functional Map of the World Challenge was to encourage researchers to apply such techniques to provide an understanding of satellite images and develop machine learning algorithms that would successfully predict the functional use of buildings and land use. To satisfy the desired data driven techniques, one million annotated images were generated and placed online.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the Intelligence Community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$112,500 and the total amount awarded was \$107,500. Prize awards in the FMOW Challenge break down as follows: First Place - \$25,00, Second Place - \$16,000, Third Place - \$12,000, Fourth Place - \$8,000, Fifth Place - \$5,000,

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<sup>54</sup> The website for the Functional Map of the World (FMOW) Challenge can be viewed at <https://www.iarpa.gov/challenges/fmow.html>.

Undergrad - \$5,000, Open Source (x3) - \$5,000, Best POI - \$5,000, Progress Prizes (x3) - \$3,000, Workshop Presenter (x5) \$2,500. The Prizes covered participation in the challenge, with a set aside of travel money awarded for those selected to travel to the final workshop held by IARPA in conjunction with SpaceNet. At the final workshop, the winners were able to present their solution to a government group interested in Geospatial Imagery.

*Solicitation of Submissions:* Participants in the previous Multi-View Stereo 3D Challenge were solicited along with members from academia, the computer vision field, and other computer vision entities. The challenge attracted a wide audience of competitors from various fields, as well as participation from within the Topcoder community.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition

*Participation Requirements:* The target audience for this challenge was data scientists, computer vision programmers, and others interested in the realm of satellite imagery data. Solvers 18 and over were eligible, including those from around the globe, with the exception of those who reside in Iran, Cuba, North Korea, Crimea Region of Ukraine, Sudan, or Syria. In addition, those who are on the Specially Designated Nationals list promulgated and amended, from time to time, by the United States Department of the Treasury were ineligible.

*Evaluation of Submissions:* For this data science competition, there was a data set released with training data and test data for solvers to work with. They created their algorithms and submitted results to a holdback data set that calculated a provisional leaderboard that alerted people to progress over the duration of the challenge. At the end of the challenge, the algorithms were run against a final data set the solvers had not seen or interacted with previously. This final score and review of their code identified the winning solution. Solvers were also asked to document their algorithms and code for final evaluation to ensure that the code was understandable and doing what was intended in the challenge.

*Results:* A total of 858 registered participants generated 1408 entries (submitted by 69 participants) between September and December 2017. Ten prizes were awarded to 11 winners.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* IARPA released the full data set, including the sequestered data, on SpaceNetTM after the challenge in order to further scientific research on the data. See [https://spacenetchallenge.github.io/datasets/fmow\\_summary.html](https://spacenetchallenge.github.io/datasets/fmow_summary.html) for more information. Data is now available for free to download, removing the cost burden to efficiently accessing the data. Three open source solutions released to the public to allow the computer vision community to keep working on improved solutions.

*Solution Types:* Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

**B.9.4 Fusion of Face Recognition Algorithms (FOFRA)<sup>55</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* How can the data outputs of multiple face recognition algorithms be leveraged to improve overall accuracy? There is a large literature on biometric fusion intended to improve accuracy via fusion of multiple modalities (e.g., face + fingerprint), multiple algorithms, or multiple samples. However, most of the research has only addressed one-to-one (1:1) verification at the score level. This prize challenge is aimed at stimulating research into methods to improve one-to-many (1:N) identification accuracy via template-level fusion. Further accuracy gains could be realized by fusing feature-level templates or through more innovative score-level fusion methods informed by modern data science.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$70,000, but no working submissions were received. There were five prizes available, though none were awarded: Verification Score-level Fusion (\$8,000), Verification Template-level Fusion (\$16,000), Identification Score-level Fusion (\$11,000), Identification Template-level Fusion (Two-way) (\$18,000), and Identification Template-level Fusion (Three-way) (\$17,000).

*Solicitation of Submissions:* The prize challenge was advertised through iarpa.gov, challenge.gov, and nist.gov with all rules and participation instructions. Organizations signed a participation agreement with the National Institute of Standards and Technology (NIST) and submitted executable software to NIST for evaluation. IARPA is in the process of evaluating the prize challenge to determine lessons learned so as to inform how or if to proceed with re-launching the challenge. The challenge received 16 requests for the training/validation data, which is low for a biometrics challenge but still significant enough that more submissions were expected.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* No evaluation was performed due to a lack of functioning software submissions. NIST was to evaluate the performance of submitted algorithms by conducting

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<sup>55</sup> The website for the Fusion of Face Recognition Algorithms (FOFRA) can be viewed at <https://www.iarpa.gov/index.php/working-with-iarpa/prize-challenges/1110-fusion-of-face-recognition-algorithms-fofra-prize-challenge>.

standardized biometric tests involving a sequestered testing and evaluation dataset. Metrics and evaluation conditions were published in the prize challenge rules ahead of time. Results were to be presented to a panel of U.S. Government employee judges who then would select winners based on technical performance.

*Results:* One entry was submitted between May 23 and August 6, 2018. No prizes were awarded.

*Budget and Resources:* N/A

*Partnerships:* IARPA partnered with NIST for this challenge.

*Advancement of Agency Mission:* Face recognition is used in many U.S. Government missions, including counter terrorism, criminal justice, and national security. Face recognition error rates, particularly on uncontrolled face imagery, are well above zero. While algorithm development has seen considerable investment, other mechanisms for improving accuracy are known. Among them, there is a large academic literature on biometric fusion, covering multimodal and multi-algorithmic fusion. It shows that substantial accuracy gains can be made over using a single mode, or a single algorithm alone, and this can be achieved, in large part, using quite simple methods. The gains decrease when the fused inputs are correlated. The vast majority of the literature addresses biometric verification, rather than identification. Moreover, the literature covers score-level fusion rather than feature (i.e. template) level fusion. The latter, on information theoretic grounds, offers greater accuracy gains at the expense of some complexity.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.9.5 Geopolitical Forecasting Challenge<sup>56</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY18 and is underway.

*Competition Goals:* Decision makers rely on the Intelligence Community (IC) to provide accurate and relevant geopolitical forecasts, and IARPA is working to identify methods to maximize the quality of these forecasts. The Geopolitical Forecasting (GF) Challenge sought to crowdsource innovative algorithms for integrating crowdsourced forecasts and other data into accurate, timely forecasts on worldwide issues. The effort was run in parallel to IARPA's geopolitical forecasting research program Hybrid Forecasting Competition (HFC). Challenge Solvers competed on a largely overlapping set of Individual Forecasting Problems (IFPs) as HFC research teams and were given access to the same human forecaster data stream. In addition to the provided data stream, solvers were free to use other data streams and existing/developed models for the challenge.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broader audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the IC. The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can

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<sup>56</sup> The website for the Geopolitical Forecasting Challenge can be viewed at <https://www.iarpa.gov/challenges/gfchallenge.html>.

be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes in shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered amounts to \$200,000. The first place overall prize is \$20,000, and the second through fifth place overall prizes are \$12,000, \$10,000, \$7,000, and \$4,000, respectively. A bonus “Ultimate Forecaster” award with a total value of \$40,000 was available to the solver who finished in first place. Additional bonus awards included the Star Forecaster awards, which provides for \$30,000 split amongst all eligible solvers/teams. Additional incentives and milestone prizes include a Best in Domain/Region Pair prize purse of \$25,000 (five awards of \$5,000 each), a Best Undergraduate award of \$4,000, a Milestone 1 award of \$7,500 (ten awards of \$750 each), a Milestone 2 award of \$10,000 (ten awards of \$1,000 each), a Milestone 3 award of \$12,500 (ten awards of \$1,250 each), an Election Forecaster Award of \$10,000, a Spring Forecaster award of \$2,400 (three awards of \$800 each), an Interim Prize of \$2,600, and a Workshop Presenter Prize of \$2,500. Non-monetary incentives included an opportunity to interact with IARPA Program Manager Dr. Seth Goldstein, and attendance at the IARPA Hybrid Forecasting Competition Principal Investigator meeting/GFChallenge workshop.

*Solicitation of Submissions:* GF Challenge Solvers submitted their forecasts via a platform built by Cultivate Labs. They were able to access the IFPs, submit their forecasts, view a leaderboard, and view their scores on the various IFPs through this platform. Solvers were also required to submit a Final Solver Document, where they provided greater context and explanation for their solutions in a narrative format.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* To be eligible to win a prize under this competition, an individual or entity: (1) Must have completed and submitted a registration form at HeroX GF Challenge; (2) Must be an individual or team each member of which is 18 years of age or over, or an incorporated entity; and (3) May not be a Federal entity or Federal employee acting within the scope of their employment. An individual or entity shall not be deemed ineligible because the individual or entity used Federal facilities or consulted with Federal employees during a competition if the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis. Some participating individuals or organizations were not eligible for prizes. However, these solvers did have the opportunity, upon IARPA approval, to participate in the challenge and be eligible for ranking on the leaderboard.

*Evaluation of Submissions:* For most of the prize categories, the score was the sum of solvers’ Net Brier Points (NBPs) over all germane IFPs for that category. NBPs measure solver performance versus a baseline based on current state-of-the-art human forecast collection and aggregation methods derived from the IARPA ACE program. To be eligible for overall prizes, solvers needed to have attempted at least 70% of all IFPs and have positive NBPs (i.e., beat the state-of-the-art baseline) on more than 50% of IFPs attempted. For overall performance prize bonuses, solvers needed to meet qualifying criteria listed above and additionally beat the GF Challenge Baseline and HFC Top score. To be eligible for milestone or domain/region prizes a solver must have submitted forecasts for at least 80% of the IFPs considered for that prize. For Milestone Prizes, only the IFPs that were resolved during that time period counted for that Milestone’s prizes. IFPs that were opened, but not resolved, during a Milestone did not count. Those IFPs were counted towards the Milestone period in which the IFP resolves. Net Brier Points were calculated using a metric, based on the Brier score, which incorporates forecast accuracy, timeliness,

and confidence in contrast to the state-of-the-art baseline. This baseline was available to solvers via the Cultivate Labs platform. HFC Top Score was the top scoring method, coming out of the parallel HFC research program; it was visible on the leaderboard during the challenge.

*Results:* There were 17 participants in this challenge. A total of 46 prizes were awarded to 10 participants, totaling \$125,150. One challenge participant, a University Affiliated Research Center, relinquished prizes in order to be eligible for the competition. Eight participants had forecast methods that outperformed the benchmark, which was the prior state of the art in forecast aggregation from the IARPA ACE program. These methods also outperformed the best HFC methods, albeit with relaxed participation rules as compared with the HFC Performers.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* IARPA's mission is to envision and lead high-risk, high-payoff research that delivers innovative technology for future overwhelming intelligence advantage. The GF Challenge invited Solvers from around the world to develop solutions that produced probabilistic forecasts in response to numerous closed-ended forecasting questions that concerned specific, objectively verifiable geopolitical events containing timeframes with deadlines and locations. Questions like: Who will win the upcoming presidential election in Egypt? What will the spot price of Brent Crude oil be on [date]? This challenge directly advanced IARPA's mission to engage the public by challenging them to develop solutions that are capable of processing data and making forecasts. Methods that outperformed the state-of-the-art or HFC Performer methods overall, or on specific subsets of forecasting questions (e.g., for particular regions or topics) have the potential to inform geopolitical forecasting within the intelligence community.

*Solution Types:* Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

### **B.9.6 Mercury Challenge<sup>57</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY18, and is underway.

*Competition Goals:* In an effort to provide early warning capabilities, the Department of Defense's Integrated Crisis Early Warning System and IARPA's Open Source Indicators programs want to leverage novel statistical and machine learning techniques using publicly available data sources to forecast societal such as civil unrest and disease outbreaks with a high degree of accuracy. Participants are encouraged to develop and test innovative forecasting methods that ingest and process publicly available data sources to predict military activity, non-violent civil unrest, and infectious disease in specific places of interest.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Engage new people and communities

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research

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<sup>57</sup> The website for the Mercury Challenge can be viewed at <https://www.iarpa.gov/challenges/mercury.html>.



problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$100,000. During the first scoring period, \$21,000 will be given out to six total winners. During the second scoring period, \$79,000 will be given out to nineteen total winners.

*Solicitation of Submissions:* The challenge was marketed through press release, media hits, social media, email outreach, two early Q&A sessions, and a community day. The challenge was also marketed to the Topcoder community.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Other - WeWork; Other - Topcoder

*Participation Requirements:* To be eligible to win a prize under this competition, an individual or entity: must be an individual or team each of whose members are 18 years of age and over, or an incorporated entity; may not be a Federal entity or Federal employee acting within the scope of their employment. An individual or entity shall not be deemed ineligible because the individual or entity used Federal facilities or consulted with Federal employees during a competition if the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis. Federal grantees may not use Federal funds to develop challenge solutions unless consistent with the purpose of their grant award. Federal contractors may not use Federal funds from a contract to develop challenge applications or to fund efforts in support of a challenge submission.

*Evaluation of Submissions:* For military activity forecasts, the effectiveness of each participant's methods will be judged using the following metrics: (1) Lead Time, the number of days between the date the forecast was produced and the date the actual event was reported; (2) F-Score, the harmonic mean of Precision; and (3) Recall Quality Score (QS), the similarity of warning details to event details in terms of the distance between the warning location and the event location, the number of days between the warning Event Date and the actual Event Date, and agreement between warning and event actor and event subtype. QS is measured on a scale of 0.0 to 4.0. For count forecasts, which include civil unrest (CU) events and disease, the effectiveness of each participant's methods will be judged using the following metrics: (1) Lead Time, the average number of days between the date the forecasted count was submitted and the effective Event Date; (2) Weekly Counts, where the week is defined as the International Organization for Standardization week, which starts on Monday and ends on Sunday; (3) Monthly Counts, where the effective Event Date is the 15th of the month; and (4) Quality Score, the average quality score of each valid forecast (ranges from 0 to 1), which is based on the difference between the forecast count and the actual count. Ranking of participants who achieve these two thresholds will be done using Quality Score carried to three significant digits. In the event of a tie additional significant digits will be used to determine the final winners. The Mercury Challenge will compare participant submissions against a "base rate" model. Base Rate models are models that only use information included in the history of observed events. It is expected that Participant models will score better than the base rate models. The top scorers who beat the baseline will be awarded the Best Overall prize(s).

*Results:* At the time of this report, no prizes have been awarded. The challenge is broken up into two separate scoring periods: (1) August 7 to October 31, 2018, and (2) November 1, 2018 to January 31.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* IARPA's mission is to lead high-risk, high-payoff research that delivers innovative technology for future overwhelming intelligence advantage. The Mercury Challenge invited technologists, data scientists, and machine learning engineers who are skilled at breaking down complex data to participate. Surprise events such as the fall of the Berlin Wall, Iraq's invasion of Kuwait, the civil unrest that gave rise to the Arab Spring, and Russian incursions into Ukraine, forced rapid responses in the absence of data related to the underlying causes of these events. IARPA aims to connect the dots that lead up to events such as these. This challenge directly advances IARPA's mission to engage the public by challenging them to develop solutions by making forecasts.

*Solution Types:* Ideas; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* N/A

### **B.9.7 MORGOTH'S CROWN (Modeling of Reflectance Given Only Transmission of High-Concentration Spectra for Chemical Recognition over Widely-Varying Environments)<sup>58</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* The aim of MORGOTH'S CROWN challenge was to crowdsource breakthroughs in infrared (IR) spectral modeling that could enable predictions of trace chemical spectra on a surface from bulk reflectance or absorption spectra. A major hurdle for active/passive-standoff detection in real-world settings is compensating for spectral changes due to chemical or physical interactions of chemicals with a substrate and/or from physical characteristics of the chemical (e.g., particle size and shape, deposition, thickness, etc.). An improved or breakthrough IR spectral model would enable easier construction of more comprehensive and robust chemical detection libraries that would enhance passive or active infrared chemical detection probabilities in complex environments. Participants were asked to generate an algorithm that would predict the spectra of combinations of chemicals and substrates that were not used in the training data. For example, if the training set involved caffeine layered on aluminum, participants could have been asked to predict the spectra of caffeine on glass or acetaminophen on aluminum.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes in shorter timelines.

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<sup>58</sup> The website for MORGOTH'S CROWN can be viewed at [www.iarpa.gov/challenges/morgothscrown.html](http://www.iarpa.gov/challenges/morgothscrown.html).

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$50,000 and the total amount awarded was \$49,500. The top five awards were distributed as follows: First Place: \$20,000, Second Place: \$15,000, Third Place: \$10,000, Fourth Place: \$2,000, and Fifth Place: \$1,000. Three bonus prizes were offered, to include: Progress Prize 1: \$1,000, Progress Prize 2: \$500, Progress Prize 3: \$500 (not awarded). Non-monetary incentives included the opportunity to present solutions at a government workshop.

*Solicitation of Submissions:* The target audience were members of academia, small businesses, and experts across the globe who deal with spectroscopy, chemistry, physics, etc. We reached out via email and social media and marketed through the Topcoder platform in addition to listing on Challenge.gov. Outreach hit over 2,000 email contacts.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Topcoder solvers pool

*Participation Requirements:* The challenge targeted chemists, computer scientists, the machine learning community, and anyone else who may want to participate in a data analysis challenge. U.S. and foreign participants were solicited. The only limitation on participation was that anyone affiliated with either a SILMARILS (Standoff ILLuminator for Measuring Absorbance and Reflectance Infrared Light Signatures) program performer or test and evaluation team member had to recuse themselves from winning prizes, but could participate and be scored.

*Evaluation of Submissions:* An automated scoring function based on a non-linear combination of Spectral Information Divergence and Spectral Angle Mapper metrics was used to provide an overall “closeness of fit” score between the predicted spectra and the measured ground truth data (test data set), with higher scores indicating better fits. Challenge participants were provided with their composite score, and allowed to submit multiple predictions of the test data set over the course of the challenge in order to iteratively improve their algorithms. At the conclusion of the challenge the ten highest scoring participants submitted their algorithm code to the MORGOTH’S CROWN challenge team, where the algorithms were run to provide predictions of an additional 18 different substrate and chemical morphology combinations which the participants had never seen or been able to score their algorithm against during development (validation data set). Scores against this validation set were used to determine the final challenge rankings and prizes.

*Results:* Of the 664 entries submitted by 37 participants between July 26 and September 20, 2017, seven prizes were awarded to five winners.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* IARPA’S MORGOTH’S CROWN prize challenge was a crowdsourced effort to encourage new approaches in infrared spectral modeling to quantitatively predict trace spectra on surfaces from bulk reflectance spectra. All algorithm development methods and algorithm types were allowed, ranging from traditional first-principle physics based models to pure machine learning approaches. After developing and training their algorithm using the training data set, which was provided with full characterization and metadata, performers were asked to submit spectral predictions for 18 different substrate and chemical morphology combinations. The results of the MORGOTH’S CROWN challenge showed that machine-learning based approaches were better able to quantitatively predict new spectra than physics-based models. This indicates that new approaches to chemical spectral prediction, which is important for detecting traces of explosives, narcotics, and other chemical hazards on surfaces are needed.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.9.8 Nail-to-Nail (N2N) Fingerprint Challenge<sup>59</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* The goal of the N2N Challenge was to improve biometric fingerprint collection and recognition systems by eliminating plain fingerprint captures. IARPA was looking for new and innovative approaches to developing an N2N fingerprint capture device that: (1) Does not require a human operator (though verbal instructions can be provided); (2) Is capable of collecting full nail-to-nail friction ridge surfaces that lead to biometric recognition that is as good or better than existing standard human operator assisted methods; (3) Is able to capture the information in the same or less time as existing approaches; (4) Enables fully- or semi-cooperative subject interaction; (5) Uses contact or contactless capture methods; and (6) Uses novel or conventional fingerprint sensor hardware.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than using a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes in shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$290,000 and the total amount awarded was \$255,000. Prizes were awarded in the following manner: Print Provider (x8) - \$8,000, Master Builder (x8) - \$2,000, Workshop Presenter (x5) - \$5,000, Best Latent Accuracy - \$25,000, Fastest Scan - \$25,000, Best Gallery Accuracy - \$25,000, Grand Prize - \$100,000. In the event that no one met the metrics for the Grand Prize, a Second Place of \$15,000 and Third Place of \$10,000 were to be awarded in the following categories: Best Latent Accuracy, Fastest Scan, and Best Gallery Accuracy. Non-monetary incentives included the opportunity to present findings at the N2N Workshop held at the Biometrics Congress Conference in Washington, DC.

*Solicitation of Submissions:* The challenge was promoted on challenge.gov and iarpa.gov along with press releases, an email campaign and a social media campaign. As this was a three-stage downselect challenge, marketing was only done at the start of the challenge as new solvers could not join the challenge after the first downselect period.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

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<sup>59</sup> The website for the Nail-to-Nail (N2N) Fingerprint Challenge can be viewed at <https://www.iarpa.gov/challenges/n2n/n2n.html>.

*Participation Requirements:* The challenge was open to all U.S. and foreign citizens, companies, teams, and any organization or single participant. Solvers were required to submit a write up, as well as safety review documents in order to participate in the Live test and undergo a safety evaluation as well as Human Subjects Training.

*Evaluation of Submissions:* The first round of submissions were evaluated and feedback provided to participants on considerations and pros and cons of their devices in preparation for Stage 2. During Stage 2, Solvers submitted a device documentation review as well as a video demonstrating their device in action. Solvers were then judged by a government panel and those whose devices were feasible were invited to the Live Test event. During the Live Test event, Solvers captured fingerprints from human test subjects. The same human test subject prints were also captured by the baseline station run by professional hands-on print collectors as well as a set of latent prints collected by forensic examiners. At the end of the challenge, the prints were sent through a government matching system and compared against the baseline rolls for each human test subject. The matching results were used to calculate the final results of the challenge.

*Results:* Of the 15 entries submitted by nine participants between February 2 and September 22, 2017, seven prizes were awarded to eight winners.

*Budget and Resources:* N/A

*Partnerships:* N/A

*Advancement of Agency Mission:* The challenge produced a new public fingerprint dataset containing 41,177 fingerprint images and 13,644 latent images, a subset of which will be released for scientific research. New methods were discovered for fingerprint scanning from academic research and prototype design using new materials and ways of thinking. The challenge compared the efficacy of current state-of-the-art COTS (commercial off the shelf) products to understand their strengths in three areas: live matching, latent matching, and speed. Areas of improvement in large-scale latent print processing and capture were identified. Finally, the challenge shed new light on the comparison of current gold-standard methods of fingerprint collection.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

### **B.9.9 OpenCLIR (Open Crosslingual Information Retrieval)<sup>60</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched in FY17 and is underway in FY18.

*Competition Goals:* The goal of the OpenCLIR (Open Cross Language Information Retrieval) evaluation is to develop methods to locate text and speech content in documents (speech or text) in low-resource languages using English queries. This capability is one of several expected to ultimately support effective triage and analysis of large volumes of data in a variety of less studied languages. Successful systems will be able to adapt to new languages and new genres.

*Goal Types:* Advance scientific research; Develop technology

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<sup>60</sup> The website for OpenCLIR can be viewed at <https://openclir.nist.gov/>.

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than using a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$30,000, which includes \$10,000 for the Text Award and \$20,000 for the Auditory Award.

*Solicitation of Submissions:* Email lists of natural language processing practitioners, IARPA Twitter (hashtag #OpenCLIR), and a Keynote Address at a machine translation conference were used to advertise the challenge. Participants did not specify how they learned of the challenge so we have no data on which approach was most effective.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Announcement in conference keynote address

*Participation Requirements:* Participants should have a background in natural language processing technology.

*Evaluation of Submissions:* Participants were judged on two criteria: (1) performance on the CLIR detection metric, Actual Query Weighted Value (AQWV), weighted 80%, and (2) comprehensiveness of system description, weighted 20%.

*Results:* The challenge is not yet complete. The challenge evaluation period is from March 11, 2019 to March 15, 2019 with system descriptions due March 29, 2019.

*Budget and Resources:* N/A

*Partnerships:* The Federal Bureau of Investigation's National Virtual Translation Center provided annotated data for the evaluation. The National Institute of Standards and Technology provided visiting foreign researchers to run the challenge at their cost, approximately \$40,000.

*Advancement of Agency Mission:* When the challenge is complete, it should advance the state of the art in low resource machine translation, cross-lingual information retrieval and automatic speech recognition.

*Solution Types:* Software and apps; Ideas; Scientific

*Plan for Upcoming 2 FYs:* N/A

#### **B.9.10 The ODNI-ODUSD(I) Xamine Challenge: Machine Verification of Collected Information<sup>61</sup>**

*Lead Sponsoring Agency:* ODNI

*Authority:* N/A

*Status:* This competition was launched in FY18 and is underway.

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<sup>61</sup> The website for The Odni-Ousd(i) Xamine Challenge: Machine Verification of Collected Information can be viewed at [www.innocentive.com/ar/challenge/9934079](http://www.innocentive.com/ar/challenge/9934079).



*Competition Goals:* Machine-based approaches to generating and evaluating analytic products from disparate structured and unstructured data types are emerging areas of research for the U.S. Intelligence Community (IC). As these approaches mature beyond demonstration systems with controlled data sources, such IC systems will require a means for inspecting and ensuring the integrity of the data that are ingested by these systems. These considerations will become particularly critical as the information available to the IC's analytic community continues to exceed the ability for traditional, human vetting. Accordingly, the ODNI and the Office of the Under Secretary of Defense for Intelligence [OUSD(I)] are seeking ideas and descriptions of a viable technical approach for enabling the automated validation of information prior to the dissemination of machine-generated intelligence products.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* ODNI decided to use prize competitions for this topic in order to leverage funding and reach as large an audience as possible. Competitions allow more individuals and companies to be engaged and involved than traditional contracts or grants. The Xamine Challenge attracted 119 registrants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$75,000. This prize pool reflects an initial phase, with a \$25,000 prize purse, and a second phase, with a \$50,000 prize purse. Awards for the first phase are under evaluation, and the second phase has not yet launched. The competition is solely funded by the government and no other private sector or philanthropic funds contribute to the competition prize.

*Solicitation of Submissions:* On 4 May 2018, the competition went live on the InnoCentive prize competition website and was posted on Challenge.gov. ODNI issued a press release and publicized the Challenge on social media. InnoCentive promoted the prize competition through their social media platforms (LinkedIn, Twitter, Facebook, and Google+) and weekly email blasts to over 140,000 solvers during the competition posting period. As a result of this outreach, 119 teams from 32 countries registered for the competition.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release

*Participation Requirements:* N/A

*Evaluation of Submissions:* This competition has received 15 submissions that at the time of this report are being evaluated by ODNI and OUSD(I) representatives.

*Results:* 15 entries were submitted between May 4 and July 2, 2018, and at the time of this report prizes have not been awarded.

*Budget and Resources:* OUSD(I) representatives were involved in evaluating Xamine submissions. The Air Force Research Laboratory (AFRL) and Ball Aerospace managed the contracts and sub-contracts for this prize competition. InnoCentive, Inc. was utilized as a third party vendor to help plan and conduct the prize competition.

*Partnerships:* For this prize competition, ODNI partnered with OUSD(I), AFRL, and Ball Aerospace. ODNI used the Economy Act to ensure economical and efficient services.

*Advancement of Agency Mission:* As previously stated, as machine-driven approaches to generating and evaluating analytic products mature beyond demonstration systems, IC systems will require a means for inspecting and ensuring data integrity. Through this competition, ODNI and OUSD(I) are seeking a viable technical approach to rapidly and objectively determine the trustworthiness of input information prior to the dissemination of machine-generated intelligence products that support IC missions.

*Solution Types:* Software and apps; Ideas; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* In FY19, the office of the Director of Science and Technology (DS&T) within ODNI in partnership with OUSD(I) will sponsor two public prize competitions—“Xplore” and “Xpect”—to explore opportunities, using artificial intelligence techniques, to revolutionize the IC’s finished intelligence production processes. These challenges are part of a series of efforts exploring technical approaches to accelerate and automate the production of intelligence, and build on the “Xpress”, “Xtend”, and “Xamine” challenges launched in Fiscal Years 2017 and 2018. Through the Xplore Challenge, solvers will be asked to describe artificial intelligence-based approaches for enabling the automated and predictive discovery of information. The Xpect Challenge will ask solvers to describe artificial intelligence-based approaches for automating model-based indications of change.

#### **B.9.11 The ODNI-OUSD(I) Xpress Challenge: Machine Generation of Analytic Products<sup>62</sup>**

*Lead Sponsoring Agency:* ODNI

*Authority:* N/A

*Status:* This competition was launched in FY17 and completed in FY18.

*Competition Goals:* The primary objective of this prize competition was to determine the state-of-the-art in natural language processing (NLP). ODNI wanted to examine the feasibility of using NLP and related artificial intelligence technologies to craft analytic products with national security implications.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* ODNI decided to use prize competitions for this topic in order to leverage funding and reach as large an audience as possible. Competitions allow more individuals and companies to be engaged and involved than traditional contracts or grants. The Xpress Challenge engaged over 8,000 people with 387 registrants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$500,000, which included a top award of \$100,000 for the best overall submission and \$30,000 in Early STEM Education awards for high school student team submissions. The total amount awarded was \$200,000, with \$150,000 awarded to the first place submission, and \$50,000 awarded to the second place submission. The competition was solely funded by the government and there were no other private sector or philanthropic funds contributed to the competition prize.

*Solicitation of Submissions:* On April 6, 2017, the competition went live on the InnoCentive prize competition page and was posted on Challenge.gov. ODNI issued a press release and publicized the Challenge on social media. The Armed Forces Communications and Electronics Association interviewed ODNI and published an article promoting the Challenge on May 10, 2017. InnoCentive promoted the prize competition through their social media platforms (LinkedIn, Twitter, Facebook, and Google+) and weekly email blasts to over 140,000 solvers during the competition posting period. As a result of this outreach, over 8,000 people expressed interest in the competition and viewed the prize competition page, and 387 people from 42 countries registered for the competition.

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<sup>62</sup> The website for The Odni-Ousd(i) Xpress Challenge: Machine Generation of Analytic Products can be viewed at [www.innocentive.com/ar/challenge/9933982](http://www.innocentive.com/ar/challenge/9933982).

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* This competition received 15 submissions that were evaluated using ODNI's Rating Scale for Evaluating Analytic Tradecraft Standards (RSEATS). RSEATS was created and finalized before the competition launched and solvers were given access to the evaluation methodology and award schedule. The rating scale was based on how solvers demonstrated the success of their proposal, used clear and logical argumentation, and provided the source code for validation. Of the 15 submissions, 11 were asked to provide their source code and documentation in order to reproduce the submitted analytical product. InnoCentive ran validation tests on the provided source codes. The results of these tests were sent to ODNI for final review and award decision. Literal, Inferential, and Evaluative awards were based on the top Automated Indicator Sharing (AIS) scores in each category using the RSEATS evaluation criteria. An Overall Best Solution award was to be given to the solver who produced the best cumulative scores from AIS evaluation. The final category was a Creativity award. Two submissions were selected for the awards.

*Results:* Of the 15 entries submitted between April 6 and July 5, 2017, prizes were awarded to 2 winners.

*Budget and Resources:* OUSD(I) representatives were involved in code validation in September. AFRL and Ball Aerospace managed the contracts and sub-contracts for this prize competition. ODNI's AIS completed a blind review of the submissions and scored them based on RSEATS evaluation criteria. InnoCentive, Inc. was utilized as a third party vendor to help plan and conduct the prize competition. AFCEA International provided SIGNAL Magazine content for use by the solvers participating in the competition.

*Partnerships:* For this prize competition, ODNI partnered with OUSD(I), AFRL, and Ball Aerospace. ODNI used the Economy Act to ensure economical and efficient services.

*Advancement of Agency Mission:* ODNI and OUSD(I) issued this challenge in order to understand the state of scientific advancement towards machine-generated intelligence, as advances in this area promise to reduce the amount of time devoted to thinking, understanding, and acting on the intelligence rather than just generating it. To do this, the challenge posed a representative question and asked respondents to use a completely automated system to sift through text reports and generate a finished intelligence product. ODNI and OUSD(I) did not seek any rights in the systems used to generate the product, as the focus is on assessing the state of the art in the area of machine-generated intelligence. Systems capable of winning this Challenge would be of use not just within the intelligence community, but across government agencies and the business worldwide.

*Solution Types:* Software and apps; Technology demonstration and hardware; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* In FY19, the office of the Director of Science and Technology (DS&T) within ODNI in partnership with OUSD(I) will sponsor two public prize competitions—"Xplore" and "Xpect"—to explore opportunities, using artificial intelligence techniques, to revolutionize the IC's finished intelligence production processes. These challenges are part of a series of efforts exploring technical approaches to accelerate and automate the production of intelligence, and build on the "Xpress", "Xtend", and "Xamine" challenges launched in Fiscal Years 2017 and 2018. Through the Xplore Challenge, solvers will be asked to describe artificial intelligence-based approaches for enabling the

automated and predictive discovery of information. The Xpect Challenge will ask solvers to describe artificial intelligence-based approaches for automating model-based indications of change.

### **B.9.12 The ODNI-OUUSD(I) Xtend Challenge: Machine Evaluation of Analytic Products<sup>63</sup>**

*Lead Sponsoring Agency:* ODNI

*Authority:* N/A

*Status:* This competition was launched in FY18 and is underway.

*Competition Goals:* The evaluation of analytic products is an area ripe for exploring new technological capabilities and approaches. Currently, intelligence products are reviewed—prior to publication—by numerous levels of management and edited against an IC agency’s signature style using essentially the same methods as publishers have used for generations. The ODNI and OUUSD(I) sought ideas and descriptions of a viable technical approach for enabling the automated evaluation of finished intelligence products.

*Goal Types:* Find and highlight innovative ideas; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

*Justification for Using Prizes and Challenges:* ODNI decided to use prize competitions for this topic in order to leverage funding and reach as large an audience as possible. Competitions allow more individuals and companies to be engaged and involved than traditional contracts or grants. The Xtend Challenge attracted 186 registrants.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$75,000. This prize pool reflects an initial phase, with a \$25,000 prize purse and a second phase, with a \$50,000 prize purse. Awards for the first phase have been completed, and the second phase is underway. The competition was solely funded by the government and there were no other private sector or philanthropic funds contributed to the competition prize.

*Solicitation of Submissions:* On November 16, 2017, the competition went live on the InnoCentive prize competition page and was posted on Challenge.gov. ODNI issued a press release and publicized the Challenge on social media. InnoCentive promoted the prize competition through their social media platforms (LinkedIn, Twitter, Facebook, and Google+) and weekly email blasts to over 140,000 solvers during the competition posting period. As a result of this outreach, 186 teams from 32 countries registered for the competition. The prize competition press release was issued on November 16, 2017.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release

*Participation Requirements:* N/A

*Evaluation of Submissions:* This competition received 18 submissions that were evaluated by ODNI and OUUSD(I) representatives. Of the 18 submissions, 3 were selected for initial awards from the \$25,000 prize pool and asked to provide additional information regarding their solution. Final determination of awards from the remaining \$50,000 prize pool is still pending.

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<sup>63</sup> The website The Odni-Ousd(i) Xtend Challenge: Machine Evaluation of Analytic Products can be viewed at [www.innocentive.com/ar/challenge/9934078](http://www.innocentive.com/ar/challenge/9934078).

*Results:* Of the 18 entries submitted between November 16, 2017 and January 15, 2018, three prizes were awarded in the first phase. At the time of this report, prizes for the second phase have not been awarded.

*Budget and Resources:* OUSD(I) representatives were involved in evaluating Xtend submissions. AFRL and Ball Aerospace managed the contracts and sub-contracts for this prize competition. InnoCentive, Inc. was utilized as a third party vendor to help plan and conduct the prize competition.

*Partnerships:* For this prize competition, ODNI partnered with OUSD(I), AFRL, and Ball Aerospace. ODNI used the Economy Act to ensure economical and efficient services.

*Advancement of Agency Mission:* The ODNI and OUSD(I) issued this challenge to determine a viable technical approach for enabling the automated evaluation of finished intelligence products. The evaluation of analytic products is an area ripe for exploring new technological capabilities and approaches. Currently, intelligence products are reviewed—prior to publication—by numerous levels of management and edited against an IC agency’s signature style using essentially the same methods as publishers have used for generations. This human-based approach is highly subjective and introduces latency that constrains the IC’s ability to produce effective and timely intelligence products, and may inhibit potential gains offered by advanced analytics and computational methods. For this Ideation Challenge, Solvers are asked to submit their ideas along with a well-supported, technology-based justification for how the proposed approach could evaluate analytic intelligence products. An additional award pool was available for solvers who were able to provide more detailed information such as a pseudo-code implementation of their proposed solution.

*Solution Types:* Software and apps; Ideas; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* In FY19, the office of the Director of Science and Technology (DS&T) within ODNI in partnership with OUSD(I) will sponsor two public prize competitions—“Xplore” and “Xpect”—to explore opportunities, using artificial intelligence techniques, to revolutionize the Intelligence Community’s (IC) finished intelligence production processes. These challenges are part of a series of efforts exploring technical approaches to accelerate and automate the production of intelligence, and build on the “Xpress”, “Xtend”, and “Xamine” challenges launched in Fiscal Years 2017 and 2018. Through the Xplore Challenge, solvers will be asked to describe artificial intelligence-based approaches for enabling the automated and predictive discovery of information. The Xpect Challenge will ask solvers to describe artificial intelligence-based approaches for automating model-based indications of change.

### **B.9.13 UG2 Prize Challenge<sup>64</sup>**

*Lead Sponsoring Agency:* IARPA

*Authority:* National Security Act, 50 USC 3024(n)

*Status:* This competition was launched and completed in FY18.

*Competition Goals:* This challenge sought to answer important questions for general applications related to computational photography and scene understanding, such as: What is the current state-of-the-art for image restoration and enhancement applied to images acquired under less than ideal circumstances? Or, can the application of enhancement algorithms as a pre-processing step improve image interpretability for manual analysis or automatic visual recognition to classify scene content? As

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<sup>64</sup> The website for the UG2 Prize Challenge can be viewed at <http://www.ug2challenge.org/>.

a well-defined case study, the challenge aimed to advance the analysis of images collected by small unmanned aerial vehicles (UAVs) by improving image restoration and enhancement algorithm performance using the UAVs, Glider and Ground data (UG2) Dataset.

*Goal Types:* Solve a specific problem; Advance scientific research; Develop technology; Other - Benchmark state of the art

*Justification for Using Prizes and Challenges:* IARPA uses prize challenges to reach a broad audience of scientific thinkers, including those in other parts of the world, and have them participate in research problems of interest to the intelligence community (IC). The prize challenges are a way to quickly identify new research methods, ways of thinking, and perspectives that can be applied to IC problems and IARPA programs. Prizes can be awarded in a more agile way than a traditional grant or procurement contract, and challenge problems are posed so that participants can deliver results and prototypes on shorter timelines.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and awarded was \$75,000. This includes two award categories, Image Enhancement to Facilitate Manual Inspection and Image Enhancement to Improve Automatic Object Recognition, each with first and second place prizes of \$25,000 and \$12,500, respectively. Non-monetary incentives included an opportunity to present at the 2018 IEEE Computer Vision and Pattern Recognition Conference.

*Solicitation of Submissions:* The prize challenge was advertised through [iarpa.gov](http://iarpa.gov), [challenge.gov](http://challenge.gov), and <http://www.ug2challenge.org/> with all rules and participation instructions. Organizations signed a participation agreement with the University of Notre Dame and submitted executable software to them for evaluation.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* N/A

*Evaluation of Submissions:* The University of Notre Dame evaluated the performance of submitted algorithms by conducting standardized tests involving a sequestered test and evaluation dataset. Metrics and evaluation conditions were published in the prize challenge rules ahead of time. Results were presented to a panel of subject matter expert judges who then selected winners based on technical performance.

*Results:* Of the 12 entries submitted by six participants between January 31 and April 15, 2018, four prizes were awarded to three winners.

*Budget and Resources:* N/A

*Partnerships:* The University of Notre Dame was the non-Federal partner for this challenge.

*Advancement of Agency Mission:* The advantages of conducting visual surveillance from a platform like a small UAV are clear. Man-portable systems can be launched from safe positions to penetrate difficult or dangerous terrain, acquiring hours of video without putting human lives at risk. What is unclear is how to automate the interpretation of these images, a necessary measure in the face of millions of frames from individual flights. Human analysts cannot manually sift through data of this scale for actionable intelligence information. Ideally, a computer vision system would be able to identify objects, events, and human identities of interest to analysts, surfacing valuable data out of a massive pool of largely uninteresting or irrelevant images. To build such a system, one could turn to recent machine learning breakthroughs in visual recognition, which have been enabled by access to millions of training



images from the Internet. However, such approaches cannot be used as off-the-shelf components to assemble the system IARPA desires, because they do not take into account artifacts unique to the operation of the sensor and optics platform on a small UAV.

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* N/A

## **B.10 United States Agency for International Development (USAID)**

### **B.10.1 EduApp4Syria Prize Competition<sup>65</sup>**

*Lead Sponsoring Agency:* Norwegian Agency for Development Cooperation (Norad)

*Authority:* Implementing partner ran the challenge

*Status:* This competition was completed in FY17.

*Competition Goals:* The Syrian conflict caused disruption to the education of millions of children, in addition to threatening their physical safety and psychosocial well-being. At the time the prize was launched, almost three million Syrian children were out of school. Achieving reading and writing fluency (i.e., literacy) is foundational for lifelong learning. As such, it is important to provide opportunities to develop this skill for children who may be transient. Smartphones have been a survival tool used by many refugees, and reports and findings from field trips indicate high availability among Syrian refugees. A factor that compounds the learning challenge is that Syrian children, both inside and outside of school and inside and outside of Syria, are living under the extreme stress of protracted conflict. Elevated and prolonged stress levels can impede brain development and result in learning disabilities, memory problems and emotional regulation difficulties. The EduApp4Syria competition catalyzed the development of a smartphone application that can be used to increase literacy levels in Arabic and improve psychosocial well-being for children (ages 5–10). The app is primarily meant to supplement the formal and non-formal educational programs that exist, even though it could also be used within these programs. The two winning apps, Antura and the Letters and Feed the Monster, are now available for free on the App Store and Google Play.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Engage new people and communities

*Justification for Using Prizes and Challenges:* USAID was seeking to attract innovators who likely would not be aware of or respond to other mechanisms. Additionally, this competition was conducted in partnership with Norad, who chose the mechanism. The All Children Reading Grand Challenge for Development (ACR GCD) has used both grant and prize mechanisms. One of the valuable aspects of prize competitions is that it provides an easier on-ramp for organizations to partner with ACR GCD for a competition for a shorter-term, one-off activity, and usually require a smaller financial contribution.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and total amount awarded was 15 million Norwegian Kroner (NOK) (approximately U.S. \$1,700,000). For Phase 1, Norad paid up to the sum of 2.5 million NOK (approximately U.S. \$300,000), distributed evenly among up to five suppliers. Upon entering into contract, the selected suppliers received 150,000 NOK of these funds

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<sup>65</sup> The websites for the EduApp4Syria Prize Competition are accessible at <https://allchildrenreading.org/challenge/grant-prizes/> and <https://www.norad.no/en/front/thematic-areas/education/innovation/eduapp4syria/>.

to work towards the initial deliverables. For Phase 2, Norad paid up to the sum of 7.5 million NOK (approximately U.S. \$900,000), distributed evenly among up to three suppliers. For Phase 3, Norad paid up to the sum of 5 million NOK (approximately U.S. \$600,000), distributed evenly among up to two suppliers. All awards were funded directly by the Norwegian government under a tender process by Norad. Non-monetary incentives included gaming technical expertise provide by Zynga; alpha testing conducted in Norway and beta field testing conducted in Amman, Jordan in December 2016; funding and technical advise for field testing of select applications by the United Nations International Children’s Emergency Fund (UNICEF) Ventures’ Office of Innovation; technical and impact evaluation of the two winning games by ACR GCD; promotion by ACR GCD and Norad via social media and other digital platforms; and invitations to present at events.

*Solicitation of Submissions:* ACR disseminated information about the Challenge through social media (e.g., Twitter and Facebook); the ACR GCD monthly newsletter; press releases; a dialogue conference in Oslo, Norway and Washington D.C. to attain feedback on the prize design; live video streaming that was later shared via social media; partnerships with outside organizations; and the Norad and ACR GCD websites. Competition documents and a short video about the competition were available in English and Arabic. The competition also received media coverage by Voice of America (VOA), The Guardian, ReliefWeb, Devex, and EdSource The Buzz.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - the Norad and ACR GCD websites; Other - competition documents in English and Arabic; Other - videos about the competition in English and Arabic; Other - the winning apps produced in English and Arabic

*Participation Requirements:* The supplier entering a bid must have been a legally established enterprise. If several suppliers were cooperating, only one, regarded as the main supplier, supplied necessary documentation. Legally established enterprises included (amongst others) sole proprietorships and non-profit organizations.

*Evaluation of Submissions:* A jury led by a professor in game-based learning at the Norwegian University of Science and Technology (NTNU) selected the solutions to proceed at each stage. The collaboration advisory group sent comments on the proposed solutions to the jury for its consideration, but the jury made an independent decision. The solutions were judged by established criteria at each phase: Phase 0 evaluated the bidder’s design of the prototype and plan for project execution; Phase 1 and Phase 2 evaluated the alpha and beta versions of the product, respectively, in relation to the testing specifications, the competence of project management, the project’s capacities and resources, and bidder’s plan for developing a functioning solution within the signaled timeframe; and Phase 3 evaluated the product's results with comprehensive testing through market release, outreach strategies, and improvements based on market feedback. All phases compared the product to the functional requirements listed in Part 2, “Appendix 1: Specification of Requirements” of the competition reference document.

*Results:* Of the 78 entries submitted by 78 participants between January 29, 2016 and April 1, 2016, five prizes were awarded to two winners.

*Budget and Resources:* A total of 1 full-time equivalent (FTE) was used to support the Challenge; 0.5 FTE was used in FY17 and 0.5 FTE was used in FY18. The total funding by ACR GCD in FY18 was \$200,000, which was used for the technical and impact evaluation of the two games.

*Partnerships:* Partners included the Norwegian Government, which funded the competition. Norad coordinated the competition, coordinated and hosted the competition dialogue conference in Norway,

and managed the tender process. The Department of Computer and Information Science at NTNU, contributed research and expertise in game technology, game-based learning, e-learning, m-learning, and software engineering. NTNU's main responsibilities included leading and coordinating the competition and jury process, monitoring app development and maintenance, and leading the research related to the effects of using the chosen app(s). Thee ACR GCD, in a partnership with USAID, provided prize design technical expertise, led the communication strategy and activities, coordinated and hosted a competition dialogue conference (Washington D.C.), hosted the prize runner-up and finalists' profiles on the ACR GCD website, promoted the competition, managed U.S. media relations support, served on the submission review panel, and funded the technical and impact evaluation. Orange assisted in extensive outreach to potential competitors and promoted the winning application(s) through communication campaigns with the help of other divisions like StarAfrica (For more information, please visit <http://en.starafrika.com/>). INEE served as an important source of knowledge of education in crises and conflict for the EduApp4Syria-competition. INEE provided input and quality assurance to specifications and selection processes; generated knowledge and awareness about the project among humanitarian organizations and other relevant stakeholders working on education in emergencies; and used its professional and communications network to inform potential users of the application about the learning resource once it was developed. World Vision and the Australian Government were also partners. The estimated value of partner contributions was approximately \$1.7 million.

*Advancement of Agency Mission:* The EduApp4Syria competition sought to catalyze the development of a smartphone application that could significantly increase literacy levels in Arabic and improve psychosocial well-being for children (ages 5–10) in Syrian households that use the application. The application is primarily meant to supplement the formal and non-formal educational programs that exist, even though it could also be used within these programs. The EduApp4Syria competition also profiled the critical education crisis many Syrian children face. It was a unique competition in that it not only sought to address literacy but also to improve psychosocial well-being for children greatly affected by the conflict. The two winning games, Antura and the Letters and Feed the Monster, can be downloaded for free on Google Play and the App Store. Feed the Monster has also been reverted into over 20 languages (with more anticipated), and Antura and the Letters is now available in English. The code is also available on GitHub. Advancing USAID's Mission to improve reading scores for students and provide access to reading materials in local languages, the Apps have now been downloaded on more than 125,000 devices. Impact evaluation results showed for each subtest, letter sounds, syllable reading, invented word and oral reading fluency, the treatment group gains were greater than the control group.<sup>66</sup>

*Solution Types:* Software and apps

*Plan for Upcoming 2 FYs:* All future prize commitments will be determined by the ACR Round 3 strategy, which currently in development.

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<sup>66</sup> Comings, J. (2018). Assessing the impact of literacy learning games for Syrian refugee children: An executive overview of Antura and the Letters and Feed the Monster impact evaluations. Washington, DC: World Vision and Foundation for Information Technology Education and Development.

**B.10.2 Book Boost: Access for All Challenge<sup>67</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* ADS 302.3.4.13 Grants Under Contracts (GUCs)

*Status:* This competition was launched in FY18 and is underway.

*Competition Goals:* Ensuring children have books in the language(s) they use and understand and in formats they can access is critical to building foundational literacy skills and learning to read. The Book Boost: Access for All Challenge, a challenge under All Children Reading: A Grand Challenge for Development, seeks innovative business models that incorporate accessibility components from the onset, reducing the costs of retrofitting an inaccessible book after production and thus creating a more efficient and cost-effective process. This optimization of the title development phase of the book value chain can contribute to an increased number of accessible titles as well as increased quality of accessible titles. Successful applicants will demonstrate strategies to optimize content creation by using innovative, cost-effective strategies that illustrate potential production growth of high-quality, accessible titles.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Build capacity; Stimulate a market

*Justification for Using Prizes and Challenges:* ACR GCD based the rationale for the Book Boost prize structure on the Round 1 experience of implementing challenge competitions. Despite the numerous proposals received, very few focused on the thematic areas. Smaller prize awards structured around the neglected thematic areas will encourage organizations to innovate and take more risks in implementing new ideas. ACR GCD sought to attract innovators who likely would not be aware of or respond to other mechanisms. ACR GCD has used both the grant and prize mechanisms. One of the valuable aspects USAID has found in prize competitions is that they provide an easier on-ramp for organizations to partner with ACR GCD for a competition for a shorter-term, one-off activity, and usually require a smaller financial contribution.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$360,000 and the total amount awarded was \$348,000. The top four submissions were awarded a prize of \$12,000 each before advancing to Phase 2 of the competition; the two winners of the competition were awarded a prize of \$150,000 each. The funding was equally pooled from ACR and Pearson. Non-monetary incentives included promotion by ACR GCD and the prize partners via social media and other digital platforms and invitations to present at events. Pearson also offered in-kind business planning and brainstorming sessions.

*Solicitation of Submissions:* Submissions were solicited online ([www.allchildrenreading.org](http://www.allchildrenreading.org)) and promoted to over 2,900 subscribers via the ACR social media outlets (Facebook and Twitter) and monthly newsletter. The competition was also announced via USAID, World Vision, DFAT, and Pearson and Project Literacy listserves. Submissions were accepted via Submittable,<sup>68</sup> an online proposal

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<sup>67</sup> The website for the Book Boost: Access for All Challenge can be viewed at <https://allchildrenreading.org/challenge/book-boost-access-challenge/>.

<sup>68</sup> The online proposal submission management site can be accessed at <https://bookboost.submittable.com/submit>.

submission management site. The solicitation overview was available in Arabic, French, Hindi, Portuguese, Spanish, and International Sign.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Eligible applicants include, but are not limited to, for-profit and nonprofit organizations, non governmental (NGO) organizations and associations, academic and education research institutions, faith-based organizations, civil society organizations, and foundations. Government entities are ineligible for this opportunity, but partnerships with governments are encouraged. USAID is unable to award cash prizes to suppliers of goods and services that do not meet the nationality and source definitions as referenced in 22 CFR 228.11 and 12, specifically geographic code 937. Geographic code 937 currently excludes Cuba, Iran, Libya, and North Korea.

*Evaluation of Submissions:* Business plans will be evaluated across the eight key areas outlined in the Business Model Enhancement Plan Requirements. The maximum score for a business plan is 100 points: up to 5 points can be given for summary, concept and team management; 10 points for market analysis; 25 points for strategy; 10 points for collaboration; 15 points for finances; 15 points for timeline and project planning; and 20 points for sustainability.

*Results:* Of the 15 submissions received, eight met the basic requirements for the Challenge. The top four submissions were awarded a prize of \$12,000 each before advancing to Phase 2 of the competition. The two winners of the competition were awarded a prize of \$150,000 each. The Challenge is separated into three phases. Phase 1 is the submission of the solver's business model enhancement plan. Phase 2 consists of virtual presentations by the finalists on the viability of their business plans to a panel of judges. Phase 3 is the implementation of the business model enhancement plan.

*Budget and Resources:* A third party prize vendor, Submittable, was used to accept submissions and manage the judging process for a total cost of \$4,250. Technical assistance was provided by a contractor to set-up and manage the platform at a total cost of approximately \$3,000. The leading organization in creating accessible content was contracted for technical assistance to support the design and evaluation of the prize for \$10,000, and a literacy expert was contracted for \$1,000. Approximately \$10,000 was allocated for communications support, including the translation of the prize call into multiple languages and the development of promotional and press materials. Five experts in accessible publishing and early grade reading content creation provided 15 hours of time each to evaluate all prize submissions for an estimated total of \$3,000 in in-kind support. In FY18, one FTE was used to support the competition design, launch, evaluation and testing. The total funding in FY18 to support the Challenge was \$77,301.

*Partnerships:* Challenge partners included World Vision, USAID, DFAT, and Pearson, who each shared their respective strengths, expertise, technologies, methodologies, and resources (including in-kind services, in-kind goods, and monetary) on specified activities in order to contribute to the shared goal of closing the global literacy gap. Specifically, the Challenge partners increased awareness and mobilized action; advanced best practices; and innovated for new solutions. These partnerships have been critical to the success of the Challenge. Each provided credibility to the competition and enhanced communications with publishers and content developers. The total estimated value of partner contributions is \$332,500, of which \$130,000 is from ACR and \$202,500 is from Pearson. In the future, ACR GCD aims to engage similar technical partners.

*Advancement of Agency Mission:* Learning to read is transformative and impacts a child's lifelong opportunity to reach their full potential. However, around 250 million children of primary school age

around the world are unable to recognize basic letters and numbers, even though half of them have spent at least four years in school. Despite the importance of books in boosting foundational literacy skills, there is a global shortage of books for children in many mother languages. For the estimated 19 million children globally that are blind or have low vision or the millions of children with other disabilities that impact their use of traditionally printed material, the shortage of quality books in accessible formats is even more severe. Current technologies provide the potential for publishers to produce books that are accessible and designed for reading by everyone, including those with print disabilities, but these are not being leveraged at scale. ACR GCD and Pearson's Project Literacy launched the Book Boost: Access for All Challenge to drive innovation in the publishing space to address these gaps. The Challenge seeks business models that are rooted in optimizing and increasing the number of accessible books in the title development phase of the book value chain. The competition partners believe innovative solutions in title development will improve the overall book value chain, resulting in a more cost-efficient process. An efficient value chain will increase the number of new, high-quality, accessible titles available to stakeholders involved in book distribution. As part of ACR GCD's commitment to ensuring all children learn to read, it also sources solutions that address barriers preventing children with disabilities from learning to read.

*Solution Types:* Software and apps; Technology demonstration and hardware; Business plans

*Plan for Upcoming 2 FYs:* Additional grant-funded activities will be determined by the ACR Round 3 strategy in development in FY19.

### **B.10.3 Data-Driven Farming Prize<sup>69</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* USAID Innovation Incentive Award Authority in Section 7034(d)(4) of Division K of the FY16 Department of State, Foreign Operations, and Related Programs Appropriations Act at P.L. 115-131

*Status:* This competition was completed in FY17.

*Competition Goals:* Industrial agriculture benefits from digital tools and data that provide information on how much water to use for irrigation, when to harvest crops, and what price to sell crops. Smallholder farmers could benefit from this information too. The Challenge had eight specific goals: (1) attract new approaches and tools to source, organize and translate data into actionable farming insights; (2) improve opportunities for more effective and efficient agricultural decision making in situ; (3) mobilize new talents towards the Nepali agricultural market; (4) build new partnerships in the agricultural value chain in Nepal; (5) build context specificity capacity and responsiveness to local user needs in innovators; (6) support scaling new product/services in the agricultural market in Nepal; (7) leverage investments across stakeholders to support solutions entry into the market; and (8) raise awareness on the potential of data to generate useful information for the agricultural production.

*Goal Types:* Solve a specific problem; Develop technology; Build capacity; Stimulate a market

*Justification for Using Prizes and Challenges:* Prize competitions are a tried and tested method for supporting innovation, offering a reward to those who can first or most effectively meet a defined challenge. Rather than being a reward for past achievements, prize competitions act as an incentive for meeting a specific challenge. Prizes are also a means of expanding a challenge beyond the usual participants and thus facilitate the engagement and participation of anyone who can solve the

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<sup>69</sup> The website for the Data-Driven Farming Prize can be viewed at <https://datadrivenfarming.challenges.org/>.



challenge. The Feed the Future initiative sees this open innovation approach as a critical tool in its work to improve agricultural productivity, expand markets and trade, and increase the economic resilience of vulnerable rural communities in all partner countries.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and the total amount awarded was \$300,000. Two \$100,000 awards and two \$50,000 awards were issued. The four cash prizes were distributed using Digital Development for Feed the Future’s FY16 funds. Funds were distributed via a miscellaneous obligation using the USAID Innovation Incentive Award Authority. Non-monetary incentives included enrollment in a ten-week bespoke Microsoft Innovation Center accelerator program, mentorship, and introductions to potential partners. In addition, finalists participated in Microsoft BizSpark, a global program that helps startups succeed by giving them free access to Microsoft Azure cloud services, software, and support. BizSpark startups received five Visual Studio Enterprise with MSDN subscriptions, each with a \$150 monthly Azure credit. This totaled \$750/month across all five developers to spend on Azure services. These benefits were available for one year. Microsoft BizSpark services were distributed directly to finalists by USAID’s prize partner, the Microsoft Innovation Center Nepal.

*Solicitation of Submissions:* To recruit qualified competitors, USAID relied on extensive research of promising data-driven agriculture innovations. USAID also relied on an active social media campaign; personal outreach (which was very effective, as three finalists stated they applied because a trusted contact encouraged them to do so); a webinar to coach competitors through the application process; several in-person workshops hosted in Nepal to encourage and coach applicants through the application process (which proved to be very effective for Nepali competitors); and attendance at related agriculture conferences.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Live video streaming; Other - Newspaper advertisements; Other - Participation in conferences; Other - Panels during the competition; Other - Direct outreach to promising innovators

*Participation Requirements:* In order of priority, the target solver audience was innovators working in Nepal’s agricultural technology space; innovators from around the world working in agricultural technology; and Nepali innovators working in other data communication endeavors. However, the Challenge was open to all interested individuals, groups, organizations, companies, and sources and sectors, particularly local innovators from South Asia. Though the call was global and solvers could come from all over the world, the solutions were tested and applied to Nepal. All entrants needed to demonstrate a willingness to share their experiences and help establish a body of knowledge that can bring about a sustained change in the use of data to improve agriculture productivity. Applicants needed to ensure they have the capacity to develop a prototype of the solution over the challenge time frame. Some support was provided to help achieve this, but if selected, applicants had to be able to develop and test prototypes during the course of the prize. Any intellectual property in the submission belonged to the applicant. Applicants retained the intellectual property rights to their entry to the prize. Intellectual property had to be clearly marked as proprietary, and it was the applicant’s responsibility to ensure they were not infringing on the intellectual property of others. Entries were not assessed if required fields were not complete. Entries must have been submitted in English. USAID conducted a responsibility determination prior to the award to ensure that the award to the organization met applicable U.S. laws, including regulations administered by the Office of Foreign Assets Control (OFAC) of the U.S. Department of Treasury (for more information, see <http://www.ustreas.gov/ofac>, including the list of Specially Designated Nationals).

*Evaluation of Submissions:* After applicants submitted their written applications, an internal eligibility screening and assessment was performed by subcontractors. The first round of judging was based on the written applications and performed by a judging panel. Judges from the panel came from USAID Bureau for Food Security, USAID US Global Development Lab, USAID Nepal, International Maize and Wheat Improvement Center (CIMMYT), International Center for Integrated Mountain Development (ICIMOD), Microsoft Innovation Center-Nepal, Global Open Data for Agriculture and Nutrition (GODAN), and DAI. Thirteen finalists submitted their innovations. Innovation field testing was conducted by USAID's partners, International Maize and Wheat Improvement Center (CIMMYT), and International Center for Integrated Mountain Development (ICIMOD). Test results were summarized by the field test partners and assessed by subcontractors. Thirteen finalists submitted their written development plans and pitch videos. During the second round of judging, judges reviewed the field test results, assessments, development plans, and pitch video. Four winners were recommended by the judges. Lessons learned included that judges need to see the solutions to believe that they worked; judging panels were best conducted in person; and judges should be carefully separated from the mentoring and testing process to prevent bias.

*Results:* Of the 143 applicants who provided submissions between February 9, 2017 and April 6, 2017, two \$100,000 awards and two \$50,000 awards were given. PEAT and Db2Map won the \$100,000 awards and ICT 4 Agri and Spero Analytics won the \$50,000 awards.

*Budget and Resources:* The Challenge had a \$1.2 million budget. The \$300,000 cash prize was funded through the Innovation Incentive Award Authority in FY17. A total of 0.5 FTE was also used to support the Challenge in FY17. The following items were funded through a USAID implementing partner mechanism and subcontract: seed funding at \$30,600; staffing at \$658,160; travel for innovators at \$76,500; events at \$110,000; testing and assessment at \$46,600; online platform at \$7,650; communications and outreach at \$50,490; and Monitoring, Evaluation, Research and Learning (MERL) at \$30,000.

*Partnerships:* Strong partnerships were the core of the Data-Driven Farming Prize. USAID Nepal buy-in for the program was key to the success of the Prize, and its endorsement of the activity ensured that the right networks of stakeholders were involved in the Prize. Similarly, the Prize was built in strong collaboration with local partners such as Feed the Future Initiative; GODAN; the Nepal office of CIMMYT, which provided in-kind support, mentorship, expertise, testing support, and facility use; ICIMOD, which provided in-kind support, mentorship, expertise, testing support, and facility use; and the Microsoft Innovation Center Nepal, which provided in-kind support, marketing and outreach support, Microsoft BizSpark, facilitation support, a bespoke accelerator program, mentorship, expertise, testing support, and partnership brokering. The estimated value of partner contributions is \$246,000. Such strong field partners presence, as well as the prize activities ran in the country (including the launch event, co-creation workshop, innovation marketplace to showcase solutions, and the award ceremony), attracted the interest of the Nepali agricultural private sector in witnessing the development of new effective solutions. All finalists confirmed the Prize was a tremendous platform to boost new partnerships, and more than 22 partnerships have been attributed to the Prize. USAID also found that the co-creation approach at the center of the Prize deepened partnerships between partners. For example, one of the prize partners stated “I liked seeing different agricultural stakeholders have a-ha moments about how these innovators, or these partners, or these other convened value chain actors, or these datasets could unlock a new possibility in their ability to deliver more value for smallholder farmers.”

*Advancement of Agency Mission:* USAID is the world's premier international development agency and a catalytic actor driving development results. USAID's work advances U.S. national security and

economic prosperity, demonstrates American generosity, and promotes a path to recipient self-reliance and resilience. This prize sought to catalyze local solutions to the local challenges of food security and secure livelihoods. Feed the Future believes in helping farmers extract maximum value from local agricultural production by increasing their access to the data and information needed to make more effective farming decisions. Democratizing access to data and information can drive the transformation of commercially-driven agriculture in targeted regions. As a result, the Prize aimed to support solutions for farmers and value chain actors to make effective choices to enhance their productivity, on-the-ground decision-making, and market planning.

*Solution Types:* Software and apps; Technology demonstration and hardware; Business plans

*Plan for Upcoming 2 FYs:* Following the Prize in FY17, USAID undertook a year long assessment of the Prize's impact and learned that following the Prize, the thirteen finalists and winners were able to develop 22 partnerships and leverage \$5 million in additional funding. In addition to the Prize-specific outcomes, the Prize also built a case for the value of prizes within USAID and catalyzed two additional prizes: Feed the Future's Fall Armyworm Tech Prize (FY17) and USAID/Nepal's forthcoming Counter Trafficking in Persons Tech Prize (FY18).

#### **B.10.4 Fall Armyworm Tech Prize<sup>70</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* Innovation Incentive Award Authority in Section 7034(d)(4) of Division K of the FY17 Department of State, Foreign Operations, and Related Programs Appropriations Act at P.L. 115-131

*Status:* This competition was underway in FY18.

*Competition Goals:* The fall armyworm (FAW) is not a new pest but is new to the African context. Smallholder farmers may misidentify the insect and select an improper treatment method in an effort to save their crops. Farmers urgently need clear and actionable pest identification information and a series of reasonable treatment options that take regional contexts and limitations into account. The FAW Tech Prize is seeking digital tools and approaches that provide timely, context-specific information that enable smallholder farmers and those who support them to identify, treat, and track incidence of FAW in Africa. Primary outcomes include enabling smallholder farmers and those who support them to accurately identify incidence of FAW in their crops; produce timely, context-appropriate, and empowering insights for smallholder farmers to treat the incidence of FAW; reduce productivity losses caused by FAW among those using the tool or approach; and ensure the appropriate and responsible use of pest management assessments, tools, and interventions.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity

*Justification for Using Prizes and Challenges:* Prize competitions are a tried and tested method for supporting innovation, offering a reward to those who can first or most effectively deliver a defined result. Rather than being a reward for past achievements, prize competitions act as an incentive for meeting a specific challenge. Prizes are also a means of expanding a challenge beyond the usual participants and thus facilitate the engagement and participation of anyone who can solve the challenge. The Feed the Future initiative sees this open innovation approach as a critical tool in its work

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<sup>70</sup> The website for the Fall Armyworm Tech Prize can be viewed at <https://fallarmywormtech.challenges.org/>.

to improve agricultural productivity, expand markets and trade, and increase the economic resilience of vulnerable rural communities in all partner countries.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered will be \$400,000, \$300,000 of which comes from USAID's FY17 DA funds, \$50,000 of which comes from the Foundation for Food and Agriculture Research, and \$50,000 of which comes from Land O'Lakes International Development. Five prize awards will be given. One grand prize winner will receive \$150,000; two most promising solutions will receive \$75,000 each; and two up-and-comers will receive \$50,000 each. Of USAID's \$300,000 prize purse contribution, \$100,000 will be contributed to the grand prize winner, and \$50,000 will be contributed to each of the remaining four awards. Non-monetary incentives for the 20 prize finalists will include funded travel to Kampala, Uganda for the Co-Creation event; participation in the 4-day Co-Creation event with mentors, subject matter experts, and end-users; ongoing mentorship and support to refine finalists' products/solutions; funded travel to Cape Town, South Africa for the awards event; and participation in a 3-day awards event to showcase products/solutions, network with investors/others, and attend the final awards event.

*Solicitation of Submissions:* The FAW Tech Prize solicited applications primarily through its associated online platform: <https://fallarmywormtech.challenges.org/>. The website contained a description of the Prize along with an applicant handbook. USAID also promoted and communicated the application timeline and procedures through the platform's blog and by hosting a webinar with interested individuals/organizations. The webinar was effective at answering questions on the criteria and application process among interested individuals from around the world. The Prize was also promoted through social media, email, and in-person events. On the latter, several events were held in Uganda with groups of entrepreneurs and innovators, among others. These in-person events were very effective in promoting the Prize, sharing information, and engaging new actors in a USAID competition.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Webinar

*Participation Requirements:* The Prize was open to all individuals, groups, organizations, and companies, particularly local innovators from Africa. Though the call was global and solvers can come from all over the world, the solutions will be tested and applied in field contexts in Africa. Applicants need to demonstrate a willingness to share their experiences and help establish a body of knowledge that can bring about a sustained change in smallholder farmer outreach, awareness, and action with respect to digital tools and plant health, pest management, and disease management. Applicants need to ensure they have the capacity to either adapt their existing solution to address FAW or develop a prototype of the solution within the prize time frame. Any intellectual property in the submission entry must belong to the entrant. Entrants will retain the intellectual property, and such intellectual property must be clearly marked as proprietary. It is the entrants' responsibility to ensure that they are not infringing on the intellectual property of others. Entries will not be assessed if all required fields have not been completed. This applies to any stage of submission for the Prize and also relates to missing documentation that may have been requested. Entries need to be submitted in English. USAID will conduct a responsibility determination prior to the announcement of the award to ensure that selected organizations meets applicable U.S. laws, including regulations administered by the Office of Foreign Assets Control (OFAC) of the US Department of Treasury.

*Evaluation of Submissions:* All applications were evaluated on whether the digital tool solution proposed by the applicant can be used by smallholder farmers or stakeholders who work with smallholder farmers; whether the submission provides timely, context-appropriate, and actionable

advice to users to enable them to select among available best practices in treating incidence of FAW; whether the proposed solution demonstrates a clear understanding of end-user needs; whether the proposed solution presents a tangible response to farmers' unique experience with FAW in sub-Saharan Africa; whether the applicant has considered the commercial, sustainability (i.e., financial and environmental considerations), and growth potential of their solution; and whether applicants consider international norms with respect to digital development and FAW in their proposals. Applications went through four phases of evaluation. During Phase 1 (Assessment), every application submitted was reviewed by two assessors against the evaluation criteria above. Assessors were a hybrid group consisting of both USAID staff and external members. During Phase 2 (Judging panel), the top 36 highest-scoring applications from Phase 1 were then shared with the judging panel. Each application was reviewed by three judges, scores were compiled, and all 36 were discussed by the judging panel to determine the ultimate 20 finalists. These judges were also a hybrid group from USAID and external agencies. During Phase 3 (Field testing), the 20 finalists submitted prototypes to be tested in the field by the Centre for Agriculture and Bioscience International (CABI), a prize partner. Testing included functionality testing in CABI offices in Kampala as well as user testing among farmer and extension worker focus groups at field sites in Uganda. For Phase 4 (Judging panel), the judges will review a final development plan and video summary from each of the 20 finalists and score their final submissions against the evaluation criteria above. All 10 judges will review all 20 finalists. Their scores will be combined with the field testing results from Phase 3, and these total scores will be discussed among the judges at an in-person meeting to determine the five prize award winners.

*Results:* A total of 228 applications were submitted between March 28, 2018 and May 14, 2018. The Prize is still ongoing, so no awards have been awarded yet. Five prizes will be awarded.

*Budget and Resources:* In FY18, USAID obligated \$1,000,000 of FY17 funds for the implementation of the FAW Tech Prize to an existing mechanism, Digital Frontiers, ran by DAI in the U.S. Global Development Lab. Through an open solicitation ran by DAI, Nesta was awarded a contract to implement the Prize. The contract covers all implementation costs of the Prize, including managing the application process, overseeing the web platform, facilitating a 4-day co-creation event, hosting an awards ceremony, and supporting all travel and accommodation costs of participants. In addition, \$300,000 of FY17 funds have been obligated for the prize purse. The equivalent of approximately 1 FTE from USAID has also been contributed and will provide guidance, oversight, and management of the Prize. The FTE will be split across two to three individuals in the Bureau for Food Security and U.S. Global Development Lab.

*Partnerships:* Partners of the FAW Tech Prize include Land O'Lakes International Development; Foundation for Food and Agriculture Research (FFAR); International Maize & Wheat Improvement Center (CIMMYT); CABI; Syngenta Foundation; MEST; BRAC; and the Overseas Private Investment Corporation (OPIC). Land O'Lakes International Development, FFAR, and OPIC provided support in promoting the Prize and helping to attract applicants during the launch of the Prize. CABI and CIMMYT provided subject matter experts, and MEST and BRAC provided mentors to meet and help the 20 finalists further refine their solutions. Partners helped innovators learn about the impact of FAW, determine if their technologies would be feasible, and enhance their solutions to make sure they achieve the intended goal (i.e., to provide timely, context-specific, information about FAW). FFAR, Land O'Lakes International Development, and Syngenta Foundation also met with the finalists to provide support and expertise. During the testing phase, CABI lead the development of a testing protocol and implemented against it via functionality testing in Kampala and user experience testing among farmer focus groups. During the judging process, Land O'Lakes International Development, FFAR, OPIC, and Syngenta Foundation participated as judges. Once the final winners are announced, Land O'Lakes



International Development and FFAR will contribute a total of \$100,000 in prize awards, and Syngenta will provide AgTech acceleration support for all winners.

*Advancement of Agency Mission:* At present, FAW in Africa threatens harvests and economic growth on a continental scale and could harm the progress of USAID. Through Feed the Future, USAID has helped aid agriculture-led growth, nutrition, and resilience developments on the continent. Feed the Future, America’s global hunger and food security initiative, aims to transform lives toward a world where people no longer face extreme poverty, undernutrition, and hunger. To achieve this, Feed the Future works hand-in-hand with partner countries to develop their agriculture sectors and break the cycle of poverty and hunger. Feed the Future, specifically the FAW Tech Prize, is part of the USAID response to the FAW outbreak and aims to equip farmers to protect their yields and incomes.

*Solution Types:* Software and apps; Creative (design & multimedia); Technology demonstration and hardware; Business plans; Analytics, visualizations, algorithms

*Plan for Upcoming 2 FYs:* Not applicable in regards to the Fall Armyworm Tech Prize.

#### **B.10.5 Global Lighting and Energy Access Partnership (Global LEAP) Off-Grid Refrigerator Competition<sup>71</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* Innovation Incentive Award Authority in Section 7034(d)(4) of Division K of the FY16 Department of State, Foreign Operations, and Related Programs Appropriations Act at P.L. 115-131

*Status:* This competition was underway in both FY17 and FY18 but has not concluded.

*Competition Goals:* Refrigeration holds unique potential to unlock economic and social progress for billions of people globally who have no or limited access to power. The market, however, remains nascent. The Global Lighting and Energy Access Partnership (Global LEAP) Off-Grid Refrigerator Competition seeks to catalyze new technological and design advancements in high-efficiency, low-cost refrigeration solutions. By inspiring greater participation and innovation in the market, the competition will improve access to affordable refrigeration technology for those living off-grid in developing countries. The Off-Grid Refrigerator Competition was competed under Global LEAP, a partnership that includes the U.S. Department of Energy and Power Africa. The Off-Grid Refrigerator Competition is one component of the Scaling Off-Grid Energy Grand Challenge for Development, which will contribute to increased utility of off-grid energy systems for consumers.

*Goal Types:* Find and highlight innovative ideas; Solve a specific problem; Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* Prize competitions are a tried and tested method for supporting innovation, offering a reward to those who can first or most effectively deliver a defined result. Rather than being a reward for past achievements, prize competitions act as an incentive for meeting a specific challenge. Prizes are also a means of expanding a challenge beyond the usual participants and thus facilitate the engagement and participation of anyone who can solve the challenge.

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<sup>71</sup> The website for the Global Lighting and Energy Access Partnership (Global LEAP) Off-Grid Refrigerator Competition can be viewed at <http://globalleap.org/refrigerators/>.



*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered is \$600,000. Three \$100,000 innovation incentive awards from USAID have been matched by the U.K. Department for International Development (DFID) funding for a total of \$200,000 for each of the three awards. Awards for Overall Value (\$200,000) and Energy Efficiency (\$200,000) were made in January 2018. The prize for User Appeal and Field Performance (\$200,000) is still underway and will be awarded November 2018. Non-monetary incentives included complimentary testing for all competitors, which provides vital data on product performance in both lab and field conditions. In addition, finalists receive mention in the Global LEAP catalog of finalist and award-winning products, networking opportunities with manufacturers and distributors, and enrollment in a results-based financing procurement incentives program.

*Solicitation of Submissions:* Submissions were sought through Global LEAP, Challenge.gov, and other standard channels.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies); Other - Webinar

*Participation Requirements:* N/A

*Evaluation of Submissions:* Applications were initially screened by CLASP, the implementing partner, and USAID before evaluated for award by a panel of expert judges based on data from industry-approved lab testing. USAID confirmed the analysis. The field test was conducted by implementing partners using industry-leading testing standards in Uganda, with judges then evaluating the results to identify a winner.

*Results:* Of the 55 applications received between September 22, 2016 and January 20, 2017, two prizes were awarded to Sundanzer: Energy Efficiency and Overall Value. The award for Appropriate Design and User Experience will be selected in November 2018.

*Budget and Resources:* USAID provided \$300,000 in funding to support the Prize in FY17. In addition, 1 FTE was used to support the Prize in FY17 and 0.5 FTE was used to support the Prize in FY18.

*Partnerships:* Partnerships played a critical role across the Prize. The U.S. Department of Energy was a Federal partner. Non-Federal partners included the U.K. Department for International Development, which contributed \$300,000 to the Prize; Global CLASP; IMC Worldwide; and Energy 4 Impact. Multiple donors partnered under an existing umbrella prize program (Global LEAP) to coordinate funding and design. All partners had different implementing partners who collaborated effectively to deliver the prize.

*Advancement of Agency Mission:* USAID is the world's premier international development agency and a catalytic actor driving development results. USAID's work advances economic prosperity and promotes a path to recipient self-reliance and resilience. Refrigeration can prolong the nutritional value of food, diversify diets, enable income-generating activities, and reduce the time that households spend shopping or gathering food. Thus, a prize to develop the off-grid refrigeration market and unlock economic and social progress for the 600 million people living off the grid in sub-Saharan Africa advances USAID's mission.

*Solution Types:* Technology demonstration and hardware; Business plans

*Plan for Upcoming 2 FYs:* Partners may continue prize program in outyears without USAID funding.

**B.10.6 No Lost Generation Prize Competition<sup>72</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* ADS 302.3.4.13 Grants Under Contracts (GUCs)

*Status:* This competition was launched in FY17 and is underway in FY18.

*Competition Goals:* The No Lost Generation (NLG) EdTech Summit agenda included three breakout sessions designed to bring all participants together to collaborate and form partnerships. To encourage collaboration, the NLG Prize seed funding opportunities, a prize under the All Children Reading: A Grand Challenge for Development, were provided by key sponsors, and all participants had the opportunity to apply for seed funding during the event. Basic early grade readers often focus on similar topics that could be replicated through development of Science, Technology, Engineering, and Mathematics (STEM) early reader story templates. These templates would include basic story lines but allow authors to add in images accordingly and easily translate and contextualize. Seed funding would be awarded for an innovative solution that would drive this content. The storyline templates would be made available on the Global Digital Library, providing a digital, accessible, and open source solution.

*Goal Types:* Solve a specific problem; Inform and educate the public; Engage new people and communities; Stimulate a market

*Justification for Using Prizes and Challenges:* USAID was seeking to attract innovators who likely would not be aware of or respond to other mechanisms. All Children Reading (ACR) based the rationale for a prize structure on its initial challenge funding experience; despite the numerous proposals received, very few focused on thematic areas. Smaller prize awards structured around these neglected thematic areas will encourage organizations to innovate and take more risks in implementing new ideas. Over time, ACR has used both the grant and prize mechanisms. One of the valuable aspects USAID has found in prize competitions is that they provide an easier on-ramp for organizations to partner with ACR for a competition for a shorter-term, one-off activity, and usually for a smaller financial contribution.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered and total amount awarded was \$100,000. Non-monetary incentives included engagement with partners, such as the Global Digital Library, which will host these stories on their platform in both Arabic and English. This will extend the reach of this content beyond the Asafeer app and to a global audience, with the possibility of translating these stories into many different languages.

*Solicitation of Submissions:* The NLG Prize was designed to encourage participants to attend the EdTech Summit expecting to develop action plans during breakout sessions to be put into action following the event. Only Summit participants had the opportunity to apply for seed funding during the event, and any other organizations not participating in the Summit were ineligible. Participants were encouraged to develop action plans resulting from the creativity inspired in the breakout sessions and in partnership with other organizations wherever possible. However, the eligibility parameters, though created to inspire and maximize partnerships, may have limited opportunities to engage other viable partners or create new partnerships outside the summit.

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<sup>72</sup> The website for the No Lost Generation Prize Competition can be viewed at <https://nlgedtech.com/competition-winners>.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Press release; Day-long event(s) prior to the competition; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Only those attending the EdTech Summit were eligible to compete for the seed funding.

*Evaluation of Submissions:* A hybrid team of evaluators from World Vision and USAID judged the submissions. Top proposals were selected based on their scores (out of a total of 100 points). The criteria for judging was based on four categories: Innovation (30 points), based on if the approach demonstrated innovation through engagement of traditional and non-traditional writers such as youth, those with disabilities, or children in the Arab region; Feasibility (20 points), based on if the approach demonstrated feasibility by outlining a clear mechanism for engaging writers, revising content, and ensuring the production of quality STEM story templates; Scalability (25 points), based on if pitches put forward a proposed business model that could continue engagement with writers for further contribution to book/stories creation; and Diversity of themes (25 points), based on if pitches put forward proposed STEM themes and the estimated number of templates per theme.

*Results:* Of the six entries submitted between March 2017 and April 25, 2017, two prizes were awarded. A \$50,000 prize award was made for illustrations and a \$50,000 prize award was made for story development. Both prize components were awarded to Asafeer Education Technologies FZ LLC.

*Budget and Resources:* In FY17, USAID provided \$50,000 and 0.25 FTE to support the Prize. In FY18, USAID provided \$50,000 and 0.125 FTE to support the Prize. In addition, World Vision allocated roughly 20 hours a month in support of the Prize. World Vision International also contributed educational and linguistic technical expertise to support the material development.

*Partnerships:* This prize was made possible in partnership with the NLG Initiative, which hosted and promoted the seed funding prizes. Non-Federal partners included the Australian Government and World Vision. The estimated value of partner contributions totals \$100,000.

*Advancement of Agency Mission:* The All Children Reading (ACR) partners' goals are to improve early grade reading outcomes. The NLG Prize incentivize participation in the NLG EdTech Summit. This Prize and Summit advanced each partners' goals to reach children in crisis, proving an excellent opportunity to leverage the NLG Ed Tech Summit to fulfill partner goals.

*Solution Types:* Software and apps; Creative (design & multimedia)

*Plan for Upcoming 2 FYs:* Additional grant-funded activities will be determined by the ACR Round 3 strategy in development in FY19.

### **B.10.7 Tracking and Tracing Books Prize Competition<sup>73</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* ADS 302.3.4.13 Grants Under Contracts (GUCs)

*Status:* This competition was completed in FY17.

*Competition Goals:* The objective of this competition was to seek innovations to track books destined for early grade classrooms and learning centers in low-income countries and allow stakeholders,

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<sup>73</sup> The website for the Tracking and Tracing Books Prize Competition can be viewed at [http://allchildrenreading.org/innovation/prize-winners/#tracking\\_tracing\\_books](http://allchildrenreading.org/innovation/prize-winners/#tracking_tracing_books).

ranging from parents to the Ministry of Education, to easily access tracking information. Desired outcomes included decreasing the number of books lost; improving government service delivery; finding and highlighting innovative ideas; solving a specific problem; developing technology; informing and educating the public; engaging new people and communities; and building capacity.

*Goal Types:* Improve government service delivery; Solve a specific problem; Develop technology; Engage new people and communities

*Justification for Using Prizes and Challenges:* The All Children Reading Grand Challenge for Development (ACR GCD) sought to attract innovators who likely would not be aware of or respond to other mechanisms. The ACR GCD based the rationale for a prize structure on the Round 1 experience that despite receiving numerous proposals, very few focused on the thematic areas. Smaller prize awards structured around the neglected thematic areas will encourage organizations to innovate and take more risks in implementing new ideas. ACR GCD has used both the grant and prize mechanisms. One of the valuable aspects USAID has found in prize competitions is that it provides an easier on-ramp for organizations to partner with ACR GCD for a competition for a shorter-term, one-off activity, and usually for a smaller financial contribution.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$100,000 and the total amount awarded was \$220,000. Non-monetary incentives included global recognition from the ACR GCD; communications and marketing support; invitations to exclusive events; exposure to new partnerships through the ACR GCD partner network; and expert feedback on the proposed software from child development and digital education specialists. In FY17, both tracking and tracing books solutions were alpha tested, and recommendations were made to the finalists to refine the softwares. Final tranche payments of \$25,000 each, for a total \$50,000, were paid to the two finalists in FY17.

*Solicitation of Submissions:* InnoCentive hosted the prize competition and designed a marketing and communications plan on behalf of ACR. InnoCentive not only marketed to their network of over 100,000 solvers but also targeted the broad software and mobile app development community. InnoCentive recommended expanding efforts through targeted outreach and social media outlets to attract experts, industries, and networks in areas such as big data and predictive analytics, logistics and warehouse management, freight and transport, library sciences, and engineering. ACR simultaneously used websites, social media, webinars, information sessions, and workshops to reach a large and varied audience. A few examples of methods used to market the prize competition, mobilize potential participants, and ensure high quality submissions included marketing the prize in three editions of the InnoCentive Challenge Bulletin, which goes out to around 100,000 Solvers; posting information about the Challenge several times on InnoCentive's social media accounts;<sup>74</sup> sending targeted emails to international supply chain management university professors, logistics management organizations and societies, and those working with various kinds of educational technology; and posting and engaging with social media groups and organizations related to supply chain, logistics, and educational technology.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

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<sup>74</sup> InnoCentive's Facebook post on the Challenge received over 10,950 likes. In addition, InnoCentive has more than 9,500 followers on Twitter.

*Participation Requirements:* Eligible applicants included, but were not limited to, for-profit and nonprofit organizations, non-governmental organizations and associations, academic and education research institutions, faith-based organizations, civil society organizations, and foundations. Government entities were ineligible for this opportunity, but partnerships with governments were encouraged. USAID was unable to award cash prizes to suppliers of goods and services that did not meet the nationality and source definitions as referenced in 22 CFR 228.11 and 12, specifically geographic code 937. Geographic code 937 currently excludes Cuba, Iran, Libya, and North Korea.

*Evaluation of Submissions:* There were four stages of the judging process. Stage I took place between April 27 and May 15, 2015. Assessors received access to the platform and training assistance for questions. Each team, consisting of three members, assessed 10 submissions. Team members within a team reviewed submissions in different orders. Nine semi-finalists were produced in Stage I. Stage II took place between May 18 and May 22, 2015. All team members across the three teams rescored the nine top submissions. Stage III took place between May 25 and May 29, 2015. All team members were made aware of the Stage II rankings and scores of the nine semi-finalists. During this stage, any team member could make a case for either moving a lower-rated submission into the top three or removing one submission from the top three. Stage IV took place between June 1 and June 5, 2015. Representatives of the partners met in-person and virtually to discuss the rankings and decide on the three top winners.

*Results:* Of the 10 entries submitted between January 23, 2015 and April 1, 2015, two prizes were awarded.

*Budget and Resources:* In FY17, 0.5 FTE supported the competition through alpha testing, solution refinement, and final payment. A total of \$25,000 in funding was used to support alpha testing in the form of travel and accommodations for finalists, testing logistics, technical consulting, and reporting.

*Partnerships:* The prize was conducted in partnership by the USAID, World Vision, and the Australian government. The estimated value of partner contributions is \$50,000. The competition was managed by InnoCentive. With over 12 years of experience pioneering the fostering of innovation and technology from external networks, in addition to previous work with ACR on the Enabling Writers Prize Competition, InnoCentive had capable staff and a highly-relevant solver community to effectively manage the Track and Trace Prize Competition. Building off of InnoCentive's expertise in running prize competitions, ACR was able to run the competition as efficiently and effectively as possible. ACR recommends this model to other prize competitions.

*Advancement of Agency Mission:* Each of the ACR GCD partners' goals is to improve reading. Books are essential to early grade reading instruction. However, both textbooks and supplemental reading materials ordered for low income countries often do not end up in the hands of the students who need them. Textbooks and materials can go astray at any stage in the delivery process, including at the point-of-entry for imported textbooks; at the central warehouses for nationally-produced materials; during transportation across difficult and sometimes insecure routes; or during final distribution to regional offices and classrooms. The Tracking and Tracing Books Prize Competition spurred development of four tracking software systems tested in over 1,000 school sites in Malawi, Nigeria, and Afghanistan. To advance the mission, further integration of tracking systems requirements will be embedded into program solicitations.

*Solution Types:* Software and apps; Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* All future prize activities will depend on the ACR GCD Round 3 Strategy.

**B.10.8 WomenConnect Challenge<sup>75</sup>**

*Lead Sponsoring Agency:* USAID

*Authority:* ADS 302.3.4.13 Grants Under Contracts (GUCs)

*Status:* This competition was launched in FY17 and is underway in FY18.

*Competition Goals:* Technology is revolutionizing the world by providing tools for entrepreneurship as well as access to critical health, education, and life-enhancing information. However, women increasingly have limited access to technology, resulting in a digital gender divide. There are 1.7 billion women in low- and middle-income countries who still do not own mobile phones, and the gap between the number of men and women using the internet has grown steadily over the past 3 years. The persistent digital gender divide is reinforcing or even exacerbating existing socioeconomic gaps between men and women. By reducing this divide, women and girls will have access to life-enhancing information, networks, and services, reducing poverty and driving inclusive economic growth. The WomenConnect Challenge (WCC) is a global call for solutions to improve women's participation in everyday life by meaningfully changing the ways women and girls access and use technology. USAID is looking to identify and accelerate comprehensive solutions that empower women and girls to access and use digital technology to drive positive health, education, and livelihood outcomes for themselves and their families.

*Goal Types:* Solve a specific problem

*Justification for Using Prizes and Challenges:* Given the anticipated number of awards and interest in this topic, a challenge seemed like the most favorable and fair way to address the incoming proposals. USAID also received input from teams that have previously done Grand Challenges who believed the WCC was a fit for the challenge model.

*Cash Prize Purses and/or Non-Cash Prize Awards:* The total prize purse offered was \$1,000,000 and the total amount awarded was \$900,000. Non-monetary incentives included acceleration support at a semi-finalist workshop in Washington, D.C.

*Solicitation of Submissions:* The Challenge call was announced online and through a social media campaign launched from USAID in Washington, D.C. in conjunction with missions around the world. There was also a launch event on International Women's Day where the USAID Administrator, the USAID Senior Deputy Assistant Administrator, and the Advisor to the President spoke. The launch garnered a large amount of attention and produced a distribution list of 10,000 interested people. Partner organizations and several newsletters also mentioned the launch.

*Solicitation Types:* Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Day-long event(s) prior to the competition; Live video streaming; Partnership with outside organizations (e.g., private companies, non-profit organizations, other Federal agencies)

*Participation Requirements:* Government entities were not allowed to participate. In addition, countries needed to have USAID presence.

*Evaluation of Submissions:* The initial judging narrowed down the 531 proposals to 40 proposals. The evaluation was done by a recruited group of judges across USAID and private sector organizations with domain expertise in either gender, technology, and/or development. Diversity was key in recruiting judges, and at least 45% of the judges were from the Global South. The judging criteria was set by the

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<sup>75</sup> The website for the Womenconnect Challenge can be viewed at <https://www.usaid.gov/wcc>.



implementing partner and approved by the WCC manager. From the top 40 proposals, a five-person Technical Evaluation Committee (TEC), consisting of higher-level experts, scored proposals and whittled the number to 20 semi-finalists using a judging matrix also developed by the implementer and approved by the WCC manager. Semi-finalists were able to rewrite proposals based on feedback, and the same TEC used a third judging matrix to select nine awardees.

*Results:* Of the 531 entries submitted between March 8, 2018 and May 20, 2018, a total of nine prizes were awarded. Winners included AfChix, Equal Access International, Gram Vaani, Humanitarian OpenStreetMap Team, Innovations for Poverty Action, Institute for Financial Management and Research, Mali Health, Gapi and Bluetown, and Viamo.

*Budget and Resources:* In FY17, \$1.4 million and one FTE were used to support the Challenge. In FY18, \$96,000 and one FTE were used to support the Challenge. A total of \$500,000 was used to support a third-party company to manage the challenge design and operations.

*Partnerships:* Georgetown Business School donated classroom space for the semi-finalist workshop and reception.

*Advancement of Agency Mission:* This award advances USAID's mission by demonstrating the positive impact that digital technology can have on the gender digital divide, which affects approximately 1.7 billion women who are not able to use phones or the internet, through gender equity programming and the creation of new evidence to close the divide. Without this new evidence and programming, this divide will continue to grow and make it impossible for women, who are key to sustainable community development, to take advantage of all the digital international development programming that agencies are moving towards.

*Solution Types:* Software and apps; Creative (design & multimedia); Technology demonstration and hardware

*Plan for Upcoming 2 FYs:* The next phase of WomenConnect Challenge is to make the first payments to awardees and start conducting field visits with the desire to collaborate more with local missions who may be interested in augmenting these programs or making a country-specific challenge. There is interest in scaling the positive outcomes of the WCC, which would require additional USAID and partner commitment to provide the necessary funds.