A. Prizes and Challenges under the COMPETES Reauthorization Act of 2010

This Appendix provides agency-submitted summaries of prizes and challenges conducted in FY17 and FY18 under the prize authority provided in COMPETES and does not include any prizes and challenges conducted under other authorities. Please note that agency plans for the upcoming two fiscal years are notional and subject to the availability of funding. It should also be noted that the DOE American Inventions Made Onshore (AIM Onshore) prize is included as part of Appendix A but was not included in the report analyses as it was received after the submission deadline.

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A.1 Department of Agriculture (USDA)

A.1.1 National School Lunch and School Breakfast 2017 Verification Response Rate Challenge[1]

Lead Sponsoring Agency: Food and Nutrition Service (FNS)

Status: This competition was completed in FY17.

[1] The website for the National School Lunch and School Breakfast 2017 Verification Response Rate Challenge can be viewed at https://www.challenge.gov/challenge/usda-school-meal-programs-verification-response-rate-challenge/.

Competition Goals: School districts approve around five million household applications for free or reduced-price school meal benefits each year. Each year, school districts are required to identify a small percentage of those applications for verification. The identified households must send proof of income so the school districts can verify the student's eligibility status. Households that do not respond to verification are changed to paid status. We know that some households that fail to respond are eligible for benefits. Even so, many districts struggle to get even half of their households to respond, and for some it is even fewer. Other districts have identified low-cost and creative strategies that allow them to exceed 70 (and even 80 or 90) percent response rates. The Verification Response Rate Challenge was a public forum to exchange ideas on how to increase household response in the annual verification process. Through this challenge, school district and state agency staff were able to share their verification success stories and/or were encouraged to build on others' submissions with constructive feedback and suggestions.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Engage new people and communities

Justification for Using Prizes and Challenges: This Challenge was intended to generate creative ideas for increasing household response to verification. The prizes were intended to be fun and to encourage friendly competition among school districts across the country. Rather than monetary prizes, challenge winners were announced at the 2017 School Nutrition Association Annual National Conference in front of their peers and other interested parties at a session devoted to the verification process. FNS believes that the challenge model provided access to the talents of individuals that it would have been unlikely to reach through traditional methods. FNS was looking to develop a series of unique verification response solutions, which left a great deal of room for creativity. A traditional data collection contract would have been a more expensive (the challenge incurred no cost to the government) and less efficient way to tap school districts representing different geographic locations, different student populations, and facing different challenges.

Cash Prize Purses and/or Non-Cash Prize Awards: There were no monetary prizes for this challenge. The contest offered non-monetary recognition on the contest website and at the 2017 School Nutrition Association (SNA) annual conference in the following categories: "Potential Game Changer" (up to 3), "Popular Choice," "Best Documented," "Honorable Mention" (up to 2).

Solicitation of Submissions: FNS worked with its Office of Chief Communications Officer (OCCO) and with the SNA to promote the challenge. OCCO used social media and press announcements while SNA reached out to its membership through its newsletter and emails. Additionally, FNS used its network of contacts with school district staff to let them know about the challenge and asked those contacts to further spread the word about the challenge. The challenge was also featured on the FNS rotating banner on its website. FNS' impression is that SNA's communication with its members and using the network to spread the word about the challenge were the most effective methods of communication. FNS discovered that school districts developed small competitions among themselves to see which district would have the best solution. The lessons learned suggest that for this type of challenge, tapping informal networks and using personal contacts to engage school district staff were the most effective ways to publicize the challenge.

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: The only requirement for participation was to have an idea about how to encourage households to respond to verification. Thus while the majority of those who entered the challenge were school districts, some private individuals also submitted solutions.

Evaluation of Submissions: FNS staff reviewed all of the challenge submissions to narrow the pool down to the top ten submissions. The top ten solutions were presented to the judging panel which consisted of two FNS career staff and the president of the SNA. The criteria for both reviews were the same. Each solution was judged on demonstrated effectiveness (35%), research and creativity (35%), and presentation, clarity, and persuasiveness (30%). For each solution, judges awarded up to 35 points for the strength of evidence provided in support of the solution's impact on household response (e.g., evidence of documented changes in response rates after the district implemented its solution), 35 points for solutions that made effective use of independent research and creativity (e.g., solutions that revealed insight into the barriers to household response and offered creative approaches to overcome those barriers), and 30 points for presentation, clarity, and persuasiveness (designed specifically for untested solutions or ones where the impact on household response was difficult to prove). The two-tiered judging process proved to be effective—narrowing the pool to the top ten solutions provided for more focused judging of only the best submissions.

Results: Of the 36 entries submitted between May 4 and June 15, 2017, seven prizes were awarded to five winners.

Budget and Resources: FNS estimates that the work to create the challenge, including developing and overseeing the challenge and writing the materials necessary for the challenge required one month of staff time (1/12 FTE). This challenge did not require a budget as all of the prizes were non-monetary and there were no third party vendors. The judging panel volunteered to judge the contest submissions, and the time allocated for the two FNS judges to review the submissions is included in the FTE estimate.

Partnerships: FNS did not partner with any outside organization. However, because the intended participants were local education agency officials who manage the school meal programs, FNS reached out to the SNA to promote the challenge.

Advancement of Agency Mission: School districts are actively involved in finding effective ways of getting households to respond to verification requests. This challenge provided a forum for school district staff to share their experience and expertise with other school districts in a collaborative fashion, where staff could propose ideas and those ideas could be expanded through discussion boards. The goal of this effort was to provide a number of options schools districts might use to increase their verification response rates, reduce the time and expense associated with repeat follow-up reminders to households, and reduce the risk that eligible children lose access to program benefits. FNS used the challenge format to maximize school district staff engagement and uncover the most effective solutions. It was equally important that school districts were provided with an opportunity to highlight their work. At the end of the challenge, USDA featured the winning submissions at the 2017 SNA's Annual National Conference in Atlanta. FNS also produced a verification tool-kit that is available to all school districts nationwide that highlights practices and ideas from contest participants. Because school districts vary, the opportunity to provide a range of solutions is very important and the challenge format allowed school district staff (and others) an opportunity to participate at essentially no cost. The Agency's mission was advanced not only through the identification of different ways to attack the problem of non-response, but also in providing an opportunity for school districts to actively participate in the identification of those solutions.

Solution Types: Creative (design & multimedia); Ideas

Plan for Upcoming 2 FYs: The FNS office that developed this challenge is not considering additional challenges at this point (this was the second challenge run from this office). However, FNS' experiences with both challenges have been positive, and FNS may look into opportunities for future challenges.

A.1.2 2017 Innovations in Food and Agricultural Science and Technology (I-FAST) Prize Competition[2]

Lead Sponsoring Agency: National Institute of Food and Agriculture (NIFA)

Status: This competition was completed in FY17.

Competition Goals: NIFA announced the I-FAST prize competition to develop and implement the Innovations in Food and Agricultural Science and Technology (I-FAST) Program. NIFA partnered with the National Science Foundation (NSF) Innovation Corps (I-Corps) to provide entrepreneurship training to NIFA grantees under this I-FAST pilot program. The goals were to identify valuable product opportunities that can emerge from NIFA-supported academic research. Selected NIFA I-FAST project teams participated in the educational programs with NSF I-Corps Program. Over a period of twelve months the NIFA-supported teams in the I-FAST program learned what is needed to achieve an economic impact with their particular innovation. The final goal of the I-FAST Competition was to facilitate technology transfer of innovations that can make an impact in the marketplace and the global economy.

Goal Types: Advance scientific research; Develop technology; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: Given the length of time for this prize (one year) and the travel requirements for team members to participate in the three-day kick off and lessons-learned training by the NSF I-Corps program, a prize competition was used to facilitate the teams to complete this requirement. The teams were also required to take several trips throughout the year of the prize competition to conduct customer interviews and discover their technology's market.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $400,000, or $50,000 for up to eight teams, and the total amount awarded was $150,000, as only three teams were selected to participate in the final program. Non-monetary incentives included mentoring and training.

Solicitation of Submissions: The prize competition was published on the Federal Register and also e-mailed to the agency's listservs as a solicitation of submissions. The agency is exploring additional sources as solicitation methods to increase the pool of applicants in future competitions.

Solicitation Types: Email (e.g., listservs); Press release

Participation Requirements: The Competition had a two-phase selection process. Teams initially submitted a pre-application to the competition via www.Challenge.gov and by email to contest@nifa.usda.gov. The pre-application had to contain a three-page executive summary that described the following: Composition of the team and roles of the members proposing to undertake the commercialization feasibility research, including the entrepreneurial lead, principal investigator, and mentor; Point of contact information for all of the members; Relevant current/previous NIFA award(s) including award number, project title, and the NIFA program the award was funded under; Brief description of the potential commercial impact and commercialization plans. From the pre-applications, NIFA conducted phone interviews and selected teams that were invited to submit full applications. From the full applications, NIFA selected the winning teams.

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[2] The website for the 2017 Innovations in Food and Agricultural Science and Technology (I-FAST) Prize Competition can be viewed at https://www.Challenge.gov/challenge/2017-innovations-in-food-and-agricultural-science-and-technology-i-fast-prize-competition-only-selected-pre- applicants-are-eligible/.

Evaluation of Submissions: NIFA screened all entries for eligibility and completeness. Entries from teams that did not meet the eligibility requirements and/or that failed to include required submission elements were not evaluated or considered for award. Eligible and complete entries were judged by a fair and impartial panel of individuals from NIFA and NSF. The Judging Panel evaluated the pre-application to determine the following: (1) Did the proposed technology receive past NIFA funding within the specified timeframe? (2) Did the team have the required team members and are the roles of each team member clearly described and meet the noted responsibilities? (3) Did the commercialization plan provide a good understanding of the team's knowledge of the current state of the art and how the technology could enter into a potential market? Following the evaluation, the Judging Panel conducted a phone interview with each selected team. This emphasized the required time commitment and availability of the entire team to complete the NSF I-CORPS program during one of the fall 2018 cohorts.

Results: Of the four entries submitted by 16 participants in the full application phase between September 15 and October 6, 2017, three prizes were awarded to nine winners.

Budget and Resources: The Small Business Innovation Research (SBIR) 3% administrative fund as authorized by Congress was used for this prize. In FY17 and FY18, $14,058 of funding and 0.25 FTEs were used each fiscal year.

Partnerships: Expertise from several members of NSF was used during the judging process of conducting phone interviews with the teams. During the required kick-off and lessons learned training, the NSF staff provided expert instructors and training modules.

Advancement of Agency Mission: The NIFA USDA mission is to invest in and advance agricultural research, education, and extension to solve societal challenges. As part of this mission, NIFA is charged with providing grant funding for research, education, and extension that addresses key problems of national, regional, and multi-state importance in sustaining all components of agriculture. A majority of NIFA grant funding is provided to academic institutions to focus on developing research in the areas of farm efficiency and profitability, ranching, renewable energy, forestry (both urban and agroforestry), aquaculture, rural communities and entrepreneurship, human nutrition, food safety, biotechnology, and conventional breeding. The purpose of the I-FAST Competition is to identify NIFA-funded research teams who will receive additional support, in the form of mentoring, training, and funding to accelerate the translation of knowledge derived from fundamental research into emerging products and services that can attract subsequent third-party funding. Leveraging experience and guidance from established entrepreneurs and a targeted curriculum within the NSF I-Corp program, NIFA I-FAST teams learned to identify valuable product opportunities that can emerge from NIFA supported academic research. The I-FAST competition helped create a stronger national ecosystem for innovation that couples scientific discovery with technology development to address agricultural and societal needs.

Solution Types: Software and apps; Ideas; Technology demonstration and hardware

Plan for Upcoming 2 FYs: The NIFA I-FAST program will be soliciting applications again for FY19 and FY20 to exhaust funds from previous years and if the SBIR 3% administrative fund is renewed by Congress.

A.2 Department of Commerce (DOC)

A.2.1 2017 RAMP: Reusable Abstractions of Manufacturing Processes[3]

Lead Sponsoring Agency: National Institute of Standards and Technology (NIST)

Status: This competition was launched and completed in FY17.

Competition Goals: The goal of this competition was to help familiarize the research community with a recent standard for modeling manufacturing processes developed by the American Society for Testing and Materials (ASTM) E60.13 Subcommittee on Sustainable Manufacturing, to provide an opportunity for participants to put this standard into practice in modeling processes of their own interest, and to share their experiences in applying the standard across a variety of manufacturing processes. Formal methods for acquiring and exchanging information about manufacturing processes will lead to consistent characterizations and help establish a mechanism for reuse of these models. Standard methods will ensure effective communication of computational analytics and sharing of sustainability performance data. In addition, the use of a reusable standard format is expected to further the models suitable for automated inclusion in a system analysis, such as a system simulation model or an optimization program.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Advance scientific research; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: A prize-based approach enabled NIST to attract the attention and participation of a broad group of researchers by offering a modest cash prize and the opportunity to present their entry at a technical conference. Because the entry process is simple and easy to navigate, researchers could focus their efforts solely on the technical aspects of their competition entries.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and total amount awarded was $3,250. Non-monetary incentives included the opportunity for finalists to present their entries to a judging panel in a session at the 2017 American Society of Mechanical Engineers (ASME) International Manufacturing Science and Engineering Conference held in Los Angeles, California. Partners of the Challenge provided award plaques and travel stipends.

Solicitation of Submissions: NIST used email, Challenge.gov, the NIST website and social media to announce the 2017 ASME International Manufacturing Science and Engineering Conference. The email announcements went to people who had previously expressed an interest in Reusable Abstractions of Manufacturing Processes (RAMP), as well as to a targeted list of university professors and departments involved in manufacturing-related work.

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 - Interactive webinar

Participation Requirements: The target audience for RAMP 2017 was students in engineering programs with a familiarity of manufacturing processes and interest in sustainability. To be eligible for a cash prize, the official representative (individual or team lead, in the case of a group project) had to be age 18 or older at the time of entry and a U.S. citizen or permanent resident of the United States. In the case

[3] The website for the 2017 Ramp: Reusable Abstractions of Manufacturing Processes can be viewed at https://www.Challenge.gov/challenge/ramp-reusable-abstractions-of- manufacturing-processes-2017/.

of a private entity, the business had to be incorporated in and maintain a primary place of business in the United States or its territories. Participants could not be a Federal entity or Federal employee acting within the scope of his or her employment. Eligibility excluded NIST employees and NIST Researcher Associates as well as direct recipients of NIST funding awards to collaborate on the development of the ASTM standard E3012-16. Employees of the National Science Foundation (NSF), the ASTM, and the ASME Manufacturing Science and Engineering Conference (MSEC) Conference Organizers were excluded from participating but members of these organizations were eligible to enter. Any other individuals or legal entities involved with the design, production, execution, distribution or evaluation of the RAMP Challenge were not eligible to participate.

Evaluation of Submissions: Subject matter experts consisting of NIST staff generated a rating on a scale of 0 to 100 and wrote a brief narrative for each entry using five equally weighted criteria: (1) Completeness: Submission follows the guidelines and includes all necessary components. All submissions must describe the approach taken to validate the work and provide both a graphical and formal representation of the Unit Manufacturing Process (UMP) information model. (2) Complexity: Model reflects the complexities of the manufacturing process, especially those which influence sustainability indicators such as energy and material consumption. (3) Clarity: Model is clear in describing the process and the process-related information. (4) Accuracy: Submission accurately models the process as shown through validation. (5) Novelty: Approach taken develops new techniques to advance model reusability or reliability. Using scores provided by the subject matter experts, the Challenge manager identified the top eight submissions. A panel of judges (four from academia, and one from industry), appointed by the Acting NIST Director, reviewed the entries and subject matter expert input. The panel of judges participated in a session at the 2017 ASME International Manufacturing Science and Engineering Conference where finalists gave a brief presentation. The judges ranked the finalists to determine winners using five weighted criteria: (1) Complexity, 10%; (2) Clarity, 10%; (3) Accuracy 35%; (4) Novelty, 35%; and (5) Presentation, 10%.

Results: Of the 14 entries submitted by 32 participants between December 19, 2016 and April 17, 2017, eight prizes were awarded to eight teams, with 21 individuals total.

Budget and Resources: In FY17, one FTE was used to support the design and management of the Challenge. The total funding for FY17 was $4,778, which included $3,250 designated for cash prizes and $1,528 for overhead costs on cash prizes. Funds for all costs provided in the budget were appropriated funds from the FY17 NIST Scientific Research and Technical Services account.

Partnerships: The ASME hosted the final portion of the competition at its Manufacturing Science and Engineering Conference. In addition, ASME provided subject matter experts and judges for the Challenge. The NSF provided travel funding for finalists, experts, and two of the competition judges. ASTM International provided access to the standard document, funding for award plaques, and subject matter expertise. The estimated value of partner contributions is $6,500. Travel stipends contributed by NSF totaled approximately $6,000 and award plaques provided by ASTM were valued at approximately $500.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. The mission includes the development and dissemination of technical standards that support industrial competitiveness, such as those developed in ASTM E60.13. The 2017 RAMP Challenge not only serves to raise awareness and application of a manufacturing standard that NIST helped develop, but it lays a foundation of knowledge to aid development, collection, and reuse of manufacturing models. Formal methods for acquiring and exchanging information about manufacturing processes will lead to consistent characterizations and

help establish a collection for reuse of these models. Standard methods will ensure effective communication of computational analytics and sharing of sustainability performance data. Results of the competition assist NIST by demonstrating the use of a reusable standard format leading to models suitable for automated inclusion in a system analysis, such as a system simulation model or an optimization program.

Solution Types: Software and apps; Analytics, visualizations, algorithms; Other - Manufacturing process models conforming to ASTM E3012-16

Plan for Upcoming 2 FYs: NIST disseminated these sustainable manufacturing standards and hosted an additional RAMP challenge in 2018.

A.2.2 2018 RAMP: Reusable Abstractions of Manufacturing Processes[4]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY18.

Competition Goals: The goal of the competition was to help familiarize the research community with a standard for modeling manufacturing processes that was developed by the ASTM E60.13 Subcommittee on Sustainable Manufacturing. NIST led the development of this standard working in partnership with ASTM International. The challenge provided an opportunity for participants to put those standards into practice in modeling processes of their own interest, and to share their experiences in applying the standards across a variety of processes. Formal methods for acquiring and exchanging information about manufacturing processes will lead to consistent characterizations and help establish a mechanism for reuse of these models. Standard methods will ensure effective communication of computational analytics and sharing of sustainability performance data. In addition, the use of a reusable standard format is expected to further the models suitable for automated inclusion in a system analysis, such as a system simulation model or an optimization program.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Advance scientific research; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: A prize-based approach enabled NIST to attract the attention and participation of a broad group of researchers by offering a modest cash prize and the opportunity to present their entry at a technical conference. Because the entry process was simple and easy to navigate, researchers could focus their efforts solely on the technical aspects of their competition entries.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $3,250 and the total amount awarded was $2,850. The first place winner was awarded $1,000, the second place winner was awarded $750, the third place winner was awarded $500, and three runners up received $200 each. Non-monetary incentives included the opportunity for finalists to present their entries at the co-located ASME International Manufacturing Science and Engineering Conference 2018 and the 46th North American Manufacturing Research Institution of the Society of Manufacturing Engineers (NAMRI/SME) North American Research Conference in College Station, Texas. Award plaques were provided by ASTM International, and travel stipends were offered through NSF.

[4] The website for the 2018 Ramp: Reusable Abstractions of Manufacturing Processes can be viewed at https://www.Challenge.gov/challenge/ramp-reusable-abstractions-of- manufacturing-processes/.

Solicitation of Submissions: Email, Challenge.gov, the NIST website, and social media announcements were all used to promote this competition. NIST sent email announcements to people who had previously expressed an interest in the RAMP 2017 competition and a targeted list of university professors and departments involved in manufacturing-related work. The challenge partners notified their memberships and communities using email and other tools.

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 - Interactive webinar

Participation Requirements: The target audience for RAMP 2018 was students in engineering programs with a familiarity of manufacturing processes and interest in sustainability. A participant (whether an individual, team, or entity) must have registered to participate and complied with all of the requirements under section 3719 of title 15, United States Code. The official representative (individual or team lead, in the case of a group project) had to be age 18 or older at the time of entry and a U.S. citizen or permanent resident of the U.S. or its territories. In the case of a private entity, the business had to be incorporated in and maintain a primary place of business in the U.S. or its territories. Participants could not be a Federal entity or Federal employee acting within the scope of his or her employment. Eligibility excluded NIST employees and NIST Research Associates as well as direct recipients of NIST funding awards to collaborate on the development of the ASTM standard E3012-16. Employees of the NSF, the ASTM, the ASME MSEC Organizers, and the NAMRI/SME Organizers were excluded from participating but members of ASTM, ASME and SME were eligible to enter. Any other individuals or legal entities involved with the design, production, execution, distribution or evaluation of the RAMP 2018 Challenge were not eligible to participate. Participation was subject to all U.S. Federal, State and local laws and regulations.

Evaluation of Submissions: Finalists were selected by NIST subject matter experts applying five weighted criteria: (1) Completeness, 10%: Submission follows the guidelines and includes all necessary components. All submissions must describe the approach taken to validate the work and provide both a graphical and formal representation of the UMP information model. (2) Complexity, 15%: Model reflects the complexities of the manufacturing process, especially those which influence sustainability indicators such as energy and material consumption. (3) Clarity and adherence to the theme as described in the Challenge Rules, 30%: Model is clear in describing the process and the process related information and its contribution to advancing the theme. (4) Accuracy, 30%: Submission accurately models the process as shown through validation. (5) Novelty, 15%: Approach taken develops new techniques to address the theme and to advance model reusability or reliability. A panel of five judges appointed by NIST's Director (three from academia and two from NSF) determined the winners based on review of subject matter results, accounting for 75% of the score, along with presentation clarity, content, and quality conveyed during in-person presentations at a session of the co-hosted ASME International Manufacturing Science and Engineering Conference 2018 and the 46th NAMRI/SME North American Research Conference, which accounted for 25% of the score.

Results: Of the nine entries submitted by 32 participants between January 29 and April 21, 2018, six prizes were awarded to six teams, with 21 individuals total.

Budget and Resources: In FY18, one FTE was used to support the design and management of the Challenge, as well as to develop competition resources such as the Unit Manufacturing Process Builder, an online tool available for participants to use when creating their entries. The total funding for FY18 was $4,190, including $2,850 designated for cash prizes and $1,340 for overhead costs on cash prizes. Funds for the Challenge came from appropriated funds in the FY18 NIST Scientific Research and Technical Services account.

Partnerships: NSF, ASTM International, ASME, and SME were supporting organizations on the Challenge, contributing in a variety of ways including providing the conference room for the finalist presentations; helping to promote the Challenge through their networks; and serving as judges or providing suggestions of academic experts to serve as judges. ASTM provided plaques for the winners (approximately $500 in value) and NSF offered travel stipends to finalists (approximately $5,000 in value). The partnership was effective in reaching a broader community of solvers and bringing greater attention to the importance of technical standards.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. The mission includes the development and dissemination of technical standards that support industrial competitiveness, such as those developed in ASTM E60.13. The 2018 RAMP Challenge not only serves to raise awareness and application of a manufacturing standard that NIST helped develop, but it lays a foundation of knowledge to aid development, collection, and reuse of manufacturing models. Formal methods for acquiring and exchanging information about manufacturing processes will lead to consistent characterizations and help establish a collection for reuse of these models. Standard methods will ensure effective communication of computational analytics and sharing of sustainability performance data. Results of the competition assist NIST by demonstrating the use of a reusable standard format leading to models suitable for automated inclusion in a system analysis, such as a system simulation model or an optimization program.

Solution Types: Software and apps; Analytics, visualizations, algorithms; Other - Manufacturing process models conforming to ASTM E3012-16

Plan for Upcoming 2 FYs: NIST will continue to disseminate these sustainable manufacturing standards and may host additional RAMP challenges (to be determined).

A.2.3 Agile Robotics for Industrial Automation Competition (ARIAC)[5]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY18.

Competition Goals: ARIAC is a simulation-based competition designed to address a critical limitation of robots used in industrial environments: they are not as agile as they need to be. Many robots are not able to quickly detect failures or recover from those failures. They are not able to sense changes in their environment and modify their actions accordingly. The goal of ARIAC is to enable industrial robots on workshop floors to be more productive, autonomous, and responsive to the needs of shop floor workers by utilizing the latest advances in artificial intelligence and robot planning.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology

Justification for Using Prizes and Challenges: The prize competition allowed NIST to gain a wider range of solutions to industrial challenges for a lower cost compared to traditional mechanisms such as grants or contracts, and helped grow awareness of the NIST research program in robotic systems for manufacturing. This competition resulted in six unique approaches to solving manufacturing robotic challenges that directly addressed the pain points experienced by industry. A contract to accomplish

[5] The website for the Agile Robotics for Industrial Automation Competition (ARAIC) can be viewed at https://www.Challenge.gov/challenge/ariac/.

the same task would have been much more expensive than the cash prize purse, and would not have had the same diversity of solutions.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $17,500. Non-monetary incentives included paid travel expenses for the winners to attend a workshop focusing on the theme of the competition.

Solicitation of Submissions: NIST solicited participation on Facebook and Twitter feeds, Challenge.gov, and relevant mailing lists. Over 50 teams registered for the competition and six teams made it to the finals.

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

Participation Requirements: The target audience for ARIAC was scientists and engineers from industry and academia who are knowledgeable about robot control software. To be eligible for a cash prize, a participant—whether an individual, team, or legal entity—had to have registered to participate and complied with all of the requirements under section 3719 of title 15 United States Code. At the time of entry, the official representative (individual or team lead, in the case of a group project) had to be age 18 or older and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business had to be incorporated in and maintain a primary place of business in the United States or its territories. Participants could not be a Federal entity or Federal employee acting within the scope of his or her employment. NIST employees were not eligible to participate. In addition, interested participants who do not meet the eligibility requirements to win a prize (i.e., individuals who are neither a U.S. citizen nor a permanent resident of the United States or non-US-based entities) were encouraged to participate in the Competition. They were invited to register on the ARIAC website and download the training material. The performance obtained by these participants was displayed on the ARIAC website in the same manner as the performance obtained by participants who were eligible to win cash prizes.

Evaluation of Submissions: The winners were determined by a panel of three judges (one NIST employee and two individuals from industry) appointed by the NIST Director. The following judging criteria were used: (1) Overall performance based on scoring metrics described in the official rules of the Challenge (80 points). Using automated scoring metrics, the first place entry was awarded 80 points, the second place entry was awarded 70 points, the third place entry was awarded 60 points, and so on. (2) Novelty of approach and alignment with spirit of competition (20 points). At the judges' sole discretion, up to 20 points were awarded for entries that showed novel approaches to solving the agility challenges and whose approaches were consistent with the spirit of the competition of coming up with industrially-implementable approaches that will help industry make better use of their robotic platforms. Each entry was eligible for up to 20 points, and more than one entry could receive all 20 points (or any other value). This approach of combining an automated score with one assigned by judges provided an additional mechanism to award novel approaches and was an effective structure for a successful competition that rewarded high-performing entries aligned with the goals and spirit of the competition.

Results: A total of 50 teams participated in the Challenge between January 26, 2018 and May 17, 2018. Three prizes were awarded to three teams.

Budget and Resources: In FY18, one FTE supported the design and implementation of the Challenge. The total budget in FY18 for the Challenge was $160,270, of which $100,000 was for a contract with Open Source Robotics Foundation, $17,500 was for the prize purse, $23,500 was for travel expenses for the winners to attend a workshop, and $19,270 was for overhead costs. Funds for all costs provided in the budget were from the FY18 NIST Scientific Research and Technical Services account (appropriated funds).

Partnerships: A contract was awarded to Open Source Robotics Foundation to develop the infrastructure for the competition (e.g., building and hosting the competition's web platform) and assist with automated scoring.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST staff involved in this competition worked closely with industry to understand their challenges in implementing robotic systems for manufacturing applications, and built the competition around these topics. By incentivizing research teams to address these industry challenges in the competition, NIST supports the development of technology solutions to help U.S. industry become more competitive in the global market.

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

Plan for Upcoming 2 FYs: NIST intends to continue its research program on measurement science and standards for robotics in manufacturing, and will use challenges as appropriate to engage the community and drive innovative solutions to research problems in this space, whether ARIAC or another similar challenge.

A.2.4 Federal Impact Assessment Challenge[6]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY17.

Competition Goals: Despite the proliferation of Federal research and the profound effect that many federally developed technologies have on our everyday life, more effort is needed to assess the impact of these technologies. The goal of this Challenge was to advance the methods for assessing impact and provide case studies of technologies transferred from Federal laboratories. The Challenge called on researchers to analyze a federally developed technology that has been transferred to the private sector, and present the results in a paper suitable for an archival publication.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Inform and educate the public; Engage new people and communities

Justification for Using Prizes and Challenges: A prize competition served as an incentive for graduate students and economic researchers to focus on assessing the impact of Federal technology transfer activities. NIST determined that the offer of a modest cash prize, opportunity for the article to be published, and the simple registration and participation process would incentivize participants and allow NIST to identify a new cadre of researchers interested in technology transfer.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $20,000. Non-monetary incentives included the opportunity for the winning papers to be published in the Journal of Technology Transfer. No awards were made for the Challenge because there were no eligible winners.

Solicitation of Submissions: The Challenge was issued on Challenge.gov. NIST gave a presentation of the Challenge to the Interagency Working Group on Technology Transfer, which informed all Federal agencies of the Challenge. In addition, NIST issued press releases, and distributed flyers to academic institutions, research organizations, and economic conferences. NIST also made a presentation on the Challenge at the 2016 Technology Transfer Society Annual Conference at Arizona State University.

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[6] The website for the Federal Impact Assessment Challenge can be viewed at https://www.Challenge.gov/challenge/federal-impact-assessment-challenge/.

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

Participation Requirements: The target audience was economic researchers, including graduate students working on dissertations. The Federal Impact Assessment (FIA) Challenge was open to all individuals over the age of 18 who are residents of the 50 United States, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. In the case of private entities, either non-profit or for-profit, corporations and institutions shall have been incorporated in, and maintained, a primary place of business in the United States or its territories. An individual, whether participating singly or with a group, must be a citizen or permanent resident of the United States. Federal employees were not eligible to participate. Any individuals or legal entities that had received Federal funds for the development of any part of a submission were ineligible. Any other individuals or legal entities involved with the design, production, execution, distribution, or evaluation of the FIA Challenge were also not eligible to participate. A participant would not be deemed ineligible because the participant consulted with Federal employees or used Federal facilities in preparing its submission to the FIA Challenge if the employees and facilities were made available to all participants on an equitable basis.

Evaluation of Submissions: Three subject matter experts reviewed each submitted paper, assigning a numerical score and providing a brief assessment of how well four evaluation criteria were met: (1) description of the technology (up to 20 points); (2) description of the demand environment (up to 30 points); (3) description of methodologies used to gather and assess impact data (up to 20 points); and (4) description of the economic and/or societal impacts that resulted from the technology transferred from the Federal agency (up to 30 points). The NIST Director appointed a panel of judges to review the papers and the corresponding reviews provided by subject matter experts. The panel consisted of three individuals (all Federal employees) with broad representation of relevant areas to the Challenge. The judges evaluated each paper using three equally weighted criteria: novelty of the approach, scope of the assessment, and quality of the paper. In this Challenge, only one paper was received. According to the processes outlined in the official rules of the Challenge, the paper was reviewed by subject matter experts and the judging panel determined the paper should receive an award. However, the submitting team was later determined to be ineligible and no prize was awarded. A lesson learned was that a more focused challenge may elicit greater participation. The theme of federal impact assessment was perhaps too broad for potential solvers. In the future, NIST may focus on a specific technology area or identify some transferred technologies so that the solvers can focus on their impact assessment.

Results: One entry was submitted by four participants between September 27, 2016 and May 31, 2017. No prizes were awarded.

Budget and Resources: In FY17, 0.5 FTE supported the design and execution of the Challenge, including addressing inquiries and conducting technical reviews of the submission.

Partnerships: The journal of Technology Transfer agreed to review the winners of the Challenge and consider them for publication in their journal.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. On behalf of the Department of Commerce, NIST has a unique role in promoting and reporting on the overall strength of Federal efforts in technology transfer, including delivering annual reports to the White House and Congress on the use of technology transfer by the Department of Commerce and across all agencies. The Challenge also supported a Presidential memorandum that called on Federal agencies to establish performance goals, metrics, evaluation

methods, and implementation plans to improve the effectiveness of Federal technology transfer activities. The Federal Impact Assessment Challenge was designed to encourage efforts to conduct research in the area of studies that assess the impact of technologies transferred from Federal laboratories.

Solution Types: Ideas; Analytics, visualizations, algorithms; Other - Economic impact assessment

Plan for Upcoming 2 FYs: There is a continuing need to assess the economic impact and/or return on investment for Federal research. Future challenges are possible mechanisms to stimulate research in this area.

A.2.5 NIST the Future of Public Safety Technology 100K Video Series Challenge[7]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY17.

Competition Goals: The goal of the Challenge was to create a series of seven videos that explain open innovation and NIST's Public Safety Communications Research Open Innovation Accelerator program to the public, while covering each of the key public safety technology programs covered by the NIST Public Safety Research Communications (PSCR) Division. In addition to educating the audience, the videos also invited people and companies across America to participate in future crowdsourcing competitions.

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

Justification for Using Prizes and Challenges: For the creation of videos, a crowdsourced prize competition provided the opportunity for more diverse submissions, in a quick timeframe. The use of traditional contractual mechanisms (e.g., contracts, grants) would have limited entries and the ability for teams to be formed through the ideation phase. A phased prize competition allowed for more submissions in the concept phase with down-selection to follow-on phases, resulting in quality, production-ready end products in a short timeframe.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000 and the total amount awarded was $100,000. Non-monetary incentives included access to PSCR researchers and public safety professionals during the Challenge. Winners were invited to attend the PSCR 2018 Public Safety Broadband Stakeholder Meeting.

Solicitation of Submissions: NIST PSCR employed the vendor, Tongal, through the NASA Center of Excellence for Collaborative Innovation (CoECI) blanket purchase agreement. Tongal reached out to its 120,000+ members with email blasts and postings on its website and social platforms. The vendor worked with NIST PSCR to announce and promote the project on the NIST website and social media pages (Facebook and Twitter), including a direct link to Tongal's project page. Lessons learned from the solicitation process included recognizing that crowdsourcing allowed for unique and powerful ideas; that timelines built into the process supported a quality product with oversight; that crowdsourcing allowed experts to team with new people using a collaborative website; and that social media and online communities attracted the right solvers.

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

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[7] The website for the NIST the Future of Public Safety Technology 100K Video Series can be viewed at https://www.Challenge.gov/challenge/nist-the-future-of-public-safety- technology-100k-video-series/.

Participation Requirements: The target audience for the Challenge was video producers and cinematography artists with interest in public safety. To be eligible, individuals must have been age 13 or older at the time of entry and U.S. citizens or permanent residents of the United States. In the case of private entity, the business shall have been incorporated in, and maintained, a primary place of business in the United States or its territories. A minor (for these purposes, a person under the age of 18 years of age, or under 19 years of age if the individual is a resident in Nebraska or Alaska or under 21 years of age in Mississippi) submitting an entry for a project must have received his/her parent/legal guardian's permission and included his/her parent/legal guardian's name and contact information on the official entry form where indicated. Participants may not be a Federal entity or Federal employee acting within the scope of their employment. NIST Guest Researchers, as well as direct recipients of NIST funding awards through any Center for Excellence established by NIST, were also not eligible for entrance. Multiple individuals and/or legal entities may have collaborated as a group to submit a single entry, but a single individual from the group must be designated as an official representative for each entry. That designated individual was responsible for meeting all entry and evaluation requirements.

Evaluation of Submissions: The vendor, Tongal, reviewed all submissions to ensure they met the minimum requirements. Then, NIST PSCR utilized three types of evaluators - subject matter experts (SMEs), public safety focus groups, and a judge, appointed by the NIST Director. The SMEs reviewed the submissions and offered their expert opinions and recommendations to the judges. The SMEs and focus groups were a hybrid of NIST researchers and active first responders; the judge was a Federal employee. During each stage (concept, pitch, and video) of the challenge, Tongal evaluated the submissions for compliance with the objectives and the official rules of the contest. After it was determined the contestant complied with the objectives and official rules, SMEs and focus groups reviewed the submissions and offered recommendations to the judge. The appointed judge had sole discretion regarding the determination of awards in accordance with the rules for the Challenge. Key lessons learned during the evaluation process were that using active first responders for reviews brought operational accuracy to the end products; the use of video experts, along with NIST staff, provided critical feedback on the quality of the end products; designing the challenge with multiple stages, phased appropriately along a condensed timeline, ensured good engagement with the contestants and review teams; and regular meetings between the SMEs and the stage 2 winner provided quality and accuracy to the end solution.

Results: Of the 107 entries submitted by 200 participants, six prizes were awarded to five teams consisting of a total of 20 individuals. The Challenge was broken into four phases. Phase 1 (concept) had four winners. Phase 2 (the pitch) had one winner in which the most compelling pitch won. The winner of Phase 2 moved onto Phase 3 (pre-production) in which a script, storyboard, and headshots were submitted for approval. The winner of Phase 2 then moved onto Phase 4 (Video), in which 13 videos were created. Submissions were received between August 24, 2017 and December 22, 2017.

Budget and Resources: In FY17, 0.25 FTE was used to support the design and execution of the Challenge, and to manage the contract with the vendor. Excluding FTE, the total funding in FY17 was $171,600: $100,000 for the prize purse, $12,100 for overhead costs, $9,300 for travel, and $59,200 the vendor contract through NASA CoECI.[8] In FY18, 0.10 FTE was used to close out the Challenge. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513

[8] $51,800 of the total vendor contract through NASA CoECI were from FY16 obligations.

2012/2022 (for more information, see https://www.nist.gov/ctl/pscr/about-pscr). All funding used to support this Challenge was administered by NIST PSCR and came from a special appropriation.[9]

Partnerships: Federal partners included the National Telecommunications and Information Administration (NTIA) Institute for Telecommunication Sciences (ITS) and NTIA FirstNet. NTIA-ITS provided subject matter experts and NTIA FirstNet provided a judge for the Challenge. Collectively, Federal partners provided approximately 20 hours of expertise. Non-Federal partners came from various academic, private-sector, and public safety organizations, providing expertise in the areas of communication, public relations, marketing, law, and public safety. Collectively, non-Federal partners provided approximately 40 hours of expertise. The estimated value of all partner contributions is $6,000. For future challenges designed to supply production-ready videos, NIST PSCR recommends using a mix of consultants from various disciplines, such as, public relations, marketing, communications law, along with the true subject matter experts, the first responders.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The 2017 NIST The Future of Public Safety Technology 100K Video Challenge advanced NIST and NIST's PSCR missions through the creation of videos to engage the public in solving technical, scientific, and creative problems to advance technologies that public safety workers use in their jobs.

Solution Types: Creative (design & multimedia); Ideas

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

A.2.6 NIST Virtual Public Safety Test Environment Challenge[10]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY17.

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[9] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities.

[10] The website for the NIST Virtual Public Safety Test Environment Challenge can be viewed at https://www.Challenge.gov/challenge/nist-virtual-public-safety-test- environment-challenge/.

Competition Goals: The purpose of the Challenge was to generate ideas and designs for measurement environments that use immersive virtual reality (VR) tools in conjunction with physical spaces to simulate first responder scenarios for accurate and repeatable testing of new first responder interfaces and technologies.

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

Justification for Using Prizes and Challenges: Prize competitions were selected to crowdsource and gain many ideas in a short period of time, as well as to initiate visibility and awareness for the public safety research mission. There is a lack of repeatable test environments available using virtual reality tools for first responders, which made contracting vehicles not practical. Likewise, many members of the gaming community and virtual reality design shops do not currently focus their user interfaces on first responders. Partnerships or memorandums of understanding (MOUs) with other entities were not considered as ideal. For example, the Department of Defense virtual reality prototypes/training environments do not fully reflect the requirements and have not been available to the public safety community. The prize competition also served as a preferred method to achieve NIST PSCR's mission to work with new innovators and individuals in the communication technology communities and encourage more rapid development of technology for the public safety community.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $50,000 and the total amount awarded was $50,000. Non-monetary incentives included attendance at the PSCR 2017 Public Safety Broadband Stakeholder Meeting to present their results and interact with over 500 meeting participants who represented all segments of the public safety community; and access to PSCR researchers and other challenge subject matter experts. The value of non-cash prizes awarded was $7,000.

Solicitation of Submissions: The vendor, HeroX/Topcoder, advertised the Challenge on their website, their social media accounts (Facebook, LinkedIn, Goggle+, Twitter), and on Challenge.gov. HeroX used their database of 5,000 contacts based on demographics of individuals and organizations who would likely participate in the Challenge. This targeted outreach resulted in approximately 250 click-throughs to the Challenge page. The vendor also included the competition in their March and April newsletters. The vendor had 14 forum posts throughout the course of the Challenge; the 14 posts spun off five threads that included questions and clarification on the challenge scope and guidelines. Lessons learned include extensive targeted outreach was important in building the participant community; forums helped to keep participants engaged during the competition; and repeated posts in social media helped spur interest in the Challenge.

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 - Vendor-directed outreach efforts

Participation Requirements: The target audience was individuals familiar with the needs of first responders and a familiarity with the capabilities of using virtual/immersive environments with physical spaces to create accurate first responder scenarios. To be eligible for the cash prizes, individuals must have been age 18 or older at the time of entry and a U.S. citizen or permanent resident of the United States, or its territories. In the case of a private entity, the business must have been incorporated in and maintained a primary place of business in the United States or its territories. Participants may not be a Federal entity or Federal employee acting within the scope of their employment. Participants, including individuals and private entities, must not have been convicted of a felony criminal violation under any Federal law within the preceding 24 months and must not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative

remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. Participants must not have been suspended, debarred, or otherwise excluded from doing business with the Federal Government. Multiple individuals and/or legal entities could collaborate as a group to submit a single entry and a single individual from the group must have been designated as an official representative for each entry.

Evaluation of Submissions: The vendor, HeroX, evaluated all 21 entries to ensure they met the minimum requirements. They determined that seven entries did not meet the minimum viability requirements of the Challenge. NIST PSCR utilized three types of evaluators: HeroX, subject matter experts (SMEs), and a judge. HeroX provided initial scoring and forwarded the 18 submissions with comments and scores to the NIST evaluation panel for review. The SMEs reviewed the submissions and offered their expert opinions and recommendations to the judge. The SMEs were a hybrid of NIST researchers and public technology officials; the PSCR Division Chief was appointed by the NIST Director to serve in the role of judge. PSCR evaluated the submitted documents/solutions for compliance with the objectives and the official rules of the contest. Key lessons learned during the evaluation process include public voting for the non-cash, honorable mention award was a benefit to improve crowdsourcing efforts and awareness for NIST PSCR research; the Challenge allowed NIST PSCR to launch a second VR challenge using concepts learned from this challenge; frequent feedback to contestants is crucial to maintain the lifecycle of prize competitions, government research interest, and involvement with the research topic.

Results: Of the 21 entries submitted by 60 participants between March 28, 2017 and May 03, 2017, five prizes were awarded to teams.

Budget and Resources: In FY17, 0.25 FTE was used to support the design and execution of the Challenge. Total funding for the Challenge, excluding FTE, was $66,000: $50,000 for the prize purse, $7,000 for non-cash awards in the form of travel support, and $9,000 for overhead costs. Funding for the vendor contract through NASA CoECI totaled $47,400 and came from FY16 obligations. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513 2012/2022 (for more information, see https://www.nist.gov/ctl/pscr/about-pscr). All funding used to support this challenge was administered by NIST PSCR and came from a special appropriation.[11]

Partnerships: The Department of Homeland Security provided approximately 25 hours of subject matter expertise for the Challenge. Non-Federal partners included public safety professionals and provided approximately 15 hours of subject matter expertise. Both Federal and non-Federal partners reviewed submitted concept papers, and provided the public safety, first-responder perspective during the review process. The estimated value of all partner contributions is $3,000.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's PSCR Program drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR

[11] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities.

works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the- art technologies that consumers on commercial networks now expect. The 2017 Virtual Public Safety Test Environment Challenge advanced NIST and NIST's PSCR missions by involving a diverse community of virtual reality (VR) and augmented reality (AR) experts to conceptualize and produce ideas for physical measurement environments using virtual reality tools. This challenge test environment introduced new solvers—i.e. gaming industry communities, startups, and small business—to the public safety industry. The selected solutions will provide researchers with a controlled and repeatable environment for use with virtual reality tools specific to the public safety community. In addition, NIST PSCR will have increased test environments for public safety users.

Solution Types: Ideas; Technology demonstration and hardware

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

A.2.7 PerfLoc: Performance Evaluation of Smartphone Indoor Localization Apps[12]

Lead Sponsoring Agency: NIST

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

Competition Goals: The goal of the Challenge was to incentivize the creation of the best possible indoor localization and tracking app for Android smartphones using NIST test data. Indoor localization is the capability to determine the location of an entity to be localized (or tracked), such as a person, a robot, or some other object equipped with an appropriate electronic device. While mapping apps on today's cellphones can provide some navigation capability, they usually rely on GPS or Wi-Fi signals and are often not very accurate, particularly in buildings and subterranean structures such as tunnels, caves, and underground mines. The goal of the Challenge was to spur the development of localization apps that can use the sensors available in a phone and the strength of other signals available, such as those from Wi-Fi access points and cellular base stations, to pinpoint a highly accurate location estimate. Localization and tracking, whether indoors or outdoors, has a wide range of applications, including emergency response and law enforcement.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology

Justification for Using Prizes and Challenges: The PerfLoc competition presented a daunting technical challenge to the localization and tracking community. A prize competition was used to incentivize as many solvers as possible to apply their expertise to this important technical challenge that can address needs in the public safety research communications community.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $35,000 and the total amount awarded was $20,000. Non-monetary incentives included inviting finalists to the NIST campus in Gaithersburg, Maryland, to conduct live tests during the App Demo Days where the winner was

[12] The website for the PerfLoc: Performance Evaluation of Smartphone Indoor Localization Apps can be viewed at https://perfloc.nist.gov.

determined; invitational travel funds for the winning team and the highest scoring team (not eligible for a cash prize) to showcase their results at an international conference; and attendance to the annual PSCR Public Safety Broadband Stakeholder Meeting. The value of the non-cash prize awards was $8,000.

Solicitation of Submissions: The Challenge was announced through several outlets. It was posted on Challenge.gov and NIST used social media (Linked In, Facebook) to promote the Challenge. The Challenge manager shared information about the Challenge with professional colleagues at scientific meetings and through scientific societies. The PSCR program also distributed information about the Challenge. Due to the highly technical nature of the competition, these methods for outreach were effective in identifying potential solvers. NIST held a webinar to provide details about PerfLoc that included a Q&A session, and the webinar was archived online.

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

Participation Requirements: The target audience for the Challenge was experts in academia and the private sector with understanding of location-based sensing and tracking algorithms, and the ability to create an app using their algorithm. To be eligible for a cash prize, a participant (whether an individual, team, or legal entity) must have registered to participate and complied with all of the requirements under section 3719 of title 15 United States Code. At the time of entry, the official representative (individual or team lead) must have been 18 years of age or older and a U.S. citizen or permanent resident of the U.S. or its territories. In the case of a private entity, the business must have been incorporated in and maintained a primary place of business in the United States or its territories. Participants may not be a Federal entity or Federal employee acting within the scope of their employment. NIST employees and NIST Research Associates as well as direct recipients of NIST funding awards for NIST projects in the development of an Android app in the area of the Challenge were not eligible to participate. Any other individuals or legal entities involved with the design, production, execution, distribution, or evaluation of the PerfLoc Prize Competition were also not eligible to participate. In addition, interested participants who did not meet the eligibility requirements to win a prize (i.e., individuals who were neither a U.S. citizen nor a permanent resident of the United States or non-US-based entities) were encouraged to participate in the competition.

Evaluation of Submissions: The PerfLoc Performance Evaluation Portal generated a score for each uploaded entry. An entry consisted of a set of location estimates generated by the participant's app. The algorithm for evaluating these entries is described in detail in the official rules for the Challenge. Each entry was automatically assigned a score up to 80 points by the evaluation software, based on the methodology provided in the rules. The top three teams eligible for a cash prize were selected as finalists. Finalists were invited to the NIST campus to test their apps in live testing scenarios during App Demo Days. The winner was determined by the judge, the PSCR Director, appointed by the NIST Director. The judging criteria were as follows: (1) overall performance on the PerfLoc Performance Evaluation Portal (80 points maximum), and (2) Performance during App Demo Days at NIST, including localization accuracy and latency of the app (20 points maximum).

Results: Of the 16 entries submitted by 152 participants between March 22, 2017 and January 17, 2018, one prize was awarded to one team.

Budget and Resources: A total of 0.75 FTE was used in FY17 and FY18 to support the technical design and supervision of the Challenge. The total funding for FY17 was $101,500. It was used to support two NIST research associates (not Federal employees) to design and implement technical aspects of the Challenge (i.e., measurements for the NIST test data, website and scoring algorithm, monitoring entries, and live testing at App Demo Days). The total funding for FY18 was $161,100. Of the total, $101,500 was to support two NIST research associates to design and implement technical aspects of

the Challenge (i.e., measurements for the NIST test data, website and scoring algorithm, monitoring entries, and live testing at App Demo Days); $11,000 was for travel support for finalists to attend App Demo Days and an international conference; $25,000 was for surveying Wi-Fi access points on NIST's Gaithersburg campus; $20,000 was for the prize purse; and $3,600 was for overhead costs. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513 2012/2022 (for more information, see https://www.nist.gov/ctl/pscr/about-pscr). Funding used to support this challenge (i.e., travel, surveying, and cash prize) was administered by NIST PSCR, and came from a special appropriation.[13]

Partnerships: N/A

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. PSCR has identified a portfolio of key technology areas as part of its research and development program. The PerfLoc Prize Competition supports location-based services, one of the areas, which aims to advance technologies to seamlessly locate, track, and inform first responders while operating indoors.

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

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

A.2.8 The Unlinkable Data Challenge: Advancing Methods in Differential Privacy[14]

Lead Sponsoring Agency: NIST

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

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[13] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities. Funds to support two research associates were from the FY 2018 NIST Scientific Research and Technical Services account (appropriated funds).

[14] The website for The Unlinkable Data Challenge: Advancing Methods in Differential Privacy can be viewed at https://www.Challenge.gov/challenge/the-unlinkable-data-challenge-advancing- methods-in-differential-privacy/.

Competition Goals: As the industry that serves public safety moves towards advanced analytics, the sharing of datasets is necessitating the ability to quickly and properly de-identify data sets with tested, validated, high-speed algorithms to ensure the protection of personally identifiable information (PII) for both public safety personnel and individuals in the community. The purpose of the Challenge is to incentivize solvers to develop algorithms that can protect PII while maintaining a dataset's utility, by increasing the efficiency and speed of robust data de-identification for public safety and differential privacy. The Challenge is designed to stimulate and grow the algorithm developer community and produce a viable mid-stage solution for data de-identification. Specifically, the Challenge is intended to develop enhanced versions of the multiplicative weights and exponential mechanism algorithm that will outperform the original algorithm by several orders of magnitude, to the point where the resulting algorithms will be of practical use for privacy-preserving data release.

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

Justification for Using Prizes and Challenges: NIST opted to use prize competitions to crowdsource and gain many ideas in a short period of time, as well as to initiate visibility and awareness for the public safety research mission. For data de-identification, a prize competition was selected to quickly advance the development of algorithms to support data de-identification using differential privacy. Holding a prize competition in data science is a well-understood and effective way to crowdsource ideas and teams for solving problems. Because differential privacy is not a well-known concept or commonly tackled method to solve data de-identification, using a third party vendor to encourage involvement by new solvers outside of the academic community was important. Using a data science vendor was also valuable for outreach to the data science community and to host the coding platform on which to run the competition. Stage 2 of the Challenge requires an evaluation of the source code, which will be compiled and run on the host platform. The prize competition also served as a preferred method to achieve NIST PSCR's mission to work with new innovators and to encourage more rapid development of data de-identification for data analysts working on public safety issues.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $190,000 and the total amount awarded, to date, is $40,000. Non-monetary incentives included attendance to the PSCR 2019 Public Safety Broadband Stakeholder Meeting to present their results and interact with over 500 meeting participants who represent all segments of the public safety community; and access to NIST PSCR researchers and other challenge subject matter experts.

Solicitation of Submissions: The vendor, HeroX/Topcoder, advertised this challenge on their website, their social media accounts (Facebook, LinkedIn, Goggle+, Twitter) and NIST posted information on Challenge.gov. HeroX used their database of 5,000 contacts based on demographics of individuals and organizations who would likely participate in the challenge. For stage 1 of this competition, the vendor had six forum posts and more are anticipated as the Challenge progresses.

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 - HeroX and TopCoder outreach efforts

Participation Requirements: The target audience is innovators from various industries such as data security, data analysis, privacy protection, pseudonymization, health information technology, etc. To be eligible for a cash prize, a participant (whether an individual, team, or legal entity) must have registered to participate and complied with all of the requirements under section 3719 of title 15, United States Code. At the time of entry, the official representative (individual or team lead, in the case of a group project) must have been age 18 or older and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business shall have been incorporated in and

maintained a primary place of business in the United States or its territories. Participants may not be a Federal entity or Federal employee acting within the scope of their employment. NIST employees were not eligible to participate. A participant shall not be deemed ineligible because the participant consulted with Federal employees or used Federal facilities in preparing its submission to the NIST Unlinkable Data Challenge: Advancing Methods in Differential Privacy Prize Competition if the Federal employees and facilities were made available to all Participants on an equitable basis.

Evaluation of Submissions: Stage 1 evaluation was completed in September 2018. The vendor, HeroX, evaluated all 11 entries to ensure they met the minimum requirements. NIST PSCR utilized three types of evaluators: vendor staff, subject matter experts (SMEs), and a judge, appointed by the NIST Director. The judge determined the winners of Stage 1. The SMEs were a hybrid of agency staff and non-Federal volunteers; the judge was a NIST employee.

Results: Of the 11 (Stage 1—concept paper) entries submitted between May 1, 2018 and August 2, 2018, five prizes were awarded to three teams. Stage 2, an algorithm coding contest based on concepts from Stage 1, is planned for October 2018 through May 6, 2019.

Budget and Resources: In FY17, 0.1 FTE was used to support the Challenge and $637,500 was spent on the third party vendor contracted through NASA CoECI. In FY18, 0.25 FTE was used to support the Challenge. Total funding for the Challenge in FY18 was $47,380, $40,000 of which was for the prize purse, $2,500 of which was for travel support, and $4,880 of which was for overhead costs. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513 2012/2022 (for more information, see https://www.nist.gov/ctl/pscr/about-pscr). Funding used to support this challenge (i.e., travel, surveying, and cash prize) was administered by NIST PSCR, and came from a special appropriation.[15]

Partnerships: The Department of Homeland Security and the U.S. Census Bureau provided subject matter experts for the Challenge. Non-Federal partners included volunteers from various academic and private-sector research organizations. They contributed approximately 80 hours for Stage 1 as subject matter experts, reviewing submitted concept papers and data sets. Non-Federal partners will provide the external expertise for differential privacy during the review process. The estimated value of all partner contributions was $8,000.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the-art technologies that consumers on commercial networks now expect. The Unlinkable Data Challenge, Advancing Methods in Differential Privacy, aims to advance NIST and NIST's PSCR missions by developing more advanced differential privacy methods that can substantially improve the privacy

[15] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities.

protection of a dataset while maintaining the dataset's analytical usefulness. Advancement of differential privacy algorithms that redact personally identifiable information (PII) while retaining data utility will increase the number of available datasets for researchers who focus on public safety issues. Examples of public safety research issues are: identifying risks in aviation, identifying patterns of violence in local communities, contingency planning in disaster scenarios, and assisting in tracking contagious diseases. Developments coming out of this competition would help drive major advances in the practical applications of differential policy for public safety researchers.

Solution Types: Software and apps; Ideas; Analytics, visualizations, algorithms; Other - Concept papers

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

A.2.9 The Unmanned Aerial Systems Flight and Payload Challenge[16]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY18.

Competition Goals: The Challenge supports the public safety community and its stakeholders by driving innovations in unmanned aerial systems (UAS), sometimes referred to as drones. One of the barriers for UAS use in a public safety realm is payload versus flight time. Vertical takeoff and landing (VTOL) UAS provide many different mission capabilities, but their flight time is limited. The payload capacity, energy source and flight time are linked through design trade-offs that can be optimized for efficiency and flexibility. The Challenge was designed to seek maximum UAS flight time, while carrying a set payload, for a reasonably-priced UAS. The ability to stay airborne in this manner can support first responders' communication technology on the ground while they conduct their search. The advancement of UAS research will help search and rescue operations support payloads for wireless communications or other life-saving goods to save lives.

Goal Types: Solve a specific problem; Advance scientific research; Develop technology; Stimulate a market

Justification for Using Prizes and Challenges: Existing research, development, testing and evaluation (RDT&E) of UAS does not focus on the needs of first responders. New RDT&E efforts on UAS were needed to adequately support first responders' needs such as long-term operation and performance in hazardous or remote environments. NIST used prize competitions to crowdsource and gain many ideas in a short period of time, as well as to increase visibility and awareness for the public safety research mission. Typical contracting vehicles, including partnerships with academic institutions, would not have provided the development and evaluation of multiple concepts, from a diverse submission audience, in a short time period. The prize competition also served as a preferred method to achieve NIST PSCR's mission to work with new innovators and to encourage more rapid development of UAS technology for first responders.

[16] The website for The Unmanned Aerial Systems Flight and Payload Challenge can be viewed at https://www.Challenge.gov/challenge/the-unmanned-aerial-systems-flight-and- payload-challenge/.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $432,000 and the total amount awarded was $250,000. Non-monetary incentives included attendance at the PSCR 2018 Public Safety Broadband Stakeholder Meeting to present results and interact with over 500 meeting participants who represent all segments of the public safety community and access to NIST PSCR researchers and other challenge subject matter experts. The value of non-cash prizes awarded was $22,000.

Solicitation of Submissions: NIST PSCR advertised this challenge on their website, in their newsletter, and on LinkedIn and Facebook, and used the support of the NIST Public Affairs Office to run and monitor paid advertisements in social media (Facebook and LinkedIn). A lesson learned for this type of challenge was that paid advertisement in Facebook, targeted at persons aged 35-64, was more productive (cost per click) than the LinkedIn paid advertisement. Another suggestion was to use Meetup groups, academic groups, and other regional groups to improve participant solicitation.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Paid advertisements on Facebook and LinkedIn

Participation Requirements: The target audience was individuals with prior experience in building drones and/or unmanned aerial systems (UAS). To be eligible for the cash prizes, each contestant or team of contestants must have included an individual 18 years of age or older at the time of entry and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business must have been incorporated in and maintained a primary place of business in the United States or its territories. Contestants may not have been a Federal entity or Federal employee acting within the scope of their employment. NIST guest researchers, as well as direct recipients of NIST funding awards through any Center of Excellence established by NIST, were eligible to enter, but were not eligible to receive cash awards. Contestants, including individuals and private entities, must not have been convicted of a felony criminal violation under any Federal law within the preceding 24 months and must not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. Contestants must not have been suspended, debarred, or otherwise excluded from doing business with the Federal Government.

Evaluation of Submissions: NIST PSCR used two types of evaluators: subject matter experts (SMEs) and judges. The SMEs reviewed the submissions and offered their expert opinions and recommendations to the judges. The SMEs were a hybrid of NIST researchers, active first responders, and public technology officials. A panel of judges appointed by the NIST Director consisted of two NIST employees and an expert from academia. During each stage of the challenge, NIST PSCR evaluated the submitted documents/solutions for compliance with the objectives and the official rules of the contest. After it was determined the contestant complied with the objectives and official rules, SMEs reviewed the solutions/submissions and offered recommendations to the judges. Points were assigned to each finalist submission based on the UAS flight and payload review criteria in the rules. The judges had sole discretion regarding the determination of awards in accordance with the rules for the challenge. A key lesson learned during the evaluation process was that in the final stage of the competition, teams began sharing information and benefiting from outside help. This was particularly problematic because official contestants were the only ones allowed to enter and win, and it was unclear what results were being achieved by which officially entered teams and thereby eligible for awards based on the rules. In the future, NIST may design into the end of the challenge a collaboration day for more free-form collaboration, to determine if better performance can be achieved by collaboration versus competition between teams.

Results: Of the 30 entries submitted by 55 participants between January 08, 2018 and January 29, 2018, 11 prizes were awarded. Ten teams won Stage 1 (concept paper contest), and one team won the final stage (live test and evaluation) of the Challenge.

Budget and Resources: One FTE was used to support the design and implementation of the Challenge; 0.25 FTE was used in FY17 and 0.75 FTE was used in FY18. The total funding, excluding FTE, for the Challenge was $402,200: $250,000 for the cash prize purse, $45,900 for materials for the live testing event, $40,700 to support travel, $39,600 for overhead costs, $22,000 for non-cash awards, and $4,000 on advertisements. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513 2012/2022 (for more information, see https://www.nist.gov/ctl/pscr/about-pscr). Funding used to support this challenge (i.e., travel, surveying, and cash prize) was administered by NIST PSCR, and came from a special appropriation.[17]

Partnerships: Non-Federal partners included public safety professionals. They provided approximately 60 hours of effort as subject matter experts who reviewed concept papers and final submissions. They also provided a critical public safety professional perspective on the relevance of the solutions. Non-Federal partners also provided approximately 240 hours for set-up, monitoring, and break-down of the live test and evaluation event. The estimated value of partner contributions is $25,000. For future events like this UAV challenge, we recommend including non-public safety UAV-experienced partners in addition to the public safety UAV experts.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development. PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the- art technologies that consumers on commercial networks now expect. The Unmanned Aerial Systems Flight and Payload Challenge advanced NIST and NIST's PSCR missions in assessing new technologies and their ability to support field operations for first responders. One of the barriers for UAS used in a public safety realm is payload versus flight time. Vertical takeoff and landing of a UAS provides many different mission capabilities, but their flight time is limited. The payload capacity, energy source and flight time are linked through design trade-offs that can be optimized for efficiency and flexibility. With these parameters in mind, this challenge was designed to help public safety operations by keeping a UAS and its payload airborne for the longest time possible with vertical and hovering accuracy. At a cost of less than $20,000 per UAS, first responders may someday have an affordable drone in their toolkit to carry wireless networks for search and rescue operations.

Solution Types: Ideas; Technology demonstration and hardware

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[17] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities.

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

A.2.10 Virtual Reality Heads-Up Display Navigation Challenge[18]

Lead Sponsoring Agency: NIST

Status: This competition was launched and completed in FY18.

Competition Goals: The Challenge was motivated by the fact that augmented and virtual reality (AR/VR) technologies allow for testing in safe, controlled, measurable, and repeatable environments for first responders. However, there is a lack of AR/VR user interfaces focused on, and that align with the specific requirements of, the public safety community. NIST PSCR needed to expand the number of prototypes in their library to effectively test and measure AR/VR user interfaces for the public safety community. The goals of the challenge were to incentivize the creation of intuitive heads-up displays (HUD) for public safety officials within a VR environment; enable NIST PSCR to use these HUDs as a tool for testing and developing virtual reality user interfaces for first responders; engage new communities and identify stakeholders for NIST PSCR's user-interface, user-experience (UI/UX) research portfolio; and further develop HUDs with location-based capabilities in a virtual reality environment.

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

Justification for Using Prizes and Challenges: NIST selected a prize competition mechanism because the other main mechanisms available—contracts, grants, cooperative agreements, etc.—were not applicable and/or ideal. There is a lack of commercially available AR/VR user interfaces focused on the needs of first responders, which made contracting vehicles impractical. Likewise, many members of the gaming community and virtual reality design shops do not currently have readily available user interfaces or work for which a grant or cooperative agreement would align with the objective of securing multiple user interfaces for first responders. Partnerships or MOUs with other entities were also not considered appropriate; for example, the Department of Defense virtual reality prototypes/training environments have not been available to the public safety community or fully transitioned to reflect their requirements. In addition to not having other avenues to secure the virtual reality heads-up-display prototypes, the prize competition also served as a preferred method to achieve NIST PSCR's mission to work with new innovators and individuals in the communication technology communities to encourage more rapid development of technology for the public safety community.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $125,000 and the total amount awarded was $87,500. Non-monetary incentives included attendance to the PSCR 2018 Broadband Stakeholder Meeting by the finalists to present their results and interact with over 500 meeting participants who represent all segments of the public safety community and access to NIST PSCR researchers and other challenge subject matter experts. Value of the non-cash prizes awarded was $26,500.

[18] The website for the Virtual Reality Heads-Up Display Navigation Challenge can be viewed at https://www.Challenge.gov/challenge/virtual-reality-heads-up-display- navigation-challenge/.

Solicitation of Submissions: NIST PSCR advertised the Challenge on their website, LinkedIn, other social media, and their e-newsletter, and also purchased an advertisement in the monthly publication of the Virtual Reality/AR Association. Of the six prize recipients, five learned about the Challenge through the advertisement in the association newsletter, and only one of the six prize recipients saw notification of the Challenge on Challenge.gov. This served as the key lesson learned with solicitation of submissions—many of the solvers are not yet familiar with NIST or PSCR or Federal Government challenges; NIST needs to expand solicitation and communication channel beyond NIST, PSCR and Challenge.gov platforms. During the one-on-one debriefs, most of the prize winners suggested contacting applicable Meetup groups or other regional groups to advertise the challenge opportunity.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Paid advertisement in Virtual Reality/AR Association's monthly publication

Participation Requirements: The target solver audience was the virtual reality and software coding communities. To be eligible for the cash prizes, each contestant or team of contestants had to include an individual who was 18 years of age or older at the time of entry and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business must have been incorporated in and have maintained a primary place of business in the United States or its territories. Contestants may not have been a Federal entity or Federal employee acting within the scope of their employment. NIST guest researchers, as well as direct recipients of NIST funding awards through any Center of Excellence established by NIST, were eligible to enter, but were not eligible to receive cash awards. Multiple individuals and/or legal entities may have collaborated as a group to submit a single entry and a single individual from the group must be designated as an official representative for each entry. That designated individual was responsible for meeting all entry and evaluation requirements.

Evaluation of Submissions: NIST PSCR utilized two types of evaluators: subject matter experts (SMEs), who reviewed the submissions and offered their expert opinions and recommendations to the judges, and a panel of two judges appointed by the NIST Director. The SMEs were a hybrid of NIST researchers, active first responders, and public technology officials. Both judges were government officials. During each stage of the challenge, NIST PSCR evaluated the submitted documents/solutions for compliance with the objectives and the official rules of the contest. After it was determined the contestant complied with the objectives and official rules, the SMEs reviewed the solutions/submissions and offered recommendations to the judges. The two appointed judges had sole discretion regarding the determination of awards in accordance with the rules for the challenge. For the first time for NIST, there was a tie for first place. Though it was allowed within the rules based on the advice of legal counsel, a key lesson learned during the evaluation process was that it would have been helpful for explicit guidelines to be included in the rules with regard to ties. Another key lesson learned regarded SMEs. NIST PSCR should continue to have active members of the public safety community involved (police, fire and/or EMT). NIST PSCR should ensure that SMEs with industry or technology expertise also participate and that they understand the context and appropriate conditions unique to first responders.

Results: Of the 18 entries submitted by 50 participants between January 02, 2018 and January 29, 2018, six prizes were awarded to six teams. The Challenge was broken into four stages: Stage 1 consisted of a concept paper; Stage 2 consisted of a working concept and HUD prototype; Stage 3 was a HUD prototype test; and Stage 4 was a live competition of HUD prototypes.

Budget and Resources: A total of 0.6 FTE was used to design and execute the Challenge (0.1 FTE was used in FY17, and 0.5 FTE was used in FY18). Total funding for the Challenge, excluding FTE, was $182,300: $87,500 for the cash prize purse, $46,500 for travel, $26,500 for non-cash awards, and $21,800

for overhead costs. Funding for the Challenge came from the Public Safety Communications Trust Fund (006-55-0513); TAFS: 13-0513 2012/2022 for more information, see https://www.nist.gov/ctl/pscr/about-pscr). Funding used to support this challenge (i.e., travel, surveying, and cash prize) was administered by NIST PSCR, and came from a special appropriation.[19]

Partnerships: For this competition, the National Telecommunications and Information Administration's FirstNet Authority provided approximately 20 hours for evaluating submissions. Non-Federal partners included public safety professionals and first responder organizations. They provided approximately 45 hours as subject matter experts who reviewed concept papers and final submissions and provided the critical public safety professional perspective on the relevancy of the solutions. The estimated value of partner contributions is $4,300. For any future challenges focused on user interfaces and user experiences of first responders, NIST hopes to involve collaborations/partnerships to obtain the subject matter expertise of commercial/private sector technology entities, such as hardware or software-based virtual reality/augmented reality companies. This inclusion would help further advance NIST's mission to propel forward communication technology for first responders.

Advancement of Agency Mission: NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST's Public Safety Communications Research Program (PSCR) drives innovation and advances public safety communication technologies through cutting-edge research and development (R&D). PSCR works directly with first responders and the solver community to address public safety's urgent need to access the same broadband communications and state-of-the- art technologies that consumers on commercial networks now expect. The Virtual Reality Heads-Up Display Navigation Challenge advanced NIST and NIST's PSCR missions by involving the virtual reality design and gaming industry communities to collaborate with first responders and NIST researchers to create AR/VR user interfaces for the public safety community. The selected user interfaces can be utilized as safe, repeatable, and measurable training environments for the public safety community, meanwhile PSCR has increased its collection of public safety user interfaces to measure and test navigational and other included elements.

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

Plan for Upcoming 2 FYs: Potential topical areas for NIST PSCR prize competitions during the upcoming two fiscal years are location-based services to locate, track, and inform first responders while indoors under difficult conditions; cybersecurity and device security issues with the understanding of critical applications and user interfaces required by first responders; improving the opportunity and ease of real-time public safety communications analytics; and increased and improved user interfaces targeting the public safety community.

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[19] In February 2012, the enactment of the Middle Class Tax Relief and Job Creation Act marked an unparalleled push toward next-generation technologies for public safety. The legislation contained landmark provisions for the development and build out of the Nationwide Public Safety Broadband Network (NPSBN), a dedicated, interoperable network for emergency responders. The Public Safety Trust Fund (PSTF) was established to support the design and implementation of the Network. The Act charged NIST with utilizing up to $300 million of PSTF allocations to establish a research and development program to support the development and deployment of NPSBN. PSCR established the Innovation Accelerator Program to drive research and development and transform public safety communications capabilities.

A.3 Department of Energy (DOE)

A.3.1 Cleantech University Prize (Cleantech UP)[20]

Lead Sponsoring Agency: DOE

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

Competition Goals: Cleantech UP was designed to inspire clean energy innovation across the country by creating businesses from best in-class technology research, while inspiring and cultivating America's next generation of entrepreneurs to drive those businesses forward. Cleantech UP goals included: (1) catalyzing clean energy startup formation on college campuses; (2) supporting novel training and educational opportunities that equip the next generation of energy entrepreneurs and innovators across the country; (3) establishing a national-level training program and competition for America's top clean energy student entrepreneurs; and (4) creating a sustained and diverse community to support student entrepreneurs.

Goal Types: Find and highlight innovative ideas; Develop technology; Engage new people and communities

Justification for Using Prizes and Challenges: Business plan competitions like Cleantech UP are influential instruments of change because they mobilize participants and spur innovation to accelerate research. Aspiring student entrepreneurs often lack the business development skills, market exposure, and investor feedback they need to launch viable new businesses. Student entrepreneurship prizes are critical catalysts for early-stage company formation and serve an important role in supporting innovation. The prize incentive draws talented entrepreneurs and technology developers, and the prizes help capitalize early stage development by providing funding. However, companies that enter competitions are usually at their earliest stage of development, and many students who participate in competitions require additional business and technology commercialization training. Serving as a springboard for new ventures, Cleantech UP enabled DOE to reach a wider audience of problem solvers to identify and devise creative approaches to energy challenges and increase collaboration and partnerships with public, private, and philanthropic communities. With the ingenuity and passion of student entrepreneurs, prize competitions are catalysts for the innovation needed in the cleantech ecosystem. In such a challenging environment, prize competitions can play a key role in helping startups become successful businesses by providing mentorship from other successful entrepreneurs and industry experts, expanding their networks and opening opportunities for partnerships, and lending credibility and national exposure that can be crucial to securing additional funding or finding the right strategic relationships.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $570,000. DOE directly sponsored the $50,000 prize for each of the eight regional competitions, totaling $400,000 for regional prizes. The funding was allocated through a cooperative agreement awarded in 2015. The top three teams from each of the eight regional Cleantech UP collegiate competitions were invited to compete at the National Competition. The total prize purse of the National Competition amounted to $170,000. DOE sponsored $135,000, and DoD sponsored $35,000. Non-monetary incentives included access to energy entrepreneurship and commercialization training, including instruction and guidance in preparation for the competitions and supplemental curriculum that

[20] The website for the Cleantech University Prize (Cleantech UP) can be viewed at http://www.cleantechup.org/.

focused on the creation and development of student businesses in cleantech, as well as one-on-one mentorship, pitch coaching, and networking opportunities.

Solicitation of Submissions: To attract entrants, each region executed their own outreach strategy. Regional organizers used multiple media methods to disseminate information about the competitions. Some conducted informational webinars or held in-person networking events. The regional competitions utilized online application platforms for entrants to submit applications, such as YouNoodle or F6S.

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: As a program whose goals included the development of the next generation of entrepreneurs, Cleantech UP required that students be highly involved in each competition's management and execution. In order to participate in the Cleantech UP competitions, at least 50% of any participating team's formal team members had to be actively enrolled in an accredited U.S. university or college. Participants were also required to present business plans at the Cleantech UP competitions. All business plan proposals were required to fall within DOE's Office of Energy Efficiency and Renewable Energy (EERE) mission and technology portfolio.

Evaluation of Submissions: A general framework for the Cleantech UP National Competition eligibility requirements and judging criteria is outlined in a policy memo that has remained constant since the program's inception. At the regional level, each competition determines selections independently, with the guidelines instructed through the eligibility requirements developed by DOE. Independent experts hailing from multiple sectors serve as judges at the application and competition stages. At the competition stages, submissions are judged on the following components: (1) solutions/products (value proposition, market differentiation, barriers to competition, and technical feasibility), 30%; (2) go-to-market strategy (feasibility of go-to-market plan, customer access and traction, and scalability), 30%; (3) team plan (quality of business plan, commitment to enterprise, team chemistry, gaps and action plans), 20%; and (4) impact on EERE mission, 20%.

Results: Cleantech UP submission dates varied across each regional competition. Submission open dates ranged between September 2017 and February 2018, and submission close dates ranged between November 2017 and March 2018. Regional competitions were held between February and May 2018, and the National Competition was held in June 2018. Of the approximately 250 team applications submitted, 107 teams participated in the eight regional competitions, and 23 teams participated in the National Competition. In total, eight regional prizes and five national prizes were awarded.

Budget and Resources: Funding for FY17 and FY18 was obligated in FY15. In addition, 1 full-time equivalent (FTE) employee supported the program in FY17 and FY18. To execute the regional and national competitions, DOE released a competitive solicitation to determine the administrators of the competitions in 2015. In doing so, a National Hub and eight regional competitions were established. The Cleantech UP Hub organized the annual National Competition, developed an energy entrepreneurship training program, and facilitated a learning platform for best practices in energy entrepreneurship education. Each regional organizer supported the development of teams and their training by establishing and running an annual regional competition, which included recruiting applicants, mentors, judges, and other competition partners, developing an outreach and marketing plan, and promoting the event.

Partnerships: For the regional competitions and the National Competition, the National Hub and the regional organizers partnered with a variety of private sector and non-profit organizations for in-kind support, monetary contributions, judges, facility use, and marketing and outreach. The Department of

Defense (DoD) participated as a Federal partner and provided judges for the competition. Non-Federal partners included the California Institute of Technology, Carnegie Mellon University, Clean Energy Trust, Massachusetts Institute of Technology, Rice University, Rutgers University, University of California, Berkeley, University of Central Florida, and VentureWell. The DoD contributed $35,000 for a prize at the 2018 National Competition.

Advancement of Agency Mission: Startups and innovative technologies are critical to the growth of the clean energy economy in the United States. However, persistent gaps exist between innovative technology developers and entrepreneurs. Significant barriers in creating clean energy technology startups has led to a dearth of participants entering the energy entrepreneurship pipeline. Cleantech UP aims to inspire clean energy innovation across the country and close the existing gap in early-stage training.

Solution Types: Business plans

Plan for Upcoming 2 FYs: A third-party, independent impact evaluation of the Cleantech UP program is ongoing for the next two fiscal years. The evaluation will analyze commercialization outcomes and impacts, education and career trajectory outcomes and impacts, and where the most value is imparted to participants.

A.3.2 Solar in your Community Challenge[21]

Lead Sponsoring Agency: DOE

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

Competition Goals: The goal of this Challenge is to make solar significantly more accessible to low and moderate income (LMI) households, non-profits, and governmental organizations through replicable business and financial models. Through the demonstration of solar projects and programs in their communities, teams aim to design, plan, and pilot new and scalable business and financial models to overcome current market barriers that block access for these market segments. These projects and programs must directly benefit: (1) LMI households, with a minimum of 20% of the energy and benefits assigned to LMI households; or (2) non-profit organizations, state, local, or tribal governments, or community service organizations, with a minimum of 60% of the energy and benefits assigned to one of these types of entities (referred herein as “non-profits”).

Goal Types: Find and highlight innovative ideas; Inform and educate the public; Engage new people and communities; Build capacity; Stimulate a market

Justification for Using Prizes and Challenges: Community solar is a new method for providing individuals, businesses, and other customers without direct access to solar energy the opportunity to benefit from the technology. Community solar allows customers to purchase portions of much larger solar power plants and be credited the benefits from the solar energy generation. Community solar is enabled by rules developed at the local level and are not the same across the country; thus, the execution of a prize program allows for flexibility in the development of impactful solutions. Furthermore, a prize program allows for new and large groups of innovators to think beyond the regional level, leading to novel solutions that have the potential to improve individual communities and the nation.

[21] The website for the Solar in your Community Challenge can be viewed at http://solarinyourcommunity.org/.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $3 million including $2 million of seed prizes and $1 million for final grand prizes. The total amount awarded to date was $620,000. In addition, DOE allocated $3 million in non-monetary incentives for competing participants including $10,000 technical assistance vouchers to access the consultation services of over 100 Technical Assistance (TA) providers for on-demand and specialized support services. The program obligated $3 million in prior year funds to pay for these services, but the participants have access to these services in the form of vouchers, not cash. A $1 million set aside for final grand prizes is all prior year funds. A portion of the Seed prize funds have been provided using $620,000 in prior year funding.

Solicitation of Submissions: The program used a multichannel strategy to build momentum and engage a national network of innovators thinking about solar access. The strategy focused on direct engagement, partner engagement, and digital/social engagement supported by an outreach/media campaign. Direct engagement used the National Community Solar Partnership regional workshops, where the program cultivated relationships and highlighted challenges and opportunities in this area. The program also hosted a series of informational webinars and in-person presentations in industry anchor event workshops such as Solar Power International 2016. Partner engagement involved attending a dozen two-hour, in-person informational workshops organized by supporting organizations in 12 different cities. The goal of these sessions was to help teams form and inspire them to participate in the Challenge. Lastly, digital engagement included DOE's official press release, email blasts, social media posts on Twitter and LinkedIn, newsletter clips, and other online postings by staff and a dozen supporting organizations.

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: The Challenge is open to citizens or permanent residents of the United States and private or non-Federal public entities, such as townships, tribes, corporations, or other organizations, that are incorporated in and maintain a primary place of business in the United States. DOE employees, employees of sponsoring organizations, members of their immediate families (spouses, children, siblings, parents), and persons living in the same household as such persons, whether or not related, are not eligible to participate in this competition. Federal entities and Federal employees, acting within the scope of their employment, are also not eligible to participate in any portion of this competition. A participant can join the Challenge as a member of a competing team (project-focused or program- focused), or exclusively as a TA provider to help the competition teams throughout the Challenge. An individual must choose to participate as either a member of a team or a TA provider. After an individual applies to one of the two options, they permanently lose their eligibility to participate in the Challenge in any other fashion. DOE, with written approval, may allow exceptions to this rule in rare cases or due to unanticipated extenuating circumstances. For full eligibility details, visit: https://www.solarinyourcommunity.org/en/page/applying-rules-en.

Evaluation of Submissions: DOE-appointed judges evaluate and score submissions based on the evaluation criteria detailed in the published rules: (1) impact, 40%; (2) innovation, 30%; and (3) team, 30%. Judges will score applications according to the criteria on a 1–5 scale. Each judge will score assigned applications independently and will recommend whether applicants should be admitted into the competition or not, and if so, whether they should receive seed awards and TA vouchers. DOE will make final selection decisions based on the final scores and may apply any of the listed program policy factors detailed in the rules.

Results: Of the 201 entries submitted between November 18, 2016 and March 17, 2017, 172 membered teams participated in the Challenge. The Challenge consisted of three phases: an initial seed round

phase, an 18-month performance period phase of additional seed round prizes, and a final prizes post performance period. Thirty-five individuals or organizations received seed awards based on progress, and these winners were announced April 28, 2017.

Budget and Resources: Funding for FY17 included $318,916 in FY17 funds along with prior year funds from FY12. Funding for FY18 was provided through regular staff salaries. In addition, two full-time equivalent (FTE) employees supported the Challenge in both fiscal years. FY17 funds are available for TA, seed funds and prize administration by a third party vendor. Of the $318,916, a total of $30,441 has been spent on prize administration. No other FY17 funds have been spent on this challenge.

Partnerships: There have been two different non-Federal prize administrators for this Challenge. The State University of New York Polytechnic Institute was in the role from April 2017 until March 2018. The International City/County Management Association has taken over the role and will remain the administrator until the end of the period of performance. The administrator manages all participant agreements and related paperwork, vouchers, and communications. In collaboration with the Solar Energy Technologies Office (SETO), the administrator also engaged with other entities and organizations to provide expertise and resources in the TA Marketplace, where over a hundred consultants created storefronts with services they can offer to teams with TA vouchers. Additional resources available to teams were generated with partnerships with General Technical Assistance consultants, who were separate from the Marketplace, and Solar Knowledge Bootcamps, which included in-person and webinar-style courses on different topics related to community solar. The total estimated value of partner contributions was between $250,000 and $300,000.

Advancement of Agency Mission: The SETO goals are to reduce the costs of solar energy technologies, safely and reliably integrate solar energy into the electric grid, and increase access to solar energy for all Americans. This aligns with DOE's mission of delivering reliable, resilient and affordable energy options to America's citizens, businesses and other energy consumers.

Solution Types: Ideas; Business plans

Plan for Upcoming 2 FYs: The Challenge is expected to end by March 2019 after announcing final prize winners.

A.3.3 The American-Made Solar Prize[22]

Lead Sponsoring Agency: DOE

Status: This competition was launched in FY18.

Competition Goals: The American-Made Solar Prize is designed to accelerate and sustain American solar innovation through a series of prize competitions while developing a diverse and powerful support network, the American-Made Network, that leverages national laboratories, energy incubators, and other resources from across the United States. Through a series of three progressive contests (Ready!, Set!, Go!) that are 90 days apart, the program will incentivize the Nation's innovators and entrepreneurs to rapidly discover, research, iterate, and deliver new solutions to market with the goal of expanding solar manufacturing in the United States. The program will also lower barriers American innovators face in reaching manufacturing scale by accelerating the cycles of learning and supporting partnerships that connect entrepreneurs to the private sector and the network of DOE's national laboratories.

[22] The website for the The American-Made Solar Prize can be viewed at https://americanmadechallenges.org/solarprize.html.

Goal Types: Find and highlight innovative ideas; Develop technology; Engage new people and communities; Build capacity; Stimulate a market

Justification for Using Prizes and Challenges: The Solar Prize utilizes a new program structure that is designed to strengthen and scale critical connections that accelerate and sustain American innovation through two intertwined tracks: prize competitions and the establishment of the American-Made Network. The unique American-Made Network takes a structured approach to bring diverse sources of support, such as DOE's national laboratories, business incubators, and prototype fabrication facilities, together under one umbrella. This approach is designed to be fast, agile, flexible, scalable, and extend beyond solar to other technology domains and sectors. Instead of investing in one-of-a-kind solutions or scaling "safe-bet" approaches with dated technologies, the Solar Prize will apply a resource-multiplying approach that not only invests in multiple new innovations but also creates a foundation for expanding support for future manufacturing growth. This will simultaneously enable the rapid development of technology and strengthen critical connections for commercialization. While global competitors are spending their resources scaling legacy technology, this program develops next-generation commercially viable solutions, planting the seeds for a U.S. manufacturing renaissance.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $3 million for technology development competitors. The remaining $1.5 million will be used for vouchers for competitors for use at National Laboratories and other fabrication locations and awards to members of the American-Made Network based on their engagement with winning teams. Funds have yet to be allocated to any awardees. Non-monetary incentives include dedicated support and mentorship from five members of the American-Made Network, referred to as Power Connectors, and vouchers to use at any of the DOE's 17 national labs and qualified private facilities for qualified winners. Remaining funds allocated to this round are for administration purposes.

Solicitation of Submissions: The program used a multichannel strategy to build and engage a community of solvers in the Solar Prize. The strategy focused on direct engagement, partner engagement, and digital /social engagement. Direct engagement included hosting a series of informational webinars, in-person presentations in industry anchor events such as Intersolar and key meetings (e.g DuraMat Annual Workshop), and a focus workshop during Solar Power International. Partner engagement involved members of the American Made Network, such as Cleantech San Diego, who hosted in-person, live streamed presentations to inform and support innovators in their local communities interested in competing in the Solar Prize. In addition to DOE's official press release featuring quotes from Secretary Perry, digital engagement utilized email blasts, social media posts on Twitter and LinkedIn, newsletter clips, and other online postings by staff and a dozen members of the American Made Network. Digital engagement was supported by an outreach/media campaign led by a National Renewable Energy Lab (NREL) team for more than 60 days prior the submission deadline in October 2018. NREL staff engaged in 30-day media/outreach campaign coordinating weekly with members of the American Made Network.

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: Competitors are entrepreneurial individuals or teams legally residing or based in the U.S., including members of one or multiple organizations, students, university faculty members, small business owners, researchers, or anyone with the desire and drive to transform ideas to impactful realities. Individuals can compete alone or as a group. For the Ready! Contest, an individual prize competitor (who is not competing as a member of a group) must be a United States citizen or a permanent resident. A group of individuals, competing as one competitor, may win, provided that the

team captain responsible for the submission is a United States citizen or a permanent resident. Private entities must be incorporated in and maintain a primary place of business in the United States. Only winners of the Ready! Contest may compete in the subsequent Set! and Go! Contests. Set! and Go! contests are not open for submissions at the time of this report.

Evaluation of Submissions: For the Ready! Contest, the prize administrator screens all completed submissions and assigns subject matter expert judges to independently score the content of each submission. Judges score the submissions based on the content of a 90-second video and narrative answers to four questions about the problem, innovation, team, and plan. Judges evaluate submissions by agreeing or disagreeing with assigned 18 statements on a 1–6 scale, with 1 corresponding to "strongly disagree" and 6 corresponding to "strongly agree". These statements are the judging criteria as described in the Solar Prize rules document published online: https://americanmadechallenges.org/American-Made_Solar_Prize_Rules.pdf. The Ready! Contest is still open for submission.

Results: Ready! Contest submissions opened June 7, 2018 and closed October 5, 2018. Winners were announced in February 2019. Twenty teams were selected to compete in the Set! and Go! Contests and were awarded $50,000 each. The teams are actively competing now and will pitch their innovations to a panel of judges at the Set! Demo Day on June 6, 2019 at Greentown Labs. Winners of the Set! Demo Day have a chance to win up to $200,000, plus vouchers to be used at national laboratories. All 20 teams also have the opportunity to compete at the Go! Demo Day, which will take place on September 24, 2019 at Solar Power International (SPI), with a chance to win $500,000, plus additional vouchers to be used at national laboratories. Round 2 of the Solar Prize has been announced and all new Ready! submissions are due by July 16, 2019.

Budget and Resources: $5.3 million in total funding was authorized, excluding DOE Federal and contractor staff. The total funding for this round of the prize was funded from prior year funds. Note FY19 funds obligated by Congress for the prize will be used on round 2 to be released later in FY19. In addition, three FTE employees support the Prize for FY18. Expenditures in FY18 have totaled $385,121 and were used as follows: $341,209 for the prize administrator (NREL), $2,303 for the web platform (HeroX), and $41,609 for payments to connectors. As noted earlier, the funds expended in FY18 were from prior years.

Partnerships: NREL was the primary non-Federal partner and served as the prize administrator. The program also established the American-Made Network, currently consisting of 90 organizations, that includes DOE's 16 national labs and five strategic partners: Elemental Excelerator (CA, HI), Greentown Labs (MA), Nation of Makers (MD), Powerhouse (CA), and Wilton E. Scott Institute for Energy Innovation (PA). Dozens of incubators, private fabrication facilities, and industry partners constitute the remaining Network members. Partners are funded for their role by DOE, and most partner activities are underway. The list of members of the Network is online at: https://americanmadechallenges.org/network.html.

Advancement of Agency Mission: New energy technologies have begun to reshape the national and global energy landscape. Advanced electrification, digitization, and deployment of grid-connected distributed energy assets are changing the energy industry. The United States has been at the forefront of this transformation, and as technologies, markets, service, and capital providers have evolved over the past decade, there is a need to reinvigorate our entrepreneurs across all facets of the Nation's energy system to rapidly compete and shape these new frontiers. The Solar Prize empowers the country's entrepreneurs and innovators to utilize technologies and innovations developed through DOE's early-stage research and development, ultimately bringing new American-made products to market and achieving DOE's mission of creating and sustaining leadership in the transition to a global clean energy economy.

Solution Types: Software and apps; Ideas; Technology demonstration and hardware; Business plans; Scientific

Plan for Upcoming 2 FYs: The program design allows for one round to be run in a fiscal year. SETO plans to run future rounds in each of the next two fiscal years. FY19 funding was provided in FY19 Committee Language, and appropriations for FY20 are pending.

A.3.4 American Inventions Made Onshore (AIM Onshore)[23]

Lead Sponsoring Agency: DOE

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

Competition Goals: The American Inventions Made Onshore (AIM Onshore) is a prize competition designed to incentivize incubators, accelerators, and other intermediary organizations to help energy technology innovators close the manufacturing-readiness gap. Two critical issues prevent transformative energy technologies from being manufactured in the United States: (1) American scientists and engineers are often not taught the fundamentals of manufacturing, which can lead to errors that are prohibitively costly to correct downstream; and (2) American technology inventors and manufacturers are largely disconnected, causing many inventors to outsource their design and manufacturing to product design firms. By incentivizing intermediary organizations to provide manufacturing fundamentals training to American innovators and forge partnerships between innovators and domestic manufacturers, AIM Onshore seeks to create an interface between American innovators and manufacturers to ultimately make it easier for U.S. technologies to be manufactured domestically.

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

Justification for Using Prizes and Challenges: DOE's AIM Onshore prize competition seeks creative, specific, and innovative proposals to deliver DOE's Build4Scale manufacturing training to innovators and create partnerships between U.S. innovators and U.S. manufacturers. Successful proposals had to include a sustainable revenue model to ensure the initiative will be viable past the point of government funding. Utilizing a prize structure allows DOE to make efficient use of government resources, offer a simplified application, and utilize a pay-for-performance structure to catalyze sustainable, resource-multiplying investments by the private sector. Through AIM Onshore, hardware innovators (scientists, engineers, inventors) will receive basic manufacturing training and form partnerships with domestic manufacturers for initial production. Small and medium-sized domestic manufacturers will be able to identify new business prospects—hardware innovators developing next-generation technologies with growth potential.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $950,000. Four organizations were selected for AIM Onshore's Initial Prize ($150,000 each). After one year, the two best-performing Initial Prize winners will receive the AIM Onshore Final Prize ($250,000 for first place; $100,000 for second place).

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[23] The website for American Inventions Made Onshore (AIM Onshore) can be viewed at http://build4scale.org/. The DOE American Inventions Made Onshore (AIM Onshore) prize was received after the submission deadline for this report. Although it has been included in Appendix A for completion, it was not counted in analyses.

Solicitation of Submissions: The program started building and engaging the targeted audience with the roll-out of DOE's Build4Scale training. Build4Scale offers the only online manufacturing training designed specifically for scientists and engineers developing energy hardware technology prototypes. Potential applicants had time to acquaint themselves with Build4Scale and how this resource could position them to apply for the prize. Once the prize competition was announced, DOE promoted the prize through direct engagement, engagement of the entrepreneurship community, and interagency and social media engagement. DOE engaged the challenge.gov community, the Small Business Administration, and the Commerce Department's Manufacturing Extension Partnership Centers, amongst others. The National Renewable Energy Lab (NREL), as prize administrator, also directed an outreach campaign, as did the entities involved in developing Build4Scale.

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: Incubators, accelerators, universities, community and technical colleges, manufacturing institutions, and other intermediary organizations that serve hardware technology innovators were encouraged to apply for the AIM Onshore prize competition. The prize competition sought creative, specific, and innovative proposals for designing a credible plan to: (1) deliver Build4Scale training to innovators and (2) forge partnerships between innovators and domestic manufacturers. The proposal must show how the participant will execute the plan, and how (1) and (2) can be continued beyond the period of government funding via a financially sustainable revenue model, i.e. through recurring revenue streams.

Evaluation of Submissions: NREL initially screened submissions for compliance with the Official Rules. The screened submissions were then separately scored on multiple criteria by a panel of judges on a scale of 0-100 points (one hundred being the highest). The average score in each criterion was computed, and the average scores were combined to compute a total score. The entries with the highest final scores were recommended for selection for the Initial Prize. For the Initial Prize, three criteria were used for scoring: Potential for Impact (30 points); Quality of Plan (40 points); and Team Experience and Abilities (30 points). For the Final Prize, three criteria will be used for scoring: success in training innovators (30 points); success in forging partnerships between innovators and domestic manufacturers (30 points); and success in proving a viable, sustainable revenue model (40 points). Metrics of evaluation will include the depth and extent of training delivered, the number of contracts signed between innovators and domestic manufacturers, and the revenue obtained from recurring sources (i.e., non-grants) via the participant's revenue model.

Results: The submissions for the Initial Prize of AIM Onshore opened February 6, 2018 and closed April 4, 2018. The winners of the Initial Prize were announced on June 13, 2018 at the 2018 MForesight National Summit in Washington DC. Of the 20 entries submitted for the Initial Prize, four prizes were awarded. Submissions for the Final Prize opened May 30, 2019 and will close June 20, 2019. The winners of the Final Prize are expected to be announced on July 25, 2019.

Budget and Resources: NREL received $257,000 in FY18 to administer the award. In addition, 1.25 FTE employees support the prize for FY18.

Partnerships: NREL is the primary non-Federal partner for this prize and serves as the prize administrator.

Advancement of Agency Mission: AIM Onshore is part of a DOE initiative to close the gap between American innovators who develop new energy technologies and domestic manufacturers who produce them. The training equips American scientists and engineers with knowledge of basic manufacturing

processes, an understanding of product design for manufacturing, and the know-how to make and evaluate manufacturing-related decisions. By requiring winners to demonstrate a sustainable revenue stream to continue providing the training, DOE is leveraging a small initial federal investment in an initiative that will ultimately be sustained by the private sector.

Solution Types: Software and apps; Creative (design & multimedia); Ideas; Business plans; Scientific

Plan for Upcoming 2 FYs: There are no current plans to run additional prizes in this space.

A.4 Department of Interior (DOI)

A.4.1 Saving the ʻŌhiʻa – Hawaiʻi's Sacred Tree[24]

Lead Sponsoring Agency: Department of the Interior (DOI)

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

Competition Goals: The Rapid ʻŌhiʻa Death (ROD) disease is an extremely serious threat to Hawaiʻi's native forests, as well as the ecology, hydrology, economy, and cultures of Hawaiʻi. The fungal disease currently requires a $10+ million response through 2019 and could prove to be even more costly if it is not contained, eliminated, and prevented in the near future. The goal of the ʻŌhiʻa Challenge is to create new technologies to identify and eradicate the ROD disease. In particular, this challenge seeks tools and solutions to advance field-based detection of ROD in asymptomatic trees; detection of the fungus at the landscape level; and environmental pathway identification, including predictive assessment.

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; Stimulate a market

Justification for Using Prizes and Challenges: Limited funds require unlimited thinking. A well of unlimited thinking can be created by motivating individuals and organizations both in and outside of the traditional fungicide field to compete for these funds. Where, with a traditional grant or contract for $100,000, the Department might possibly get one or two people working on a very complex issue, with the challenge prize DOI can bring in multiple organizations who will compete both for the purse and distinction of winning the prize. Also, challenges only pay for successful performance of a task, which ensures the taxpayer only pays for results.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $70,000 and the anticipated total amount awarded is $70,000. Non-monetary incentives included recognition and networking.

Solicitation of Submissions: Applications will be solicited via Challenge.gov. The Department will have a better idea about the effectiveness and lessons learned after the competition has finished in FY19.

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: This Challenge is being conducted by DOI under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C. § 3719) as amended by the American

[24] The website for Saving the ʻŌhiʻa – Hawaiʻi's Sacred Tree can be viewed at Challenge.gov, with additional information at https://conservationx.com/challenge/invasives/ohia.

Innovation and Competitiveness Act of 2017 (PL-114-329). Accordingly, cash prize purse awards for this Challenge may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States.

Evaluation of Submissions: A panel of experts from conservation, industry, and technological innovation sectors will judge the Challenge entries against several criteria. Primary criteria for selecting the winner(s) include scalability, ease of use, and cost efficacy. Secondary criteria include cultural acceptability, sustainability, feasibility, and expected contribution to solving the ROD problem.

Results: Of the entries submitted between August 28, 2018 and April 1, 2019, one prize will be awarded.

Budget and Resources: Total funding for the Challenge is $100,000, all from FY18 funds. Of this, $30,000 is obligated to be used to support the contract with Conservation X Labs (CXL) to help manage the Challenge, including proper formulation of the Challenge's public material, rules, and guidelines. In addition, the total activity will require 0.15 FTE with one-third each from the National Park Service (NPS), the National Invasive Species Council (NISC) Secretariat, and DOI. The above figures exclude any additional resources that may be obtained by CXL to support the prize activity. CXL's interest and potential to garner additional funding to support this activity was a factor in its selection as the contractor.

Partnerships: This Challenge brings together a range of Federal, State, and private stakeholders committed to battling Rapid ʻŌhiʻa Death. Panelists on the Challenge include members of the interagency ROD working group and the outreach and education group, specifically from the NPS, the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service(USFWS), as well as the University of Hawaii and State of Hawaii Division of Forestry. DOI is reaching out to other partners, including Office of Hawaiian Affairs and University of Hawaii to leverage its efforts to promote the Challenge and find innovative solutions to this problem.

Advancement of Agency Mission: This Challenge meets the following Priorities of the DOI Secretary: (1) Creating a Conservation Stewardship Legacy Second Only to Teddy Roosevelt; (2) Restoring Trust with Local Communities; and (3) Generating Additional Revenues to Support DOI and National Interests. In relation to the first Priority, four National Parks and one Fish and Wildlife Refuge are already affected by ROD. Without immediate action, the fungi has the potential to spread to the rest of the Hawaiian Islands National Parks and Refuges as well as other natural areas. In relation to the second Priority, the ROD fungi know no borders. It is through partnerships with state and local government, private entities, and the Native Hawaiian Community, that these invasive fungi can be controlled and eventually eradicated from the Hawaiian Islands. In relation to the third Priority, according to the State of Hawaiʻi biosecurity plan, Koʻolau Mountain Watershed on Oʻahu provides $14B in economic and ecosystem services. ROD, which is currently limited to Hawaiʻi Island, if it migrates to Oʻahu would deeply affect the Koʻolau watershed.

Solution Types: Ideas; Technology demonstration and hardware; Scientific

Plan for Upcoming 2 FYs: ROD and other invasive species pose some of the greatest threats to the fulfillment of the NPS mission in Hawaiian parks. The potential losses due to ROD are irreversible and will threaten our economy and way of life. There is widespread support among Hawaii's land managers in NPS and other organizations of the threat posed by ROD, and a genuine willingness to cooperate and share information. ROD research and management is a top priority for scientists and land managers in NPS, USGS, and USFWS, and will remain so for the next decade unless a solution is found to eliminate this disease.

A.4.2 Arsenic Sensor – Stage 1[25]

Lead Sponsoring Agency: Bureau of Reclamation (USBR)

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

Competition Goals: Measuring levels of arsenic in the environment and in drinking water is important for protecting human health. Drinking water and wastewater treatment facilities are subject to arsenic regulations in order to limit human exposure and environmental contamination. While current analytical methods are suitable for ensuring regulatory compliance, there is a need for rapid, low-cost monitoring of arsenic that would benefit water treatment plant operations, wastewater monitoring, contaminated site remediation, private well owners, scientific research and other interested parties.

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: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $50,000. Cash prizes of $50,000 were distributed to six winning solvers as determined by the judging panel with one winner paid $10,000 by non-Federal partner, Xylem, Inc. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage

[25] The websites for the Arsenic Sensor – Stage 1 are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=61730; https://www.usbr.gov/research/challenges/arsenicsensor.html; https://www.innocentive.com/ar/challenge/9933765; and https://www.challenge.gov/challenge/arsenic-sensor-challenge-stage-1/.

ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with the National Aeronautics and Space Administration (NASA) Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream Research and Development (R&D) magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as a "Theoretical Challenge." Submissions consisted of a written description and rationale for why the Solver believes the proposed solution would meet or exceed the criteria stated in the prize competition posting document. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened through conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 39 entries submitted by 217 participants between December 13, 2016 and March 13, 2017, five prizes were awarded to seven winners (one award paid by non-Federal partner, Xylem, Inc.).

Budget and Resources: In FY17, there was 0.12 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: Reclamation partnered with the U.S. Environmental Protection Agency (EPA) for design and judging; the Indian Health Service for design and judging; the National Institute of Standards and Technology (NIST) for design and judging; the Agricultural Research Service for design; the U.S. Agency for International Development for design; the USGS for design and judging; and Xylem, Inc. for judging and paying a $10,000 purse award to one winner.

Advancement of Agency Mission: Stage 1 of the Arsenic Sensor prize competition sought concepts for rapidly, accurately, and cost-effectively measuring arsenic in water through improved sensor technologies. Current analytical methods are suitable for ensuring regulatory compliance, but there remains a need for rapid, low-cost monitoring of arsenic. The selected ideas represent a positive step forward to better understand and manage water quality, potentially opening up more usable supplies for the West and the country.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a methods for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; and in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.3 Colorado River Basin Data Visualization[26]

Lead Sponsoring Agency: USBR

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

Competition Goals: The Bureau of Reclamation plays a significant role in managing the Colorado River Basin (CRB), including operating dams and canals to deliver water and generate power, overseeing water allocations and water use, and protecting and restoring habitat for endangered and threatened species. Management of the CRB is governed by numerous compacts, laws, court decisions and decrees, and regulatory guidelines collectively known as the "Law of the River." Reclamation relies on a broad range of CRB data to support short-term water management and long-term planning, including data on historical, current, and projected weather and climate conditions, reservoir storage and releases, and streamflows and diversions. State and local agencies, water users, recreationists, researchers and other stakeholders and partners also rely on CRB data for a wide variety of uses. Reclamation is currently working to make CRB data open and accessible to both Reclamation and non-Reclamation users; however, better approaches to visualizing CRB data are needed to improve data exploration, analysis, interpretation, and communication by internal and external users. In particular, better visualization approaches are needed to improve understanding and communication of current and projected conditions in the basin and the water management actions that affect those conditions.The objective of the visualization tool is to support exploration and understanding of climate, hydrology, river, and reservoir conditions across the CRB, as well as how these conditions vary in space and time. The tool should also help users understand how fluctuations in river and reservoir conditions relate to user interests, such as water supply and recreation opportunities.

Goal Types: Improve government service delivery; Solve a specific problem; Advance scientific research; Develop technology; Inform and educate the public; Engage new people and communities

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[26] The websites for the Colorado River Basin Data Visualization are accessible at https://www.usbr.gov/research/challenges/datavis.html; https://www.innocentive.com/ar/challenge/9933882; and https://www.challenge.gov/challenge/colorado-river-basin-data-visualization-challenge/.

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $60,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Nine cash prizes of $60,000 were distributed to 12 winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious

submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as a "Theoretical Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 24 entries submitted by 254 participants between September 7 and November 17, 2017, nine prizes were awarded to 12 winners.

Budget and Resources: In FY17 the funding was $15,134 and there was 0.59 FTE used. In FY18, the funding was $60,000 and there was 0.37 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service.

Partnerships: USBR partnered with USGS for design and judging; National Oceanic and Atmospheric Administration (NOAA) for design and judging; U.S. Department of Agriculture for design and judging; and International Boundary and Water Commission for design and judging.

Advancement of Agency Mission: Successful development of innovative, interactive, and user-driven visualizations of CRB data will facilitate improved data analysis and decision making by Reclamation and non-Reclamation users. Integrated visualization of CRB data and ancillary information will improve interpretation and understanding of basin conditions, management actions that affect those conditions, and legal and regulatory factors that influence management actions. Reclamation anticipates implementing the winning solution(s) as part of a new web-based data analysis and visualization tool; a successful solution will help to make this tool a common platform for communication and collaboration between Reclamation and CRB stakeholders and partners.

Solution Types: Analytics, visualizations, algorithms

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.4 DataApp: A Mobile App Framework for Field Data Capture[27]

Lead Sponsoring Agency: USBR

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

Competition Goals: Data collection is fundamental to water and environmental science and management. Streamflows, reservoir elevations, and flows in canals and conduits, for example, are continuously monitored to support water management decisions ranging from real-time operations to long-term planning. Data are routinely collected to monitor infrastructure conditions and identify maintenance priorities, and a wide range of environmental data are collected to characterize habitat conditions, monitor fish and wildlife populations, and support ecosystem restoration programs.Scientists, engineers, and technicians are increasingly using mobile devices such as tablets and smartphones to record measurements, document site locations via the Global Positioning System (GPS), and take photos and notes in the field. Although numerous apps are already available to support general data collection on mobile devices, these existing apps do not provide the functionality and flexibility needed to support the broad range of current water and environmental monitoring needs. More importantly, these existing apps do not support the development, integration, and sharing of new and unique features and functions to meet the specialized needs of individual data collection scenarios and communities of practice. DataApp Challenge Stage 1 was the first stage of a planned three-stage challenge seeking development of new and improved software application (app) frameworks to support electronic data collection and capture using mobile devices (i.e., smartphones and tablets) across a diverse range of water and environmental data collection situations.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $30,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48

[27] The websites for the DataApp: A Mobile App Framework for Field Data Capture are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=62551; https://www.usbr.gov/research/challenges/dataapp.html; https://www.innocentive.com/ar/challenge/9933881; and https://www.challenge.gov/challenge/dataapp-a-mobile-app-framework-for-field-data-capture-stage-1/.

C.F.R.). Cash prizes of $30,000 were distributed to seven winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Ideation Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and

arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 24 entries submitted by 167 participants between May 23 and July 6, 2017, prizes were awarded to seven winners.

Budget and Resources: For FY17, the funding was $40,000 with 0.31 FTE used. For FY18, the funding was $30,000 with 0.02 FTE used. FTE reported is based on labor budget consumption during the indicated FY. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: Partnered with the USGS for design and judging, and the NPS for judging.

Advancement of Agency Mission: Development of a flexible, extensible, and open source data collection app framework for GPS-enabled mobile devices will facilitate the use of mobile devices for field data collection, which in turn will improve data collection efficiency, lower data collection costs, and improve data quality, transparency, and dissemination for applications to management, decision making, and scientific discovery. Flexibility and extensibility will allow the use of mobile devices for across broader range of data collection situations, whereas use of open source software will allow data collection communities of practice to develop common protocols and standards for data collection, management, and sharing.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, “Can this work?”; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.5 Detecting Leaks and Flaws in Water Pipelines - Stage 1[28]

Lead Sponsoring Agency: USBR

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

Competition Goals: Reclamation’s water conveyance system includes over 20,000 miles of buried pipelines made of various materials including metal, plastic, concrete, and composite. Municipal water utility collaborators also have extensive transmission and distribution pipeline networks. Pipeline components, such as joints, fittings, valves, linings, and individual pipe sections are subject to leakage due to damage, corrosion, and other types of degradation. Detecting water loss from pipelines will trigger appropriate maintenance, allowing conservation of scarce water resources and more reliable service to clients. Presently, the available water pipeline leak detection techniques might be suitable

[28] The websites for the Detecting Leaks and Flaws in Water Pipelines - Stage 1 are accessible at https://www.usbr.gov/research/challenges/leakypipes.html; https://www.innocentive.com/ar/challenge/9933883; and https://www.challenge.gov/challenge/detecting-leaks-and-flaws-in-water-pipelines- stage-1/.

for determining general system delivery information or for close evaluation of small pipeline sections, none accommodate the needs to efficiently inspect thousands of miles of pipelines and to precisely determine leak location and severity. In addition, many of the techniques are unable to inspect the pipe while it is in service (pressurized, flowing water in pipe) or cannot overcome operational complications such as limited pipe entry points, diameter changes, elevation changes, or lateral bends.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $75,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Five cash prizes from the $75,000 were distributed to 12 winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES

Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as a "Theoretical Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 54 entries submitted by 294 participants between March 8, 2018 and May 8, 2018, prizes were awarded to five winners.

Budget and Resources: For FY17, the funding was $15,134 with 0.3 FTE used. For FY18, there was no monetary funding, but there were seven FTE used. FTE reported is based on labor budget consumption during the indicated FY. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service.

Partnerships: The Design Team in-kind Partners were the San Diego County Water Authority, Southern Nevada Water Authority, and Isle Utilities. The Judging Team in-kind partners provided subject matter experts for the panel, and included USBR, U.S. Army Corps of Engineers (USACE), Calleguas Municipal Water District, Central Arizona Project, Denver Water, Great Lakes Water Authority, Isle Utilities, Southern Nevada Water Authority, and the San Diego County Water Authority. The estimated value of partner contributions was $30,000 in FY17 and $90,000 in FY18.

Advancement of Agency Mission: Reclamation seeks methods and technologies that can reliably and easily detect leaks and flaws in operating, pressurized water pipeline infrastructure regardless of size, depth of burial, pipe material or interior lining. Our primary focus is finding condition assessment solutions for 48-inch or greater pipe diameters and for steel and prestressed concrete cylinder pipe types, although solutions for all pipe types and diameters greater than 24 inches will be considered. This competition advances the agency's mission to reliably deliver water to our clients by allowing the agency to be proactive in pipeline leak detection and repair.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have

no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.6 Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees and their Foundations[29]

Lead Sponsoring Agency: USBR

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

Competition Goals: The quality of life for many people around the globe depends on water storage behind earthen dams, water movement within earthen canals, and flood-protection behind levees. However, earthen dams, canals and levees are prone to internal erosion of soils caused by seepage, either through or under the structures. The internal erosion process is largely invisible as it occurs below the ground surface. By the time visible signs are present, damage has likely occurred to the structure that will require mitigation or repair. Earlier detection is required to increase the time available to intervene, and to decrease the extent and cost of repairs.While there are a number of specific erosion mechanisms, they all share a common feature: the erosion results in the movement of soils from an initiation point to an exit point. The distance from the initiation point to the exit point can be as small as a few meters, or as large as hundreds of meters. If soil movement can be detected earlier, problems can be corrected and damage avoided. The Bureau of Reclamation, in collaboration with the U.S. Army Corps of Engineers, is seeking new methods for detecting the movement (erosion) of soils in earthen structures and foundations. These methods may detect internal erosion either directly or indirectly (detecting properties that typically indicate internal erosion is taking place). The goal is to detect soil movement earlier than occurs by current visual inspection and instrumentation methods.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of

[29] The website for Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees and their Foundations are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=60541; https://www.usbr.gov/research/challenges/soilmovement.html; https://www.innocentive.com/ar/challenge/9933649; and https://www.challenge.gov/challenge/detecting-soil-movement-in-embankments/.

national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $20,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Cash prizes of $20,000 were distributed to five winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Ideation Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution

by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 29 entries submitted by 133 participants between March 31 and May 10, 2016, prizes were awarded to five winners.

Budget and Resources: For FY17, the funding was $20,000 with 0.05 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: USACE and the State of Colorado Dam Safety Program provided in-kind support for design and judging of the prize competition. The agencies also provided assistance with marketing and outreach. No monetary or non-cash awards were provided by partners. In 2017, the estimated value of partner contributions was $7,000.

Advancement of Agency Mission: This prize competition sought methods to detect the movement of material earlier than observable by currently used visual inspection and instrumentation methods. This could help prevent the loss of life, property and interruption of the service the infrastructure provides. Furthermore, the reliability of water infrastructure is improved.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, “Can this work?”; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.7 Downstream Fish Passage at Tall Dams[30]

Lead Sponsoring Agency: USBR

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

Competition Goals: Reclamation sought new ideas for ensuring successful and cost-effective downstream passage of juvenile fish at tall (high-head) dams. The solutions addressed reducing: stress

[30] The websites for the Downstream Fish Passage at Tall Dams are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=59159; https://www.usbr.gov/research/challenges/fishpassage.html; https://www.innocentive.com/ar/challenge/9933648; and https://www.challenge.gov/challenge/downstream-fish-passage-at-tall-dams/.

(e.g. crowding, removal from water, disorientation); physical damage on fish; interference with the operation of the dam (flood control, energy, water distribution); and total costs.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $20,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Cash prizes of $20,000 were distributed to four winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions

were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Ideation Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 44 entries submitted by 180 participants between March 31 and May 10, 2016, prizes were awarded to four winners.

Budget and Resources: For FY17, the budget was $20,000 and there was 0.05 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment. Budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: USGS, NOAA-National Marine Fisheries Service, and USACE provided in-kind support for design and judging of the prize competition. The Federal agencies also provided assistance with marketing and outreach. One subject matter expect from State of California Department of Water Resources also provided in-kind design and judging assistance. No monetary or non-cash awards were provided by partners. The estimated value of partner contributions was $24,000.

Advancement of Agency Mission: Reclamation and other Federal, State, and local organizations have a stake in recovering threatened and endangered fish. This prize competition was developed to help migrating juvenile fish get over or around tall dams. Moving migrating juvenile fish past tall dams will ensure habitat connectivity that many threatened and endangered fish populations need to survive and reproduce.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem. For fish passage, this is likely the ability to guide fish through a reservoir and

successfully attract them to the fish collection and conveyance feature of the system. A tighter, sharper focus on the critical pieces of the problem may help solvers better focus and deliver.

A.4.8 Eradication of Invasive Mussels in Open Water - Stage 1[31]

Lead Sponsoring Agency: USBR

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

Competition Goals: Two species of dreissenid mussels, Dreissena polymorpha (zebra mussel) and Dreissena rostriformis "bugensis" (quagga mussel), have become established in freshwater lakes, reservoirs, and rivers in the United States. Invasive dreissenid mussels pose significant challenges for Reclamation and all agencies and industries that manage water. Invasive mussels are prolific breeders and settle on or within water facility infrastructure such as water intakes, gates, diversion screens, hydropower equipment, pumps, pipelines, and boats. Infested water and hydropower infrastructure can fail or choke off water transmissions. Invasive mussels negatively impact the natural ecology, which can be detrimental to native and endangered species, including native fisheries. Maintaining and operating water supply and delivery facilities, water recreation, and other water dependent industries and economies in mussel infested water bodies are dramatically more expensive and complex. Public recreation may also be severely impacted by mussel infestations, from shell fragments degrading swim beaches to increased requirements and cost for boaters. Management of invasive mussel infestations can also lead to restricted public access, in some cases through a complete ban on public use of infested waters. Currently, no practical methods exist for large-scale eradication of invasive dreissenid mussel populations once they become widely established in a reservoir, lake, or river (referred to as "open water"). Reclamation sought innovative solutions for 100% eradication of zebra and quagga mussels in open water through direct mortality or through non-lethal treatment that lead to their eventual eradication. Proposed treatments must be specific to invasive mussels without significant harm to non-target organisms such as native mussels or threatened and endangered species.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

[31] The websites for the Eradication of Invasive Mussels in Open Water - Stage 1 are accessible at https://www.usbr.gov/research/challenges/mussels.html; https://www.innocentive.com/ar/challenge/9933880; and https://www.challenge.gov/challenge/eradication-of-invasive-mussels-in-open-water- stage-1/.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse of $100,000 was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.).

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website.

Evaluation of Submissions: The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution against the criteria stated in the prize competition posting document.

Results: Of the 67 entries submitted by 238 participants between December 14, 2017 and February 28, 2018, three prizes were awarded to four winners.

Budget and Resources: In FY17, the funding was $15,134 and there was 0.01 FTE used. In FY18, the funding was $100,000 and there was 0.25 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year, divided by $200,000 per FTE; work represents finalizing design, launch support, competition judging and final reporting. Budget reported excludes FTE staffing, and includes purse payment and budget consumption by prize competition vendor service for design support.

Partnerships: USACE, USGS, and Molloy & Associates LLC provided in-kind support for design and judging of the prize competition. Partners also provided assistance with marketing and outreach. One subject matter expert from Portland State University also provided in-kind design and judging

assistance, but the university was not a full partner. No monetary or non-cash awards were provided by partners.

Advancement of Agency Mission: Invasive dreissenid mussels pose significant challenges for Reclamation and all agencies and industries that manage water. Invasive mussels are prolific breeders and settle on or within water facility infrastructure such as water intakes, gates, diversion screens, hydropower equipment, pumps, pipelines, and boats. Infested water and hydropower infrastructure can fail or choke off water transmissions. Invasive mussels negatively impact the natural ecology, which can be detrimental to native and endangered species, including native fisheries. Maintaining and operating water supply and delivery facilities, water recreation, and other water dependent industries and economies in mussel infested water bodies are dramatically more expensive and complex. Public recreation may also be severely impacted by mussel infestations, from shell fragments degrading swim beaches to increased requirements and cost for boaters to have their watercraft inspected and decontaminated, and potential impacts on populations of game fish. Management of invasive mussel infestations can also lead to restricted public access, in some cases through a complete ban on public use of infested waters. Eradication of invasive dreissenid mussels ensures Reclamation's ability to meet water and power deliveries now and into the future.

Solution Types: Ideas; Technology demonstration and hardware; Scientific

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a methods for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see.

A.4.9 Indirect Estimates of Reservoir Water Storage[32]

Lead Sponsoring Agency: USBR

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

Competition Goals: Water storage in reservoirs behind dams is a vital component for water management, and the amount available defines the delivery of benefits from reservoirs. Available water storage, over time, decreases as sediment deposition occurs, thus decreasing the capacity for storage. This sediment deposition, known as sedimentation, also adversely affects reservoir infrastructure operation and maintenance such as outlet works and water intakes. Assessing the loss of storage capacity currently is an expensive and time consuming process performed directly by in-field surveys. The Bureau of Reclamation, in collaboration with the U.S. Army Corps of Engineers, was seeking a cost effective method to indirectly estimate the storage capacity and/or sediment volume (storage loss) in reservoirs. This is a Reduction-to-Practice Challenge required written documentation, source code, and delivery of an executable application.

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

[32] The websites for the Indirect Estimates of Reservoir Water Storage are accessible at https://www.usbr.gov/research/challenges/waterstorage.html; https://www.innocentive.com/ar/challenge/9933766; and https://www.challenge.gov/challenge/estimating-reservoir-water-storage/.

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $75,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). A partial cash prize of $1,000 was distributed to 1 winning solver as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine.

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious

submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as a "Theoretical Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 20 entries submitted by 280 participants between February 22 and May 22, 2017, a prize was awarded to one winner.

Budget and Resources: In FY17, there was $1,000 of funding and 0.09 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: USACE provided in-kind services for two subject matter experts to design and judge the prize competition including an in-person judges meeting. USACE also assisted with marketing and outreach. No monetary or non-cash prize awards were provided by partners.

Advancement of Agency Mission: Measurement of reservoir storage loss due to sediment accumulation is paramount in supporting Reclamation's mission. Reservoir sedimentation is a chronic problem that has become more visible and has continually increasing impacts with the aging of dams. Sediment deposition in reservoirs limits the active life of reservoirs by reducing reservoir storage capacity and impacting structures such as outlet works and water intakes. In order to determine the magnitude and rate of sedimentation to assess future impacts, direct measurements, such as a bathymetric (below water) survey in combination with a topographic (above water) survey are necessary. This process can be costly and time consuming. As of 2015, less than 40% of Reclamation reservoirs have had at least one resurvey since first filling to estimate storage loss as a result of sedimentation. The alternative to direct measurements of storage loss is indirect estimates of storage loss. Developing an efficient and accurate indirect estimate model of reservoir storage would result in a better, faster, and cheaper solution to support Reclamation in meeting water and power deliveries now and into the future.

Solution Types: Technology demonstration and hardware

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet

system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.10 Long-Term Corrosion Protection of Existing Hydraulic Steel Structures – Stage 1[33]

Lead Sponsoring Agency: USBR

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

Competition Goals: Common hydraulic steel structures such as hydroelectric penstocks and gates corrode, or degrade, without a properly applied corrosion control method. This degradation produces a localized or general thinning of material, which reduces the structure's ability to support load, carry water, etc. Failure of hydraulic steel structures can cause extensive downtime, loss of productivity, property damage, and even loss of life.The cost of maintenance and replacement of existing corrosion control systems has increased greatly in recent decades due to increasing health, safety, and environmental concerns associated with coatings that have performed well in the past as well as the decreased life cycles of commercially available alternative coatings. New long-term solutions to protect steel structures in water immersion service will help to reduce the high cost incurred to keep steel infrastructure reliable and functional.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $75,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Five cash prizes of $47,500 were distributed to seven winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was

[33] The websites for the Long-Term Corrosion Protection of Existing Hydraulic Steel Structures – Stage 1 are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=62570; https://www.usbr.gov/research/challenges/corrosion.html; https://www.innocentive.com/ar/challenge/9933879; and https://www.challenge.gov/challenge/long-term-corrosion-protection-of-existing-hydraulic-steel-structures-stage-1/.

the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Theoretical Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 30 entries submitted by 171 participants between June 13 and September 5, 2017, five prizes were awarded to seven winners.

Budget and Resources: In FY17, there was 0.21 FTE used. In FY18 there was $47,500 in funding. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents

competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: Reclamation partnered with the U.S. Army Engineer Research and Development Center for planning and judging; NIST for planning and judging; the Naval Facilities Engineering Command for planning and judging; and North Carolina State University for judging. The estimated value of partner contributions in FY17 was $70,000.

Advancement of Agency Mission: The annual estimated cost of corrosion in the U.S. is $451 billion or 2.7% of the Nation's GDP (IMPACT Study, NACE International, 2016). This enduring cost is in spite of the development of numerous technologies dedicated to providing corrosion protection. The Bureau of Reclamation is seeking new corrosion control methods or technologies to curb the rising costs of protecting its steel structures and ensure safe and reliable operation of its water infrastructure.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.11 More Water, Less Concentrate - Stage 1[34]

Lead Sponsoring Agency: USBR

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

Competition Goals: Innovative solutions were sought to expand usable water supplies by maximizing fresh water production from inland desalination systems in a cost effective and environmentally sound manner. Currently, significant and desirable water supplies are trapped in concentrate streams that are a byproduct of desalination technologies. The cost to manage or dispose of concentrate is rather large and very limiting to utilization of desalination in inland applications. Solutions could be novel technologies or approaches that build upon existing technologies. Solutions should address one of the following objectives, 1) ways to improve overall system recovery of existing desalination technologies, 2) ways to treat concentrate streams to extract additional useable water and thus to increase overall system recovery, or 3) new high recovery desalination technologies or processes that increase overall system recovery beyond current desalination technologies.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology

[34] The websites for the More Water, Less Concentrate - Stage 1 are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=61912; https://www.usbr.gov/research/challenges/morewater.html; https://www.innocentive.com/ar/challenge/9933762; and https://www.challenge.gov/challenge/more-water-less-concentrate-stage-1/.

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $150,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Cash prizes of $150,000 were distributed to ten winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious

submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Theoretical Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 66 entries submitted by 282 participants between December 13, 2016 and March 13, 2017, eight prizes were awarded to ten winners.

Budget and Resources: There was 0.14 FTE used in 2018. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: Reclamation partnered with the EPA for design; USACE for design and judging; U.S. Army for design and judging; the Water Environment and Reuse Foundation for design, judging, and outreach; and Water Research Foundation for outreach

Advancement of Agency Mission: Currently, significant and desirable water supplies are trapped in concentrate streams that are a byproduct of desalination technologies. The cost to manage or dispose of concentrate is rather large and limiting to utilization of desalination in inland applications. This Challenge sought innovative concepts to expand usable water supplies by maximizing fresh water production from inland desalination systems, and thereby reduce the volume of concentrate.The National Academy of Sciences identified developing cost-effective approaches for concentrate management that minimize environmental impacts as one of their highest priority research topics to enable the more widespread use of desalination to expand water supplies in the United States.The demand for fresh water will be increasing, and we need to be able to develop new water supplies from non- traditional water sources, like brackish groundwater and surface water using desalination and novel technologies. The competition sought innovative concepts to expand usable water supplies by maximizing fresh water production from inland desalination systems in a cost-effective and environmentally sound manner.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as

this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.12 Pathogen Monitoring - Stage 1[35]

Lead Sponsoring Agency: USBR

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

Competition Goals: As Western U.S. water demands grow and water supplies become more scarce, water reuse is becoming an increasingly important water management strategy. Wastewater is a drought-resistant and reliable water source that is readily available in urban centers for beneficial reuse. While advanced water treatment technologies exist to produce high quality, potable water from wastewater, there is a need to better ensure treatment process integrity through improved pathogen detection and monitoring. Waterborne pathogens (e.g., bacteria, viruses, protozoa, and helminths) are regulated due to the risk they pose to human health, and their presence must be limited in water intended for potable use.The Bureau of Reclamation, with financial support from Xylem, Inc, in collaboration with the Water Research Foundation and the EPA, are seeking the development of rapid, accurate, and preferably on-line/on-site monitoring techniques to provide added protection of public health and optimize the design and operations of advanced water treatment facilities. Success could result in reliable, effective pathogen detection technologies that can facilitate public and regulatory acceptance of direct potable reuse systems.

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: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse of $40,000 was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Xylem, Inc. offered $40,000 in partner contribution. Judging is in progress.

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[35] The websites for the Pathogen Monitoring - Stage 1 are accessible at https://www.usbr.gov/research/challenges/pathogen.html; https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=62175; and https://www.innocentive.com/ar/challenge/9933767.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website.

Evaluation of Submissions: Judging is in progress at the date of this report.The judging will be conducted by blind review as all submissions will be identified solely by a number assigned by InnoCentive. Judges will be provided with scoring sheets to be completed independently after reviewing each proposed solution against the criteria stated in the prize competition posting document.The prize competition was advertised as a "Theoretical Challenge." Submissions consist of a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the prize competition posting.

Results: Entries were submitted between May 10 and August 8, 2018, and prizes and winners have yet to be determined.

Budget and Resources: In FY17, there was $15,134 of funding and 0.21 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year, divided by $200,000 per FTE; work represents finalizing design, launch support, competition judging and final reporting. Budget reported excludes FTE staffing, and includes only budget consumption by prize competition vendor service for design support. Purse consumption will occur in FY19, where maximum purse will be $80,000 with 50% involving USBR budget consumption and 50% involving partner contribution by Xylem.

Partnerships: Reclamation partnered with the EPA for design and judging; Xylem, Inc. for design and judging; and the Water Research Foundation for design, judging, and outreach.

Advancement of Agency Mission: Relamation seeks to enable the development of rapid, more accurate, and preferably on-line/on-site monitoring techniques to provide added protection of public health and

optimize the design and operations of advanced water treatment facilities. Success could result in reliable, effective pathogen detection technologies that can facilitate public and regulatory acceptance of direct potable reuse systems.Stage 1 of the competition is seeking technical proposals for how to rapidly, accurately, and cost-effectively detect viruses in water reuse treatment plants. Reclamation will award an $80,000 prize purse ($40,000 of which is provided by Xylem Inc.), among winning eligible U.S. solvers. Winning eligible international solvers may receive meritorious recognition.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a methods for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see.

A.4.13 Powering Electronic Instruments on a Rotating Shaft - Stage 1[36]

Lead Sponsoring Agency: USBR

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

Competition Goals: Reclamation's hydropower generating units are expected to safely and reliably produce the power that is delivered to the Western U.S. electric grid. Equipment monitoring techniques provide a critical advancement toward keeping these units operational and reducing costly outages. However, the monitoring equipment requires a continuous power source in order to keep it online and performing its key role. New solutions are needed to permanently install low power electronics on the generator's rotating shaft in order to collect continuous data pertinent to operation and performance of the machine. Presently, the available power sources for electronics on rotating shafts include batteries and contact solutions. Powering the electronic equipment with a battery does not provide continuous operation and requires downtime of the equipment to replace them, resulting in lost power generation. Existing contact solutions, such as slip rings, have unacceptable installation and maintenance requirements. Non-contact solutions include emerging technologies that may prove beneficial but are not yet explored for this application.

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: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater

[36] The websites for the Powering Electronic Instruments on a Rotating Shaft - Stage 1 are accessible at https://www.usbr.gov/research/challenges/shaft-power.html; https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=63143; and https://www.innocentive.com/ar/challenge/9933885.

than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse of $250,000 was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). The prize competition is open to solvers.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website.

Evaluation of Submissions: The prize competition is open to solvers.The judging will be conducted by blind review as all submissions will be identified solely by a number assigned by InnoCentive. Judges will be provided with scoring sheets to be completed independently after reviewing each proposed solution against the criteria stated in the prize competition posting document.

Results: Entries were submitted between September 6 and December 6, 2018, and winners have yet to be determined.

Budget and Resources: In FY18 there was 0.35 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year, divided by $200,000 per FTE; work represents finalizing design, launch support, competition judging and final reporting.Budget reported excludes FTE staffing, and includes only budget consumption by prize competition vendor service for design support. Phase 1 purse consumption ($50,000 of the total $250,000 purse) will occur in FY19; Phase 2 purse consumption will occur in FY19 or FY20.

Partnerships: Reclamation partnered with USACE for judging and the Bonneville Power Administration for judging.

Advancement of Agency Mission: Reclamation and our collaborators seek novel methods and technologies to reliably provide direct current power for loads of up to twenty watts to electronics on rotating shafts. Proposed solutions must be applicable to rotating shafts that are 18- to 144-inch diameter, whether at rated speed (80 to 550 revolutions per minute), standstill, or when ramping up or down. Small, lightweight solutions are preferred, and could be achieved via multiple methods, including air movement, light, vibration, magnetic induction, kinetic motion, or wireless energy transfer. A successful solution would make online, continuous monitoring of hydropower generating units possible, which increases the reliability of power delivery and reduces costly outages.

Solution Types: Ideas; Technology demonstration and hardware; Scientific

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a methods for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see.

A.4.14 Preventing Rodent Burrows in Earthen Embankments[37]

Lead Sponsoring Agency: USBR

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

Competition Goals: Rodent burrows can fill with water when water levels change, creating seepage paths, which can lead to internal erosion in embankments resulting in the potential for catastrophic failure. Embankment failures can cause property damage, loss of life, and interrupt crucial deliveries of water in the West and across the Nation. Trapping or baiting rodents on earthen embankments are short-term remedies, and experience has shown that within a short time, the rodents inevitably return. Annual programs of rodent removal over thousands of miles of earthen embankment are cost prohibitive and only marginally successful. Solvers are asked to "dig deeper" than the rodents and offer creative, cost effective, long-term solutions to this real and serious problem.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the

[37] The websites for the Preventing Rodent Burrows in Earthen Embankments are accessible at https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=60543; https://www.usbr.gov/research/challenges/rodentburrows.html; https://www.innocentive.com/ar/challenge/9933763; and https://www.challenge.gov/challenge/preventing-rodent-burrows-in-earthen-embankments/.

individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse was $20,000 and was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Cash prizes of $20,000 were distributed to five winning solvers as determined by the judging panel. Non-cash prize awards were not offered for this competition.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website. Nevertheless, submissions included all solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-U.S. citizens and entities, were recognized in publications issued by Reclamation announcing the results of the competition, such as press releases, as applicable.

Evaluation of Submissions: The prize competition was advertised as an "Ideation Challenge." Competitors were required to submit a written proposal including a detailed description and rationale for why the proposed solution met or exceeded the performance criteria stated in the Challenge posting. Submissions were evaluated by a Judging Panel composed of scientists, engineers, and other technical subject matter experts affiliated with Federal and State entities. The Panel had consultation access to technical experts outside of their expertise, as deemed necessary, to evaluate specific submissions. The judging was conducted by blind review as all submissions were identified solely by a number assigned by InnoCentive. Judges were provided with scoring sheets to be completed

independently after reviewing each proposed solution. The judges assessed the merits of each solution by the degree upon which they meet the technical requirements. They also assessed the feasibility, flexibility, cost, and scalability of the proposed concept. At the end of the independent judging the individual scores were tallied and combined. The Panel convened several conference calls and then attended an all-day web conference to discuss the strengths and weaknesses of each submission and arrive at a consensus judges opinion. Solutions that did not meet all criteria, but were deemed novel, interesting, and potentially worth pursuing, were eligible to win a partial prize.

Results: Of the 75 entries submitted by 224 participants between August 29 and October 11, 2016, prizes were awarded to five winners.

Budget and Resources: In FY17, there was $20,000 in funding and 0.29 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service occurred prior to FY17.

Partnerships: USACE and State of Colorado Natural Resources Dam Safety Branch provided in-kind support for design and judging of the prize competition. The agencies also provided assistance with marketing and outreach. No monetary or non-cash awards were provided by partners.

Advancement of Agency Mission: Rodents can burrow through both sides of an embankment providing a pathway for water to move through and erode the embankment, potentially causing serious issues for the surrounding communities. Burrows may also intersect or expose other anomalies in the embankment that may result in a failure of the embankment and interruption of water supply to clients. This prize competition advanced the agency's mission of reliable water delivery by proposing new solutions to solve failures of canal embankments due to rodent burrows.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a method for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see. For prize competitions, such as this one, where a successful system needs to solve a suite of different problems to successfully meet system requirements, a separate prize for each piece of the problem should be considered. Alternatively, Reclamation could consider a competition that focuses only on the most difficult part of the system problem.

A.4.15 Sub-Seasonal Climate Forecast Rodeo[38]

Lead Sponsoring Agency: USBR

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

Competition Goals: Water managers need more skillful information on weather and climate conditions with lead-times ranging from 15 days to 45 days and beyond. Lacking skillful sub-seasonal information limits water managers' ability prepare for shifts in hydrologic regimes, such as the onset of drought or

[38] The websites for the Sub-Seasonal Climate Forecast Rodeo are accessible at https://www.usbr.gov/research/challenges/forecastrodeo.html; https://www.drought.gov/drought/sub-seasonal-climate-forecast-rodeo; https://www.innocentive.com/ar/challenge/9933764; and https://www.challenge.gov/challenge/sub-seasonal-climate-forecast-rodeo/.

occurrence of wet weather extremes. The challenge of sub-seasonal forecasting is that it encompasses the time frame where initial state information (e.g., coupled land-atmosphere processes) becomes less important and slowly varying long term states (e.g., sea surface temperatures, soil moisture, snow pack) become more important to prediction skill. This is a Reduction to Practice Challenge. Solvers will have three months to develop their system before the forecasting rodeo begins, at which point they are asked to provide forecasts every two weeks over a 13 month period, with the first month being a "pre-season" to become familiar with the submission and evaluation processes. Including judging, awarding of prizes, and identification of next steps, the expected completion is mid-2018. It is possible that another competition may be a recommended next step, perhaps focusing on extremes or a longer outlook. A variety of prizes may be awarded as part of this competition, the total of which is approximately $800,000. Prize categories are based on skill at two outlook timescales (weeks 3-4 and weeks 5-6) and for temperature as well as precipitation.

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

Justification for Using Prizes and Challenges: A prize competition was selected as a preferred method to achieve the aforementioned goals because it helps engage a non-traditional, national solver community while also complementing traditional research designed to target the most persistent science and technology challenges. Competitions also can incentivize the submission of solutions. They are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Reclamation selected a prize competition to address this technical Challenge because it allowed the agency to pay only for results; established an important goal without having to limit approaches or teams that are most likely to succeed; increased the number and diversity of the individuals, organizations, and teams that would address the problem or challenge of national/international significance; can stimulate private sector investment that is many times greater than the cash value of the prize; and furthered Reclamation's mission by attracting more interest and attention to a defined program, activity, issue or concern.

Cash Prize Purses and/or Non-Cash Prize Awards: The cash prize purse of $800,000 was funded via Reclamation's Science and Technology Program, Research and Development Office as per Federal Acquisition Regulation (FAR, as codified at Chapter 1 of Title 48 of the Code of Federal Regulations, 48 C.F.R.). Judging is in progress.

Solicitation of Submissions: Reclamation created a unique webpage as well as cross-posted at Challenge.gov and InnoCentive sites. A video was created and shared via YouTube to support social media outreach, while a webinar was hosted to accompany the launch news release. InnoCentive was the prize competition administrator. The advantage of contracting with InnoCentive was the ability to bundle and brand the portfolio of Reclamation's Water Prize Competition Center while leveraging InnoCentive's global network of 380,000+ individuals. Overall, the quality and types of proposed solutions varied significantly. Many submissions, any of whom could be a potential winner, proposed technologies or methods already in practice with little or no potential to improve existing capabilities. Others, although some might be considered novel or different, were judged to not meet solution requirements or not feasible. No new, ready-to-implement, "silver bullet" was found to solve this difficult problem; however Reclamation understands this is not a realistic expectation for a single-stage ideation prize completion. Five solutions were considered worthy of a prize award consistent with the stated prize competition rules and criteria. Lessons learned include the need for casting a wider solver net, as well as more support for the payments process. With this in mind, Reclamation is pursuing an Interagency Agreement with NASA's Center of Excellence for Collaborative Innovation to allow access

to trending models, infrastructure, expertise and multiple external competition crowdsourcing services.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - Advertisement in Reclamation's Knowledge Stream R&D magazine

Participation Requirements: This prize competition targeted the Challenge.gov and InnoCentive solver communities. This Challenge was conducted under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C.§ 3719). The Act states that awards for this Prize Competition may only be given to an individual that is a citizen or permanent resident of the United States, or an entity that is incorporated in and whose primary place of business is in the United States. Other restrictions were published in the Challenge Specific Agreement on the InnoCentive website.

Evaluation of Submissions: Judging is in progress.

Results: Entries were submitted between December 20, 2016 and May 3, 2018, and winners are yet to be determined.

Budget and Resources: In FY17, the funding was $64,757 and there was 0.3 FTE used. In FY18, the funding was $104,926 and there was 0.15 FTE used. FTE reported is based on labor budget consumption during the indicated fiscal year. Work represents competition judging and final reporting. Budget reported excludes FTE staffing, and includes only purse payment; budget consumption by prize competition vendor service.

Partnerships: NOAA co-led the design of this Challenge along with Reclamation. NOAA will also host the leaderboard and assist with evaluating the submissions. NOAA's mission includes science, service and stewardship. Specifically, NOAA aims to understand and predict changes in climate, weather, oceans, and coasts; to share that information and knowledge with others; and to conserve and manage coastal and marine ecosystems and resources (www.noaa.gov). USGS and USACE contributed subject matter experts to review and assist with the design of this Challenge. The mission of the USGS is to serve the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life (www.usgs.gov). The mission of the USACE is to deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation's security, energize the economy and reduce risks from disasters (www.usace.army.mil).

Advancement of Agency Mission: Techniques that outperform current forecast practices are expected to offer valuable insight as to how operational forecasts can be improved at the sub-seasonal timescale. This in turn will offer a variety of sectors—not just water management—much needed information to better manage resources and prepare for extreme events. A few examples include advanced emergency preparedness, enhanced water order scheduling, and wildfire management.

Solution Types: Analytics, visualizations, algorithms

Plan for Upcoming 2 FYs: Future consideration to increase the effectiveness and efficiency of conducting prize competitions include: incorporating a methods for judges to quickly set aside solutions that have no merit, such as a quick initial reality check on the question, "Can this work?"; in addition to the stated judging criteria, incorporate a free format field for each judge to characterize the merits of the solution in their own words based on the strengths and weaknesses they see.

A.5 Department of Health and Human Services (HHS)

A.5.1 AHRQ Step Up App Challenge: Advancing Care Through Patient Assessments[39]

Lead Sponsoring Agency: Agency for Healthcare Research and Quality (AHRQ)

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

Competition Goals: While patient-reported outcomes (PRO) data have proven useful to healthcare providers, they are not widely used in clinical settings. Existing PRO data collection methods can inconvenience busy patients and providers and make the data difficult to access and analyze due to a lack of standardization. Developing an easily adoptable tool that collects and shares standardized data should help solve this problem and advance the state of PRO usage. In this Challenge, AHRQ is looking for teams to design, develop, and pilot a user-friendly application that simplifies and standardizes the process of collecting, interpreting, aggregating, and sharing PRO data related to physical function outcomes in the ambulatory care setting.

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 prize competition furthers AHRQ's mission by generating innovative ideas to address agency goals. The hope is that attracting diverse teams via a challenge competition can bring innovation. The prize competition stimulates private sector investment that is many times greater than the cash value of the award. AHRQ can receive innovative solutions within a short time frame.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $250,000. In Phase one, AHRQ awarded ten winners with $12,000 each. In Phase two, three winners were awarded. The grand prize winner was awarded $35,000 and invited to pilot their app with MedStar Health. Second- and third-place winners received $30,000 and $25,000, respectively. The grand prize winner will receive another $40,000 after the pilot test.

Solicitation of Submissions: AHRQ promoted the Challenge through the Blue Button 2.0 Developer Conference, AHRQ's press release, blog, listserv, social media (e.g., Facebook, Twitter), and stakeholders outreach. The Office of the National Coordinator for Health Information Technology (ONC) also promoted the Challenge through their listserv.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Blue Button 2.0 Developer Conference; Other - Webinar

Participation Requirements: Participants in the AHRQ Step Up Challenge are subject to the following requirements: (1) Shall have registered to participate in the Challenge under the rules promulgated by the Agency for Healthcare Research and Quality; (2) Shall have complied with all the stated requirements of the Step Up App Challenge; (3) In the case of a private entity, shall be incorporated in and maintain a primary place of business in the United States, and in the case of an individual, whether participating singly or in a group, shall be a citizen or permanent resident of the United States; (4) May not be a Federal entity or Federal employee acting within the scope of their employment; (5) Shall not be an HHS employee working on their applications or Submissions during assigned duty hours; (6) Shall

[39] The website for the AHRQ Step Up App Challenge: Advancing Care Through Patient Assessments can be viewed at https://www.Challenge.gov/challenge/ahrq-step-up-app-challenge/ https://www.ahrq.gov/stepupappchallenge/index.html.

not be an employee of the Agency for Healthcare Research and Quality; (7) Federal grantees may not use Federal funds to develop COMPETES Act Challenge applications unless consistent with the purpose of their grant award; and (8) Federal contractors may not use Federal funds from a contract to develop COMPETES Act Challenge applications or to fund efforts in support of a COMPETES Act Challenge Submission.

Evaluation of Submissions: Phase one evaluation criteria included team/participant capabilities (20%), impact (30%), feasibility (30%), and originality (20%). Phase two evaluation criteria includes technical merit (40%), usability and functionality (30%), and deployability (30%).

Results: In October 2018, ten winners were selected from Phase one to compete in Phase two (app development). In March 2019, three winners were selected from Phase two. The grand prize winner is partnering with MedStar Health to pilot test the winning app (Phase three). Phase three pilot testing is scheduled to complete in September 2019.

Budget and Resources: AHRQ received funding from the Secretary's portion (managed by ASPE) of the Patient Centered-Outcomes Research Trust Fund to manage a project to advance the collection and use of patient-reported outcome data through health information technology. AHRQ devoted $250,000 to hire a contractor to manage the Challenge and allocated another $250,000 as the total prize pot. AHRQ program staff manages the Challenge including being a COR on the contract to manage the Challenge, coordinating with Federal partners, and working with AHRQ's Office of Communications to promote the Challenge. AHRQ Office of Communications staff set up an AHRQ microsite for the Challenge and promoted the Challenge via different mechanisms such as social media and blog posts. Approximately 1 FTE was utilized.

Partnerships: The AHRQ Step Up App Challenge is one component within a PRO project funded by Secretary's portion (managed by the Office of the Assistant Secretary for Planning and Evaluation) of the Patient-Centered Outcomes Research Trust Fund. ONC received $2 million as a partner in the PRO project. ONC provides technical expertise and hired a contractor to develop the technical specifications that will be used in the AHRQ Step Up App Challenge. ONC also shares experience with hosting challenges and promoted AHRQ's Challenge through their listserv. NIH provides expertise and consultation regarding the Patient-Reported Outcomes Measurement Information System (PROMIS®) physical function measures that are used in the Challenge. They also connected AHRQ staff with the faculty member at Northwestern University who manages the PROMIS Assessment Center Application Program Interface (API). A faculty member at Northwestern University provides in-kind technical support regarding the use of the PROMIS Assessment Center API to Challenge participants.

Advancement of Agency Mission: AHRQ is the lead Federal agency charged with improving the safety and quality of America's health care system. AHRQ develops the knowledge, tools, and data needed to improve the health care system and help Americans, health care professionals, and policymakers make informed health decisions. The Step Up App Challenge is part of AHRQ's ongoing effort to help shape the Nation's digital health care ecosystem and realize its potential to improve outcomes through broader use of patient data. PRO data or patient self-assessments offer a complementary perspective to clinician assessments and are also used in research to explore patient perspectives about their treatments, health outcomes, and the quality of services they received. Having user- friendly apps that are capable of collecting standardized PRO data in various ambulatory settings can increase clinicians' ability to use the data or easily share these data across health systems for research or other purposes, including quality improvement.

Solution Types: Software and apps

Plan for Upcoming 2 FYs: AHRQ will be hosting at most two challenges in the form of a datathon or codeathon that focuses on increasing accessibility to data analytics and utilizing AHRQ's rich data resources to develop innovative and timely insights into the healthcare system to make data more accessible to the public. This will address AHRQ's mission to make health care safer, higher quality, more accessible, equitable, and affordable is understood and used.

A.5.2 2017 Million Hearts® Hypertension Control Challenge[40,41]

Lead Sponsoring Agency: Centers for Disease Control (CDC)

Status: This competition was completed in FY17.

Competition Goals: Heart disease and stroke are the first and fifth leading causes of death in the United States. High blood pressure, or hypertension, is a leading risk factor for both conditions with approximately 1.5 million heart attacks and strokes occurring in the U.S. annually. Yet, of the 75 million adults with hypertension only half have their blood pressure under control. The Million Hearts® Hypertension Control Challenge seeks to identify clinical practices and health systems that excel in hypertension control and to identify the successful strategies used by those who excel in hypertension control in order to broadly share and promote those strategies. Through past challenges, including the 2017 Challenge, CDC has identified 83 clinical practices and health systems who care for 5 million patients with hypertension. The average control rate among these champions is 79%.

Goal Types: Find and highlight innovative ideas

Justification for Using Prizes and Challenges: The Million Hearts® initiative, co-led by CDC and the Centers for Medicare and Medicaid, aims to prevent a million heart attacks and strokes and related conditions by 2022. In support of that goal, CDC was interested in gathering documentation from clinical practices and health systems regarding successful strategies that support hypertension control. The 2017 Hypertension Control Challenge was a way to recognize and promote clinicians who are excelling at hypertension control in their patient population and then using their successful strategies to encourage others to improve hypertension control.

Cash Prize Purses and/or Non-Cash Prize Awards: No prize purse or monetary incentives were offered for this Challenge. Champions received local and national recognition through the Million Hearts® and CDC websites, as well as national press releases congratulating the champions. Documentation of clinical systems and strategies champions adopted that support hypertension control are housed online and attributed to the champions.

Solicitation of Submissions: The Challenge was promoted through Challenge.gov, the Million Hearts® website, through social media (Facebook, Twitter), and by other Federal and non-Federal partners. All HHS agencies are Million Hearts® partners. The Challenge was also promoted through email to partners.

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 - Website

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[40] The website for the 2017 Million Hearts® Hypertension Control Challenge can be viewed at https://www.challenge.gov/challenge/2018-million-hearts-hypertension-control- challenge/.

[41] The 2017 Million Hearts® Hypertension Control Challenge was conducted under the COMPETES Reauthorization Act of 2010, as well as Public Health Service Act 42 USC 241.

Participation Requirements: The 2017 Million Hearts® Hypertension Control Challenge was open to public and private individual clinicians, practices, and health systems providing health care services to patients in a U.S. State or territory. Participants were required to treat all adult patients with hypertension in the practice seeking care, not a select subgroup of patients; treat a minimum of 500 adult patients annually; have a hypertension control rate of at least 70% during the 12-month reporting period; have a data management system (electronic or paper) that allows for verification of data submitted; and be free from convictions or pending investigations of criminal and health care fraud offenses and must not have any serious sanctions for healthcare fraud or mis-prescribing of prescription medications.

Evaluation of Submissions: Applications were initially evaluated by CDC staff for completeness and plausibility and any areas of concern are noted. A contractor experienced in validating hypertension control rates completed a background check on the applicants. Data validation was done by the contractor to determine if proper methods were used in calculation the hypertension control rates and various patient population characteristics such as the prevalence of hypertension in their population. Applicants were required to submit documentation that a random sample of the hypertensive population (up to 30 patients) had a documented diagnosis of hypertension prior to the most recent blood pressure measurement. CDC reviewed all information from the contractor and submitted the findings to a panel of judges who were CDC FTEs for determination of whether the applicants satisfied the requirements for being a champion. In 2017, applicants were required to have at least a hypertension control rate of 70%.

Results: Of the 98 entries submitted by participants, prizes were awarded to 24 winners.

Budget and Resources: Agency resources included 5% FTE time; $40,000 cost to build the data collection website; and $179,000 contractor cost for data validation.

Partnerships: Non-Federal partners included the National Association for Chronic Disease Directors.

Advancement of Agency Mission: Hypertension is a leading risk factor for heart disease and stroke, the first and fifth leading causes of death in the U.S., respectively. Prevention of heart disease and stroke is a major focus for CDC's National Center for Chronic Disease Prevention and Health Promotion. The CDC and the Centers for Medicare and Medicaid co-lead the Million Hearts® initiative, with a mission to prevent a million heart attacks, strokes, and related conditions by 2022.

Solution Types: Ideas

Plan for Upcoming 2 FYs: The 2018 Million Hearts Hypertension Control Challenge is in the final stages and champions will be announced in November 2018. The 2019 Challenge is planned to launch in February 2019.

A.5.3 2018 Million Hearts® Hypertension Control Challenge[42,43]

Lead Sponsoring Agency: CDC

Status: This competition was underway in FY18.

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[42] The website for the 2018 Million Hearts® Hypertension Control Challenge can be viewed at https://www.challenge.gov/challenge/2018-million-hearts-hypertension-control- challenge/.

[43] The 2018 Million Hearts® Hypertension Control Challenge was conducted under the COMPETES Reauthorization Act of 2010, as well as Public Health Service Act 42 USC 241.

Competition Goals: Heart disease and stroke are the first and fifth leading causes of death in the United States. High blood pressure, or hypertension, is a leading risk factor for both conditions with approximately 1.5 million heart attacks and strokes occurring in the U.S. annually. Yet, of the 75 million adults with hypertension only half have their blood pressure is under control. The Million Hearts® Hypertension Control Challenge seeks to identify clinical practices and health systems that excel in hypertension control and to identify the successful strategies used by those who excel in hypertension control in order to broadly share and promote those strategies. Through past challenges, including the 2017 challenge, CDC has identified 83 clinical practices and health systems who care for 5 million patients with hypertension. The average control rate among these champions is 79%.

Goal Types: Find and highlight innovative ideas

Justification for Using Prizes and Challenges: The Million Hearts® initiative, co-led by CDC and the Centers for Medicare and Medicaid, aims to prevent a million heart attacks and strokes and related conditions by 2022. In support of that goal, CDC is interested in gathering documentation from clinical practices and health systems regarding successful strategies that support hypertension control. The 2018 Hypertension Control Challenge is a way to recognize and promote clinicians who are excelling at hypertension control in their patient population and then using their successful strategies to encourage others to improve hypertension control.

Cash Prize Purses and/or Non-Cash Prize Awards: No prize purse or monetary incentives are offered for this challenge. Champions will receive local and national recognition through the Million Hearts® and CDC websites, as well as national press releases congratulating the champions. Documentation of clinical systems and strategies champions adopted that support hypertension control will be housed online and attributed to the champions.

Solicitation of Submissions: The Challenge is promoted through challenge.gov, the Million Hearts® website, through social media (Facebook, twitter), and by other Federal and non-Federal partners. All HHS agencies are Million Hearts® partners. The Challenge was also promoted through email to partners.

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 - Website

Participation Requirements: The Million Hearts® Hypertension Control Challenge is open to public and private individual clinicians, practices, and health systems providing health care services to patients in a U.S. State or territory. Participants are required to treat all adult patients with hypertension in the practice seeking care, not select a subgroup of patients; must treat a minimum of 500 adult patients annually; have a hypertension control rate of at least 80% during the 12-month reporting period; have a data management system (electronic or paper) that allows for verification of data submitted; and be free from convictions or pending investigations of criminal and healthcare fraud offenses and must not have any serious sanctions for healthcare fraud or mis-prescribing of prescription medications.

Evaluation of Submissions: Applications are initially evaluated by CDC staff for completeness and plausibility and any areas of concern are noted. A contractor experienced in validating hypertension control rates completes a background check on the applicants. Data validation is done by the contractor to determine if proper methods were used in calculation the hypertension control rate and various patient population characteristics such as the prevalence of hypertension in their population. Applicants must submit documentation that a random sample of the hypertensive population (up to 30 records) has a documented diagnosis of hypertension prior to the most recent blood pressure measurement. CDC reviews all information from the contractor and submits the findings to a panel of judges who are CDC FTEs for determination of whether the applicants have satisfied the requirements

for being a champion. In 2018, applicants were required to have at least a hypertension control rate of 80%.

Results: At the time of this report, the 2018 Million Hearts Hypertension Control Challenge had received 23 entries by participants. Champions will be announced in November 2018.

Budget and Resources: Agency resources included 5% FTE time; $40,000 cost to build the data collection website; $179,000 contractor cost for data validation.

Partnerships: Non-Federal Partners included the National Association for Chronic Disease Directors.

Advancement of Agency Mission: Hypertension is a leading risk factor for heart disease and stroke, the first and fifth leading causes of death in the U.S., respectively. Prevention of heart disease and stroke is a major focus for CDC's National Center for Chronic Disease Prevention and Health Promotion. The CDC and the Centers for Medicare and Medicaid co-lead the the Million Hearts® initiative, with a mission to prevent a million heart attacks, strokes, and related conditions by 2022.

Solution Types: Ideas

Plan for Upcoming 2 FYs: Challenges are planned to launch in February of 2019-2022.

A.5.4 The Healthy Behavior Data Challenge[44]

Lead Sponsoring Agency: CDC

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

Competition Goals: The Healthy Behavior Data Challenge responds to the call for new ways to address the challenges and limitations of self-reported health surveillance information and tap into the potential of innovative data sources and alternative methodologies for public health surveillance. The Division of Population Health at the CDC wanted to explore new, innovative alternative approaches to gather key health-related information, data that are critical for effective and efficient public health program and policy planning and implementation. The Healthy Behavior Data Challenge supported the development and implementation of prototypes to use these novel methodologies and data sources (e.g., wearable devices, mobile applications, and/or social media) to enhance traditional chronic disease surveillance systems in the areas of nutrition, physical activity, sedentary behaviors, and sleep among the adult population aged 18 years and older.

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

Justification for Using Prizes and Challenges: The Behavioral Risk Factor Surveillance System (BRFSS) is the Nation's premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. Continued data collection methodological research is needed. In recent years, the reduced BRFSS funding did not allow for funding of innovative research in data collection methodology. Challenges and competitions enabled the Federal Government to tap into the expertise and creativity of the public in new ways. Challenges and competitions are high-risk, high-reward policy tools that can foster collaboration and participation in government activities through the process of co-creation. As an inducement of participation, challenges and competitions may offer a variety of prizes including

[44] The website for the The Healthy Behavior Data Challenge can be viewed at https://www.Challenge.gov/challenge/the-healthy-behavior-data-challenge/.

cash, recognition, or the deployment of a winning solution. Federal agencies have explicit statutory authority to conduct Challenges and award prizes through the America COMPETES Act.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000 and the total amount awarded was $85,000. The Population Health Surveillance Branch (PHSB) awarded $5000 to each of the five Phase I winners. The Phase II winners were award $40,000 and $20,000 for first and second place, respectively. All prizes were awarded in FY18.

Solicitation of Submissions: The Healthy Behavior Data Challenge was a main stage announcement at the 2017 Health Datapalooza on April 29, 2017. The Challenge was posted on Challenge.gov, Twitter, CDC Govdelivery for those interested in BRFSS, and on the CDC Website.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Other - Announcement of the Challenge at the 2017 Health Datapalooza

Participation Requirements: N/A

Evaluation of Submissions: A committee of FTEs consisting of 13 staff members read and rated the submissions for Phase I. Each committee member provided an independent rating. The committee then met to achieve consensus on the winners of Phase I. A total of 6 FTEs reviewed the more limited submissions for Phase II. Each member provided independent reviews of each of the submissions and committee meetings were held to reach consensus.

Results: Phase I (prototype development) received nine submissions between April 29 and July 31, 2017 and awarded $5,000 each to five challenge winners. Phase II (prototype implementation) received four submissions between October 26, 2017 and January 31, 2018, and awarded $40,000 and $20,000 to the first and second place winners, respectively.

Budget and Resources: The Innovation Fund (IFund) supported the prize money costs associated with the Challenge. PHSB was awarded $100,000 through the IFund to research an innovative data collection methodology using wearable devices. PHSB awarded $5,000 to each of the five Phase I winners. The Phase II winners were award $40,000 for 1st place and $20,000 for 2nd place. There were 3 FTEs that participated in the meetings to design the implementation of the Challenge. There were 13 FTEs that reviewed and scored the Phase I submissions. There were 6 FTEs that reviewed and scored the Phase II finalist. FTEs were able to complete these tasks without additional budget.

Partnerships: PHSB partnered with HHS, the Public Health Agency of Canada, Canadian Institutes for Health Research, and MaRS Discovery District.

Advancement of Agency Mission: Public health information is essential to plan, fund and evaluate health program outcomes, and to understand population health status, use of preventive measures and risk behaviors. Population health surveillance has tracked self-reported health behaviors using a variety of data collection modes in the past. These include personal interviews, telephone surveys, paper and pencil questionnaires and web-based data collection. These methods are both costly and time consuming and are subject to measurement error related to recall and selective bias. Wearable devices track a number of health behaviors in a passive manner which eliminates bias. The ability to track data using wearable devices apps, and other social media has the potential to decrease costs and eliminate some bias. This project will advance understanding of whether wearable device information can be used to supplement surveillance data. This information will forward the goal of efficient data collections methods which can be used to track healthy behaviors such as adequate sleep, physical activity and nutritious food consumption.

Solution Types: Software and apps; Ideas

Plan for Upcoming 2 FYs: Development of a challenge aimed at discovering and testing novel ways to validate the fruits and vegetable questions from the BRFSS using wearable devices.

A.5.5 2016 FDA Naloxone App Competition[45]

Lead Sponsoring Agency: Food and Drug Administration (FDA)

Status: This competition was completed in FY17.

Competition Goals: The primary objectives of the prize competition were to spur innovation around the development of an app that increases the likelihood of timely naloxone administration by connecting opioid users experiencing an overdose with nearby naloxone carriers; propose innovative solutions to the opioid overdose epidemic; and to foster the development of a multi-disciplinary community engaged in addressing this public health issue.

Goal Types: Find and highlight innovative ideas; Engage new people and communities

Justification for Using Prizes and Challenges: One of the goals was to spur innovation in this area and the opportunity to launch a crowd-sourced challenge best supported this goal.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $40,000. Non-monetary incentives included the opportunity to participate in a Code-A-Thon with background presentations by experts from NIH, National Highway Traffic Safety Administration (NHTSA), the Substance Abuse and Mental Health Services Administration (SAMSHA), and FDA.

Solicitation of Submissions: We used the Challenge.gov platform to receive submissions. Participants were asked to submit a brief synopsis of their idea and a video detailing their prototype design.

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 judges were cross-agency. Prior to the in-person judging conference, all of the judges completed scoring sheets for the qualifying submissions. At the judging conference, each judge was provided the scores along with summary data on overall scoring for a submission. The judges reviewed any outliers and decided that the top six teams would move to the next phase of judging. Using a pairwise comparison for the top six submissions, the judges chose one winner.

Results: N/A

Budget and Resources: To execute this Challenge, there were 2 FTEs devoted to all aspects of designing, executing, and closing out the Challenge. This included creating the websites, managing the promotion/marketing of the competition, responding to inquiries from interested participants, organizing the Code-A-Thon, convening the judging panel and handling the budget and administrative aspects of the competition. FY17 funding was $40,000, with $20,000 from the Office of Public Health Strategy and Analysis (OPHSA) and $20,000 from the Patient Affairs and Stakeholder Engagement (PASE) staff.

[45] The website for the 2016 FDA Naloxone App Competition can be viewed at https://www.Challenge.gov/challenge/the-2016-fda-naloxone-app-competition/.

Partnerships: FDA received in-kind support from NIH, SAMSHA, and NHTSA in the form of presenters, judges, and participants at Code-A-Thon.

Advancement of Agency Mission: The 2016 FDA Naloxone App Competition aligned with agency's mission to promote the safe use of opioids.

Solution Types: Software and apps

Plan for Upcoming 2 FYs: The Commissioner recently released FDA's Strategic Policy Roadmap outlining four priority areas: (1) reduce the burden of addiction crises that are threatening American families; (2) leverage innovation and competition to improve health care, broaden access, and advance public health goals; (3) empower consumers to make better and more informed decisions about their diets and health; and expand the opportunities to use nutrition to reduce morbidity and mortality from disease; (4) strengthen FDA's scientific workforce and its tools for efficient risk management. There may be opportunities in these areas for challenge competitions.

A.5.6 Bridging the Word Gap Challenge[46]

Lead Sponsoring Agency: Health Resources and Services Administration (HRSA)

Status: This competition was completed in FY17.

Competition Goals: The word gap is the difference between the number of words children from low-income families are exposed to as compared to children from high-income families. By age three, children from low-income families are hearing 30 million fewer words than those from higher-income families. This is staggering and it can have serious consequences. It can influence how young children develop language skills and affect their future performance in school and ultimately in their careers. The main goal of the Challenge was to spur the development of a low-cost, scalable, technology-based intervention that drives parents and caregivers to talk and engage in more back-and-forth interactions with their young children. But in addition to spurring innovation in technology-based solutions, the larger goals were also to raise awareness of the word gap issue, to spur innovation in the market, and to partner with non-traditional partners to address this issue through innovative means.

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: While HRSA and others are actively investing in research to better understand the word gap issue, approaches to develop tools to encourage parents and caregivers to better interact with their children and expose them to more words are also needed. The Challenge was crafted to attract a wide range of innovators and to encourage development of low-cost, scalable technology-based interventions. These interventions would not only immediately benefit children from low-income families, but serve as tools to further research. It would also encourage more diverse approaches to increase the odds of breakthrough solutions. HRSA selected the challenge mechanism to solicit creative solutions and to attract new thinking and new combinations of talent to this issue. Additionally, as opposed to a grant or contract where an agency pays for the final product at the initial time of award, the HRSA wanted to establish the three-phase structure where applicants would learn what was working and what was not working, continuously incorporate user feedback, and refine each iteration until the best possible innovation was developed. This structure was highly effective and resulted in the development of tested, improved, human-centered final solutions. Semi-finalists, who would otherwise have been ineligible for grants or contracts, echoed this unique

[46] The website for the Bridging the Word Gap Challenge is archived at: http://wordgap.capconcorp.com/.

opportunity to participate in a Federal program. Winners represented, among others, Silicon Valley start-ups, local non-profits, and a group of former teachers turned farmers. One feedback quote we received from a semi-finalist highlights the role the challenge mechanism can play: "I wish more of the Federal Government were like this. I've submitted super long grant applications with bizarre formatting requirements. Due to their sheer length, I now disregard most such programs. In contrast, I have nothing but positive things to say about this experience. If the government really wants to attract innovation from places like Silicon Valley this is how you should do it."

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $300,000. Non-monetary incentives included expert feedback, public recognition, access to one-on-one advisors, connections to stakeholders in the field, networking opportunities, and a live broadcast Demo Day.

Solicitation of Submissions: HRSA Maternal and child Health Bureau (MCHB), as well as the contractor, Sensis, used social media, email outreach, partnerships with outside organizations, and live video streaming of the Demo Day to market the competition as well to promote the winners of each phase. The solicitation strategy reached diverse populations outside of the normal reach of government to garner Phase 1 submissions, including technology sector, start-ups, and communities of solvers. The Challenge was also promoted through existing grantee networks, which led to greater awareness of the challenge and submissions from academia. The nine challenge advisors widely promoted the Challenge through their professional networks, which include non-profit early childhood organizations, the technology field, and pediatric networks. The help of these advisors was critical to the success of outreach efforts.

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: The Challenge used the standard eligibility requirements as suggested in the HHS IDEA Lab guidance.

Evaluation of Submissions: A Federal judging panel, with input from the challenge advisors, made the judging decisions in all phases. For Phase 1, both qualitative and quantitative goals were set that allowed for a cohort of the highest-scoring submissions to be discussed and then evaluated based on these scores in addition to qualitative considerations. For Phases 2 and 3, the judging was also based on a set of previously established criteria, and the judges and advisors used both quantitative and qualitative means to determine the winners. These evaluation methods have been highly effective. More details on the evaluation criteria for each phase are available on the website, but included elements such as accessibility, measurability, sustainability, impact, implementation, and evidence-base.

Results: Of the 80 entries submitted for Phase 1 between November 9, 2015 and January 29, 2016, 10 winners were awarded $10,000 each. Of these 10 entries, five winners were awarded $25,000 each during Phase 2, which ran March 11 through August 11, 2016. One grand winner was awarded $75,000 in Phase 3 which ran September 26, 2016 through March 26, 2017.

Budget and Resources: HRSA MCHB worked with a contractor to implement the Challenge. Sensis was awarded an approximately $296,000 contract for 3 years in September 2014. In 2016, HRSA MCHB used $16,000 to fund the travel of the nine Phase 1 winners to attend and compete in the in-person Demo Day held at HHS, where the 5 winning teams were announced for Phase 2. These resources are separate and distinct from the prize purse. The Challenge utilized approximately 1.5 FTE. The source of funds is the Social Security Act, Title V, Special Projects of Regional and National Significance. Specifically, the

amount allocated is as follows: Appropriation: 75-15—0354 Allotment: HRMCHB49000 Allowance: 1650100089 Amount: $300,000 (obligated).

Partnerships: As mentioned before, nine expert advisors provided insight and guidance on all aspects of the Challenge, including design and evaluation criteria, and who also served as individual mentors to the Phase 1 winners and judges. HRSA partnered with other agencies to staff the Federal judging panel; Federal judges included staff from the Department of Education, the Office of the Assistant Secretary for Planning and Evaluation, and the Administration for Children and Families. The primary lesson learned from these partnerships is the incredible value of the perspectives of a diverse set of expert advisors whose feedback to the teams greatly improved the quality of their interventions as they developed.

Advancement of Agency Mission: The mission of HRSA is to improve health and achieve health equity through access to quality services, a skilled health workforce and innovative programs. As part of HRSA, the mission of MCHB is to improve the health of America's mothers, children, and families. The Challenge produced one grand winner and the seeding and support for five innovations that are available for widespread use through iTunes and Google Play, helping HRSA MCHB in addressing the word gap and in advancing the health and well-being of America's children.

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

Plan for Upcoming 2 FYs: N/A

A.5.7 Addressing Opioid Use Disorder in Pregnant Women and New Moms[47]

Lead Sponsoring Agency: HRSA, Maternal and Child Health Bureau (MCHB)

Status: This competition was launched in FY18.

Competition Goals: Women who are pregnant or are new mothers struggling with opioid use disorder face a variety of barriers in obtaining safe and effective care and treatment including limited access to quality care, significant stigma, interactions with the criminal justice system, and limited social supports. Women and families in rural and under-resourced communities are particularly affected. The Challenge's main goal is to improve access to quality health care, including substance use disorder and treatment, recovery, and support services for pregnant women with opioid use disorders, their infants, and families, especially those in rural and geographically isolated areas. The Challenge will solicit innovative technology solutions aimed at reducing the barriers to care experienced by pregnant women and new moms with opioid use disorder.

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: This Challenge will support the development and testing of low-cost, scalable tech innovations to improve access to quality health care for pregnant women and new moms with opioid use disorder. The goal is to reach a diverse audience of solvers, and those who are not traditional HRSA stakeholders or grantees. Additionally, HRSA hopes to accelerate the

[47] The website for the Addressing Opioid Use Disorder in Pregnant Women and New Moms can be viewed at https://mchbgrandchallenges.hrsa.gov/challenges/addressing-opioid-use-disorder- pregnant-women-and-new-moms.

proliferation of technology-based solutions in a more accelerated timeline than a contract or grant would allow.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $375,000, which will be awarded in three phases. Phase 1 will include seven to ten winners each of whom will be awarded up to $10,000 for design. Phase 2 will include three to five winners each of whom will be awarded up to $25,000 for development and small-scale testing. The grand winner will be awarded up to $150,000 in Phase 3. The source of funds is the Social Security Act, Title V, Special Projects of Regional and National Significance. Specifically, the amount allocated is as follows: Appropriation: 75-17-0354 Allotment: HRMCHB49000 Allowance: 1650100089 Amount: $375,000 (obligated). Non-monetary incentives included expert feedback, public recognition, access to one-on-one advisors, connections to stakeholders in the field, and networking opportunities.

Solicitation of Submissions: HRSA MCHB and the support contractor, Capital Consulting Corp, have used social media, email outreach, and partnerships with outside organizations to market the competition. MCHB also widely promoted the Challenge through existing grantee networks, with a goal of greater awareness of the challenge and submissions from academia. Ten challenge advisors widely promoted the Challenge through their professional networks, which include health systems, non-profit early childhood organizations, the technology field, and maternal and child health networks.

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: Eligibility requirements are the standard requirements for HHS challenges.

Evaluation of Submissions: A Federal judging panel, with input from the challenge advisors will make the judging decisions in all phases. For each phase, the evaluation criteria will be adjusted, however the core subjects of accessibility, sustainability, impact, and innovation will be guides for the judging of submissions. Review criteria for all three Phases can be found at: https://mchbgrandchallenges.hrsa.gov/challenges/addressing-opioid-use-disorder-pregnant-women-and-new- moms/review-criteria.

Results: Phase 1 submissions were collected September 19 through November 19, 2018, and the Challenge is ongoing.

Budget and Resources: HRSA MCHB worked with a contractor to implement the Challenge. Capital Consulting Corp was awarded a $1,9013,755.34 contract for 3 years in September 2017. The contract funding supports managing all four challenges, as well as the prize money for all three phases. Additionally, approximately 2.5 FTEs have been involved in managing the project.

Partnerships: MCHB partnered with the National Institutes of Health (NIH) and the Centers for Medicare and Medicaid Services (CMS) to develop the Federal judging panel. The expert panel incorporated experts in the field of maternal and child health, including policy makers, providers, consumer of services and Federal representatives. These individuals provided insight on all aspects of the design and evaluation criteria and will serve as advisors to the Phase 2 challenge winners. Their involvement is invaluable to the success of this initiative. The primary lesson learned from our partnerships is the incredible value of a diverse set of expert advisors. They provide unique insights into multiple aspects of the process and their feedback to the teams will greatly improve the quality of their interventions as they proceed through each stage of the Challenge. The partnerships have assisted in the promotion of the Challenge in all phases, particularly in the initial phase in attracting high-quality applicants.

Advancement of Agency Mission: Spurring the use of technology to address barriers to treatment and care will help advance HRSA and MCHB missions to improve the health of women and children, as well

as achieve health equity through access to quality services. Along with the general population, there has been a rapid rise in opioid use among pregnant women in recent years resulting in a surge of infants born with Neonatal Abstinence Syndrome (NAS), increasing nearly fivefold nationally between 2000 to 2012. This increase has led to rising costs of care and gaps in services for this population. Medicaid payments to hospitals for NAS treatment services have increased from about $564 million to $1.2 billion nationwide, with more than 80 percent of NAS cases paid for by Medicaid. Despite this rising need, availability of services for pregnant and postpartum women is limited. Family-centered approaches to recovery address many of the barriers to care that women and families face, and research shows that women are more likely to seek and stay in treatment longer if they are able to maintain their caregiving role while in treatment, as well as either stay within the same treatment services or retain relationships with treatment providers throughout the provision of services. Technological innovations are poised to address these gaps and improve treatment and recovery services for pregnant women and new moms suffering from opioid use disorder.

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

Plan for Upcoming 2 FYs: Ten Phase 1 winners were chosen in Winter 2019, one winner dropped out. The Challenge is currently in Phase 2 with Demo Days scheduled for Fall 2019. Three to five Phase 2 winners will be announced on September 13, 2019 and will proceed to Phase 3.

A.5.8 Care Coordination for Children with Special Health Care Needs (CSHCN)[48]

Lead Sponsoring Agency: HRSA, MCHB

Status: This competition was launched in FY18.

Competition Goals: This Challenge will support the development and testing of low-cost, scalable, technology-based innovations to meet the needs of children with special health care needs (CSHCN) and their families. Innovations should improve the quality of care, enhance family engagement, and positively impact health care outcomes with the potential of saving costs to families, society, and to the health care system. An additional goal is to create partnerships between HRSA/MCHB and non-traditional partners to address issues through innovative technology solutions.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Develop technology; Engage new people and communities; Stimulate a market; Other - Improve health care delivery and experiences of health care

Justification for Using Prizes and Challenges: HRSA/MCHB sees the use of Federal prize challenges as a way to reach non-traditional partners—academics, entrepreneurs, private sector start-ups, research and development accelerators, non-profit organizations, the technology sector—to encourage new and different innovative approaches to address the need for cross-system information management for CSHCN in a way that our traditional grant programs would be unable to do. Given the complexity of the problem, solutions must come from multiple sources, involve multiple levels and sectors, and take into account the synergy of multiple strategies.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $375,000, which will be awarded in three phases. Phase 1 will include seven to ten winners each of whom will be awarded up to $10,000 for the Design. Phase 2 will include three to five winners each of whom will be awarded up to

[48] The website for the Care Coordination for Children with Special Health Care Needs (Cshcn) can be viewed at https://mchbgrandchallenges.hrsa.gov/challenges/care-coordination-cshcn/.

$25,000 for the Development and Small-Scale Testing. The final winner will be awarded up to $150,000 in Phase 3. The Challenge utilized approximately 0.5 FTE. The source of funds is the Social Security Act, Title V, Special Projects of Regional and National Significance. Specifically, the amount allocated is as follows: Appropriation: 75-17-0354 Allotment: HRMCHB49000 Allowance: 1650100089 Amount: $375,000 (obligated). Non-monetary incentives included expert feedback, public recognition, access to one-on-one advisors, connection to stakeholders in the field, and networking opportunities.

Solicitation of Submissions: HRSA/MCHB and Capital Consulting Corp have used social media, email outreach, and partnerships with outside organizations to market the competition. MCHB also widely promoted the Challenge through existing grantee networks and children with special health care needs stakeholder groups. The challenge advisors promoted the Challenge through their professional networks, which include health professional organizations, academia, family support and advocacy organizations, technology and health informatics fields, and maternal and child health networks.

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: Eligibility requirements are the standard requirements for HHS challenges.

Evaluation of Submissions: A Federal judging panel, with input from the Challenge advisors will make the judging decisions across all phases. Review criteria for all three Phases are available at https://mchbgrandchallenges.hrsa.gov/care-coordination- cshcn/review-criteria.

Results: Entries were submitted from August 30 through October 30, 2018, and the Challenge is ongoing.

Budget and Resources: HRSA MCHB has worked with a contractor to implement the Challenge. Capital Consulting Corp was awarded a $1,913,755.34 contract for 3 years in September 2017. The contract funding supports managing all four challenges, as well as the prize money for all three phases. Additionally, multiple Federal staff members have been involved in managing the project.

Partnerships: MCHB partnered with other agencies to develop the Federal judging panel; Federal judges include staff from the ONC and the AHRQ. Partnerships with the expert panel and Federal judges have been invaluable. The expert advisors and Federal judges actively participated in the challenge development process. These individuals provided guidance in all aspects of the Challenge design, including the development of submission and review criteria. Their feedback and identification of resources greatly improved the quality of the Challenge solicitation. The partnerships have ensured vital stakeholders' views and needs are incorporated into the challenges, and wide promotion of the Challenge in stakeholder communities. Challenge advisors have donated time throughout the duration of the Challenge in-kind.

Advancement of Agency Mission: This Challenge addresses HRSA's mission which is to improve health and achieve health equity through access to quality services, a skilled health workforce and innovative programs. As part of HRSA, MCHB is committed to ensuring children with special health care needs, who account for approximately 19% of U.S. children, receive family-centered, community-based, coordinated care. This Challenge will address care coordination for CSHCN, particularly those with medical complexity, who often require complex and long-term health services, consume a disproportionate share of children's health care dollars, and experience disparities in accessing care. Effective care coordination and communication with the efficient flow of information across providers and settings have been demonstrated to improve the quality and experiences of care. However, for CSHCN, communication across systems of care is often fragmented and uncoordinated. HIT tools and low cost digital interfaces that enable consolidation and sharing of health information for use by families will contribute to care coordination across settings and providers for optimizing quality of care and experiences of these children and their families

Solution Types: Software and apps; Technology demonstration and hardware; Analytics, visualizations, algorithms

Plan for Upcoming 2 FYs: Phase 1 winners were chosen in Winter 2019. The Challenge is currently in Phase 2 with Demo Days scheduled for Fall 2019. Three to five Phase 2 winners will be announced on September 13, 2019 and will proceed to Phase 3.

A.5.9 Remote Pregnancy Monitoring[49]

Lead Sponsoring Agency: HRSA, MCHB

Status: This competition was launched in FY18.

Competition Goals: Many women who are low-income in both rural and urban communities face barriers in accessing prenatal care, many of which continue into the postpartum period (i.e., up to 3 months post-birth). Personal barriers (e.g., work, childcare, transportation, education, culture, and language), health system barriers (e.g., hours of operation, and lack of services), and environmental barriers (e.g., location, and connectivity or cell phone coverage) make it difficult to attend prenatal and postpartum care appointments. The current paradigm for prenatal care includes 15 face-to-face visits with providers. The content of those visits includes critical medical services, risk assessments, patient education, and building of trusting patient-provider relationships. The main goal of this Challenge is to solicit innovative solutions that increase remote and virtual access to quality care for low-income pregnant women. Such innovations may include alleviating barriers to quality care and improving communications among patients, providers and/or broader support networks. Solutions will empower pregnant women with knowledge and tools to take charge of their health and their care.

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: This Challenge will support the development and testing of low-cost, scalable tech innovations to improve the ability of prenatal care providers to monitor the health and wellbeing of pregnant women, while helping pregnant women to monitor their own health and make informed decisions about care. The goal is to reach a diverse audience of solvers, and those who are not traditional HRSA stakeholders or grantees. Additionally, HRSA hopes to accelerate the proliferation of technology-based solutions in a more accelerated timeline than a contract or grant would allow.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $375,000 and has not yet been awarded. Phase 1 will include seven to ten winners, each of whom will be awarded up to $10,000 for design. Phase 2 will include three to five winners, each of whom will be awarded up to $25,000 for the development and small-scale testing. Phase 3 will award the final winner up to $150,000. The source of funds is the Social Security Act, Title V, Special Projects of Regional and National Significance. Specifically, the amount allocated is as follows: Appropriation: 75-17-0354 Allotment: HRMCHB49000 Allowance: 1650100089 Amount: $375,000 (obligated). Non-monetary incentives included expert feedback, public recognition, access to one-on-one advisors, connections to stakeholders in the field, and networking opportunities.

Solicitation of Submissions: HRSA MCHB and Capital Consulting Corp, have used social media, email outreach, and partnerships with outside organizations to market the competition. We also widely

[49] The website for the Remote Pregnancy Monitoring can be viewed at https://mchbgrandchallenges.hrsa.gov/challenges/remote-pregnancy-monitoring.

promoted the Challenge through existing grantee networks, with a goal of greater awareness of the challenge and submissions from academia. The ten challenge advisors widely promoted the challenge through their professional networks, which include non-profit early childhood organizations, the technology field, and maternal and child health networks.

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: Eligibility requirements are the standard requirements for HHS challenges.

Evaluation of Submissions: A Federal judging panel, with input from the challenge advisors will make the judging decisions across all phases. For each phase, the evaluation criteria will be adjusted, however the core subjects of accessibility, sustainability, impact, and innovation will be guides for the judging of submissions. Review criteria for all three phases are available at https://mchbgrandchallenges.hrsa.gov/challenges/remote-pregnancy-monitoring/review-criteria.

Results: Entries were submitted between September and November 2018, and the Challenge is ongoing.

Budget and Resources: HRSA MCHB has worked with a contractor to implement the Challenge. Capital Consulting Corp was awarded a $1,913,755.34 contract for 3 years in September 2017. The contract funding supports managing all four challenges, as well as the prize money for all three phases. Additionally, multiple Federal staff members have been involved in managing the project. Approximately 2.5 FTEs were utilized in FY18.

Partnerships: HRSA partnered with other agencies to develop the Federal judging panel, which includes staff from NIH and CMS. The expert panel incorporated experts in the field of maternal and child health, including policy makers, providers, consumer of services and Federal representatives. These individuals provided insight on all aspects of the design and evaluation criteria and will serve as advisors to the Phase 2 challenge winners. Their involvement is invaluable to the success of this initiative. The primary lesson learned from these partnerships is the incredible value of a diverse set of expert advisors. They provide unique insights into multiple aspects of the process and their feedback to the teams will greatly improve the quality of their interventions as they proceed through each stage of the Challenge. The partnerships have assisted in the promotion of the Challenge in all phases, particularly in the initial phase in attracting high-quality applicants. Challenge advisors have donated time throughout the duration of the Challenge in-kind.

Advancement of Agency Mission: The mission of HRSA is to improve health and achieve health equity through access to quality services, a skilled health workforce and innovative programs. As part of HRSA, the mission of MCHB is to improve the health of America's mothers, children and families. Recent trends in hospital closures in rural America increase the need for technological innovations that support remote monitoring of pregnant women. Between 2004 and 2014, 179 rural counties (9% of all rural counties) lost access to in-county hospital obstetric services, and the percent of all rural counties in the U.S. that lacked hospital obstetric services increased from 45% to 54%, due to hospital and obstetric-unit closures. Many low-income women, in both rural and urban communities, do not access prenatal care. Technological advances have improved the ability of healthcare providers to monitor their patients from afar. Spurring the use of technology to address barriers to prenatal care will help advance HRSA and MCHB missions to improve the health of women and children, as well as achieve health equity through access to quality services.

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

Plan for Upcoming 2 FYs: Ten Phase 1 winners were chosen in Winter 2019, one winner dropped out. The challenge is currently in Phase 2 with Demo Days scheduled for Fall 2019. Three to five Phase 2 winners will be announced on September 13, 2019 and will proceed to Phase 3.

A.5.10 Using Technology to Prevent Childhood Obesity in Low-Income Families and Communities[50]

Lead Sponsoring Agency: HRSA, MCHB

Status: This competition was launched in FY18.

Competition Goals: The goal of this Challenge is to support the creation of multiple innovations to promote healthy weight for low-income children and families. The innovations will be community-driven, empowering to families, and technology-based. Potential areas of focus include (1) promoting access to healthy, affordable food, particularly for families and individuals who are food insecure or are living in food deserts; (2) supporting community-owned solutions that increase families' knowledge and skills related to healthy eating and nutrition; (3) finding innovative ways that increase physical activity, while accounting for social, cultural, and environmental barriers in low-income communities; and (4) empowering families to achieve healthy eating practices, healthy lifestyles (including reduced screen time, reduced sedentary behaviors, and good sleep hygiene), and sustainable changes in the home environment, while accounting for limited access to healthy foods and other barriers in low-income communities.

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; Stimulate a market; Other - Improve health care delivery and experiences of health care

Justification for Using Prizes and Challenges: Innovative solutions and partnerships are necessary to tackle the many factors affecting childhood obesity in low-income families and communities. A challenge will maximize competition and spur innovation for and within communities in a cost-effective and accelerated timeframe. It will reach a broader stakeholder group and allow engagement of non-traditional partners who can bring new thinking to address this issue. Some examples include entrepreneurs, private sector start-ups, research and development accelerators, non-profit organizations, and the technology sector. A challenge will also provide support for the development of novel and innovative community-owned ideas through a pay-for-results mechanism, ultimately leading to the development of multiple scalable interventions. Childhood obesity is a complex and multi-faceted public health issue and solutions must come from multiple sources, involve multiple levels and sectors, and take into account the synergy of multiple strategies. By using a challenge mechanism, everyone can be a part of the solution and everyone has the potential to be a game changer.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $375,000 and has not yet been awarded. Phase 1 will include seven to ten winners each of whom will be awarded up to $10,000 for design. Phase 2 will include three to five winners each of whom will be awarded up to $25,000 for development and small-scale testing. Phase 3 will award the final winner up to $150,000. The source of funds is the Social Security Act, Title V, Special Projects of Regional and National Significance. Specifically, the amount allocated is as follows: Appropriation: 75-17-0354, Allotment: HRMCHB49000, Allowance: 1650100089, Amount: $375,000 (obligated). Non-monetary incentives

[50] The website for the using Technology to Prevent Childhood Obesity in Low-Income Families And Communities can be viewed at https://mchbgrandchallenges.hrsa.gov/challenges/preventing-childhood obesity.

included expert feedback, public recognition, access to one-on-one mentoring with Expert Advisors, connection to stakeholders in the field, and networking opportunities.

Solicitation of Submissions: HRSA MCHB and Capital Consulting Corp have used social media, email outreach, and partnerships with outside organizations to market the competition. We also widely promoted the Challenge through existing grantee networks and healthy weight stakeholder groups. The challenge advisors promoted the Challenge through their professional networks, which include health professional organizations, academia, non-profit organizations, technology and health informatics fields, and maternal and child health networks. The project lead also briefed policy makers and promoted the Challenge at the Back-to-School Congressional Workshop—Examining Solutions to Address Childhood Obesity: Policymaker and Community Perspectives. Coordinated by the Campaign to End Obesity, the workshop briefing convened thought leaders from Capitol Hill and the community to examine evidence-based solutions to address childhood obesity.

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 - Congressional Workshop; Other - presentations to stakeholders

Participation Requirements: Eligibility requirements are the standard requirements for HHS challenges.

Evaluation of Submissions: A Federal judging panel, with input from the challenge expert advisors will make all final decisions regarding winners across all Phases. Review criteria can be found at: https://mchbgrandchallenges.hrsa.gov/challenges/preventing-childhood-obesity/review-criteria.

Results: Entries were submitted between July 24 and September 18, 2018, and the Challenge is ongoing.

Budget and Resources: HRSA MCHB has worked with a contractor to implement the Challenge. Capital Consulting Corp was awarded a $1,913,755.13 contract for 3 years in September 2017. The contract funding supports managing all four challenges, as well as the prize money for all three phases. Multiple Federal staff members have been involved in managing the project. The Challenge utilized 0.5 FTE in FY18.

Partnerships: HRSA partnered with the Centers for Disease Control and Prevention/Division of Nutrition, Physical Activity, and Obesity and the National Heart, Lung, and Blood Institute to staff the Federal judging panel. HRSA partnered with non-Federal partners including Robert Wood Johnson Foundation, The Nemours Foundation, Alfred I. Dupont Hospital for Children, Northeastern University, Louisiana Department of Health, University of Minnesota School of Public Health, and Northwestern University Feinberg School of Medicine to staff the Expert Advisory Panel. Partnerships with the expert advisors and Federal judges have been invaluable. The experts and Federal judges actively participated in the challenge development process. These individuals provided guidance in all aspects of the challenge design, including the development of submission and review criteria. Their feedback and identification of resources greatly improved the quality of the challenge solicitation. The partnerships have ensured vital stakeholders' views and needs are incorporated into the challenges and wide promotion of the Challenge in stakeholder communities. Expert advisors will also provide mentoring to semi-finalist winners, providing a non-financial incentive for potential solvers. Challenge expert advisors have donated time throughout the duration of the Challenge in kind.

Advancement of Agency Mission: HRSA's mission is to improve health and achieve health equity through access to quality services, a skilled health workforce, and innovative programs. As part of HRSA, MCHB's mission is to improve the health of America's mothers, children, and families. Childhood obesity is a growing epidemic in the United States with low-income families and communities disproportionately affected. Individuals in low income communities are at increased risk for both food insecurity and obesity: they do not have sufficient opportunities to buy healthy, affordable food and this inequitable

access to healthy food is a major contributor to health disparities. Potential solutions from this Challenge will target both access to healthy foods as well as innovations around healthy weight behaviors, with the goal to empower families in low-income communities to achieve healthy weight behaviors and make sustainable changes in the home environment. This Challenge will address childhood obesity prevention, particularly those in low-income communities, and supports several of HRSA's goals: build healthy communities (goal 3), improve health equity (goal 4), and improve access to quality care and services (goal 1).

Solution Types: Software and apps; Creative (design & multimedia); Ideas; Technology demonstration and hardware; Analytics, visualizations, algorithms; Other - A new or enhanced service; Other - a new channel; Other - a new platform or network; Other - a new system design

Plan for Upcoming 2 FYs: Phase 1 winners will be selected in Fall 2018. Phase 2 winners will be selected in Spring 2019. The Phase 3 winner will be selected in Fall 2019.

A.5.11 Rare Diseases are not Rare! Challenge[51]

Lead Sponsoring Agency: National Institutes of Health (NIH), National Center for Advancing Translational Sciences (NCATS)

Status: This competition was launched in FY18.

Competition Goals: NCATS is seeking innovative ways to communicate with and educate people about rare diseases through social media or art. The goal of this Challenge, which is being led by NCATS' Office of Rare Diseases Research, is threefold: (1) raise awareness for all rare diseases in a collective manner, (2) bring attention to the many people with rare diseases, and (3) highlight the need for research and the development of new treatments.

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

Justification for Using Prizes and Challenges: Challenge and prize competitions are an important, cost-effective tool in Federal agencies' innovation toolboxes. They identify and reward creative solutions to an array of problems by utilizing the talents of citizen solvers and crowdsourcing. These competitions use cash prizes and non-cash incentives to advance the mission, reaching beyond the usual suspects to inspire inventive approaches to issues, effective public engagement, and new ideas and technologies. Prizes offer the option of involving the public in judging, a feature that is especially important for competitions such as this.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $5,000 to be shared among three awardees. Additionally, the winners and ten honorable mentions will be posted on the NCATS website.

Solicitation of Submissions: NCATS uses the following vehicle to publicize the opportunity to increase the number and quality of submissions: (1) publish a notice in the NIH Guide to Grants and Contracts to announce the competition, (2) post the notice on the government-wide Challenge.gov site, (3) post the Challenge on the NCATS challenges website, (4) link to the Challenge page from the NCATS funding opportunities page, (5) announce the Challenge at professional meetings, (6) advertise via social media (Twitter, e-newsletters, etc.), and (7) announce the Challenge at NCATS Day.

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[51] The website for the Rare Diseases are not Rare! Challenge is accessible at https://challenge.gov/a/buzz/challenge/69/ideas/top.

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

Participation Requirements: N/A

Evaluation of Submissions: The evaluation will be conducted by a panel of Federal and non-Federal judges with expertise directly relevant to this Challenge. Entries will receive up to five points for each of the following criteria: (1) how creative and original is the entry?, (2) to what extent does the entry address rare diseases collectively?, and (3) how likely is it that the entry could be an effective communication vehicle? Will it appeal to a broad audience? Is it easy to disseminate?

Results: Entries were submitted between September 30 and October 31, 2018.

Budget and Resources: The Challenge utilized approximately 2.5 days of one FTE in FY18.

Partnerships: N/A

Advancement of Agency Mission: The general purpose of NCATS is to transform the translational process so that new treatments and cures for diseases can be delivered to patients faster by understanding the translational process to create a basis for more science-driven, predictive and effective intervention development for the prevention and treatment of all diseases. This Challenge will lead to innovative ways to communicate with others and to educate people about rare diseases through social media and/or art.

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

Plan for Upcoming 2 FYs: N/A

A.5.12 NEI 3-D Retina Organoid Challenge (3-D ROC)[52]

Lead Sponsoring Agency: NIH, National Eye Institute (NEI)

Status: This competition was completed in FY17.

Competition Goals: The goal of this Challenge was to develop innovative ideas to create human three-dimensional (3D) retinal tissues that can faithfully model ocular disease or develop drugs. The current animal models and cell lines used to screen drugs and model disease are of limited utility. Using advanced tissue engineering techniques in 3D bioprinting and microfluidics, these improved human retina models will allow new insights into the biology and pathology of various vision impairments and diseases. NEI expected the Challenge to nucleate multidisciplinary teams of bioengineers, materials scientists, chemists, and vision scientists and help breakdown silos in various sub-specialties and help transform the way vision research is conducted.

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

Justification for Using Prizes and Challenges: House Appropriations FY 2016 Report language directed NEI "to create a challenge program to advance the speed of basic research to cure retina disease." Developing retinal organoids is an unmet research need that will speed basic and therapeutic research. The challenge vehicle would spur interest from researchers from outside the vision field especially from bioengineers, material scientists, stem cell biologists, and developmental biologists. It would also

[52] The website for the NEI 3-D Retina Organoid Challenge (3-D ROC) can be viewed at https://nei.nih.gov/content/3-d-roc-challenge-details.

encourage partnerships with industry in order to allow the commercialization of new 3D culture platforms that could promote the discovery of treatments to a variety of retinal diseases.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000 and the total amount awarded was $90,000. The Challenge also offered the opportunity to be featured on the NEI website.

Solicitation of Submissions: NEI solicited submissions by attending several conferences including the annual meetings of the Tissue Engineering and Regenerative Medicine International Society, the Society of Developmental Biology, the Association for Research in Vision and Ophthalmology (ARVO), and a Cold Spring Harbor Laboratory course "Vision: A Platform for Linking Circuits, Behavior & Perception." After the Challenge launched, NEI ran an online advertising campaign which targeted articles from journals across the Nature Publishing Group platform and placed an announcement of the Challenge in an e-alert for Nature Cell Biology subscribers. NEI also had an active social media awareness campaign through the NEI Twitter account.

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 - Online advertising with the journal Nature

Participation Requirements: Although all researchers were eligible, NEI tried to attract bioengineers and other neuroscientists outside of the vision field. Participants were encouraged to form multidisciplinary teams via an online forum where they could have a profile and post their interests and expertise. Most teams that participated included at least one vision researcher.

Evaluation of Submissions: NEI used a technical review panel to help review the submissions and provide the expertise about the methods and technology proposed in the submissions. They provided comments on the submissions to the Federal judges who were drawn from a variety of institutes and other agencies, which included the National Science Foundation and the Department of Defense.

Results: Of the 13 entries submitted by 50 participants between June 1 and August 1, 2017, one prize was awarded to one winner.

Budget and Resources: A full time employee was recruited to manage the Challenge competition. A working group of about 6 NEI staff convened about twice a month to help with the activities of the Challenge such as developing advertising materials, coordinating outreach activities, and organizing review meetings. The initial amount obligated in FY17 was $100,000, which included $10,000 for a trainee category. The Challenge utilized 2 FTEs and funded $5162.52 for online and print advertising in FY17.

Partnerships: NEI partnered with ARVO for outreach purposes, as the majority of vision researchers are ARVO members. NEI sent information about the Challenge to ARVO members and gave a presentation at the ARVO annual meeting (estimated value: $1000).

Advancement of Agency Mission: NEI was established to protect and preserve the vision of the American people. As an institute under NIH, NEI conducts and supports research that helps prevent and treat eye diseases and other disorders of vision. This Challenge served to develop methodology and technology to advance the speed of basic research to treat retina disease.

Solution Types: Ideas; Scientific

Plan for Upcoming 2 FYs: From the submissions received through this initial ideation Challenge, the development of more robust retina organoids was deemed feasible to accomplish within two to three

years. This prompted the development of a follow-up challenge in FY18 that will go until March 2020 to spur the creation of retinal organoids that could better model disease and test drugs.

A.5.13 NEI 3-D Retina Organoid Challenge (3-D ROC) 2020[53]

Lead Sponsoring Agency: NIH, NEI

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

Competition Goals: The goal of the 3D Retinal Organoid Challenge 2020 is to stimulate research into making more robust and reproducible retinal organoids to better model retinal disease or to test drugs. NEI hopes to draw attention to this goal and to recruit researchers from outside the vision field. NEI encouraged support from companies to help the participants accomplish their research without Federal funding.

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: House Appropriations FY 2016 Report language directed NEI "to create a challenge program to advance the speed of basic research to cure retina disease." Developing retinal organoids is an unmet research need that will speed basic and therapeutic research. The challenge vehicle would spur interest from researchers from outside the vision field especially from bioengineers, material scientists, stem cell biologists, and developmental biologists. The Challenge would also encourage partnerships with industry in order to allow the commercialization of new 3D culture platforms that could promote the discovery of treatments to a variety of retinal diseases.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $1,000,000. In the first round, up to six awards of up to $100,000 were to be granted in Fall 2018. The final round of prizes will be awarded in Spring 2020 and will include up to three awards totaling $400,000 and may include any additional money not awarded from the first round. Non-monetary incentives included opportunities to work with companies and receive discounts on reagents, services, and equipment. Inventors also retain intellectual property on final products, which may have significant commercial and research value.

Solicitation of Submissions: NEI solicited submissions by attending or sending flyers or slides to numerous conferences and meetings. NEI also sent emails to various listservs, posted on social media and notified other relevant NIH grantees through program officers at other institutes.

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: Although all researchers were eligible, NEI tried to attract bioengineers and other neuroscientists outside of the vision field. Participants were encouraged to form multidisciplinary teams via an online forum where they could have a profile and post their interests and expertise.

Evaluation of Submissions: NEI will use a technical review panel to help review the submissions and provide the expertise about the methods and technology proposed in the submissions. They will provide comments on the submissions to the Federal judges who will be drawn from a variety of institutes and other agencies involved in tissue engineering.

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[53] The website for the NEI 3-D Retina Organoid Challenge (3-D ROC) 2020 can be viewed at https://nei.nih.gov/content/2018-reduction-practice-challenge.

Results: First round entries were submitted between September 4 and October 1, 2018. Final submissions will be submitted between February 14 and March 2, 2020.

Budget and Resources: A full time employee managed the Challenge competition. A working group of about 6 NEI staff convened about once a month to help with the activities of the Challenge such as developing advertising materials, coordinating outreach activities, and organizing review meetings. The amount obligated in FY18 was $1,000,000. The Challenge utilized 2 FTEs in FY18.

Partnerships: NEI has developed informal partnerships with corporate sponsors who have pledged to offer discounts or in-kind contributions to challenge participants in terms of products, services, or consulting. Two companies have signed Memoranda of Understanding to pledge support that would be in excess of $50,000 to participants. In-kind services or resources have not yet been utilized by participants. Non-Federal partners did not give directly to prize funding.

Advancement of Agency Mission: NEI was established to protect and preserve the vision of the American people. As an institute under NIH, NEI conducts and supports research that helps prevent and treat eye diseases and other disorders of vision. This challenge program serves to catalyze technological and methodological advances that will improve our understanding of retinal disease and enable the development of treatments.

Solution Types: Scientific

Plan for Upcoming 2 FYs: No additional challenges are planned for this institute until this Challenge has completed.

A.5.14 Improving Care for People with Alzheimer's Disease and Related Dementias using Technology (iCare-AD/ADRD) Challenge[54]

Lead Sponsoring Agency: NIH

Status: This competition was launched in FY18.

Competition Goals: Navigating the complex U.S. healthcare system can be challenging for persons with dementia and their caregivers. They must pursue an uncertain course of care, of unknown duration, across different care settings and interact with many different types of care providers and interventions. This Challenge is intended to stimulate innovation in the use of technology to improve care coordination, navigation, and aid with the care experience, so that overall dementia care quality is improved. This Challenge invites solutions that involve the development of an IT system-level, computer, mobile, or other form of technology-based application. The solutions may involve creation of a new technology application, or modification or novel implementation of an existing technology. The solutions may be targeted at consumers (persons with dementia or caregivers), healthcare providers, healthcare service organizations, health systems, or community, local, and State governments. Specific methods for stimulating uptake and use of the solutions must be included with the proof-of-concept demonstrations.

Goal Types: Develop technology

Justification for Using Prizes and Challenges: Traditional mechanisms, such as grants and contracts, would not produce the desired innovation at such a speed. Additionally, this Challenge encourages

[54] The website for the Improving Care for People with Alzheimer's Disease and Related Dementias using Technology (iCare-AD/ADRD) Challenge can be viewed at https://nia.nih.gov/challenge-prize.

multi-stakeholder connections and adoption of the most relevant technological innovations to close the identified gap in dementia care quality.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $400,000. Up to three winners will be awarded. The first, second, and third-place winners will receive up to $250,000, $100,000, and $50,000, respectively. Additional solvers may be recognized with non-monetary awards. Awards are not expected to be distributed until FY19. The prize funds for this Challenge were obligated in FY18 from the National Institute on Aging's (NIA) annual appropriations.

Solicitation of Submissions: NIA promoted the iCare-AD/ADRD Challenge widely, to many public sectors and via a number of vehicles, including but not limited to outreach through the Advisory Council on Alzheimer's Research, Care, and Services; NIH-wide SBIR networks, which reached over 20,000 recipients; and through Challenge.gov's government-wide listserv. NIA also used its relationships with a number of stakeholder groups to publicize the challenge. NIA will consider the prize submissions generated (e.g., number, quality, relevance) to gauge the effectiveness of these outreach methods, and the institute will use this information to inform future prize activities.

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: Examples of possible solvers include small businesses, individuals—including but not limited to people living with dementia and caregivers—midsize to large technology companies, health insurance companies, electronic health record (EHR) vendors, students working collaboratively across multiple disciplines, health systems, states, and counties implementing care coordination programs.

Evaluation of Submissions: A panel of Federal employees serving as judges will review the Challenge submissions using the following criteria: (1) creativity and innovation (20%), (2) rationale and potential impact (20%), (3) value to relevant stakeholders (20%), (4) usability (20%), and (5) functional product feasibility (20%)

Results: Entries will be submitted between September 2018 and June 2019.

Budget and Resources: In FY18, the only resource used for the iCare-AD/ADRD Challenge was FTE time, estimated at 0.048 FTE. This Challenge was launched at the end of FY18, thus most of the activities in FY18 included agency planning and promotion of the Challenge. Examples of activities include drafting challenge ideas, soliciting public input, analyzing public comments, obtaining agency clearance, and posting challenge information via the internet.

Partnerships: N/A

Advancement of Agency Mission: Per 42 U.S.C. 285e, the mission of NIA is to conduct and support biomedical, social, and behavioral research, training, health information dissemination, and other programs with respect to the aging process and the diseases and other special problems and needs of the aged. As many as 5.5 million Americans age 65 and older are estimated to be living with Alzheimer's disease, the most common form of dementia. Many more under age 65 are also affected. In addition, many thousands more have Alzheimer's disease-related dementias. Effective dementia care management has been shown to improve outcomes such as reducing behavioral and psychological symptoms of dementia and lower health care costs by reducing emergency department visits, inpatient hospitalizations, and some readmissions. Research based models of dementia care have evolved in recent years and have the potential to improve outcomes. This Challenge is intended to stimulate innovation in use of technology to improve care coordination and/or navigation so that overall dementia care quality is improved, thus advancing the NIA mission described above.

Solution Types: Software and apps

Plan for Upcoming 2 FYs: In the next two fiscal years, the field of Alzheimer's disease and related dementias will continue to present opportunities for prize competitions. NIA will gauge the benefits of utilizing this mechanism and more traditional funding sources when setting priorities and helping spur innovation in the field.

A.5.15 Open Science Prize[55]

Lead Sponsoring Agency: NIH

Status: This competition was completed in FY17.

Competition Goals: The goal of the Open Science Prize (OSP) was to stimulate the development of novel and ground-breaking tools and platforms to enable the reuse and repurposing of open digital research objects (e.g., data, publications, and other research outputs) relevant to biomedical or health applications. The prize also aimed to forge new international collaborations to bring together open science innovators from the United States and abroad to co-develop services and tools of benefit to the global research community.

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

Justification for Using Prizes and Challenges: The use of prize competitions as a funding mechanism has several advantages over traditional funding mechanisms, such as grants and contracts. Awards are only given to successful solutions, solvers can include anyone with the skills and knowledge to address the specified solution, and the time and expense to run a prize competition is typically much less than a traditional funding mechanism. For example, traditional NIH grants such as the Small Business Innovation Research and Small Business Technology Transfer or Research Project Grant (RO1) funding mechanisms tend to favor academic researchers (investigator background and research environment are two criteria in the peer-review process) and typically take a significant amount of time to produce results. The OSP was open to all interested solvers, and the entire process was completed in two years from conceptualization to awarding of the grand prize. Finally, co-funding collaborative projects with international funders using traditional government funding mechanisms can be complicated compared with prize competitions. The OSP provided an administrative mechanism through which three partnering agencies could share funding responsibilities and in-kind resources.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $710,000, including six first round prizes at $80,000 each and one grand prize of $230,000. The National Institutes of Health Big Data to Knowledge Initiative provided $355,000 and $355,000 came from its partner, the Wellcome Trust. A portion of the funds ($80,000) was contributed to the Wellcome Trust by the Howard Hughes Medical Institute (HHMI). The NIH funded the U.S. solvers only. The other partners funded the international solvers. The prize money from the NIH was awarded to the prize winners through a contract vehicle NIH established with the Capitol Consulting Corporation to oversee prize administration. Phase 1 prizes were awarded in May 2016. The NIH portion was $240,000 in FY16, awarded to U.S. the solvers by the contract vehicle. The Phase 2 grand prize was awarded in February 2017. The NIH portion was $115,000 in FY17, awarded to the U.S. solvers through the contract vehicle. All six finalists were invited to showcase their applications at a symposium held in Bethesda, MD in

[55] The website for the Open Science Prize can be viewed at https://www.opensciencеprize.org/.

December 2016. They were also invited to showcase their winning submissions on the Open Science Prize Website.

Solicitation of Submissions: The NIH utilized social media, email outreach, webinars, and press releases in its initial marketing of the prize. Solicitations occurred during FY16. During FY17, an important aspect of the outreach strategy has been showcasing results at public events that garner media attention. Also notably, in FY17, during Phase 2 of the prize competition, NIH showcased the finalists' solutions at the Big Data to Knowledge Open Data Science Symposium, a full-day event celebrating uses of open data and open science at NIH. For this event, NIH utilized live streaming and social media as way of engaging diverse audiences. NIH and Wellcome Trust also utilized this meeting to launch five weeks of public voting as a way to engage diverse audiences and expose the public to the prototypes developed by the six finalist teams. Throughout this prize competition, NIH has worked closely with partner organizations such as the Federal Community of Prizes and Challenges, and open data and open science organizations to help educate the public about the prize and the resulting solutions.

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 Prize was open to international teams, whose membership had to include at least one individual or group based in the United States, and at least one individual or group based in another country. There was no limit on the size of teams, and teams could include individuals and groups based at academic research institutions, not-for-profit bodies, and private sector organizations.

Evaluation of Submissions: Participants were given wide latitude to choose their project and build their prototype accordingly. Judging was based on the following criteria: (1) Impact: What level of impact and benefit could the proposal—if successful—deliver to the research enterprise and health/healthcare research? Does the proposal/prototype address implementation in multiple settings in a cross-national manner?, (2) Innovation: What level of creativity and technological innovation does the entrant demonstrate?, (3) Originality: Is the technology or service genuinely novel and targeting an unmet need? Has the applicant evaluated other existing or alternative approaches, or delineated their approach in comparison to existing approaches (if applicable)?, (4) Technological viability: Is the approach proposed viable? Can the proposed technology deliver?, (5) Resource feasibility: Does the team have the required skills and resources?, (6) Advancement of Open Science: To what extent does the proposal/prototype advance the goals of open science in biomedical/health research, and fulfill the goals of openness in terms of the product and way of working? To what extent would it move the field forward?

Judges from NIH and the partnering organizations scored all of the Phase 1 and Phase 2 solutions using a five-point scale, based on these factors. The most promising solutions were submitted to a panel of external advisors for additional review. After considering the panel's viewpoints, NIH, Wellcome Trust, and HHMI judges selected the top six solutions for Phases 1 and 2.

Results: Of the 96 Phase 1 submissions entries submitted by 435 solvers from 45 countries between October 20, 2015 and February 29, 2016, six prizes of $80,000 each were awarded to six teams consisting of 33 total individuals. In Phase 2 (May 9, 2016 through December 1, 2017), a single grand prize was awarded on February 29, 2017.

Budget and Resources: The NIH utilized one and a half staff persons to oversee conceptual development of the prize, develop judging materials and judging processes, and coordinate all promotional and outreach activities. The Wellcome Trust utilized roughly the same number of employees for these tasks,

focusing particularly on development of the website and on- line tools such as the public voting site. NIH utilized a contractor to assist with the logistical aspects of the prize, including meeting coordination, webinars, travel of participants to events and payment of prizes to winning teams. NIH's share of the grand prize was $115,000. In addition, NIH established a multi-year contract with Capitol Consulting Corporation, spending approximately $50,000 for prize administration in FY17.

Partnerships: This Prize was a collaboration between the Wellcome Trust and HHMI. The partners provided substantial in-kind support, expert advice, marketing, and outreach. The Wellcome Trust maintained the voting and submissions portal. The partners co-authored an article detailing their lessons learned from the OSP (see https://doi.org/10.1371/journal.pbio.2002617). The seven findings were: 1) partnerships are always more time-consuming than first imagined; 2) a two-step funding model is an effective way to encourage innovation whilst minimizing the cost; 3) public participation is a good way to increase the reach of the competition and generate interest and enthusiasm for open data; 4) proposals at differing stages of development were received; 5) setting a broad remit allowed a wide-range of ideas to be proposed, but the six finalists naturally did not fully represent the breadth of the ideas proposed; 6) the international funding partnership increased both the global reach of the competition as well as the resources available; and 7) it is recommended that funders consider ways to incentivize the sustainability of tools and technologies that leverage open biomedical data to improve biomedical research and public health.

Advancement of Agency Mission: The importance of open data and open science for NIH is reflected in its strategic plan, which states, "NIH will serve as a focal point for catalyzing this historic research opportunity, continuing to leverage its roles as an influential convener and major funding agency to encourage rapid, open sharing of data and greater harmonization of scientific efforts." Wellcome Trust has long championed open scientific research, including open access to publications and, more recently, the sharing of research data sets and computer code. Similarly, HHMI has a long-standing policy that strongly encourages their investigators to make publications publicly available and make data and other research materials available to the other scientists. The Open Science Prize is strongly aligned with NLM's recently released Strategic Plan, titled "A Platform for Biomedical Discovery and Data-Powered Health," which includes a strategic goal to "reach more people in more ways through enhanced dissemination and engagement pathways" and a distinct objective to "foster open science policies and practices."

Solution Types: Software and apps; Ideas; Technology demonstration and hardware; Analytics, visualizations, algorithms; Scientific

Plan for Upcoming 2 FYs: While NLM has no imminent plans for a follow-up prize, the agency has a strong commitment to furthering open science policies and practice. It is conceivable that NLM may wish to engage in another open innovation activity with these or other partners given the success of this effort in advancing open science.

A.5.16 Storytelling About Wellness in Tribal Communities[56]

Lead Sponsoring Agency: NIH

Status: This competition was completed in FY17.

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[56] The website for the Storytelling About Wellness in Tribal Communities can be viewed at https://www.Challenge.gov/challenge/storytelling-about-wellness-in-tribal-communities/ ; https://www.federalregister.gov/documents/2016/11/28/2016-28497/announcement- of-requirements-and-registration-for-storytelling-about-health-and-wellness-in-american.

Competition Goals: The goal of this Challenge was to develop a brief digital story (i.e., a video) that communicates how traditions and heritage promote health in American Indians and Alaska Natives (AI/AN). The videos would augment the agency's ongoing efforts to inform a strengthened research portfolio that advances AI/AN research needs. This challenge was also designed to attract more interest and attention to the research needs of these communities and communicate these needs in a culturally appropriate manner.

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

Justification for Using Prizes and Challenges: To commemorate Native American Heritage Month, NIH celebrated the use of storytelling to convey stories of health and wellness. Use of this mechanism allowed the agency to reach out to non-traditional audiences that would not necessarily be immediately eligible for a grant or contract.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $10,000. The first place winner was invited to a meeting of the NIH Tribal Advisory Committee.

Solicitation of Submissions: The Challenge was announced in the Federal Register; on Challenge.gov; on the Division of Program Coordination, Planning, and Strategic Initiatives' website; a blog post from the NIH Director; and through flyers made available at meetings and downloaded from the internet. A number of groups further disseminated the Challenge to listservs and to interested parties.

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

Participation Requirements: The NIH outlined eligibility requirements in the Federal Register and included, but not limited to U.S. citizens or businesses, an adult 18 years of age or older, not an employee of NIH, among other things. The announcement was clear that Tribal governments and employees, and community members, schools, organizations, and others were eligible to participate.

Evaluation of Submissions: NIH evaluated the submissions in accordance with judging criteria stated in the Federal Register announcement. Judges reviewed the submissions online and scored through an electronic scoring system. The approach generally worked well for the number of submissions received. This approach to judging may not necessarily be scalable to a larger number of submissions.

Results: Of the 32 entries submitted between November 28, 2016 and January 31, 2017, five prizes were awarded to five winners.

Budget and Resources: The NIH used approximately 0.1 FTE to design, announce, judge, and otherwise administer the challenge. In addition, NIH engaged a contractor to assist in developing the online scoring system. Their effort was approximately $1,000. Several NIH employees of varying grade levels were also involved in the judging panel.

Partnerships: N/A

Advancement of Agency Mission: This Challenge is consistent with the statutory authority of the Division of Program Coordination, Planning, and Strategic Initiatives, National Institutes of Health. The Division identifies research that represents important areas of emerging scientific opportunities, rising public health challenges, or knowledge gaps that deserve special emphasis and would benefit from conducting or supporting additional research that involves collaboration between two or more national research institutes or national centers, or would otherwise benefit from strategic coordination and planning. As part of this authority, the Division oversees the Tribal Health Research Office, whose function includes managing information dissemination related to tribal health research coordination. The winning videos submitted for this Challenge will help communicate about health and wellness of AI/AN communities. AI/AN communities have higher rates of diseases and disorders across several areas

of health such as: diabetes, chronic liver disease, certain cancers, mental health, and substance use. Factors known to contribute to health status and disparities are complex, and include social and historical factors, ethnicity, culture, historical trauma, socioeconomic status, gender/sex, age, geographical access to care, and levels of insurance as well as underlying biology, physiology, and genetics. The NIH hopes that this Challenge will incentivize the public to showcase the strengths and resilience of these communities, their heritage and traditions, and how their culture promotes their health and well-being.

Solution Types: Creative (design & multimedia)

Plan for Upcoming 2 FYs: NIH does not have any related plans in this area at the moment.

A.5.17 A Wearable Alcohol Biosensor: A Second Challenge[57]

Lead Sponsoring Agency: NIH, National Institute on Alcohol Abuse and Alcoholism (NIAAA)

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

Competition Goals: The goal of the Challenge was to produce a prototype of a sleek, unobtrusive smart electronic device incorporated into clothing or an accessory and capable of monitoring blood alcohol non-invasively and in real time. Highest priority was given to devices that used non-invasive technologies to measure alcohol concentration in blood or interstitial fluids, as opposed to detection of alcohol exuded through the skin in sweat or vapor. Such a device would significantly advance current alcohol monitoring capabilities. The envisioned wearable alcohol monitors would serve useful purposes in alcohol research and treatment settings, could play a role in public safety, and would be of interest in the consumer market to individuals interested in tracking personal health parameters. Designs could have emphasized any of these potential market subsets or sought to be broadly marketable.

Goal Types: Solve a specific problem; Advance scientific research; Develop technology; Stimulate a market

Justification for Using Prizes and Challenges: The prize competition provided a mechanism to enlist innovators and talented people who would not typically apply for a NIH grant and encourage them to present novel and innovative solutions to real-time alcohol measurement in humans. Enlisting individuals beyond the traditional NIAAA grantee community was especially beneficial for the biosensor challenge where engineering expertise was needed and is not typically found. The competitive nature of the Challenge broadened awareness about alcohol research needs within and beyond the alcohol research and treatment communities.

Cash Prize Purses and/or Non-Cash Prize Awards: A total of $300,000 was obligated from the unconditional gift funds for the purpose of a first ($200,000) and second prize ($100,000). After judging, NIAAA determined that only one entry met the requirements for an award. Following consultation with NIH general counsel, NIAAA confirmed its ability to award a lessor amount of $100,000 to the entrant who held the most promise for achieving the goals of the competition. The remaining $200,000 was de-obligated and returned to the unconditional gift fund.

Solicitation of Submissions: NIAAA issued a NIH press release, posted an announcement on the Challenge.gov website, published an announcement video on the NIAAA website, issued tweets from

[57] The website for the A Wearable Alcohol Biosensor: a Second Challenge can be viewed at https://www.Challenge.gov/challenge/wearable-alcohol-biosensor/.

the NIAAA twitter account, and notified contacts in media outlets from the first competition, academic institutions and engineering circles. Two NIAAA staff members attended conferences to publicize the availability of the Challenge and assess other potential technologies that might be useful in meeting the alcohol measurement goals. One member spoke at the Consumer Electronic Show and the technology portion of the South By South West conference. These activities resulted in promising contacts for future collaborations and introduced NIAAA and its mission to technologists and engineers, some of whom are considering applying for NIAAA small business grants.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Presentations at conferences

Participation Requirements: America COMPETES Act requirements limit the Challenge to U.S. citizens and U.S.-based companies. Within those parameters, this Challenge was open to individuals, small businesses, academic groups, and non-profit organizations.

Evaluation of Submissions: Submitted solutions were judged on the following criteria: (1) achievement of real time-monitoring and quantification of blood alcohol level; (2) collection and interpretation of data; (3) elimination of as much of the biological and device-related delays as possible through innovative, validated, and verifiable techniques; (4) secure storage or wireless transmission of data to a smartphone or other device; (5) operation from a dependable and rechargeable power source; (6) plans for process of manufacture and likelihood of bringing the product to market; and (7) appeal and acceptability to wearers. The functionality of prototypes was evaluated by NIAAA in a laboratory setting. Judging was done by a panel of NIH employees selected by NIAAA with knowledge in alcohol pharmacokinetics, chemistry, engineering, information technology and system security, behavioral and social sciences, and wearables.

Results: Of the five entries submitted by between December 10, 2016 and May 15, 2017, one prize were awarded to one winner.

Budget and Resources: The NIAAA staff involved in the prize competition contributed approximately 248 hours of effort as this round of the competition was built upon the previous year's challenge. For this version of the competition, the largest amount of NIAAA staff time was dedicated to attending and presenting at technology conferences, estimated at $7107.33 in FY17. These activities raised awareness of the Challenge and the broader mission of NIAAA. The prize money was obligated from NIAAA's unconditional gift funds.

Partnerships: N/A

Advancement of Agency Mission: The mission of the NIAAA is to generate and disseminate fundamental knowledge about the effects of alcohol on health and well-being, and apply that knowledge to improve diagnosis, prevention, and treatment of alcohol-related problems, including alcohol use disorder, across the lifespan. The development of alcohol biosensors that can be worn and used by individuals in the course of their daily lives will advance NIAAA's mission by providing more accurate tools for alcohol researchers, clinicians, and therapists and individuals seeking healthy lifestyle choices. Current technologies for continuous alcohol monitoring, which are commonly used in the criminal justice system, are effective but cumbersome. Moreover, they only take readings every 30 minutes, and they reflect blood alcohol content as it was 60–90 minutes prior to assessment, not in real time. Recent developments in electronics, miniaturization, wireless technology, and biophysical techniques of alcohol detection in humans increase the likelihood of successful development of a useful real-time alcohol biosensor. The NIAAA believes that this Challenge will further stimulate investment from public and private sectors in the development of real-time alcohol biosensors that will be appealing to

individuals, treatment providers, and researchers and will continue to further NIAAA's mission to improve diagnosis, prevention, and treatment of alcohol related problems.

Solution Types: Software and apps; Technology demonstration and hardware; Analytics, visualizations, algorithms

Plan for Upcoming 2 FYs: NIAAA is looking for novel means to engage individuals and institutions in the miniaturization of a spectroscopic solution for blood alcohol monitoring; establishing biomarkers for alcohol research; and novel interventions through technology to assist persons with problem drinking.

A.5.18 Design by Biomedical Undergraduate Teams (DEBUT)[58]

Lead Sponsoring Agency: NIH, National Institute of Biomedical Imaging and Bioengineering (NIBIB)

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

Competition Goals: The DEBUT Challenge was open to teams of undergraduate students working on projects that develop innovative solutions to unmet health and clinical problems, the proposed goals are: (1) to provide undergraduate students valuable experiences such as working in teams, identifying unmet clinical needs, and designing, building and debugging solutions for such open-ended problems; (2) to generate novel, innovative tools to improve healthcare, consistent with NIBIB's purpose to support research, training, the dissemination of health information, and other programs with respect to biomedical imaging and engineering and associated technologies and modalities with biomedical applications; (3) to highlight and acknowledge the contributions and accomplishments of undergraduate students; and (4) to encourage students to think about the patentability, market potential, and economic feasibility of the solutions they developed.

Goal Types: Find and highlight innovative ideas; Develop technology; Engage new people and communities; Build capacity; Other - Educate Biomedical Engineering Students

Justification for Using Prizes and Challenges: Prizes offer a way to directly incentivize undergraduate students in biomedical engineering and physical science to participate in conceiving and developing unique bioengineering innovations. DEBUT also excites and invigorates biomedical engineering faculty and departments. Students and faculty take on increasingly sophisticated projects in the hopes of winning a prize. This cannot be easily accomplished by a traditional grant mechanism. The monetary prizes combined with the recognition of winning undergraduates teams at the annual meeting of the Biomedical Engineering Society provide encouragement to the teams to further advance their projects and take it to market where they have the potential to address unmet needs in healthcare.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered in FY17 was $65,000 ($45,000 from NIBIB and $20,000 from VentureWell) and the full amount was awarded. The total prize purse offered in FY18 was $65,000 ($45,000 from NIBIB and $20,000 from VentureWell) and is expected to be fully distributed in FY18. In both fiscal years, first, second, and third place prizes were $20,000, $15,000, and $10,000, respectively. VentureWell awarded two additional prizes, the Venture prize ($15,000) and the Design Excellence prize ($5,000). There were five honorable mentions in FY17 and six honorable mentions in FY18. The Challenge also offered commendation at a major annual scientific meeting (Biomedical Engineering Society) with a session dedicated to DEBUT.

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[58] The website for the Design by Biomedical Undergraduate Teams (DEBUT) can be viewed at https://www.nibib.nih.gov/training-careers/undergraduate-graduate/design-biomedical- undergraduate-teams-debut-challenge.

Solicitation of Submissions: In addition to NIBIB's social media and email outreach efforts, VentureWell contributed to publicizing the competition through direct mailing and social media. VentureWell also was in charge of the receipt of the entries and initial 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: DEBUT is geared toward undergraduate students in biomedical engineering (BME). Teams made up of at least three undergraduate students can compete in the competition. At least one student must be in a BME department. Foreign students can compete and receive public recognition if their team wins. However, they are not eligible to receive prize money.

Evaluation of Submissions: The NIBIB Director was responsible for the final designation of winners of the NIBIB prizes. This designation was based on the evaluation of a judging panel made up of NIH staff with related expertise. This panel took into consideration the evaluation of a panel of experts VentureWell convened in order to make its selections for Venture and Design Excellence prizes. All judging was based on the review criteria announced for the prizes.

Results: In FY17, 41 eligible entries were received from 22 universities in 16 different states by the deadline on May 31, 2017, engaging 224 students. In FY18, 36 eligible entries were received from 25 universities in 15 different states by the deadline on May 31, 2018, engaging 180 students. Ten prizes were awarded.

Budget and Resources: Three members of NIBIB staff were mostly responsible for the management of the competition and the awarding of prizes. Eight other staff members were involved in the judging of the entries. $45,000 was distributed in total prizes yearly. FY17 and FY18 cash prizes were obligated to NIBIB's Direct Appropriation Account (TAFS 75-17-0898). VentureWell provided $20,000 in prizes yearly, bringing the challenge total for prizes to $65,000 annually.

Partnerships: Since 2016, NIBIB has been in a public-private partnership with VentureWell, a higher education non-profit that describes its mission as "to launch new ventures from an emerging generation of young inventors driven to improve life for people and the planet." The competition jointly held by NIBIB and VentureWell was able to enhance the set of prizes available to students as well as offer a single portal for submitting entries. In addition to maintaining this informational and entry submission portal, VentureWell contributed to publicizing the competition as well as the receipt and initial evaluation of the entries. VentureWell also convened its own evaluation panel in order to make its selections for Venture and Design Excellence prizes. All judging was based on the review criteria announced for the prizes. The estimated value of this partnership was $63,000 annually.

Advancement of Agency Mission: The mission of the NIBIB is to improve health by leading the development and accelerating the application of biomedical technologies. NIBIB is committed to integrating the physical and engineering sciences with the life sciences to advance basic research and medical care. This prize is designed to spark early undergraduate interest in the areas NIBIB supports. The underlying goals of the prize highlight and advance the agency's mission by: 1) providing undergraduate students valuable experiences such as working in teams, identifying unmet clinical needs, and designing, building and debugging solutions for such open-ended problems; 2) generating novel, innovative tools to improve healthcare, consistent with NIBIB's purpose to support research, training, the dissemination of health information, and other programs with respect to biomedical imaging and engineering and associated technologies and modalities with biomedical applications; and 3) highlighting and acknowledging the contributions of biomedical engineering to advancing healthcare.

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

Plan for Upcoming 2 FYs: In FY19-20, the DEBUT Challenge will continue to be open to teams of undergraduate students working on projects that develop innovative solutions to unmet health and clinical problems. No major changes are currently planned for the Challenge.

A.5.19 The 2017 "$100,000 for Start a SUD Startup" Challenge[59]

Lead Sponsoring Agency: NIH, National Institute on Drug Abuse (NIDA)

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

Competition Goals: The Challenge goal was to support research ideas that could be the basis for the development of new and potentially successful commercial applications. NIDA intended to fund the would be startup founders much earlier than most investors, incubators, or traditional models of research funding (e.g. small business grants). The Challenge allows scientists to test the hypothesis that their research idea can be fostered into a biotech startup, and that eventually these newly created startups will contribute to the pool of innovative small business companies that can successfully compete for NIDA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funding.

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

Justification for Using Prizes and Challenges: NIDA issued the "$100,000 for Start a SUD Startup" Challenge in 2016, and re-issued it in 2017. In 2016, the idea-submitting teams were from U.S. academic institutions, newly formed small business companies, and members of the general public. The selected teams were diverse in terms of age, level of education, gender, race and understanding of commercialization and entrepreneurship. Importantly, only 25% of submitted ideas came from NIDA-funded researchers. About 60% of submitted ideas came from the teams or individuals that previously did not apply for NIH grant funding. Thus, this Challenge was the preferable method to identify potential startup founders and work with them on research idea development and preparation of successful SBIR grant applications.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000. The Challenge offered up to ten awards of $10,000 each and provided mentorship support from NIDA entrepreneurship experts for development of a minimum viable proof (MVP) of the proposed product. No institutional indirect costs were allowed. The names of the winners and the titles of their submissions are posted on the NIDA web site.

Solicitation of Submissions: NIDA posted the Challenge at Challenge.gov and was responsible for the challenge outreach. The Challenge info, including the Challenge flyer, was disseminated to scientific and business communities including: NSF I-Corp Sites (46 universities); provosts of entrepreneurial universities (37 universities/contact sites); tech transfer offices of entrepreneurial universities (41 top NIDA-funded universities); 2017 Annual CPDD meeting (June 2017); 19th Annual HHS SBIR/STTR Conference (November 2017, WI); 2017 Annual Neuroscience Conference (November 2017); personal emails to all PIs who applied to RFA-DA-17-007 "Growing Great Ideas: Research Education Course in Product Development and Entrepreneurship for Life Science Researchers (R25)"; listserv of the Yale Entrepreneurial Institute; DHHS Opioid Symposium and Code-a-Thon (December 2017, DC); NIDA

[59] The website for the The 2017 " $100,000 for Start a SUD Startup" Challenge can be viewed at https://www.Challenge.gov/challenge/the-2017-100000-for-start-a-sud-startupchallenge/.

landing page rotator and NIDA challenge webpage; Academic mentors (active NIDA P01& P50 grantees); active NIDA CEBRA R21 grantees; small business companies and start-ups contacted NIDA and considered to apply to SBIR/STTR program.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - Targeted outreach of entrepreneurial organizations; Other - Presentations and flyers at scientific meetings and conferences

Participation Requirements: The Challenge was open to any individual 18 years of age or older. No prior startup experience was necessary.

Evaluation of Submissions: Submissions that were responsive and complied with the entry requirements were reviewed by a panel of judges consisting of NIDA Federal employees. The judging panel made recommendations to the award approving official based upon the following five criteria: (1) Significance and unmet needs. Are there significant needs for your product or service? Does the project address an important problem or a critical barrier to progress in the field of drug abuse research?; (2) Innovation. Does the submission seek to shift current paradigms by utilizing novel theoretical concepts, approaches, methodologies, instrumentation, service or interventions for drug abuse research? Is your product novel in a broad sense?; (3) Approach. Are the overall strategy, methodology, and analyses well-reasoned and appropriate to test the proposed idea? Has feedback from end users been incorporated into the validity of the idea proposed?; (4) Team expertise. Does the individual or team demonstrate high level of ability, perseverance and grit?; (5) Commercialization. Is there a clear path for the product or service to reach the market? Are the product users and purchasers clearly identified? Each criterion was scored with the maximum of ten points. Final recommendations are determined by a vote of the judges based on score. Scores from each criterion are weighted equally, but failure to meet a minimum standard for any one criterion might disqualify a submission.

Results: Of the 18 entries submitted by 39 participants between June 09, 2017 and December 22, 2017, ten prizes were awarded to ten teams.

Budget and Resources: NIDA Federal employees were solely responsible for solicitation and management of this Challenge. The panel of NIDA judges spent 50 FTE hours for review of submissions, scoring, and selection of the winners. The NIDA Office of Translations Initiative and Program Innovation (OTIPI) was responsible for challenge design, clearance, solicitation, management, outreach, communication with the participants and post-challenge activities. The winners of this Challenge were encouraged to use the prize funds to develop a MVP as quickly as possible and to obtain customer feedback to discover if the MVP meets the customer needs. If the product prototype was successfully validated, winners were encouraged to create or further advance their biotech startup no later than 6 months after the prize was awarded. OTIPI developed the curriculum for this post-challenge educational program and worked closely and intently with the teams to perform costumer discovery, identify product differentiation features, refine the overall value proposition, and put together competitive NIDA SBIR/STTR applications. As a result, within seven months of the post-challenge period, nine teams incorporated nine small businesses and worked to submit their SBIR /STTR applications in Fall 2018.

Partnerships: N/A

Advancement of Agency Mission: NIDA is the lead Federal agency supporting scientific research on drug use and its consequences. NIDA's mission is to advance science on the causes and consequences of drug use and addiction and to apply that knowledge to improve individual and public health. This Challenge is consistent with and advances the mission of NIDA as described in 42 U.S.C. 285o in that it supports new and potential biotech start-ups in the development of research ideas that would further

an understanding of neurobiology as it relates to substance use disorders (SUD). NIDA hopes that participation in the contest will enable scientists to test whether their research ideas can be fostered into a SUD biotech startup. The startup product could be the result of novel scientific discoveries, repurposing an existing technology for a new use, extending a research observation or discovery made in a different scientific area into SUD, devising a new business model or distribution or delivery channel that unlocks new value, or simply bringing a product or service to an underserved customer.

Solution Types: Ideas; Business plans; Scientific

Plan for Upcoming 2 FYs: Based upon the success of the "$100,000 for Start a SUD Startup" Challenge and the overwhelming positive feedback received from the teams, NIDA plans to re-issue the Challenge in 2019 and 2020.

A.5.20 Follow that Cell[60]

Lead Sponsoring Agency: NIH, National Institute of Mental Health (NIMH) and Office of Strategic Coordination

Status: This competition was completed in FY17.

Competition Goals: The goal of the Challenge was to develop new tools and methods that allow time-dependent measurements at the single-cell level in a complex tissue environment to assess functional changes, provide information on the health status of a given cell, and help guide diagnosis and therapeutic treatments related to human disease states. Technological breakthroughs in this arena could allow researchers and physicians to identify rare cells in a mixed population, such as individual cells that can transform and become cancerous, cells that are latently infected with a pathogenic virus, or cells that develop resistance to drugs over time.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology

Justification for Using Prizes and Challenges: The NIH Common Fund supported grants under the Single Cell Analysis Program (SCAP), the majority of which are associated with academic institutions. This Challenge, structured in two phases, was designed to strengthen and complement the existing SCAP grant portfolio by reaching out to a more diverse population of innovators and solvers, including not only those who are from academic institutions but also those who are from research and development communities in the private sector and those who are outside biomedical disciplines. The NIH believed this Challenge would stimulate investment from both public and private sectors in single-cell analysis research and product development, which, in turn, could lead to the development of more sensitive, robust, and cost-effective assay approaches, reagents, tools, and devices for basic research and clinical diagnosis.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $400,000. The first place individual winner was awarded $300,000 and $100,000 was split among three eligible members of the second place team. All funds were from the FY14 appropriation. Non-monetary incentives included the opportunity to present at the fifth annual Single Cell Analysis Principal Investigator Meeting.

Solicitation of Submissions: Phase 2 was a limited competition among the 16 winners and finalists from Phase 1. Phase 2 solvers were encouraged to partner with others as necessary to exercise their

[60] The website for the Follow that Cell can be viewed at http://commonfund.nih.gov/singlecell/challenge.

solutions. NIH conducted a webinar for all 16 potential solvers to answer questions about the Challenge and submission requirements. NIH kept in contact with potential solvers via direct email. Phase 1 was launched with a marketing strategy developed to define targeted methods that would be used to attract solvers at the launch and during the open period of the Challenge.The marketing plan was designed to attract a large number of varied solvers that could theorize innovative research tools, technologies or other breakthroughs that would allow identification, manipulation, or measurement of relevant biological changes at the single cell level. Outreach methods included the Federal Register Notice, NIH and contractor website postings, Nature website posting, emails, and social media.

Solicitation Types: Social media (e.g., Twitter, Facebook); Other - Webinar; Other - Direct email

Participation Requirements: The target solver audience was the community of investigators who could potentially provide solutions to the Challenge. Efforts were made to extend beyond the set of investigators already funded by NIH to pursue related areas of research. Specific eligibility requirements were posted in the Federal Register Notice.

Evaluation of Submissions: Ten solutions were submitted. InnoCentive, the contractor who hosted the platform for submission, screened for eligibility and completeness of solution. All ten solutions were forwarded to NIH for scientific evaluation. A technical evaluation panel consisting of NIH intramural investigators convened in-person to evaluate the submissions based on the criteria published in the Federal Register Notice. In parallel, NIH extramural staff reviewed top two submitted solutions for scientific alignment to SCAP, relevance to the NIH mission, and potential overlap with existing projects. Evaluation summaries were generated for all ten Phase 2 Solutions, which included the executive summary describing the research, technical evaluation panel discussion summary, and extramural staff summary. The SCAP Challenge team met to discuss the evaluation outcomes and to develop a rationale for recommending the selection of prize winners for Phase 2 competition. The judges and awarding official accepted the recommendation and approved the payment of prizes. NIMH was unable to develop a process or policy for ascertaining and managing conflict of interest of external individuals who could serve on the technical evaluation panel without limiting participation of solvers so NIMH chose to use Federal employees.

Results: Of the ten entries submitted by 27 participants between March 17, 2015 and March 30, 2017, two prizes were awarded.

Budget and Resources: Approximately 0.5 FTE was utilized to manage Phase 2 of the Challenge, including evaluation and approvals, recognition event and publicity, authorizing payment of prizes, and close-out reporting.

Partnerships: N/A

Advancement of Agency Mission: The NIH SCAP was searching for novel, robust methods for analysis of individual cells that could serve as the basis for predicting alterations in cell behavior and function over time. The ultimate goal was to develop new tools and methods that allow time-dependent measurements at the single cell level in a complex tissue environment to assess functional changes, provide information on the health status of a given cell, and help guide diagnosis and therapeutic treatments related to human disease states. Technological breakthroughs in this arena will allow researchers and physicians to identify rare cells in a mixed population, such as individual cells that may begin to transform and become cancerous; cells that are latently infected with a pathogenic virus; or cells that develop resistance to drugs over time.

Solution Types: Scientific

Plan for Upcoming 2 FYs: While other institutes at NIH are currently hosting challenges and have plans for the future, the NIH Common Fund Single Cell Analysis Program has sunset.

A.5.21 Antimicrobial Resistance, Rapid, Point-of-Need Diagnostic Test Challenge[61]

Lead Sponsoring Agency: NIH and Office of the Assistant Secretary for Preparedness and Response (ASPR), Biomedical Advanced Research and Development Authority (BARDA)

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

Competition Goals: The goals of the AMR Diagnostic Challenge are (1) to improve antibiotic stewardship and counter the increasing spread of antibiotic resistant microorganisms; (2) develop new, innovative, accurate, and cost-effective diagnostic tests to rapidly inform clinical treatment decisions, and be of significant clinical and public health utility to combat antimicrobial resistant pathogens; (3) incentivize a broad range of scientists, engineers, and innovators to develop diagnostic tests; and (4) development of unique diagnostics could facilitate the discovery of new antibiotics.

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: On September 18, 2014, the President issued Executive Order 13676 on Combating Antibiotic-Resistant Bacteria announcing the Administration would hold the Antimicrobial Resistance Diagnostic Challenge. The National Strategy for Combating Antibiotic Resistant Bacteria was released simultaneously with specific goals to address the increasing public health threat of antibiotic resistant microorganisms. An accompanying White House Fact Sheet called for NIH and ASPR/BARDA to hold a $20M challenge competition for the development of rapid, point-of-need diagnostic assays for combating antibiotic resistant pathogens. The National Action Plan for Combating Antibiotic-Resistant Bacteria issued in 2015 set three- and five-year goals for this NIH and ASPR/BARDA-sponsored competition.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $20,000,000. $50,000 was awarded to each of ten semi-finalists in Step 1 ($500,000 total), and up to $100,000 may be awarded to each semi-finalist in Step 2 ($1,000,000 total). The remaining funds ($18,500,000) will be awarded to up to three winners in FY20. Finalists will also receive public recognition.

Solicitation of Submissions: A Federal Register Notice (FRN) and a Notice in the NIH Guide for Grants and Contracts were used to initially announce the Challenge and request submissions. The Challenge is posted on the Challenge.gov website. The NIH support contractor maintains a website with frequently asked questions, which serves as the site for submissions. Amended FRNs and NIH Guide Notices were issued to provide updates for submissions for each Step of the competition. The NIH Director and ASPR issued a press release when the Challenge was announced. The NIH Director also issued a blog to encourage submissions. Emails are sent to key NIH academic, professional society, and industry partners at various stages of the Challenge soliciting submissions. A Twitter session was held with the NIH Director following announcement of the Step 1 semi-finalists. A YouTube session was held with the NIH coordinator for the Challenge. NIH and BARDA maintain websites encouraging submissions. The organizers of the U.K. Longitude Prize for an AMR diagnostic include announcements of the NIH/BARDA Challenge on their website.

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[61] The website for the Antimicrobial Resistance, Rapid, Point-of-Need Diagnostic Test Challenge can be viewed at https://www.Challenge.gov/challenge/antimicrobial-resistance-rapid-point-of-care- diagnostic-letter-of-intent/ and https://dpcpsi.nih.gov/AMRChallenge.

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: Step 1 and 2 submissions were open to all solvers; Step 3 is only open to the Step 2 semi-finalists. Solutions were welcome from individuals, teams, and entities from all U.S. sources including the public sector, private sector, and nonprofit groups. Members of the technical evaluation panel for Step 1 are not eligible to participate in or contribute to any proposal for Steps 2 and 3. Submissions are not eligible from any HHS (or its components) Federal employee. Employees of other Federal Government entities need to check with their ethics office to see if they can limit or accept the prize. Federal grantees are eligible to compete, but cannot use Federal funds to develop a submission unless consistent with purpose of their grant. Federal contractors are eligible to compete, but cannot use funds from a Federal contract to develop a submission. Solvers must be at least 18 years old and a U.S. citizen or resident. A team, led by a U.S. citizen or resident, can include international citizens, but the latter are not eligible for the cash prize. If an entity applies, it must be incorporated in the United States and maintain a primary place of business in the United States. An individual, entity, or team that is currently on the excluded parties list will not be selected as a semi-finalist or winner. An individual shall not be deemed ineligible if he or she uses a Federal facility or consults with Federal employees, as applicable, provided that such facilities and/or employees are made available on an equitable basis to all individuals or teams.

Evaluation of Submissions: All Step 1 submissions were subjected to an initial review by NIH scientific staff to ensure they are complete and within scope of the Challenge. Submissions that were incomplete were disqualified and not evaluated further. A three-tier review process was used including a technical evaluation panel, a programmatic assessment panel, and a judging panel. The technical evaluation panel, convened by the NIH Center for Scientific Review, included non-governmental scientific experts and a limited number of government scientific experts who evaluated and rated the submissions based on six criteria including: innovation; clinical significance; diagnostic performance; feasibility; time to test result; and setting and ease of use. The programmatic assessment panel, including NIH, BARDA, and FDA scientific staff, reviewed the highly rated submissions for scientific alignment with the National Action Plan for Combating Antibiotic Resistant Bacteria. The judging panel, consisting of three senior leadership members from NIH and BARDA, used the technical and programmatic evaluations to determine the semi-finalists based on innovation advancing existing clinical diagnostics and relevance to NIH's and BARDA's missions. Step 2 submissions will be subjected to similar evaluation by a technical evaluation panel based on four criteria: innovation; clinical significance; diagnostic performance and feasibility; and sample matrix/setting and ease of use/throughput. Step 3 prototype submissions will be evaluated by two independent CLIA-certified laboratories for usability, stated time to result, analytical sensitivity and specificity, as well as confirmation of analytical performance as stated in the Step 2 data submitted by the solver. The results of the CLIA laboratory testing will be submitted to a technical evaluation panel followed by review by the programmatic assessment panel, and finally submitted to the judging panel for their determination of a winner(s).

Results: A total of 74 submissions were received and 10 prizes awarded in Step 1, which opened on September 8, 2016. Twenty submissions were received and up to 10 prizes awarded will be awarded in Step 2. Up to 10 participants will submit Step 3 entries by January 3, 2020 and up to three prizes may be awarded. Step 3 winners will be announced July 31, 2020.

Budget and Resources: A total of 1.5 FTEs conducted activities related to the review, management, and approval of awards. In FY16, the National Institutes of Health/National Institute of Allergy and Infectious Diseases (NIH/NIAID) and ASPR/BARDA each provided $10,000,000 for this Challenge. In FY17, the NIH

Division of Program Coordination, Planning, and Strategic Initiatives within the Office of the Director (NIH/OD/DPCPSI) obligated and disbursed $22,000 for the Step 1 technical evaluation panel meeting. In FY18, NIH/OD/DPCPSI obligated $29,000 for the Step 2 technical evaluation panel meeting.

Partnerships: CDC and FDA provided technical and regulatory expertise to the development of the award evaluation process. They participated with NIH and BARDA scientific staff on the AMR Diagnostic Working Group. CDC scientific staff participated on the technical evaluation panel and FDA scientific staff participated on the programmatic assessment panel. Capital Consulting Corporation served as a support contractor to NIH for the Challenge and developed a website providing information to submitters as well as the mechanism to submit solutions for Steps 1 and 2 of the Challenge.

Advancement of Agency Mission: BARDA's mission is to develop and procure medical countermeasures that address the public health and medical consequences of chemical, biological, radiological, and nuclear accidents, incidents and attacks, pandemic influenza, and emerging infectious diseases. Specifically, BARDA supports the advanced development and procurement of drugs, vaccines and other products that are considered priorities for national health security. BARDA's support ensures continuity of funding at a critical point for medical countermeasures developed by industry or emerging from the basic research and preclinical development activities sponsored by NIH. In procuring medical countermeasures for the Strategic National Stockpile, BARDA enhances the capabilities of CDC to organize an effective response to a public health threat. NIH and BARDA are utilizing the AMR Diagnostic Challenge to identify novel and innovative in vitro diagnostic tests that would rapidly inform clinical treatment decisions and be of potential significant clinical and public health utility to combat the development and spread of antibiotic resistant bacteria.

Solution Types: Technology demonstration and hardware; Scientific

Plan for Upcoming 2 FYs: In FY19 and FY20, NIH and ASPR/BARDA will proceed with Steps 2 and 3, respectively, of the AMR Diagnostic Challenge.

A.5.22 The Simple Extensible Sampling Tool Challenge[62]

Lead Sponsoring Agency: Office of Inspector General (OIG)

Status: This competition was completed in FY17.

Competition Goals: The objective of this Challenge was to develop the foundation for an upgraded version of RAT-STATS software that is 508 compliant with a user friendly design. The current version of RAT-STATS is well-validated; however, its user interface can be difficult to navigate and does not meet Federal accessibility standards. OIG needed a new, modern version of the software that was easier to use and was 508 compliant. In addition, by using a competition, OIG hoped to increase public awareness about the RAT-STATS software.

Goal Types: Solve a specific problem; Inform and educate the public

Justification for Using Prizes and Challenges: The relatively small scale of the programming project made it amendable to work by a single individual knowledgeable about programming. We believed that a prize competition would lower the barrier to access and allow individuals less familiar with the government contracting process to take in the upgrade effort. In addition, the prize competition was designed to allow users to select from several different replacement packages. Finally, the problem was

[62] The website for the The Simple Extensible Sampling Tool Challenge can be viewed at https://www.Challenge.gov/challenge/statistical-software-for-healthcare-oversight/.

well amendable to a competition given that it involved clear metrics for success, but also allowed for a significant amount of creativity by the solvers. In particular, OIG had definitive performance requirements, but were interested in seeing what the public could come up with in terms of the software layout, structure, and new features.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $40,000 and the total amount awarded was $34,000. The grand prize winner was listed within the software that was created as a result of the competition. The grand prize winner was also be listed on the agency website and within the instruction manuals for the software. No private sector or philanthropic funds were contributed for the prizes. All funds were obligated and expended from HHS OIG appropriations.

Solicitation of Submissions: OIG announced the competition in the Federal Register, on the HHS/OIG agency website, the Challenge.gov website, and the Challenge.gov Twitter account. OIG also advertised the competition on several industry websites with free job posting areas. Finally, the HHS IDEA Lab included a blog posting describing the competition on its website. OIG was satisfied with the level of response received given the solicitation approach, though larger scale advertising would likely have been needed for a larger competition.

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

Participation Requirements: The contest was open to the public and anyone who could provide a solution. OIG targeted individuals who were knowledgeable about programming and software design. Rules for participation in the challenge are available at: https://www.Challenge.gov/challenge/statistical-software-for-healthcare-oversight/.

Evaluation of Submissions: A technical expert reviewed each submission to identify whether it was complete, followed the competition rules, and was able to fully replicate RAT-STATS on 60 test datasets. The expert identified three entries that met this requirement. The grand prize was selected by a committee of 12 HHS/OIG employees who represent the types of individuals who would be end users for the new software. Each of the 12 individuals voted on which of the software packages they would prefer to use. The finalist with the most votes was declared the grand prize winner.

Results: Of the eight entries submitted by between September 29, 2016 and May 15, 2017, one participant was awarded the grand prize.

Budget and Resources: The Challenge was run using only internal agency resources. In 2017, these include IT resources and approximately 200 FTE hours, including 180 hours at GS-15 level and 20 hours at GS-13 level. Funds associated with the Challenge were used to pay for cash prizes and the Federal Register Notice posting.

Partnerships: N/A

Advancement of Agency Mission: Each year HHS handles hundreds of millions of Medicare and Medicaid claims valued at more than a trillion dollars. Due to the high volume of claims, statistical sampling provides a critical tool to ensure effective oversight of these expenditures. In addition, sampling is used by the providers in their own efforts to monitor their performance. The RAT-STATS software package, which was originally developed by HHS/OIG, has a unique niche in that it provides a straightforward tool for individuals who need a simple but robust method for selecting and analyzing statistical samples. The competition was designed to advance the agency mission by helping HHS/OIG create a 508 compliant version of the RAT-STATS software that can be expanded as needed to ensure HHS/OIG can meet its audit sampling requirements moving forward.

Solution Types: Software and apps

Plan for Upcoming 2 FYs: N/A

A.5.23 Blockchain in Healthcare Code-a-Thon[63]

Lead Sponsoring Agency: Office of the National Coordinator for Health Information Technology (ONC)

Status: This competition was completed in FY17.

Competition Goals: In September 2016, ONC announced the Use of Blockchain in Health IT and Health-Related Research Challenge. The challenge solicited white papers that investigated the potential relationship between blockchain technology and its use in health IT and health-related research; these were later used to inform the Use of Blockchain in Healthcare and Health-Related Research Workshop. The workshop convened Federal, public, and private stakeholders to receive briefings from Federal and industry leaders utilizing blockchain and/or alternative distributed ledger technologies. Ultimately, participants in the Blockchain in Healthcare Code-A-Thon heard presentations from eight of the Blockchain Challenge winners, shared successes, and generated new ideas around blockchain technology solutions in the healthcare ecosystem. One of the next steps identified during the workshop was to support demonstrations and trial implementations to determine whether blockchain had a place in health IT and, if so, ascertain its role.

Goal Types: Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: Prizes were chosen with the scope to engage a broader stakeholder community including researchers, innovators and start-up or small entities to spur innovation, educate the larger community, spur adoption of metrics, and lay the groundwork for potential future collaboration.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $15,000 and the total amount awarded was $13,000. Non-monetary incentives included the opportunity to participate in the Digital Chamber of Commerce's annual Blockchain conference at Georgetown University.

Solicitation of Submissions: Solicitation of submissions included social media outreach (Twitter, LinkedIn), email blasts, and a live webinar.

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

Participation Requirements: The Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: A panel of judges assessed each solution based on the following criteria: (1) technical competence and capabilities (35%); (2) use of data to provide effective outcomes (20%), (3) creativity/innovation (20%); and (4) valuable information and insights regarding data (25%).

Results: A total of 83 participants submitted entries between January 23 and March 7, 2017 and prizes were awarded to ten winners.

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[63] The website for the Blockchain in Healthcare Code-a-Thon can be viewed at https://www.cccinnovationcenter.com/challenges/blockchain-in-healthcare-code-a- thon/.

Budget and Resources: Code-A-Thon development and preparation duties were the responsibility of ONC employees. Contract funds were used to provide event support and logistics and to fund the cash awards. The Challenge utilized 0.4 FTE and $145,000 in funding in FY17.

Partnerships: Digital Chamber of Commerce, a 801c non-profit, provided the venue, food, advertising and an opportunity for the winner to have public exposure through a Blockchain conference. Services provided in this partnership provided a better platform in which to conduct the Challenge without adding additional cost to the taxpayer. The estimated value of this partnership is $50,000.

Advancement of Agency Mission: As the final step in a progression of blockchain-centered events, the Code-A-Thon was an opportunity to ascertain if blockchain could be used to address common problem areas that affect exchange of health data on a national scale.

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

Plan for Upcoming 2 FYs: N/A

A.5.24 CHPL Data Challenge[64]

Lead Sponsoring Agency: ONC

Status: This competition was launched in FY18.

Competition Goals: The ONC Certified Health IT Product List (CHPL) Data Challenge is a call for developers, researchers, and innovators to develop a software application that makes use of the data in the CHPL API in novel ways. The application should provide solutions to challenges for healthcare providers, healthcare consumers, and the health IT community.

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

Justification for Using Prizes and Challenges: The opening up of the CHPL with an API and XML files allows the public to use its data in creative ways, including those for which ONC does not have the internal capacity to fulfill or has not even imagined. Compared to a contract or other mechanism, a prize challenge provides the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and healthcare field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists may not. The Challenge also provides an opportunity to engage app and software developers who might not be familiar with the health IT world but can bring experience and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $40,000 and has not yet been awarded. First and each of two second place runner-ups will receive $20,000 and $10,000, respectively. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: Solicitation of submissions has included social media outreach (Twitter, LinkedIn), email blasts, and a live webinar.

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

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[64] The website for the CHPL Data Challenge can be viewed at https://www.cccinnovationcenter.com/challenges/chpl-data-challenge/.

Participation Requirements: The Challenge is open to the public and targets technology developers and the health IT community. The Challenge is being run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, has the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: Submissions were evaluated in November 2018.

Results: Entries were submitted between July 10, 2018 and October 31, 2018, and the Challenge is ongoing.

Budget and Resources: Challenge development and preparation duties were the responsibility of ONC employees. Once ready for launch, the Challenge began utilizing the services of a contractor which has been involved in such duties for ONC since 2010. The current contract is funded at $125,000 and structured to provide support for up to three challenges over a one-year period. These services include hosting of the challenge website, preparation of communications materials, ongoing day-to-day activities of challenge management, and support for reviewing and awarding functions. ONC estimates the Challenge utilized approximately 0.4 FTEs in FY18.

Partnerships: N/A

Advancement of Agency Mission: The Challenge is an opportunity to solve problems using CHPL data for health care providers, health care consumers, and the health IT community. ONC anticipates that participants will create novel solutions using this data, amplified by creative user interfaces that optimize the user's understanding of the proposed issue. These solutions can help provide insight to the public of ONC's certification processes and priorities and demonstrate the program's impact.

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

Plan for Upcoming 2 FYs: N/A

A.5.25 Consumer Health Data Aggregator Challenge[65]

Lead Sponsoring Agency: ONC

Status: This competition was completed in FY17.

Competition Goals: The Consumer Health Data Aggregator Challenge had several objectives, the primary one being to increase the number of apps available to consumers that can aggregate their data from multiple sources. Specifically, this had to be done using the Fast Healthcare Interoperability Resources (FHIR) API, which is the most widely-known and developed open API for exchanging patient health data. Even as the open API with the highest level of awareness, the Challenge was also intended to raise this level higher, and to incentivize more developers to work with and familiarize themselves with FHIR.

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

Justification for Using Prizes and Challenges: Compared to a contract or other mechanism, a prize challenge provides the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provides an opportunity to engage app

[65] The website for the Consumer Health Data Aggregator Challenge can be viewed at https://www.Challenge.gov/challenge/consumer-health-data-aggregator-challenge/.

and software developers who might not be familiar with the health IT world but can bring viewpoints and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $175,000 and the total amount awarded was $160,000. In Phase 1, up to five prizes of $5,000 to $15,000 were available; four $10,000 prizes were awarded. In Phase 2, one $50,000 first prize, one $25,000 second prize, and an additional $25,000 prize for the app demonstrating the highest level of patient data exchange were available; all three were awarded, with one business winning both of the $25,000 awards. The primary non-monetary incentives were the publicity and recognition for winning an ONC challenge. Award funds were disbursed by a contractor acquired through the HHS COMPETES Blanket Purchasing Agreement.

Solicitation of Submissions: Solicitation of submissions included an announcement of the Challenge at a major industry conference, a press release, social media outreach (Twitter, LinkedIn), email blasts, and several webinars. The 25 submissions indicate that the communications vectors worked, especially the main stage conference announcement, although the large prize purse was likely also a factor.

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

Participation Requirements: While the Challenge was open to all developers, the need to understand the intersection of electronic health records (EHRs), patient care, and patient data sharing made it most relevant to companies that already had working knowledge of those areas and were active in health IT. The Challenge was run under the authority of Section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: A combined review panel of Federal and non-Federal subject matter experts reviewed and scored all Phase 1 submissions; the Federal challenge managers selected the winners, factoring in those reviews. In Phase 1, equal co-winners were chosen rather than ranked winners because the submissions, written proposals, were steps toward the eventual outcome of the Challenge, not the outcome itself. The final outcomes of Phase 2, consumer apps, were ranked and awarded on the same evaluation criteria. Four evaluation criteria were used to review submissions: (1) the technical feasibility of the plan; (2) the adherence to data privacy and security best practices and applicable law, (3) the strength of the business/sustainability plan; and (4) the provider or health IT developer partnerships. These criteria captured the most important aspects that needed to be identified in the submissions.

Results: A total of 25 entries were submitted in Phase 1 between March 1 and June 1, 2016 and four prizes were awarded. In Phase 2, entries were submitted between June 2 and November 7, 2016 and two prizes were awarded.

Budget and Resources: A small ONC team, with one primary challenge manager, developed and executed the Consumer Health Data Aggregator and Provider User Experience Challenges. Additional funds for the challenge prizes were required on top of the annual ONC challenge funding allocation; these were designated to the project from the national coordinator's discretionary pool. A third-party contractor, acquired through the HHS COMPETES Blanket Purchasing Agreement, provided administrative, management, and communications assistance. Given the challenge manager's extensive experience in running prize challenges, challenge development services were not needed.

Partnerships: N/A

Advancement of Agency Mission: The lack of interoperability between EHR systems remains a significant barrier to the modernization of health IT. FHIR is a standard designed to increase the liquidity of granular patient data. The FHIR API allows data to move between vendor systems both within and

across different providers, not to mention through third-party applications for direct use by both clinicians and consumers. Among several opportunities now enabled by this interoperability standard are the new channels being opened up for improving a provider's user experience when interacting with EHRs and the consumability of interrelated health data. The Provider User Experience Challenge, combined with its partner challenge, the Consumer Health Data Aggregator Challenge, is part of ONC's Connecting and Accelerating a FHIR App Ecosystem initiative. This initiative calls on innovators to develop market-ready software apps for consumers and healthcare providers in an effort to improve the health and care of the country.

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

Plan for Upcoming 2 FYs: N/A

A.5.26 Easy EHR Issues Reporting Challenge[66]

Lead Sponsoring Agency: ONC

Status: This competition was launched in FY18.

Competition Goals: Stakeholder feedback indicates there is a need for more efficient and user-friendly mechanisms that allow electronic health record (EHR) end users to report concerns quickly and easily with little or no disruption to their workflow. Mechanisms widely available on the market today normally require the end user to either exit the EHR system entirely or leave the current workflow process in order to report the problem. Some EHRs may include a separate error reporting module, but others require the end user to fill out a report through a totally separate mechanism. This workflow disruption is enough of a burden on users that they avoid reporting. The greater the workflow interruption the more likely they are to delay rather than report immediately while the experience is fresh and most accurately recalled, or to forego reporting entirely. Clinicians need better reporting mechanisms that are designed to address the end user's needs and are complementary with the workflow processes and systems they use.

Goal Types: Solve a specific problem; Develop technology

Justification for Using Prizes and Challenges: Compared to a contract or other mechanism, a prize challenge provides the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provides an opportunity to engage app and software developers who might not be familiar with the health IT world but can bring viewpoints and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $80,000 and has not yet been awarded. First, second, and third place winners will receive $45,000, $25,000, and $10,000, respectively. Non-monetary incentives include public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: Solicitation of submissions has included social media outreach (Twitter, LinkedIn), email blasts, and a live webinar.

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

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[66] The website for the Easy EHR Issues Reporting Challenge can be viewed at https://www.cccinnovationcenter.com/challenges/easy-ehr-issue-reporting-challenge/.

Participation Requirements: The Challenge is open to the public and targets technology developers and the health IT community. The Challenge is being run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, has the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: Submissions were evaluated in October 2018.

Results: Entries were submitted between May 22 and October 15, 2018, and the Challenge is ongoing.

Budget and Resources: Challenge development and preparation duties were the responsibility of ONC employees. Once ready for launch, the Challenge began utilizing the services of a contractor that has been involved in such duties for ONC since 2010. The current contract is funded at $125,000 and structured to provide support for up to three challenges over a one-year period. These services include hosting of the challenge website, preparation of communications materials, ongoing day-to-day activities of challenge management, and support for reviewing and awarding functions. The Challenge utilized approximately 0.15 FTE in FY18.

Partnerships: N/A

Advancement of Agency Mission: As of 2015, 96% of hospitals and 78% of office-based physicians have certified EHRs. Clinicians and other members of the health care team routinely work in fast-paced, stressful, and challenging environments. As such, they have come to increasingly rely on EHRs to retrieve patient information, assist in making complex patient care decisions, and ultimately optimize patient safety and health care quality. Despite a growing body of evidence showing the use of advanced health IT being associated with safer care on the whole, it also poses new challenges and risks when deployed into complex clinical environments. Whether through design, development, deployment, operational, or other deficiencies, studies have also shown EHRs can contribute to adverse events and fall short of expectations for safety-related usability, in addition to frustrating end users and posing avoidable risks to patients. These issues are difficult to identify and correct unless the full array of end users' concerns are regularly captured and analyzed for trends and improvement opportunities. The more easily and consistently end users can capture and share their concerns, the better that safety programs and organizations will be able to spot trends and drive improvement.

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

Plan for Upcoming 2 FYs: N/A

A.5.27 Move Health Data Forward Challenge[67]

Lead Sponsoring Agency: ONC

Status: This competition was completed in FY17.

Competition Goals: As health IT adoption continues to grow and mobile health technology becomes more accessible, consumers are playing an even greater role in how and when their health information is exchanged or shared. Unleashing this data is one of ONC's top priorities with the aim of improving individuals' ability to send, receive, find, and use their health information in the near term. To stimulate this work, sometimes referred to as consumer-mediated exchange, between and among their clinicians, hospitals, or even family members, the Move Health Data Forward Challenge was launched. The objective of the Challenge was to create API solutions combined with new implementation

[67] The website for the Move Health Data Forward Challenge can be viewed at https://www.Challenge.gov/challenge/move-health-data-forward-challenge/.

specifications, known as Health Relationship Trust (HEART), that have the potential for individuals to securely and electronically authorize the movement of their health data to destinations they choose. This builds on ONC's work with a number of security, privacy, and health information technology stakeholders to develop a set of privacy and security specifications that enable an individual to control the authorization of access to health data.

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

Justification for Using Prizes and Challenges: A prize competition was used to challenge the health IT industry to help find new technological ways to put consumers in the driver's seat when it comes to how and when their health information can be shared. This choice helped to promote innovation in the area of consumer-mediated exchange by opening up the challenge audience to include health care providers, social service organizations, developers, entrepreneurs, start-ups, early-stage companies, venture capital firms, health information exchanges, incubators, and accelerators.

Cash Prize Purses and/or Non-Cash Prize Awards: The Challenge had a prize purse of up to $250,000. In Phase 1, up to ten prizes of $5,000 were available. In Phase 2, up to five prizes of $20,000 were available. In Phase 3, up to two prizes of $50,000 were available. The primary non-monetary incentives were the publicity and recognition for winning an ONC challenge, in addition to opportunities to showcase work at ONC-sponsored events. Awards were disbursed by a contractor acquired through the HHS COMPETES Blanket Purchasing Agreement.

Solicitation of Submissions: Five public webinars with over 400 attendees total were hosted throughout the duration of the Challenge, including two webinars launching the Challenge. ONC also identified and pitched top media outlets that covered the Challenge, including ONC Federal partners, the health IT community, local and community-based health care organizations, hospitals, health systems, hospital innovation centers, and consumer groups, and subject-matter related blogs, journals, and magazines. In addition, ONC leveraged HHS and external audiences on social media to publicize the Challenge and reach target stakeholders, fostering early engagement and organic team-building through social conversation.

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 Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and HHS policy guidance. Phase 1 required participants to describe the technical, operational, financial, and business aspects of their proposed solution, and the main goal was for participants to show feasible and executable plans for innovative solutions and prove its impact potential. Phase 2 required participants to demonstrate, via a live virtual webinar, a viable solution to achieve those goals by allowing for the safe and secure exchange of consumer or provider health records. Phase 3 required participants to implement their solutions through a mobile or web-based application and to conduct a real-time product demo.

Evaluation of Submissions: For all three phases of the Challenge, a combined review panel of Federal and non-Federal subject matter experts reviewed and scored all submissions, and the Federal challenge managers selected the winners, factoring in those reviews. The review was based on adherence to submission requirements and the judging criteria outlined in the Federal Register Notice. Based on the quantitative results by the review panel and review of submissions by the Federal challenge managers,

ten winners were selected in Phase 1, five winners were selected in Phase 2, and two winners were selected in Phase 3.

Results: Of the 31 initial entries submitted by 31 participants between May 10 and September 8, 2016, 17 prizes were awarded throughout the three phases.

Budget and Resources: A small team of ONC Federal employees, with one primary challenge manager, developed and executed the Challenge. Sensis was acquired through the HHS COMPETES Blanket Purchasing Agreement. ONC worked with Sensis, a third-party contractor, who provided administrative, challenge development, management and communications assistance. The Challenge utilized approximately 0.35 FTE for challenge oversight and $200,000 over two year to fund contractor challenge management.

Partnerships: N/A

Advancement of Agency Mission: The Challenge emphasized the importance of ONC's mission, which is to improve the health and well-being of individuals and communities through the use of technology and health information that is accessible when and where it matters most. Specifically, the Challenge advanced the agency's mission by focusing on improving consumer-mediated exchange of individuals' health data. The winning solutions were able to demonstrate a consumer-facing solution that incorporated the HEART implementation specifications and used an API that empowers consumers to control the movement of their health data.

Solution Types: Software and apps; Technology demonstration and hardware; Business plans

Plan for Upcoming 2 FYs: N/A

A.5.28 Oh, the Places Data Goes: Health Data Provenance Challenge[68]

Lead Sponsoring Agency: ONC

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

Competition Goals: The goal of Phase 1 of the Data Provenance Challenge was for teams to identify real world provenance problems, understand why they are important to solve, and provide an opportunity for participants to develop practical and executable plans for innovative solutions. The goal of Phase 2 was to demonstrate a viable solution with high technological merit, test the scalability and feasibility of implementation, and assess the impact of the intended outcomes.

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

Justification for Using Prizes and Challenges: Compared to a contract or other mechanism, a prize challenge provides the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provides an opportunity to engage app and software developers who might not be familiar with the health IT world but can bring experience and knowledge from other industries to bear.

[68] The website for the Oh, the Places Data Goes: Health Data Provenance Challenge can be viewed at https://www.cccinnovationcenter.com/challenges/provenance-challenge/.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $180,000. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: ONC solicited submissions through the Federal Register Notice FRN, Challenge.gov, a contractor website, a HealthIT.gov blog post, the ONC Twitter account, a listserv announcement, email blasts, and an informational webinar. These methods appear to have been effective, having led to 19 Phase 1 submissions.

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

Participation Requirements: For Phase 1, teams were required to submit white papers that described their current capabilities and methods used to demonstrate provenance of health data. Teams were required to identify a problem they experienced that inhibited the desired or necessary amount of provenance data to be conveyed during clinical care and propose a solution. Participants were expected to articulate the technical, operational, and business aspects/impacts of their problem and solution, including but not limited to, the value proposition, key partners, implementation plan, timeline, key activities and resources, and metrics for success. Only Phase 1 winners were eligible to participate in the second and final phase, which involved the development and testing of their solution to the problem identified in Phase 1. As a condition of accepting the $20,000 award, Phase 1 winners were required to participate in Phase 2 of the Challenge. Participants submitted a recorded demonstration, solution guide and lessons learned focused on prototyping and testing the effectiveness of the solution.

Evaluation of Submissions: Judges were a combination of ONC employees and outside subject matter experts who had previously worked or were currently working with ONC. Eligible challenge entries were judged by a review panel composed of Federal employees and experts in compliance with the requirements of the America COMPETES Act and the Department of Health and Human Services judging guidelines.[69]

Results: Of the 19 entries submitted in Phase 1 between April 6 and May 22, 2017, six prizes were awarded. Phase 2 entries were submitted between June 14, 2017 and January 22, 2018, and winners announced on February 21, 2018.

Budget and Resources: Challenge development and preparation duties were the responsibility of ONC employees. Once ready for launch, the Challenge began utilizing the services of a contractor which has been involved in such duties for ONC since 2010. This contract was funded to provide challenge support and services include hosting of the challenge website, preparation of communications materials, ongoing day-to-day activities of challenge management, and support for reviewing and awarding functions. The Challenge utilized approximately 0.6 FTEs in FY17 and FY18. Additionally, the Challenge utilized $180,000 in funding in FY18.

Partnerships: N/A

Advancement of Agency Mission: With growing HER adoption comes an increasing availability of digital health tools and growing demand among consumers who want to share their data with their providers. The need for health data provenance, and standard approaches to capture it, is an important priority. Additionally, the Health IT Standards Committee has issued recommendations to ONC in the past on data provenance. Data provenance is a complex issue that plays a role in almost everything related to

[69] http://www.hhs.gov/idealab/wp-content/uploads/2014/04/HHS-COMPETITION-JUDGING- GUIDELINES.pdf

electronic data use and exchange. Thus, finding innovative and standardized solutions to improve and capture data provenance will enable the health care industry to better maximize health data that is already digitized and ready to share.

Solution Types: Ideas; Technology demonstration and hardware

Plan for Upcoming 2 FYs: N/A

A.5.29 Patient Matching Algorithm Challenge[70]

Lead Sponsoring Agency: ONC

Status: This competition was completed in FY17.

Competition Goals: The goal of the Patient Matching Algorithm Challenge was to bring about greater transparency and data on the performance of existing patient matching algorithms, spur the adoption of performance metrics for patient data matching algorithm vendors, and positively impact other aspects of patient matching such as deduplication and linking to clinical data.

Goal Types: Advance scientific research; Inform and educate the public; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: Prizes were chosen with the scope to engage a broader stakeholder community including researchers, innovators and start-up or small entities to spur innovation, educate the larger community, spur adoption of metrics, and initiate future collaboration.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $75,000. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: Groups specifically targeted for participation in the Challenge included algorithm researchers and vendors, informaticists, researchers, and start-ups.

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

Participation Requirements: The Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: Participants were evaluated on their algorithm performance in finding matched pairs in the data set provided. Each individual submission was scored automatically by a scoring server using a key for scoring and received a score for each of the following three metrics: F-Score (which is the harmonic mean between precision and recall), Precision (least mismatched patients), and Recall (least missed matches). The mathematical scoring, rather than the qualitative evaluation performed by human in most ONC challenges, may have been a contributing factor to the extremely high participation.

Results: Of the nearly 7,000 submissions[71] entries submitted by more than 140 teams between June 12 and October 12, 2017, six prizes were awarded to four individual teams (Vynca, PICSURE, Information

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[70] The website for the Patient Matching Algorithm Challenge can be viewed at https://www.patientmatchingchallenge.com/.

[71] https://www.hhs.gov/about/news/2017/11/08/hhs-names- patient-matching-algorithm-challenge-winners.html

Softworks, and Ocuvera). The winners for Best "F-score" were Vynca (first place, $25,000 prize), PICSURE (second place, $20,000), Information Softworks (third place, $15,000). The winner for Best First Run was Information Softworks ($5,000), the winner for Best Recall was PICSURE ($5,000), and the winner for Best Precision was Ocuvera ($5,000). Each winner employed widely different methods. PICSURE used an algorithm based on the Fellegi-Sunter method for probabilistic record matching and performed a significant amount of manual review. Vynca used a stacked model that combined the predictions of eight different models. They reported that they manually reviewed less than 0.001 percent of the records. Although Information Softworks also used a Fellegi-Sunter-based enterprise master patient index (EMPI) system with some additional tuning, they also reported extremely limited manual review.

Budget and Resources: ONC utilized $15,000 for MITRE contract support for Amazon Web Services testing environment, and $140,000 for ongoing challenge contract support. The Challenge utilized approximately 0.8 FTEs in FY17.

Partnerships: ONC partnered with Adam Culbertson, the Healthcare Information and Management Systems Society (HIMSS) Innovator-In-Residence.

Advancement of Agency Mission: In 2014, ONC identified patient matching as central to interoperability, reporting that it "will also address critical issues such as data provenance, data quality and reliability, and patient matching to improve the quality of interoperability, and therefore facilitate an increased quantity of information movement."[72]

Solution Types: Analytics, visualizations, algorithms; Scientific

Plan for Upcoming 2 FYs: N/A

A.5.30 Privacy Policy Snapshot Challenge[73]

Lead Sponsoring Agency: ONC

Status: This competition was completed in FY17.

Competition Goals: The Privacy Policy Snapshot Challenge was a call for designers, developers, and health data privacy experts to create an online Model Privacy Notice (MPN) generator. The MPN is a voluntary, openly available resource designed to help health technology developers who collect digital health data clearly convey information about their privacy and security policies to their users. Similar to a nutrition facts label, the MPN provides a snapshot of a product's existing privacy practices, encouraging transparency and helping consumers make informed choices when selecting products.

Goal Types: Improve government service delivery; Solve a specific problem; Inform and educate the public

Justification for Using Prizes and Challenges: Compared to a contract or other mechanism, a prize challenge provided the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provided an opportunity to engage app

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[72] ONC (2014) A 10-Year Vision to Achieve an Interoperable Health IT Infrastructure, available at https://www.healthit.gov/sites/default/files/ONC10yearInteroperabilityConceptPaper.pdf

[73] The website for the Privacy Policy Snapshot Challenge can be viewed at https://www.Challenge.gov/challenge/privacy-policy-snapshot-challenge/.

and software developers who might not be familiar with the health IT world but can bring viewpoints and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $35,000. First, second, and third place winners were awarded $20,000, $10,000, and $5,000, respectively. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: ONC solicited submissions through social media outreach (Twitter, LinkedIn), email blasts, and a live webinar.

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

Participation Requirements: The Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: Submissions were evaluated based on the following criteria: (1) accurate use of MPN content, including appropriate modification of flexible language and no deviation from standardized language; (2) use and demonstration of best practices in developing and presenting web content for consumption, including consumer testing, web design, and accessibility; (3) visual appeal of the generated MPN; and (4) ease of use for a developer to implement and use the MPN generator, including ability to customize the MPN. The submission review panel was a combination of Federal and non-Federal subject matter experts.

Results: Of the six entries submitted between December 13, 2016 and April 10, 2017, three prizes were awarded. The number of submissions fell slightly below expectations, although a smaller prize purse and an open source intellectual property policy may have contributed to the small number of submissions.

Budget and Resources: Challenge development and preparation duties were the responsibility of ONC employees. Once ready for launch, the Challenge began utilizing the services of a contractor which has been involved in such duties for ONC since 2010. This contract provided challenge support and services including hosting of the challenge website, preparation of communications materials, ongoing day-to-day activities of challenge management, and support for reviewing and awarding functions. The value of this support was estimated at $15,000. The Challenge utilized 0.4 FTEs.

Partnerships: N/A

Advancement of Agency Mission: In 2011, ONC collaborated with the Federal Trade Commission (FTC) to release a MPN; the project's goals were to increase consumers' awareness of companies' personal health record (PHR) data practices and empower consumers by providing them with an easy way to compare the data practices of two or more PHR companies. In the last five years, the health information technology market has changed significantly and there is now a larger variety of products such as mobile applications and wearable devices that collect digital health data. ONC recognized a need to update the MPN to make it applicable to a broad range of consumer health technologies beyond PHRs. More and more individuals are obtaining access to their electronic health information and using consumer health technology to manage this information. As retail products that collect digital health data directly from consumers are used, such as exercise trackers, it is increasingly important for consumers to be aware of companies' privacy and security policies and information sharing practices. Health technology developers can use the MPN to easily enter their information practices and produce

a notice to allow consumers to quickly learn and understand privacy policies, compare company policies, and make informed decisions.

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

Plan for Upcoming 2 FYs: N/A

A.5.31 Provider User Experience Challenge[74]

Lead Sponsoring Agency: ONC

Status: This competition was completed in FY17.

Competition Goals: The Provider User Experience Challenge had several objectives, the primary one being to increase the number of apps available to providers that can aggregate patient data from multiple sources into one place, and utilize modern web and information design to simplify and enhance the user experience. Specifically, this had to be done using the FHIR API, which is the most widely-known and developed open API for exchanging patient health data. Despite having a high level of awareness, the Challenge was also intended to raise awareness higher and to incentivize more developers to work with and familiarize themselves with FHIR.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Inform and educate the public; Engage new people and communities; Build capacity; Stimulate a market

Justification for Using Prizes and Challenges: Compared to a contract or other mechanism, a prize challenge provided the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provided an opportunity to engage app and software developers who might not be familiar with the health IT world but can bring experience and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The Challenge had a prize purse of up to $175,000. In Phase 1, up to five prizes of $5,000 to $15,000 were available; four $10,000 prizes were awarded. In Phase 2, one $50,000 first prize, one $25,000 second prize, and an additional $25,000 prize for the app demonstrating the highest level of patient data exchange were available; all three were awarded, with one business winning both of the $25,000 awards. The primary non-monetary incentives are the publicity and recognition for winning an ONC challenge. Award funds were disbursed by a contractor acquired through the HHS Competes Blanket Purchasing Agreement.

Solicitation of Submissions: ONC solicited submissions through an announcement of the challenge at a major industry conference, a press release, social media outreach (Twitter, LinkedIn), email blasts, and several webinars. The 34 submissions indicate that the communications vectors worked, especially the main stage conference announcement, although the large prize purse was likely also a factor.

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

Participation Requirements: While the Challenge was open to all developers, the need to understand the intersection of EHRs, patient care, and patient data sharing made it most relevant to companies that already had working knowledge of those areas and are active in health IT. The Challenge was run under

[74] The website for the Provider User Experience Challenge can be viewed at https://www.Challenge.gov/challenge/provider-user-experience-challenge/.

the authority of Section 105 of the America COMPETES Reauthorization Act and therefore had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: A combined review panel of Federal and non-Federal subject matter experts reviewed and scored all Phase 1 submissions; the Federal challenge managers selected the winners, factoring in those reviews. In Phase 1, equal co-winners were chosen rather than ranked winners because the submissions, written proposals, are steps toward the eventual outcome of the challenge, not the outcome itself. The final outcomes of Phase 2, health provider apps, were ranked and awarded on the same evaluation criteria. Five evaluation criteria were used to review submissions: (1) the technical feasibility of the plan; (2) the adherence to data privacy and security best practices and applicable law; (3) the strength of the business/sustainability plan; (4) the impact potential in a clinical setting; and (5) the provider and/or health IT developer partnerships. These criteria captured the most important aspects that needed to be identified in the submissions.

Results: Of the 34 entries submitted in Phase 1 between March 1 and June 1, 2016, four prizes were awarded. Phase 2 entries were submitted between June 2 and November 7, 2016 and two prizes were awarded.

Budget and Resources: A small ONC team, with one primary challenge manager, developed and executed the Consumer Health Data Aggregator and Provider User Experience Challenges. Additional funds for the challenge prizes were required on top of the annual ONC challenge funding allocation; these were designated to the project from the national coordinator's discretionary pool. A third-party contractor, acquired through the HHS COMPETES Blanket Purchasing Agreement, provided administrative, management, and communications assistance. Given the challenge manager's extensive experience in running prize challenges, challenge development services were not needed. The Challenge utilized approximately 0.2 FTE in FY17.

Partnerships: N/A

Advancement of Agency Mission: The lack of interoperability between EHR systems remains a significant barrier to the modernization of health IT. FHIR is a standard designed to increase the liquidity of granular patient data. The FHIR API allows data to move between vendor systems both within and across different providers, not to mention through third-party applications for direct use by both clinicians and consumers. Among several opportunities now enabled by this interoperability standard are the new channels being opened up for improving a provider's user experience when interacting with EHRs and the consumability of interrelated health data. The Provider User Experience Challenge, combined with its partner challenge, the Consumer Health Data Aggregator Challenge, was part of ONC's Connecting and Accelerating a FHIR App Ecosystem initiative. This initiative called on innovators to develop market-ready software apps for consumers and healthcare providers in an effort to improve the health and care of the country.

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

Plan for Upcoming 2 FYs: N/A

A.5.32 Proving the Potential: A Health Data and Standards Code-a-Thon[75]

Lead Sponsoring Agency: ONC

[75] The website for the Proving the Potential: a Health Data and Standards Code-a-Thon can be viewed at https://www.cccinnovationcenter.com/challenges/proving-the-potential-a-health-data- and-standards-code-a-thon/.

Status: This competition was completed in FY17.

Competition Goals: Teams were challenged to showcase their skills and vision using APIs, software development kits (SDKs), and other tools made publicly available by leading innovators in healthcare. Projects were intended to be forward-thinking, enhance interoperability, and focus on demonstrating the potential to seamlessly incorporate one or more of the assets into existing health IT systems. Contestants were to address one of the following use cases: (1) electronic quality measures and/or decision support; (2) secure and privacy preserving methods to aggregate patient data; (3) discovery of patients, providers, researchers or services.

Goal Types: Develop technology; Inform and educate the public; Engage new people and communities; Stimulate a market

Justification for Using Prizes and Challenges: Prizes were chosen with the scope to engage a broader stakeholder community, including researchers, innovators, start-ups, and small entities, to spur innovation, educate the larger community, spur adoption of metrics, and lay the groundwork for potential future collaboration.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $15,000 and the total amount awarded was $8,000. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: ONC solicited submissions through social media outreach (Twitter, LinkedIn), email blasts, and a live webinar.

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

Participation Requirements: The Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: A panel of judges assessed each solution based on the following criteria: (1) technical competence and capabilities (35%); (2) use of data to provide effective outcomes (20%); (3) creativity/innovation (20%); and (4) valuable information and insights regarding data (25%).

Results: Entries were submitted between April 11 and April 21, 2017. Three monetary awards were issued in addition to four Honorable Mention designations. Participation was lower than anticipated, leading to partial rather than complete award of the full prize purse.

Budget and Resources: Code-A-Thon development and preparation duties were the responsibility of ONC employees. Contract funds were used to provide event support and logistics and to fund the cash awards. The Challenge utilized approximately 0.2 FTE and $145,000 in funding.

Partnerships: N/A

Advancement of Agency Mission: The Challenge intended to link patient data across research, claims and clinical data sets in order to standardize the sharing of patient data across organizations. As part of a Patient Centered Outcomes Research funding opportunity within HHS, a number of open source tools and services have been built to support the use of open APIs as a means to exchange clinical and health related data. This Code-A-Thon aimed to encourage developers to leverage these assets using these underlying services and platforms to build more advanced services on top of them and showcase their innovations.

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

Plan for Upcoming 2 FYs: N/A

A.5.33 Secure API Server Showdown Challenge[76]

Lead Sponsoring Agency: ONC

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

Competition Goals: The main goal of Stage 1 was for participants to implement the Substitutable Medical Applications, Reusable Technologies (SMART) standard on FHIR Authorization specification into an existing open source FHIR code base and to develop a secure FHIR server. The main goal of Stage 2 was to further harden the open source FHIR servers by enabling dedicated testing of the security components by participants. Participants tested the winning FHIR servers from Stage 1 and identified potential security vulnerabilities. This was intended to help improve the security of current and future open source FHIR servers and add to security best practices for use of SMART on FHIR authorization.

Goal Types: 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: Compared to a contract or other mechanism, a prize challenge provided the opportunity to reach out to the public for new ideas. Individuals and entities that work daily in the health IT and health care field, interacting with patients, can bring new viewpoints to issues that ONC policy specialists cannot. The Challenge also provided an opportunity to engage app and software developers who might not be familiar with the health IT world but can bring experience and knowledge from other industries to bear.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $50,000 and the total amount awarded was $20,000. Non-monetary incentives included public recognition and opportunities to showcase work at ONC-sponsored events.

Solicitation of Submissions: ONC solicited submissions through Challenge.gov, a contractor website, a HealthIT.gov blog post, the ONC Twitter account, a listserv announcement, email blasts, and university outreach. Despite a strong effort to advertise this Challenge, there was a small number of participants. This result was not unexpected because the Challenge was a very niche topic.

Solicitation Types: Social media (e.g., Twitter, Facebook); Email (e.g., listservs); Press release; Other - University outreach

Participation Requirements: The Challenge was open to the public and targeted technology developers and the health IT community. The Challenge was run under the authority of section 105 of the America COMPETES Reauthorization Act and, therefore, had the eligibility criteria pursuant to it and to HHS policy guidance.

Evaluation of Submissions: In Phase 1, submissions were evaluated as to whether they met the FHIR Server requirements as indicated on the Challenge website. A live demonstration of the FHIR server was held with judges evaluating their adherence to the requirements. In Phase 2, submissions were

[76] The website for the Secure API Server Showdown Challenge can be viewed at https://www.cccinnovationcenter.com/challenges/secure-api-server-showdown- challenge/.

evaluated based on the most number of vulnerabilities discovered in FHIR server and two bonus categories.

Results: Of the two entries submitted between October 10, 2017 and January 15, 2018, two prizes were awarded.

Budget and Resources: Challenge development and preparation duties were the responsibility of ONC employees. Once ready for launch, the Challenge began utilizing the services of a contractor which has been involved in such duties for ONC since 2010. The current contract is funded at $125,000 and structured to provide support for up to three challenges over a one-year period. These services include hosting of the challenge website, preparation of communications materials, ongoing day-to-day activities of challenge management, and support for reviewing and awarding functions. The Challenge utilized approximately 3 FTEs in FY17 and FY18 and $20,000 in FY18 funding.

Partnerships: N/A

Advancement of Agency Mission: The Challenge sought to engage the health IT industry to identify FHIR servers that reinforce the value of following technical security best practices on an industry-wide scale. These best practices ensure the most widely-accepted and effective measures are taken, resulting in a high-quality, secure FHIR server, further helping to protect the health information it contains.

Solution Types: Software and apps; Ideas; Technology demonstration and hardware

Plan for Upcoming 2 FYs: N/A

A.5.34 HHS Opioid Code-a-Thon[77]

Lead Sponsoring Agency: Office of the Secretary, Office of the Chief Technology Officer (CTO)

Status: This competition was launched and completed in FY18.

Competition Goals: The purpose of the Code-a-Thon was to develop data-driven solutions to the opioid epidemic using Federal, State, and local (city, county) datasets. CTO's goal was for solutions identified at the Code-a-Thon to be implemented and used to address the opioid crisis.

Goal Types: Find and highlight innovative ideas; Engage new people and communities

Justification for Using Prizes and Challenges: Prizes were used to engage new communities and expertise in answering questions about the opioid epidemic, and to develop data-driven solutions.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $30,000. The $30,000 was in-kind support from co-sponsors: Socrata ($10,000), Tableau ($10,000), Alteryx ($5,000), and the University of Louisiana Lafayette ($5,000). Participants were also offered registration to attend the HHS Opioid Symposium that occurred the morning before the Challenge began.[78]

Solicitation of Submissions: CTO solicited submissions through social media and marketing emails. Non-Federal partners' outreach was critical to reaching communities that might not normally engage in government work.

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)

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[77] The website for the HHS Opioid Code-a-Thon can be viewed at https://www.hhs.gov/challenges/index.html.

[78] Information about the Symposium is available at: https://www.hhs.gov/challenges/symposium/index.html.

Participation Requirements: Interested participants were required to form teams of three to five individuals. Team needed to attest to the following qualifications: (1) team skillsets: team indicates that they possess computer programming, data analytics, and end user design skillsets; (2) team multidisciplinary expertise: team indicates expertise in any two of the following areas relevant to the challenge tracks: health, analytics, social science, design, and/or engineering; and (3) team experience: the team indicates that they collectively have ten years of experience in their respective fields and/or previously participated in a public or private sector sponsored Code-a-Thon.

Evaluation of Submissions: Participants performed a five-minute, in-person demo and provided the following information to be eligible for further review and a prize award on December 7, 2017: (1) team name, participant names, organization(s), and primary point of contact; (2) challenge track; (3) data resources utilized; (4) link to the solution, (5) written summary of the solution. The participants were judged by a group of judges from HHS, state, and private sector representatives. Solutions were judged based on design, potential for impact, technical achievement, and innovation.[79]

Results: Of the 50 team entries submitted by 300 participants on December 7, 2017, three prizes were awarded.

Budget and Resources: The Challenge utilized 2.5 FTEs in challenge planning and execution and $400,000 in FY18 funding for contract services for strategy and execution of the event.

Partnerships: Non-Federal partners sponsored prize money and provided in-kind donations for food, coffee, and snacks. Non-Federal partners also promoted the competition to increase participation. Finally, a non-Federal partner held an event prior to the Challenge. The partner convened a diverse set of stakeholders to develop design principles that helped guide challenge participants' solution development for the Challenge. Federal partners included numerous HHS subagencies (AHRQ, CMS, CDC, SAMHSA, HRSA) and other Federal agencies (Department of Transportation, Department of Justice, Department of Education, Department of Commerce, and Census Bureau). Non-Federal partners included the State of Indiana, the State of Louisiana, the State of North Carolina, the State of Virginia, Denver Health System, Socrata, Tableau, Alteryx, the University of Louisiana LaFayette, IEEE, Appriss Health, Google, Tamr, Stanford MedX. The estimated value of partner contributions is $35,000.

Advancement of Agency Mission: Teams used data from HHS and other Federal agencies, some of it released for the first time, to analyze trends and patterns and propose solutions in three challenge areas. The innovative ideas developed at the Code-a-Thon have led to solutions that are being tested in the field or to new companies being formed. Finally, the NIH NIDA Office of Translational Initiatives and Program Innovations developed a SBIR grant to support new solutions and business models relevant to the opioid epidemic.

Solution Types: Software and apps; Technology demonstration and hardware

Plan for Upcoming 2 FYs: There is a need to continue analysis of data to inform approaches to the opioid epidemic. There are also efforts within HHS to increase data sharing between agencies and analyses conducted using multiple data sources. Future plans will focus on answering questions about the opioid epidemic and other priority area topics through challenge competitions, some of which may specifically engage staff internal to HHS.

[79] More information about the evaluation process is available at: https://www.hhs.gov/challenges/code-a-thon/index.html

A.6 Department of Homeland Security (DHS)

A.6.1 Hidden Signals Challenge-"Can you Identify Biothreats in Real-Time?"[80]

Lead Sponsoring Agency: DHS Science and Technology Directorate

Status: This competition was launched and completed in FY18.

Competition Goals: The Hidden Signals Challenge called upon data innovators from a wide variety of fields—from data science, to civic tech, to epidemiology—to develop concepts (in Stage 1) and system designs (in Stage 2) for novel uses of existing data that will identify signals and achieve timelier alerts for biothreats in cities and communities. DHS intended for this work to be the first step in the design of a local and/or national-level system that could enable city-level operators to make critical and proactive decisions based on the most relevant and actionable insights. The Challenge focused on large metropolitan areas such as New York, Los Angeles, Washington D.C., Chicago, Boston, and Atlanta but was also open to solutions that address all geographic locations.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Engage new people and communities

Justification for Using Prizes and Challenges: In the context of population health, understanding and utilizing nontraditional data as prognostic indicators provides an opportunity for earlier detection and better situational awareness of potential health threats. Previous and on-going research and development (R&D) efforts have focused on obtaining personal health information; however, this information is difficult to access and not timely enough to enable early intervention. While DHS is aware of certain data sets that could be of value, a prize competition enabled solvers from a broader knowledge base to not only join unique data sets that might otherwise not be considered, but also to apply novel data-driven analytics to provide strategies and algorithms for anticipating and detecting biological threats in a timely manner. Further, surveillance and data integration are topic areas that span a broad range of industries, from commercial business intelligence to law enforcement, and a prize competition would potentially reach such needed expertise that might otherwise be missed. A prize competition enabled novel approaches to the problem.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $300,000. The prize purse was divided into two stages. In Stage 1, five finalists received $20,000 each and in Stage 2, the first place winner received $150,000 and the second place winner received $50,000. Non-monetary incentives included mentorship for problem solvers in the development and implementation of their solutions during Stage 2. All prize funds were FY17 funds from the Real-Time Biothreat Awareness Apex Program. Cash prizes were paid directly to the winners by the DHS Science and Technology Directorate.

Solicitation of Submissions: During Stage I open submissions, the Challenge sought to drive submissions from innovators and communicate the program's value to the public and stakeholders. During Stage II, the Challenge sought to drive awareness of the program to the public and stakeholders such as city-level employees, healthcare professionals, and data technology influencers across the United States. Promotion included public press announcements and targeted outreach, influencer activation, and sharing messages through the Challenge, DHS Science and Technology (S&T), and Challenge winners' channels. Press coverage included stories in 15 outlets including security (American Security Today),

[80] The website for the Hidden Signals Challenge-"Can you Identify Biothreats in Real-Time?" can be viewed at www.hiddensignalschallenge.com.

government (FedScoop), and healthcare (Fierce Healthcare). For targeted outreach, the vendor directly contacted over 350 validators, experts, and solvers and secured placement for Challenge.gov, NYC Open Data, Open Data Atlanta, Open Data D.C., and Harvard Business School Digital Initiative newsletter. A Challenge-specific newsletter (opened approximately 500 times via forwarding) and blog were also developed. Additionally, social media presence garnered more than one million impressions. Notable tweets included U.S. Chief Data Scientist DJ Patil (@DPatil), In-Q-Tel's B, Next Lab (@HarvardCIL), and data influencer (@KDNuggets). These efforts resulted in nearly 300 visitors to the Challenge website over three days, including tech giants Amazon and Microsoft, city-level employees from NYC Transit Authority and City of Palo Alto, and hospitals such as Longwood Medical and Academic Area, Children's Hospital Colorado, London School of Hygiene and Tropical Medicine, and St. Jude's Children's Hospital.

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 Challenge was open to all individuals over the age of 18 who have not been convicted of a felony. Individuals must be a United States citizen or legal permanent resident at the time of entry. In addition, the Challenge was open to all validly formed legal U.S. entities whose primary place of business was in the U.S. and have not declared or been declared in bankruptcy. Eligibility was subject to verification by the Department of Homeland Security, Science and Technology Directorate before cash prizes were awarded. For full eligibility details, visit: https://www.hiddensignalschallenge.com/rules-terms-conditions/#eligibility

Evaluation of Submissions: Selecting the five Stage I finalists involved the following work streams: (1) preliminary vetting by the vendor, with confirmation by DHS of ineligible submissions; (2) assignment of submissions to a review panel of 17 expert review panelists; (3) review panel scoring against an established rubric (originality, impact, feasibility, sustainability, scalability, team); (4) advancement of the top 20 submissions to judges; (5) judges scoring (same criteria); (6) deliberation call; (7) finalist recommendation; (8) DHS vetted finalists; and (9) clearance by DHS Office of General Counsel (OGC). Selecting the grand prize winner and runner-up for Stage II involved judges scoring against established criteria (empathy, impact, feasibility, sustainability, scalability, and team), a deliberation call, a winner recommendation, and DHS vetting and clearance of winners.

Results: The Challenge consisted of two stages. Stage I submissions opened October 17, 2017 and closed December 4, 2017. Stage I winners were announced February 14, 2018. Of the 37 submissions received in Stage I, five winners (three individuals and two teams) were selected to receive $20,000 each. Stage II was announced February 16, 2018 and submissions closed April 13, 2018. Stage II winners were announced May 30, 2018. Of the 5 submissions received in Stage II, two winners were selected. The first prize winner received $150,000 and the second prize winner received $50,000.

Budget and Resources: Funding for FY17 and FY18 totaled $507,071.48. Of the total funding, $452,772 was allotted to administer the prize through NASA's Center of Excellence for Collaborative Innovation and $36,689.48 was allotted for NASA's overhead. In addition, two full-time equivalent employees (FTEs) supported the planning stage of the Challenge in FY17[81] and 1.5 FTEs supported the execution

[81] Breakdown of FTEs in FY17: 1.5 FTEs by the DHS Science and Technology Directorate, 0.25 FTE by the DHS Prize Office and General Counsel, and 0.25 FTE by DHS Office of Health Affairs National Bio-surveillance Integration Center.

stage of the Challenge in FY18.[82] Funds provided were used to establish an interagency agreement (IA) with NASA and select a third-party prize administrator. Expenses were invoiced by NASA and prize funds were paid directly to winners by the DHS Science and Technology Directorate. Federal personnel supporting the Challenge performed activities such as preparing paperwork/documentation for the prize design, coordinating stakeholders, participating in meetings, providing subject matter expertise and services (e.g., communications and legal), and judging.

Partnerships: For this challenge, the DHS Office of Health Affairs National Biosurveillance Integration Center (NBIC) participated as the primary partner. NBIC offered in-kind support and expertise for the design and development of the Challenge, judging, and participation in the Challenge "virtual accelerator." NBIC provided additional marketing and outreach through their own communication channels, monthly forum, and stakeholder newsletter. For future challenges, clearly defining the roles and responsibilities of all partners will be critical to avoiding conflict and ensuring smooth and successful execution of the challenge. Non-Federal partners included the U.S. Department of Health and Human Services, Insight Data Science, Plymouth University, Enigma Technologies, the City of San Francisco, and Google. Total estimated value of partner contributions was $100,000.

Advancement of Agency Mission: DHS' biodetection and biosurveillance programs have found that the current detection and surveillance methods for biological threats, whether intentional releases of biological agents or infectious diseases, are not timely enough to enable early warning and intervention. Extensive literature reviews and interviews with subject matter experts have resulted in the identification of numerous problems with existing systems and biosurveillance efforts, including barriers to access of relevant situational and health data (e.g., electronic health records); confidence in data sources; uncertainty about existing, evolving, and emerging biological threats; and absence of the infrastructure, technologies, policies, and knowledge needed to effectively collect and derive insights from data. To achieve a timelier bio-surveillance enterprise, local and State entities/operators, as well as DHS operational components, must have access to a system that enables heterogeneous data sets to be captured and analyzed in real-time. These disparate data sets must be analyzed to not only understand relationships among them but also possible correlations with biological threats. By harnessing new streams of nontraditional data and information, an emerging problem may be identified more quickly and confidently, ultimately resolving the problem faster. DHS S&T challenged data innovators from a wide variety of fields to develop concepts for novel uses of existing data that will identify signals and achieve timelier alerts for biothreats in our cities and communities. Successful concepts explored connections between multiple readily accessible data sources to develop real-time insights that can improve public safety responses to emerging biothreats.

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

Plan for Upcoming 2 FYs: During the upcoming two fiscal years, DHS will focus on a priority cross-cutting and topical area: the opioid epidemic. This topic has many problem spaces that are suitable for a challenge format, including technical approaches for detection/identification as well as big data analytics.

[82] Breakdown of FTEs in FY18: 1 FTE by the DHS Science and Technology Directorate, 0.25 FTE by the DHS Prize Office and General Counsel, and 0.25 FTE by the DHS Office of Health Affairs National Bio-surveillance Integration Center.

A.6.2 Passenger Screening Algorithm Challenge[83]

Lead Sponsoring Agency: DHS Science and Technology Directorate

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

Competition Goals: Original equipment manufacturer (OEM) developers have struggled to decrease the rate of false alarms of Advanced Imaging Technology (AIT) passenger screening systems deployed at airports. False alarms result in secondary screening and pat downs, reducing checkpoint throughput and adversely impacting the traveler experience. Improved image recognition algorithms have the potential to reduce false alarms and are also critical to enabling an effective response to rapidly evolving security threats. DHS Science and Technology Directorate (S&T) and the Transportation Security Administration (TSA) used this Challenge to explore diverse and potentially more comprehensive solutions from many creative sources. Instead of partnering with OEMs on a one-on-one basis, the competition sought image recognition software (i.e., algorithms) that can be adapted into any number of hardware platforms. DHS S&T and TSA are looking to grow the industry around third-party capability providers of threat recognition algorithms. There currently is a very small technical provider base in this field, which limits the number of companies who traditionally propose solutions. DHS S&T and TSA are investigating interface standards that will allow third-party algorithms to be quickly implemented on deployed systems, allowing for rapid adaptation to changing threats in a non-proprietary way. This Challenge sought to identify third-party providers and how their creative approaches can be realized to improve security and provide a better passenger experience.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Solve a specific problem; Advance scientific research; Develop technology; Engage new people and communities

Justification for Using Prizes and Challenges: Software algorithms are purchased traditionally through OEMs and are highly proprietary to the company. This Challenge aimed to improve the procurement process by engaging skilled algorithm developers. The end results were new approaches and capabilities that were developed faster and more cost-effectively than a traditional research and development contract.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $1,500,000. Eight awards were made. The first place winner was awarded $500,000; the second place winner was awarded $300,000; the third place winner was awarded $200,000; and the fourth through eight place winners were awarded $100,000 each. DHS S&T dispersed the monetary award payments to the winners after verifying eligibility.

Solicitation of Submissions: Submissions were solicited through the Kaggle platform. The platform included automatic scoring and collaboration tools. Hosts could also view individual submissions for additional analysis. The platform allowed for both solvers and hosts to understand algorithm performance in near real-time, which resulted in strong platform engagement with significant host visibility into the algorithms. Competition marketing was used through the Kaggle platform including their website, blog, and social media. Additional marketing was done through Challenge.gov. Across these websites, there were over 300,000 page views. The Kaggle platform was determined to be the most effective marketing method.

[83] The website for the Passenger Screening Algorithm Challenge can be viewed at http://www.kaggle.com/c/passenger-screening-algorithm-challenge.

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

Participation Requirements: All participants were required to agree to non-disclosure rules in order to protect the data used in the competition. Participants were bound by the rules under the America COMPETES Act with regards to prize eligibility. There were no additional restrictions on participation in the competition.

Evaluation of Submissions: Submissions were evaluated using a quantitative log-loss metric. This metric compared the submitted confidence score for each of the 23,596 required predictions to the binary ground-truth (i.e., either an object was present or not). This comparison resulted in a quantitative metric that could then be ranked. Submissions were ultimately approved by evaluators from the DHS S&T Apex Screening at Speed program, DHS S&T Transportation Security Laboratory, and TSA.

Results: Of the 9,339 entries submitted by 586 participants between June 22, 2017 and December 15, 2017, a total of eight awards were made.

Budget and Resources: DHS S&T contributed a total of $1,122,000 through an interagency agreement with NASA's Center of Excellence for Collaboration Innovation to plan and conduct the Challenge. This included $1,030,106.52 for the prize administrator contract to Kaggle, Inc., $81,893.48 for NASA overhead, and $10,000 for a required Client Accounting Advisory Services (CAAS) audit. The $1,500,000 prize purse was dispersed by DHS S&T. The prize purse included a contribution of $1,000,000 from TSA and $500,000 from DHS S&T. In addition, 0.85 full-time equivalent employees (FTEs) supported the Challenge in FY17[84] and in FY18.[85] The source of funding for the $1,122,000 interagency agreement with NASA was from FY16 appropriated funds for Integrated Passenger Screening Systems. The source of funding for the $1,500,000 prize purse is as follows: $500,000 from FY16 appropriated funds for Integrated Passenger Screening Systems and $1,000,000 from TSA through an interagency agreement. All funding was obligated in FY17.

Partnerships: DHS S&T partnered with NASA's Center for Excellence for Collaborative Innovation. NASA provided subject matter expertise and contracting support to help execute the Challenge. In addition to NASA, DHS S&T partnered with TSA's Office of Acquisition Program Management, which provided $1,000,000 to help fund the prize purse and also provided subject matter expertise and judging support to the competition.

Advancement of Agency Mission: Over two million passengers are screened daily at U.S. airports using highly sensitive screening technology to detect potential threats and prevent them from getting through the checkpoint. While passenger security is TSA's number one priority, it is also important to speed up the screening process to ensure an enjoyable travel experience. False alarms, resulting in pat-downs and secondary screening, is a significant contributor to delays at the checkpoint. The DHS Science and Technology Directorate and TSA are striving to reduce false alarm rates, as well as develop the capability to continue to protect against new and evolving threats. A passenger screening system with much lower false alarm rates will have a significant impact to aviation checkpoint operations, improving the passenger experience and overall passenger throughput. TSA will be able to repurpose TSA officers to other critical tasks as opposed to pat-downs. Finally, better algorithms are a critical part

[84] Breakdown of FTEs in FY17: 0.25 FTE by the DHS Prize Office and General Counsel, 0.5 FTE by the DHS S&T Explosives Division, and 0.1 FTE by TSA.

[85] Breakdown of FTEs in FY17: 0.25 FTE by the DHS Prize Office and General Counsel, 0.5 FTE by the DHS S&T Explosives Division, and 0.1 FTE by TSA.

of a flexible and adaptable security posture, allowing TSA to rapidly respond based on real-time requirements.

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

Plan for Upcoming 2 FYs: For FY19, three competitions are in planning stages and one in early exploration stage for execution by DHS S&T. 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 educate and better prepare the public. Additional cross-cutting areas include first responder technologies. For 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.

A.7 Department of State (State)

A.7.1 AIT FY18 Fishackathon

Lead Sponsoring Agency: American Institute in Taiwan (AIT)

Status: This competition was launched and completed in FY18.

Competition Goals: The goal of the prize competition was to bring together thousands of concerned designers, developers, and subject matter experts to build practical technological solutions to endemic problems faced by the global fishing industry. By attracting problem solvers across the globe and encouraging them to embrace collaborative problem solving efforts, the competition aimed to produce open-source solutions to global challenges on themes such as sustainability, marketplace, and enforcement.

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: A prize competition was seen as an effective means for rewarding innovation and technological advances while encouraging young coders to continue their work in this field and collaborate together to solve tough issues. Unlike more traditional methods such as contracts, grants, and cooperative agreements, the prize competition could promote project goals, engage younger audiences, and facilitate the exchange of ideas and networks across the globe.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was 180,000 New Taiwan dollars (NTD) in Taipei: and 130,000 NTD in Kaohsiung.

Solicitation of Submissions: In FY18, the AIT utilized social media to gather interest for Fish Hackathon and learned that the competition was effective in attracting young people to showase their creativity and innovative ideas. In the end, there were 140 volunteer coders in teams of three to five in Taipei who spent a weekend developing usable mobile and technological solutions to real-world problems submitted by fisheries experts around the world. In Kaohsiung, approximately 50 participants in 17 teams participated. The AIT was also able to advertise the core programs, increasing awareness of American Innovation Center events.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - IT; Other - Home Banner; Other - Youtube

Participation Requirements: N/A

Evaluation of Submissions: Relevant experts from universities, institutions, and research centers were invited to evaluate the submissions for the prize competitions and assess different pitches by the teams. The judges represented a variety of stakeholders, including the Institute of Oceanography in National Taiwan University, Hope Bay Technologies, Inc., National Taiwan Ocean University, Cloudeep, FIH Mobile Limited, and Ocean Says.

Results: N/A

Budget and Resources: AIT did not make monetary donations to the prize competitions for this event. However, AIT Taipei contributed $9,500 USD in grants for venue setup, translations, on-site support, and promotional materials. AIT Kaohsiung contributed $3,000 USD. AIT Taipei utilized eight Information Resource Center staff members, while AIT Kaohsiung partnered with National Sun Yat-sen University American staff to help with the program. All of the American Space staff was utilized for the event and provided grants to partners for venue set up, programming, and translations.

Partnerships: Non-Federal Partners for AIT Taipei included the Council of Agriculture's Fisheries Agency, Taipei City Government, Microsoft Taiwan, and Syntrend Startup Foundation. Non-Federal Partners for AIT Kaohsiung included the Fisheries Agency, Kaohsiung Marine Bureau, and National Sun Yat-sen University. For FY18, the Fisheries Agency contributed 180,000 NTD in Taipei and 130,000 NTD in Kaohsiung. The rest of the special awards were donated by different partners such as Foundation for Women's Rights Promotion and Development and Pixnet.

Advancement of Agency Mission: The prize competition advanced the agency mission by addressing transnational challenges, encouraging innovative problem solving, developing sustainable solutions to economic challenges, and facilitating AIT's engagement with Taiwan's emerging generation of coders and technology innovators.

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

Plan for Upcoming 2 FYs: Over the next two FYs, AIT and AIT Kaohsiung will continue to conduct prize competitions to promote the Hackathons and work with Federal and non-Federal partners to provide greater incentives for participation. AIT has received positive feedback from the audiences and participants and gained great publicity for Taiwan. By bringing together coders and participants to develop solutions to unique challenges, the competition will continue to improve the sustainability of both Taiwan and the planet.

A.7.2 FY17 and FY18 NASA Hackathon

Lead Sponsoring Agency: American Institute in Taiwan (AIT)

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

Competition Goals: The goal of the National Aeronautics and Space Administration (NASA) Hackathon prize competition was to produce open-source solutions to global challenges by attracting problem solvers across the globe and encouraging them to embrace collaborative problem solving efforts.

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: A prize competition was seen as an effective means for rewarding innovation and technological advances while encouraging young coders to continue their work in this field and collaborate together to solve tough issues. Unlike more traditional methods such as contracts, grants, and cooperative agreements, the prize competition could promote project goals, engage younger audiences, and facilitate the exchange of ideas and networks across the globe.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was 440,000 New Taiwan dollars (NTD) during the FY17 NASA Hackathon and 280,000 NTD during the FY18 NASA Hackathon. FY17 non-monetary incentives included a Discovery Channel film screening for participants, a one-page advertisement in the April issue of Scientific American, and social media publicity through Pixnet. FY18 non-monetary incentives included two internship opportunities and two Xbox consoles.

Solicitation of Submissions: In both FY17 and FY18, social media platforms were utilized to gather interest for the NASA Hackathons. In FY18, Facebook granted advertisement credits to AIT, which allowed AIT to spend approximately $2000 to $3000 in promoting the Hackathon.

Solicitation Types: Social media (e.g., Twitter, Facebook); 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 - IT; Other - Home Banner; Other - Youtube

Participation Requirements: N/A

Evaluation of Submissions: Subject matter experts from universities, institutions, and research centers were invited to serve as judges for the prize competitions. The judges leveraged global criteria provided by NASA to evaluate the pitches by the competing teams.

Results: N/A

Budget and Resources: Funding from AIT for FY17 totaled $7,500 in grants for venue setup, on-site support, translations, and promotional items. AIT also provided three airplane tickets to Orlando, Florida for NASA Hackathon winners. Funding from AIT for FY18 totaled 10,000 NTD in VR Special Awards through the American Innovation Center. AIT also contributed approximately $9,000 in grants for venue setup, on-site support, translations, and promotional items. Seven American Space staff members supported the FY17 Hackathon, and eight American Space staff members supported the FY18 Hackathon.

Partnerships: FY17 non-Federal partners included the Ministry of Science and Technology, Ministry of Economic Affairs, National Taiwan University, and Taipei City Government. FY18 non-Federal partners included the National Space Organization, Chunghwa Telecom, Taipei City Government, National Taiwan Normal University, IBM Taiwan, and Micron. Estimated value of partner contributions totaled 440,000 NTD in FY17 and 280,000 NTD in FY18. In FY17, the Ministry of Science and Technology funded $180,000 NTD of the grand awards, Microsoft donated 60,000 NTD in food and two Xbox consoles, and Intel donated a few monetary awards. In FY18, the National Space Organization funded $180,000 NTD in cash rewards, Microsoft donated 60,000 NTD in food and two Xbox consoles, and IBM offered internship opportunities. The remaining special awards were donated by different partners.

Advancement of Agency Mission: The prize competition advanced the agency mission by addressing transnational challenges, encouraging innovative problem solving, developing sustainable solutions to economic challenges, and facilitating AIT's engagement with Taiwan's emerging generation of coders

and technology innovators. There was an average of 50 groups that signed up in both years, which indirectly helped advertise AIT's core programs and increased the target audiences' awareness of the American Innovation Center events.

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

Plan for Upcoming 2 FYs: AIT will continue to conduct prize competitions to promote the Hackathons and work with non-Federal and Federal partners to provide greater incentives for participation.

A.7.3 Boldline P3 Accelerator – Cohort 1[86]

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

Status: This competition was launched and completed in FY18.

Competition Goals: Boldline is the U.S. Department of State's new partnership accelerator aimed to support and scale innovative public-private partnerships (P3s). One of the first programs of its kind, Boldline supported social good P3s that address pressing global challenges and focused on giving them tools to scale their missions. The main goal of Boldline was to build and deploy strategic connections and collaborations aimed at strengthening the global partnership building ecosystem, promoting and facilitating connectivity between the private sector and governments, and fostering innovative partnership business models. Boldline took the often dotted lines between government, private sector, and civil society and created a bold line between the sectors through partnerships.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity; Other - Build public-private partnerships

Justification for Using Prizes and Challenges: The U.S. Department of State, in close collaboration with industry leaders, organized a one-week partnership building accelerator program that brought together public institutions, corporations, innovation companies, entrepreneurship support organizations, and financial institutions to galvanize interest for the participating partnerships and to help build the framework for these partnerships in targeted countries. The program identified timely P3s in the early development stages of their partnerships and P3s ready to scale their operations and activities. Through a one week accelerator and ongoing support, Boldline provided the individuals and institutions behind these partnerships with mentorship, access to resources, government relations, and global networks needed to scale their impact. The accelerator took place in February 2018 in Washington, DC, and participation in the program was highly competitive.

Cash Prize Purses and/or Non-Cash Prize Awards: Non-monetary incentives included mentorship, networking, and training by DOS employees and non-government subject matter experts on public-private partnerships, private sector engagement, and other relevant topics.

Solicitation of Submissions: Submissions for Boldline were obtained from the Federal prize competition website, www.challenges.gov, and the DOS website, www.state.gov/partnerships.

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)

[86] The website for the Boldline P3 Accelerator – Cohort 1 can be viewed at https://www.state.gov/s/partnerships/boldlineaccelerator/index.htm.

Participation Requirements: N/A

Evaluation of Submissions: Submissions were evaluated by a selection committee of leadership in S/GP.

Results: Applications for Boldline opened November 1, 2017 and closed November 21, 2017. The accelerator programming occurred between February 26 and March 2, 2018. Of the 52 entries submitted by nine participants, nine winners were selected.

Budget and Resources: Funding for FY18 totaled $15,991. Funds provided were used for the venue, participant lodging, supplies (printing and audio/video rental), and representative and sponsor funds for catering meals. Five permanent government FTEs and five contractor FTEs supported the challenge in FY18.

Partnerships: The DOS Office of International Religious Freedom within the Bureau of Democracy, Human Rights, and Labor served as a Federal partner during the first cohort.

Advancement of Agency Mission: Boldline advanced the mission of the U.S. Department of State's Office of Global Partnerships by strengthening and deepening U.S. diplomacy and development around the world through partnerships that leverage the creativity, innovation, and core business resources of partners for greater impact. The Office is a center of excellence for collaboration between the U.S. Department of State, the public and private sectors, and civil society. The Department recognizes that it takes more than governments to address many global issues and believes that partnerships with the private sector, civil society, philanthropy, and other non-governmental organizations are necessary for our national security and diplomacy objectives.

Solution Types: Ideas; Other - Partner building; Other - Relationship building; Other - Networking

Plan for Upcoming 2 FYs: The DOS is planning to conduct more Boldline cohorts based on the Secretary's priorities and the DOS' Mission and Goals. Each cohort will focus on a specific topic set and be supported by other State bureaus, offices, and posts (domestic and abroad). The second Boldline P3 Accelerator cohort focused on supporting partnership creation for International Religious Freedom. The third Boldline P3 Accelerator cohort, which is still in progress, will focus on supporting partnership creation for countering propaganda and disinformation abroad.

A.7.4 Boldline P3 Accelerator for Religious Freedom (RF) – Cohort 2[87]

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

Status: This competition was launched and completed in FY18.

Competition Goals: Boldline Religious Freedom (RF) is the U.S. Department of State's partnership accelerator aimed to support and scale innovative public-private partnerships (P3s) to promote and defend religious freedom around the world. Boldline RF supported stakeholders who are leading social good P3s that align with U.S. foreign policy priorities and focused on giving them tools to scale their missions. The main goal of Boldline RF was to build and deploy strategic collaborations aimed at advancing religious freedom globally by facilitating connectivity between the private sector and governments, fostering innovative partnership models, and providing mentoring and training. Through this accelerator program, Boldline RF took the often dotted lines between government, private sector, and civil society and created a bold line between the sectors through partnerships. The Department defines a partnership as a collaborative working relationship that includes non-governmental partners

[87] The website for the Boldline P3 Accelerator for Religious Freedom (RF) – Cohort 2 can be viewed at https://www.state.gov/s/partnerships/boldlineaccelerator/index.htm.

in which the goals, structure, and governance, as well as roles and responsibilities, are mutually determined and decision-making is shared. Successful partnerships entail shared objectives, transparency, mutual risks and benefits, and accountability.

Goal Types: Improve government service delivery; Find and highlight innovative ideas; Develop technology; Inform and educate the public; Engage new people and communities; Build capacity; Other - Build public-private partnerships

Justification for Using Prizes and Challenges: The U.S. Department of State, in close collaboration with industry leaders, will organized a three-day partnership building accelerator program that brought together civil society organizations, public institutions, corporations, innovation companies, entrepreneurship support organizations, and financial institutions to galvanize interest for the participating partnerships and to help build the framework for these partnerships in their respective countries. The DOS sought the participation of stakeholders representing partnerships in the early development stages or P3s ready to scale their activities and engage additional partners. The Boldline P3 Accelerator provided the individuals and institutions behind these partnerships with the mentorship, skills training, government relations, and global networks needed to scale their impact. The accelerator took place in October 2018 in Washington, D.C., and participation in the program was highly competitive.

Cash Prize Purses and/or Non-Cash Prize Awards: Non-monetary incentives included mentorship, networking, training by DOS employees and non-government subject matter experts on public-private partnerships, private sector engagement, other relevant topics.

Solicitation of Submissions: Submissions for Boldline were obtained from the Federal prize competition website, www.challenges.gov, and the DOS website, www.state.gov/partnerships.

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: Submissions were evaluated by a selection committee of leadership in S/GP.

Results: Applications for Boldline opened June 22, 2018 and closed August 23, 2018. The accelerator programming occurred between October 22 and October 24, 2018. Of the 31 entries submitted by six participants, six winners were selected.

Budget and Resources: Funding for FY18 totaled $38,160. Funds provided were used for the venue, participant lodging, supplies (printing and audio/video rental), third part mentor fees, and representative and sponsor funds for catering meals. Five permanent government FTEs and five contractor FTEs supported the challenge in FY18.

Partnerships: The DOS Office of International Religious Freedom within the Bureau of Democracy, Human Rights, and Labor and the Global Engagement Center served as Federal partners during the first cohort.

Advancement of Agency Mission: The U.S. Department of State's Office of Global Partnerships and Office of International Religious Freedom worked in collaboration to provide the Boldline RF accelerator program. Boldline advanced the missions of both offices by strengthening and deepening U.S. diplomacy and development around the world through partnerships that leverage the creativity, innovation, and core business resources of partners for greater impact while also promoting and defending freedom of religion, conscience, and belief for all people around the world. The U.S. Department of State's Office of Global Partnerships is a center of excellence for collaboration between

the U.S. Department of State, the public and private sectors, and civil society. The Department recognizes that it takes more than governments to address many global issues and believes that partnerships with the private sector, civil society, philanthropy, and other non-governmental organizations are necessary for our national security and diplomacy objectives.

Solution Types: Ideas; Other - Partner building; Other - Relationship building; Other - Networking

Plan for Upcoming 2 FYs: The DOS is planning to conduct more Boldline cohorts based on the Secretary's priorities and the DOS' Mission and Goals. Each cohort will focus on a specific topic set and be supported by other State bureaus, offices, and posts (domestic and abroad). The third Boldline P3 Accelerator cohort, which is still in progress, will focus on supporting partnership creation for countering propaganda and disinformation abroad.

A.7.5 DOS Fishackathon[88]

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

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

Competition Goals: The U.S. Department of State launched Fishackathon in 2014 to bring together amateur and professional volunteer coders to develop practical, technological solutions addressing challenges in sustainable fishing worldwide.

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

Justification for Using Prizes and Challenges: A hackathon was utilized to engage atypical actors in the development of solutions to challenges facing fisheries worldwide and to promote awareness of sustainable fishing issues among populations unaware of these challenges. The hackathon model typically attracts students and young tech-focused individuals who can apply "outside-the-box" thinking to a sphere they aren't typically involved with.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $200,000 in Amazon Web Service (AWS) credits, provided by AWS. Non-monetary incentives included free .co and .us domain name registrations, provided by Hover.

Solicitation of Submissions: DOS used a global hackathon model to solicit submissions for solutions to the challenges facing fisheries worldwide. Though the solutions proposed by participants have potential for further development and life beyond the competition, the most immediate result of the competition is the awareness of sustainable fishing issues spread to students and tech communities around the globe. The competition was advertised digitally through Hackernest's extensive network and the networks of the regional hosts and sponsors.

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: Target solver audiences included coders, software developers, designers, subject matter experts, and students. Advanced registration for the event(s) was required, but open to all interested in participating.

[88] The website for the Fishackathon can be viewed at www.fishackathon.co.

Evaluation of Submissions: Submissions were judged by a panel of subject matter experts assembled by Hackernest on creativity, feasibility, and impact.

Results: Entries were submitted by more than 3,500 participants globally between February 10 and February 11, 2018. The Grand prize was awarded to one team of five individuals, and there were 35 regional winning teams.

Budget and Resources: The Department of State's only financial commitment to the program was used to purchase promotional materials for the U.S. events. All other costs were covered by Hackernest and regional hosts. This amounted to one FTE in each FY17 and FY18, and funds of $1,289 in FY18.

Partnerships: Non-Federal partners include Hackernest, in both FY17 and FY18, and EachMile in FY18. Hackernest managed all logistics related to the 2018 event, including raising funds, recruiting regional hosts, and all promotion related to the competition. EachMile will take on the role of managing partner for the 2019 event. The total estimated value of partner contributions is $500,000 in kind.

Advancement of Agency Mission: N/A

Solution Types: Software and apps; Ideas

Plan for Upcoming 2 FYs: EachMile plans to revamp the focus of Fishackathon when they run the competition in 2019. They will emphasize developing solutions for capturing data using sensors and the Internet of Things, and sharing data using open platforms and blockchain technology. The global event, which takes place the weekend of October 5th and 6th of 2019, will home in on a select number of cities, rather than the widespread approach favored in past years of the hackathon.

A.7.6 Competition for the President's Day[89]

Lead Sponsoring Agency: U.S. Embassy Astana

Status: This competition was launched and completed in FY18.

Competition Goals: The goal of the competition was to learn more about American culture and holidays.

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

Justification for Using Prizes and Challenges: Prizes were utilized to encourage participants to continue learning and share their knowledge on social media.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $100. The prize came from the U.S. Consulate General. Non-monetary incentives included T-shirts.

Solicitation of Submissions: The competition was announced on social media and monitored by an Information Assistant.

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

Participation Requirements: N/A

Evaluation of Submissions: Participant answers were evaluated on the basis of accuracy.

Results: Ten winners were awarded prizes.

[89] The website for the Competition for the President's Day can be viewed at https://www.instagram.com/p/BfXrQIqBPa7/?hl=en&taken-by=uscgalmaty.

Budget and Resources: Over five days, an Information Assistant tracked the answers posted by participants.

Partnerships: N/A

Advancement of Agency Mission: The competition helped advance the agency mission to promote American culture.

Solution Types: Ideas

Plan for Upcoming 2 FYs: The U.S. Consulate tries to engage with online audiences by organizing quizzes or competitions to increase the number of followers, promote global engagement, and spread knowledge of U.S. customs and traditions. Similar competitions will be organized in the upcoming years.

A.7.7 3-2-1 GO![90]

Lead Sponsoring Agency: U.S. Embassy Koror, Public Diplomacy

Status: This competition was completed in FY17.

Competition Goals: The goal of 3-2-1 GO! was to raise awareness for the Olympic Sport Envoy visit. The challenge was to "like" the post highlighting the Olympic Sport Envoy visitor and download a free Olympic poster linked to a State Department promotion of the U.S. Olympic Team.

Goal Types: Inform and educate the public

Justification for Using Prizes and Challenges: A prize competition was utilized to measure the effectiveness of using social media to raise awareness and engage with the community of Palau.

Cash Prize Purses and/or Non-Cash Prize Awards: Non-monetary incentives included a free Olympic poster.

Solicitation of Submissions: The competition leveraged the U.S. Embassy Koror Facebook page.

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

Participation Requirements: The target audience was the community of Palau.

Evaluation of Submissions: Facebook Analytics was used to measure the number of engagements.

Results: N/A

Budget and Resources: No funds were required for this challenge, and two hours of labor supported the project. A link to a free poster offered by the State Department was provided as an incentive for liking our Facebook post.

Partnerships: The State Department provided the five Olympic posters.

Advancement of Agency Mission: 3-2-1 GO! acted in parallel with the "Plant, Eat and Move" campaign by working to educate Palau's youth on noncommunicable disease (NCD) reduction and active lifestyle choices to combat Palau's growing problem with NCD rates and obesity. Through outreach activities,

[90] The website for the 3-2-1 GO! can be viewed at https://business.facebook.com/usembassykoror/publishing_tools/?section=PUBLISHED_POSTS&sort[0]=published_time_descending&current_page=3, the link has expired but I can provide a picture if necessary.

such as highlighting the visit of U.S. Olympic Sport Envoy, the competition utilized social media to raise awareness and engage with the community of Palau.

Solution Types: Analytics, visualizations, algorithms

Plan for Upcoming 2 FYs: The lessons learned from 3-2-1 GO! will support the design and execution of future prizes and challenges.

A.7.8 E-Farmer Support App

Lead Sponsoring Agency: U.S. Embassy Phnom Penh

Status: This competition was underway in FY18.

Competition Goals: AMK Microfinance Institution Plc. (AMK) proposed a grant to develop an innovative approach to invest in farmer capacity building and technical assistance. The grant was awarded by Feed the Future Harvest II with the goal to improve the farming sector as a whole as well as contribute to AMK's business objectives of increasing farmer productivity and reducing default rates. AMK demonstrated their ownership of this activity by investing in a feasibility study for this platform, seeking support in co-funding application development, content development, and marketing, and requesting expert advice for directly supporting farmers in the United States Government Zone of Influence. AMK anticipates that this initiative will be profitable by 2021, and Harvest II has requested that they provide lessons learned and a sustainability plan by the end of the grant period (June 2019) to analyze the business case for commercial viability, including costs (operation, content updates, and maintenance) and revenue sources.

Goal Types: Solve a specific problem; Develop technology; Build capacity; Stimulate a market

Justification for Using Prizes and Challenges: In order to achieve the goals, Harvest II issued a grant to AMK Microfinance Institution Plc. to implement the E-farmer Support App activity. Through this grant, farmers are expected to increase their productivity by incorporating appropriate improved technologies promoted through the app. Furthermore, this activity supports an innovative idea by a finance institution that is actively pursuing inclusive growth goals. Harvest II expects the project to have several important demonstration effects within the broader market system.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000 and the total amount awarded is expected to be $83,420. As of FY18, $13,000 of the cash prize amount was expended.

Solicitation of Submissions: Harvest II published a Grant Program Statement (GPS) in the local newspaper advertising the E-Farmer Support App project. Of the concept papers submitted in response to the GPS, AMK Microfinance Institute Plc. was selected to implement the project. The GPS is considered a competitive grant solicitation method due to its full and open publication and the project's clear and consistent application of identical, clearly stated evaluation criteria across all concepts/applications received.

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

Participation Requirements: Through this E-solution, AMK expects to reach 3,000 farmers, 15% of which will be horticulture farmers.

Evaluation of Submissions: AMK's concept note scored high enough to pass to the application phase, which required scoring 70% or more against the grant criteria. The full grant application from AMK was then evaluated by Harvest II's grants evaluation committee and scored in five categories:

implementation plan, sustainability and replicability, measurable impact, budget, and budget contribution.

Results: N/A

Budget and Resources: Funding in FY18 totaled $13,000 and was allocated between six AMK deliverables: (1) $4,000 for the AMK workplan, which outlined the planned activities during the grant period and the person responsible for each activity; (2) $1,000 for the summary of the planned design for database and app architecture, including wireframe; (3) $3,000 for the schedule of original content to be developed and released with Version 1 launch; (4) $1,500 for the list of recruited Agronomist and Community Facilitators in Bakan, Krokor districts, Pursat province, and Moung Russei, Sangke districts in Battambang province; (5) $3,000 for the summary of existing agronomic knowledge contents to be uploaded on mobile app version 1; and (6) $500 for the draft marketing materials, such as leaflets to promote app usage. In addition, one FTE employee supported the project in FY18. The total of non-cash prize amount expenditure, including Harvest II staff time, was $20,000.

Partnerships: The estimated value of partner contributions totaled $147,002.

Advancement of Agency Mission: The E-Farmer Support App is being created to freely share information and agronomic knowledge, as digital solutions can work to close some of the production-technical knowledge gaps of farmers. In addition, the app aims to ultimately expose farmers to business-related services, including finding sellers, buyers, and technical advisors, while helping to reduce default rates among AMK's borrowers. Thus, the E-Farmer Support App contributes to Mission Objective 4.2 (CDCS DO 3): Strengthen sustainable and resilient pathways out of poverty.

Solution Types: Software and apps; Other - Agronomic knowledge transfer

Plan for Upcoming 2 FYs: If AMK deploys the mobile app version 1 successfully, AMK will further develop the app into version 2 and 3 to serve purposes beyond farming, including linking farmers to input supply companies, horticulture buyers, and other private sectors. Mobile app version 2 will be released by April 2019.

A.7.9 Centennial Logo Competition[91,92]

Lead Sponsoring Agency: U.S. Embassy Riga

Status: This competition was launched and completed in FY18.

Competition Goals: The goal of the Centennial Logo Competition was to receive an attractive, eye-catching new logo for the Embassy to use to brand events during the Latvian centennial of independence, to increase our social media following, and to assist with Latvia'seconomic development by providing a professional graphic design tool as a prize.

Goal Types: Improve government service delivery; 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: Using the incentive of a prize, and publicizing the contest widely through our social media was an effective and cost-efficient solution to obtain a new embassy

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[91] The website for the Centennial Logo Competition can be viewed at https://www.facebook.com/usembassyriga/photos/a.170854467457/10156215371167458/?type=3&theater.

[92] The Centennial Logo Competition was conducted under the COMPETES Reauthorization Act of 2010, as well as the Smith Mundt Act.

logo. We received 34 submissions in the contest, and were able to choose the best one. The prize offering was a cost-efficient means of stimulating a considerable amount of graphic design work. Furthermore, the publicity that the contest received on social media was a very valuable side benefit of the competition format. The prize that we awarded (an iPad Pro) is a graphic design tool that enabled the winner of the competition to pursue more professional design work, thus stimulating innovation and economic development in Latvia.

Cash Prize Purses and/or Non-Cash Prize Awards: The prize offered for the Competition was an Apple ipad Pro 9.7 (worth $912.74). The prize was procured using the Public Affairs Section's 2018 program budget.

Solicitation of Submissions: We announced the competition via social media posts which we pinned to the top of our social media pages throughout the duration of the Competition, for maximum exposure. The participants submitted their logo designs to the Embassy via email. We then posted all the submitted designs on our embassy social media for the public to vote on the best design. The ultimate selection was based on a jury of embassy staff, with the public vote counting in the case of a tie among jury members.

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

Participation Requirements: The competition is open to anyone aged 16 and over and who is currently residing in Latvia. Employees of the U.S. Government and their immediate family members were not eligible to participate. There was no limit to the number of entries per person. Group entries were acceptable, but only one prize would have been awarded to the group. No registration or participation fee was required to enter this contest.

Evaluation of Submissions: The ultimate selection was based on a jury of six embassy staff with the public vote counting in the case of a tie among jury members. This format left the ultimate decision on the winner in the embassy's hands, but simultaneously stimulated a lot of interest and traffic on our social media platforms. This format worked very well, in retrospect. With regard to the online voting, it drove lots of interest and traffic on our social media platforms. However, we found that some of the logo designs received many more votes than others, mainly based on the energy with which the submitter of the design tried to share the Embassy posts with their friends online, rather than the quality of the submission. In other words, if we had left the decision on the logo purely up to an online vote, we might not have given the award to the best candidate. The system that we used was effective, in that it left the ultimate decision in the hands of the embassy judges, while also stimulating public interest and participation.

Results: Of the 34 entries submitted by 18 participants between February 13, 2018 and March 4, 2018, 1 prize was awarded to 1 winner.

Budget and Resources: Our locally-employed social media coordinator spent approximately 40 working hours designing the social media post, collecting entries, and responding to participants, procuring the prize, and arranging the prize-giving ceremony at the Embassy. There was also a small amount of time spent by the jury in judging the contest submissions. We allocated $912.74 of PD Program funds toward purchasing the prize.

Partnerships: N/A

Advancement of Agency Mission: Latvia is currently celebrating its 100th year of independence, and the embassy public affairs section is branding its outreach programs this year under the theme Latvia and the U.S.: 100 Years of Friendship. To gain publicity for our programs and also to harness the graphic design skills of the Latvian public, we created this logo competition. We gained maximum exposure for

the competition on social media by posting all of the entries publicly and encouraging online voting for the best logo. This gained the embassy many new social media followers and publicity for our programs. For a relatively small expense, we received many excellent graphic design submissions, the winner of which we are using as an official embassy logo during the Latvian centennial year. The contest prize, an Apple ipad Pro 9.7, served to increase the technological capacity of the Latvian public. Specifically, it provided a professional work tool to a young Latvian whose goal is to work in the graphic design field. The logo competition, therefore, directly contributed to two of our mission objectives: to strengthen the Latvian economy and economic ties to the U.S., and to promote partnership with the U.S. through our shared values.

Solution Types: Creative (design & multimedia); Ideas

Plan for Upcoming 2 FYs: We have no specific plans for other competitions at the moment, but an interesting idea in light of Latvia's centennial would be to use social media to publicize a competition among the Latvian and U.S. public to submit historical photos, documents or artifacts highlighting the U.S.-Latvian relationship over the past century.

A.8 Department of Transportation (DOT)

A.8.1 Solving for Safety Visualization Challenge[93]

Lead Sponsoring Agency: USDOT, Bureau of Transportation Statistics

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

Competition Goals: The Solving for Safety Visualization Challenge is designed to advance the use of data visualizations and visual analytics for answering analytical questions related to roadway and rail system safety. Currently transportation decision makers have a limited number of analytical visualization tools available that reveal insights, and even fewer focused on safety and prevention of serious crashes. Analytical visualization tools can cast new light on the data to reveal insights not seen though tabular analysis. A new opportunity lies in the rapid growth and advancement in technology and analytics markets combined with the volume and variety of transportation and other data now collected by the public and private sectors. Technology has already changed how we get around. USDOT seeks to harness the power of visualization technology to reduce surface transportation crashes.

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

Justification for Using Prizes and Challenges: The Solving for Safety Visualization Challenge can act as an engine in driving serious crash reduction. By incentivizing innovation, USDOT is attracting the best Solvers from around the nation to come up with new tools for visualizing the risks of serious crashes. As with other government competitions, the Solving for Safety Visualization Challenge aims to create a vibrant community of thinkers and doers who drive revolutionary innovation. One goal of the Challenge is to empower traditional and non-traditional transportation groups to raise awareness about and take up the quest of improving road and rail user safety - an issue that impacts all lives. The transportation safety community has welcomed innovation, but will benefit futher from the perspective and skills of

[93] The website for the Solving for Safety Visualization Challenge can be viewed at https://www.transportation.gov/solve4safety.

diverse subject areas. To foster new, novel, and innovative analytical visualization tools, USDOT is seeking Solvers and data from a variety of sectors. By hosting a prize competition rather than awarding grants or contracts, USDOT is alleviating traditional burden of entry issues and is inviting Solvers from outside the traditional transportation safety arena to use their innovative methods and techniques to solve for safety. In doing so, USDOT will expand its reach for raising awareness about transportation safety and will continue cultviating a culture of transportation safety.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $350,000 and the challenge consists of three stages. Five semi-finalists will compete for a portion of the $100,000 interim prize and two final stage Solvers will compete for a portion of the $250,000 final prize. Non-monetary incentives include national recognition of their work by USDOT.

Solicitation of Submissions: As part of its Safety Data Initiative, on June 14, 2018, the USDOT convened the Safety Data Forum to engage a diverse group of stakeholders in discussion about opportunities to leverage data analytics tools to predict and prevent transportation fatalities and injuries. The forum was attended by representatives of data and technology firms, universities, national safety organizations, and all levels of government. The forum included remarks and presentations from USDOT leaders and staff on Safety Data Initiative pilot projects, the announcement of the Solving for Safety visualization Challenge. On the same day, a Federal Register Notice was published and the Solving for Safety Visualization Challenge webpages went live.

On June 15, 2018, the Bureau of Transportation Statistics began posting Tweets about the Challenge, which were reposted by other USDOT offices and partners. As part of a Safety Data Forum follow-up email, attendees were encouraged to participate in and share the Solving for Saferty Visualization Challenge with their networks. On June 25, 2018, USDOT published a Briefing Room web article describing the competition. Three Stage I webinars were hosted and recorded to connect with potential Solvers and provide additional information about the competition.

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

Participation Requirements: Eligible Solvers are individuals or teams (United States and U.S. territories) from the business and research communities. This includes organizations such as: technology companies, analytics firms, transportation carriers, industry associations, research institutions, universities, mapping and visualization providers.

Evaluation of Submissions: In Stage I, Ideation, all Solvers participating in the Challenge will develop ideas for an analytical visualization tool. Five Stage I semi-finalists will be invited to Stage II as semi-finalists to develop their ideations into proofs of concept and compete for a cash prize. If a selectee declines to participate in the next stage, an alternate may be selected. The Stage I judging criteria applying to all tools include: *Benefits* (appeal to user), *Data* (novel use), *Technology* (easily maintained), and *Cost to Implement*. *Insights* and *Simulation* criteria apply only to discover insight tools and simulation tools, respectfully. These criteria area weighted equally. The evaluation panels will consider each proposal's alignment with each of these criteria and make recommendations to the selecting official. In Stage II, Concept, the five semi-finalists from Stage I will develop their ideations into proofs of concept (i.e., detilaed system designs and prototypes) for an analytical visualization tool. The five semi-finalists will compete for part of a $100,000 prize purse for their proofs of concept. Stage II judging criteria applying to all tools include: Techincal Approach, Design and Desirability, Analytical Depth, Technology Transfer Readiness Level and Feasibility, Testing and Deployment Approach, and Team. Based on review of the Stage II submissions by the judges, two of the five semi-finalists will also advance to Stage III as finalists. An additional semi-finalist may also recive an honorable mention, but not advance to Stage III. If a selectee declines to participate in the next stage, an alternate may be selected.

In Stage III, Tool, the two finalists from Stage II will further devleop their proofs of concept into full working analytical visualization tools. The two finalists will compete for a $250,000 prize purse, with each receiving a minimum of $50,000. The Stage III prize purse will be awarded to the winners based on the judges' review of the Stage III submissions. Judging criteria for Stage III are preliminary. Final judging criteria for Stage III will be provided to finalists advancing to this stage and posted on the Challenge website.

Results: During Stage I, 54 entries were submitted by participants between June 14, 2018 and July 31, 2018. Stages II and III are currently in development. In October 2018, five Stage I semi-finalists were invited to Stage II as semi-finalists to develop their ideations into proofs of concept and compete for a cash prize. Stage II is in progress and Stage III is currently in development. Prizes have not yet been awarded.

Budget and Resources: In FY18 the Bureau of Transportation Statistics (BTS) allocated $476,000 of the Agency's funds authorized in the FAST Act, sec. 6002 (a)(6). $350,000 was obligated for competition prizes as described in section 6. $63,000 was obligated for a BTS Fellow from the Department of Energy's Oak Ridge Institute for Science and Education Program. The BTS Fellow serves as the Challenge developer and coordinator. Approximately $44,000 of the $63,000 was expended in FY18 fo the Fellow. $63,000 was obligated for the DOT Volpe Center, a cost reimbursable unit of DOT that provides support for the evaluation of ideations submitted to the competition. All funds obligated to Volpe were expended. The .25 FTE represents the program management and oversight from the BTS Director of Spatial Analysis and Visualization, review of documents by counsel and the DOT staff who evaluated the ideations.

Partnerships: Challenge Innovation Agents are companies and organizations interested in providing real-world knowledge, guidance, insight, issues, and data to Solvers, especially those new to the transportation safety space. These groups do not enter into a partnership agreements with USDOT. Rather, Innovation Agents support the Challenge by providing Solvers with resources. Solvers are encouraged to seek support from Innovation Agents to strengthen their individual/team expertise. USDOT provides a public listing of two types of Challenge Innovation Agents: Technical Assistance and Data. Technical Assistance (T.A.) Innovation Agents can provide interested Solvers with knowledge, guidance, insight and issues related to transportation safety. T.A. Innovation Agents may be able to provide technial assistance related to key safety issues impacting their members or employees, transportation safety techniques, transportation system characteristics, users and operations, approaches from other industries and sectors. Data Innovation Agents can provide interested Solvers with access to data or analytic techniques that can be used in the analytical visualization tools. Use of a wide variety of disparate data is encouraged to gain insights into reduced fatalities and serious injuries on the U.S. road and rail systems.

Advancement of Agency Mission: Safety has consistently been USDOT's top strategic and organizational goal. USDOT is pursuing data-informed decision-making to help strategically prioritize and address transportation safety risks. One pillar of this approach is data visualization. USDOT is seeking clear, compelling data visualization tools that make data analysis and insights accessible to policy-makers, transportation providers and the public who make safety choices every day. The USDOT created the Safety Data Initiative (SDI) to support its high priority goal of reducing highway fatalities and serious injuries. The SDI seeks to strategically prioritize and address transportation safety risks through data-informed decision-making. The Solving for Safety Visualization Challenge is an SDI project that challenges innovators from across the nation to develop analytical visualization tools that can help reduce serious crashes on the US road and rail system. USDOT's vision for the Safety Data Initiative is to integrate data sources with each other and with new 'big data' sources that are becoming available

to enhance our understanding of crash risk and our ability to mitigate it. The initiative seeks to build USDOT's capacity to translate the successes of predictive data analytics tools used by private industry and universities to identify systemic factors contributing to serious crashes. It comprises three core components: data visualization, data integaration, and predictive insights.

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

Plan for Upcoming 2 FYs: N/A

A.9 Environmental Protection Agency (EPA)

A.9.1 Advanced Septic System Nitrogen Sensor Challenge[94,95]

Lead Sponsoring Agency: EPA

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

Competition Goals: Conventional septic systems are not designed to remove nitrogen, which can lead to problems like excess nitrogen loading to waterways. This Challenge encourages the development and commercialization of an inexpensive nitrogen sensor designed to monitor the performance of innovative and alternative nitrogen removal onsite wastewater treatment systems (OWTS). Adding nitrogen sensors to advanced septic systems will help stakeholders know that their systems are performing as intended and protect valuable coastal resources. Ultimately, such a sensor will give regulators, communities and homeowners long-term assurance of onsite system performance.

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

Justification for Using Prizes and Challenges: Running this Challenge as a prize competition rather than a contract, grant, or cooperative agreement allows EPA to meet the goal of the Challenge in the most efficient manner. Rewarding only the teams who present the best sensor creates a level of competition that raises the expectations of each participating team. It was made clear at the beginning of the Challenge that only the top teams would win monetary prizes for Phase I, the Ideation Challenge, and an International Standards Organization Standard 14034 Environmental Technology Verification for Phase II, if their sensor successful performs during the six month field test in 2019.

Cash Prize Purses and/or Non-Cash Prize Awards: For Phase I of the Challenge, the total prize purse offered was $55,000, and the total amount awarded was $52,500. The prizes allocated were $20,000 for first place, $15,000 for second place, $10,000 for third place, and $2,500 for three honorable mention awards.[96] Non-monetary incentives included recognition on Challenge.gov and the Challenge support contractor page. For Phase II, selected sensors which successfully will receive International Standards Organization (ISO) Environmental Technology Verification (ETV) Standard 14034 verification

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[94] The website for the Advanced Septic System Nitrogen Sensor Challenge can be viewed at http://www.verifiglobal.com/en; https://challenge.gov/a/buzz/challenge/filter?challenge-name=Advanced+Septic+System+Nitrogen+sensor+challenge&agency=18&prize-start=&prize-end=&sort-option=1.

[95] Phase II of the Advanced Septic System Nitrogen Sensor Challenge was conducted under the authority of Sections 104(a) and (b) of the Clean Water Act.

[96] One honorable mention award winner was not eligible under the guidelines of the COMPETES authority.

statements and reports. These reports are internationally accepted as the highest level of testing for environmental technologies.

Solicitation of Submissions: The methods used for solicitation of Phase I included tweets from the EPA Twitter account, emails to EPA listserves, one official EPA press release, posting and outreach through the challenge support contractor via www.innocentive.com. Outside organizations promoted the challenge in the same manner. For Phase II, the solicitation was limited to EPA tweets and social media, one EPA press release, EPA emails to Phase I proposal submitters, EPA Nutrient Challenge companies/teams and EPA listserves, outreach to water sensor technology list serves and posting on www.Verifiglobal.com.

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 - InnoCentive (for Phase I)

Participation Requirements: Phase I was open to companies, teams and universities, but prizes could only be awarded to U.S. entities or citizens. The submissions were written proposals with references to research conducted. Phase II is open to any team, company or university that has a wastewater sensor prototype for nitrate and ammonium or total nitrogen.

Evaluation of Submissions: For Phase I, EPA selected a committee of 12 external judges drawn from non profits, USGS, academia, Suffolk County NY and state regulators, the Massachusetts Alternative Septic System Test Center and the septic system manufacturers' organization. EPA met with the judges before the Challenge was launched, and they all gave input on the challenge goals and the judging criteria. The judges made recommendations, which were shared with EPA senior management for final decisions. For Phase II, the sensor prototypes will be evaluated based on their performance during the 6 month ISO EVT 14034 field verification test in 2019. The testing will be conducted according to the test quality assurance plan, which was developed by EPA; the Challenge contractor, Battelle; and a Technical panel, which includes several of the Phase I judges.

Results: For Phase I, the Ideation challenge, 18 entries were submitted by participants between January 17, 2017, and April 17, 2017, and prizes were awarded to six winners. Two entries have been submitted to date for Phase II, the prototype testing program, which opened on December 18, 2017 and has submission due dates of January 31, 2018, August 31, 2019, and December 7, 2018. Phase II will conclude on February 21, 2020.

Budget and Resources: This Challenge used 1 FTE over each FY17 and FY18. FTE activities for Phase I and II included problem formulation; coordinating partners, input from 8 states, Suffolk County, NY and other stakeholders on the sensor performance goals, challenge design, launch, management, and judging; and organizing the Sensor Showcase Day awards ceremony on June 29, 2017. In addition, Phase II has included the development of the ISO ETV 14034 test quality assurance plan. Funding for contract support amounted to $20,000 in FY17, and $157,000 in FY18. For Phase I, contractor support was engaged for reviewing the challenge, posting it online, and managing the submissions. For Phase II, contractor support is being used for the ISO ETV 14034 testing process and also for research on water sensor data management best practices and standards.

Partnerships: For Phase I, the U.S. Geological Survey and the Nature Conservancy contributed their expertise on water sensors and onsite wastewater treatment systems and provided input on problem definition, design, and judging. These organizations have continued their involvement for Phase II through participation on the Technical Panel.

Advancement of Agency Mission: This Challenge advances the EPA's mission by addressing nitrogen pollution in salt water from septic systems. Conventional on-site wastewater treatment systems, or

OWTS (also referred to as septic systems) are not designed to remove nitrogen to the extent required for avoiding harmful algal blooms and for protecting and restoring many productive and valuable marine and coastal waters. While EPA does not directly regulate OWTS, the Agency works closely with States and coastal communities dealing with the difficult technical and economic issues posed by nitrogen pollution.

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

Plan for Upcoming 2 FYs: This challenge will continue into FY20 and concludes on February 21, 2020.

A.9.2 Campus RainWorks Challenge[97]

Lead Sponsoring Agency: EPA

Status: This competition was completed in FY17, and the FY18 competition is underway.

Competition Goals: The Campus RainWorks Challenge is a green infrastructure design competition for American colleges and universities that seeks to engage with the next generation of environmental professionals, foster a dialogue about effective stormwater management, and showcase the environmental, economic, and social benefits of green infrastructure practices.

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: Prizes incentivize participation in the challenge.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered is $16,000, to be awarded to the first and second place winners in the demonstration project and master plan categories. First place teams in each category will receive a student prize of $2,000 and a faculty prize of $3,000 to support green infrastructure training and/or research. Second place teams in each category will receive a student prize of $1,000 and a faculty prize of $2,000. Non-monetary incentives included feedback on student green infrastructure designs from industry experts at EPA, the Water Environment Federation (WEF), the American Society of Landscape Architects (ASLA), and the American Society of Civil Engineers (ASCE).

Solicitation of Submissions: Submissions are solicited through EPA's green infrastructure webpage. Outreach is conducted through email, social media, press releases, and through cooperating organizations, including WEF, ASLA, and ASCE.

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: Student teams must be affiliated with an academic institution that meets the following description: A degree-granting, public or private institution of higher education located in the U.S., State and local governments, federally recognized Indian Tribal Governments, and U.S. territories or possessions.

Evaluation of Submissions: Qualifying submissions will be judged by two rounds of reviewers that include EPA staff, industry professionals, and academics from noncompeting colleges or universities. First round judges will score submissions on a scale of zero to 100 using pre-identified criteria. Based

[97] The website for the Campus RainWorks Challenge can be viewed at www.epa.gov/campusrainworks.

on the average of all scores for each submission, the top submissions will be recommended to a Final Panel of judges. The Final Panel will then rank the top submissions and recommend finalists in each category to a lead judge in EPA's Office of Water. The lead judge will assess the recommendations based on the criteria identified and select the first and second place winners in each category.

Results: Registration for the Challenge takes place September 1 through September 30, 2018. Entries are due December 14, 2018. Judging occurs January through March 2019, and the four winners will be announced in April 2019.

Budget and Resources: EPA used one FTE in each FY17 and FY18 for this Challenge.

Partnerships: EPA has a memorandum of understanding with WEF, ASLA, and ASCE. These organizations volunteer time to publicize the Campus RainWorks Challenge in advance of registration. Members of these organizations also volunteer their time as judges to help evaluate entries.

Advancement of Agency Mission: The Campus RainWorks Challenge is a green infrastructure design competition for American colleges and universities that seeks to engage with the next generation of environmental professionals, foster a dialogue about effective stormwater management, and showcase the environmental, economic, and social benefits of green infrastructure practices. Stormwater runoff is a significant source of water pollution in communities across the United States. The Campus RainWorks Challenge invites students to create green infrastructure designs can protect public health and water quality today and in the future.

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

Plan for Upcoming 2 FYs: The Campus RainWorks Challenge is an annual challenge that follows the same facilitation process and requires the same amount of funding and FTEs from one year to the next.

A.9.3 Nutrient Sensor Action Challenge - Stage I[98]

Lead Sponsoring Agency: EPA

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

Competition Goals: Many organizations and communities are interested in utilizing automated sensors to provide improved spatial and temporal data that can help inform decisions and actions to protect and restore our Nation's water resources. The goal of this Challenge was for teams to develop plans that demonstrate their ability to deploy and effectively use low-cost continuous nutrient sensors to collect and manage data according to specified standards, and describe how collected information from the sensors may be used in decision-making pertaining to nutrient pollution.

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: Running this Challenge as a prize competition rather than a contract, grant, or cooperative agreement encouraged multiple teams to compete to develop the best project plans. Since this was a challenge, the agency is only obligated to pay a prize if a solution is submitted that met the challenge criteria. The notion of a competition created enthusiasm and brought attention to the issue of nutrient pollution.

[98] The website for the Nutrient Sensor Action Challenge - Stage I can be viewed at https://www.challenge.gov/challenge/nutrient-sensor-action-challenge/.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $50,000, which allowed five $10,000 prizes to be awarded. Non-monetary incentives included recognition, informational webinars, monthly newsletters, and the opportunity for peer networking.

Solicitation of Submissions: Strategies to solicit participation included tweets from the EPA Twitter account, emails to listservs, an EPA press release as well as announcements at conferences and conference calls with relevant organizations. Partner organizations promoted the Challenge in similar ways.

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: Phase I of the Challenge was open to communities and organizations in the United States interested in deploying continuous nutrient sensors to address a nutrient pollution problem.

Evaluation of Submissions: A panel of nine judges was convened to review and evaluate the submissions. Judges evaluated submissions based on the challenge criteria including monitoring, analytics and interpretation, communication, and use. The judges were from government and private organizations. The judges made recommendations to EPA senior management who made the final selection.

Results: Of the 29 entries submitted by 29 participants between July 26, 2017 and September 20, 2017, 5 prizes were awarded to 5 winners. This is Stage I of a two stage challenge. Stage II is a separate challenge.

Budget and Resources: FY17 resources used to support the Challenge included $30,000 in funding and less than one FTE. Contract support was used for the development of communication materials.

Partnerships: Federal partners included NIST, USDA, USGS, and NOAA. Non-Federal partners included the Alliance for Coastal Technologies at the University of Maryland. The estimated value of in kind support received from partners was $40,000.

Advancement of Agency Mission: This Challenge advances the agency's mission by addressing the need for better and more timely information pertaining to water quality, specifically nutrient pollution. The Challenge called on teams to create innovative partnerships to design a strategy for the successful deployment of sensors, manage resulting data, and demonstrate how collected information may be used in decision-making pertaining to nutrient pollution.

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

Plan for Upcoming 2 FYs: Potential expansion into use of artificial intelligence and machine learning to improve decision-making

A.9.4 Nutrient Sensor Action Challenge - Stage II[99]

Lead Sponsoring Agency: EPA

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

[99] The website for the Nutrient Sensor Action Challenge - Stage II can be viewed at https://www.challenge.gov/challenge/nutrient-sensor-action-challenge-stage-ii/.

Competition Goals: This Challenge is Stage II of the Nutrient Sensor Action Challenge calls for teams to demonstrate effective and strategic deployment of nutrient sensors, management and use of the resulting data to inform a decision(s) and action(s) that result in improved nutrient management.

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: Nutrient pollution is a very costly and complex issue. Traditional strategies and approaches have had limited results. This Challenge continues to build on the success and progress of the interagency Challenging Nutrients Coalition. Challenges and prizes offer new opportunities to generate interest around the problem of nutrient pollution. This Challenge has engaged teams and organizations that would typically not be working with EPA. A challenge also has the advantage of only paying out a prize if a team has met the requirements of the challenge.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $100,000. Up to two prizes totaling $100,000 will be made in 2019. Non-monetary incentives include recognition, informational webinars, networking, and feedback from judges.

Solicitation of Submissions: The methods used for solicitation of the Challenge included tweets from the EPA Twitter account, emails to listservs, EPA press releases, and partnerships with outside organizations that promoted the Challenge in the same manner.

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: Stage II is open to communities, tribes, states, and other organizations in the United States interested in deploying nutrient sensors to address an important nutrient-related water quality issue. Participation in Stage I of the Challenge is not a requirement for participation in Stage II.

Evaluation of Submissions: A panel of judges will be convened for evaluating the submissions received; judging will take place in February 2019. Judges will evaluate submissions based on the requirements specified in the Challenge. The panel of judges will make recommendations that will be shared with EPA senior management for final decision.

Results: Of the 7 entries submitted by 7 participants between March 1, 2018 and January 31, 2019, 2 potential prizes will be awarded.

Budget and Resources: Scientists, data specialists, administrative and communication support were provided by EPA and the partner agencies in support of this Challenge. In FY18, funding in the amount of $30,000 and less than one FTE supported this Challenge. Contract support was used to develop and design communication and outreach materials.

Partnerships: Federal partners include NIST, USDA, USGS, and NOAA. The estimated value of in kind support from partners is $40,000.

Advancement of Agency Mission: This Challenge advances the agency's mission by helping to empower and incentivize communities to collect data and information that will enable them to make more effective decisions about water quality and specifically pertaining to nutrient pollution.

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

Plan for Upcoming 2 FYs: Potential follow-on challenges focusing on using data networking, artificial intelligence, and machine learning to inform decisions about nutrient pollution.

A.10 Federal Trade Commission (FTC)

A.10.1 IoT Home Inspector Challenge[100]

Lead Sponsoring Agency: FTC

Status: This competition was completed in FY17.

Competition Goals: Every day, American consumers use internet-connected devices to make their homes "smarter." Consumers can remotely program their smart home devices to turn on their lights, start the oven, and turn on soft music so they return to a comfortable environment when they get home from work. While these smart devices enable enormous convenience and safety benefits, they can also create security risks. Lax internet of things (IoT) device security can threaten not just device owners, but the entire internet, as demonstrated by the Mirai botnet and other highly-publicized Internet attacks. The IoT Home Inspector Challenge encouraged the public to create a tool that consumers could deploy to guard against security vulnerabilities in software on the IoT devices in their homes. The tool sought would, at a minimum, help protect consumers from security vulnerabilities caused by out-of-date software. The primary objectives were to engage the public to think about the security risks and mitigations related to smart devices and to encourage the development of a technical tool to help protect consumers from security vulnerabilities caused by out-of-date software.

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

Justification for Using Prizes and Challenges: Staff research and discussions with experts led the FTC to understand that out-of-date software presents a security issue. Device manufacturers do not always provide security updates for their products, but even when they do consumers may not know that they have been released, where to get the updates, and how to install them. Updating is a particular challenge for products that are low-cost and where consumers have not typically maintained an ongoing relationship with the manufacturer (for example, lamps). Finally, the IoT ecosystem is still evolving and there is no common standard for the technologies, so it is difficult to find a solution that applies across technologies. In sum, risks from old and unpatched software contained in home IoT devices will only increase. Many experts consulted agreed that this was an area where a challenge would be extremely useful.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $34,000, and the total amount awarded was $28,000. The prizes allocated were $25,000 for first place and $3,000 for honorable mention. The original allocation included amounts for up to three honorable mentions, but the judges only awarded one.

Solicitation of Submissions: The agency promoted the challenge to the general public through press releases announcing the contest and the official rules, along with multiple blog posts on the FTC's consumer and business blogs, the use of social media, a special webpage for contest material and posting on the Challenge.gov website.

[100] The website for the IoT Home Inspector Challenge can be viewed at https://www.ftc.gov/iot-home-inspector-challenge.

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

Participation Requirements: N/A

Evaluation of Submissions: An expert panel of judges reviewed submissions using the following criteria, where each overall section was allocated a certain number of points. Section I: How well does it work? The instructions outlined a number of components for this section, including (1) Recognizing what IoT devices are operating in the consumer's home; (2) Determining what software version is already on those IoT devices; (3) Determining the latest versions of the software that should be on those devices (with a feasible plan for finding sources of information about what version should be on the device and explaining the technical means by which that information would be procured); and (4) Assisting in facilitating updates, to the extent possible. Section II: How user-friendly is the tool? How easy is your tool for the average consumer, without technical expertise, to set up and use? Section III: How scalable is the tool?

Results: Of the entries submitted between March 1 and May 22, 2017, two prizes were awarded.

Budget and Resources: In terms of manpower, the time dedicated to the project included the development of the subject for the contest, developing criteria, consulting a variety of subject-matter outside experts and selecting potential judges for the contest. FTC records indicate a total of 0.5 FTE were used in FY17 to execute the prize competition, however, there was likely an additional 0.25 FTE used that were attributed other activity codes.

Partnerships: N/A

Advancement of Agency Mission: As part of its mandate, the FTC has engaged in research, advocacy, education, policy work, and law enforcement activity to protect consumers in the United States. This work includes efforts aimed at protecting consumers in an ever-changing marketplace, and that includes IoT devices in the home. While IoT or "smart" devices may provide enormous benefits, such as convenience and safety benefits, they can also create security risks. One way the agency tackles these challenges has been through targeted law enforcement. The FTC has also worked to raise awareness about risks and possible mitigating measures through public discourse and through educational materials. The FTC's law enforcement, policy, and education efforts alone cannot address the issue for a number of reasons. First, there are an increasing number and variety of IoT devices today and updating each is complex. In addition, ordinary consumers cannot easily take action to secure their devices, or even just to discover if their software is up-to-date, unless they are aware of the risks, are very motivated to address them, and have a considerable amount of detailed technical know-how.

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

Plan for Upcoming 2 FYs: The FTC agency has held four challenges in the last four years and has found them to be valuable, but has no immediate plans to conduct another challenge.

A.11 General Services Administration (GSA)

A.11.1 Student Design Competition: New San Francisco Federal Building Plaza[101]

Lead Sponsoring Agency: GSA

[101] The website for the Student Design Competition: New San Francisco Federal Building Plaza can be viewed at https://www.Challenge.gov/challenge/student-design-competition-new-san-francisco-federal-building-plaza/.

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

Competition Goals: This competition sought ideas that would activate the New San Francisco Federal Building plaza for the benefit of building users and the general public. The New San Francisco Federal Building located at 90 7th Street has become a landmark in San Francisco, California. Its layout and functions celebrate the importance of the city and the urban environment, combining amenities and public space that are designed to enhance the immediate area and the adjacent neighborhood. The offices support the energy and spirit of those who work there and those who visit. Its systems are outstanding examples of integrated engineering and sustainable design, reflecting the wise stewardship of limited resources. Together, these attributes make this a project that has stimulated critical interest.

The original vision for the plaza was that it would be a welcome civic space that is flexible and allows for outdoor dining, concerts, and markets. Since the completion of the building's construction 10 years ago, only the cafe uses the plaza for outdoor dining, and no concerts, markets, or any other public functions have used this space.

Goal Types: Improve government service delivery; 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: Holding a design competition for architecture, landscape architecture, and urban design students supported and advanced GSA's mission in a number of ways. The local community in the neighborhood surrounding the building were engaged in the entry evaluation process and, therefore, had their own voice heard.Students are not licensed architects and so provisions of the Brooks Act and FAR 36.601 do not apply because the competition limited entrants to students. In contrast, holding a design competition to hire a licensed architect or engineer would have required compliance with Brooks Act, FAR 36, and FAR 15, and so the source selection and evaluation board (SSEB) prohibited community stakeholders from participating directly in the evaluation of entries. The potential ideas generated by the competition included design and construction solutions or programming a new function for the plaza without changing it, or yet some other solution that does not necessarily require expensive renovation. This was unlike a competition to hire an architect or design-build team because the scope was undefined and may not have even involved renovation work to implement. Having a cash prize attracted far greater interest, improved the quality of the most successful entries and increased the opportunity for recognition.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $1,750. Non-monetary incentives included public acknowledgement on the Challenge.gov website. Three individual cash awards were given to the three winners of the Challenge by sending pre-paid charge-cards (American Express) with a letter to the winners. These pre-paid charge-chards were purchased by the GSA in FY17 under the agency's micro-purchase authority. The value of each card was $1000, $500, and $250, corresponding to 1st, 2nd, and 3rd place prizes, respectively. The honorable mention award-winner received a letter and their proposal was featured on the Challenge.gov website along with the prize-winners.

Solicitation of Submissions: The entire solicitation and submission process was handled on the Challenge.gov platform. GSA published an article about the solicitation on the GSA.gov blog website which linked to the Challenge.gov website. GSA shared the links via its social media accounts on Twitter and Facebook. Additionally, GSA contacted several online architecture and design competition blogs that were not affiliated with any government agency to notify them about the Challenge and they chose to publish links to the Challenge.gov solicitation. These included www.archdaily.com, www.competitions.archi, www.aias.org, and www.archinect.com.

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

Participation Requirements: The targeted solvers included students of architecture, landscape architecture, urban design, or related programs. The following statement was published in the rules, terms, and conditions for the Challenge: "Only individual submissions are allowed, no team submissions. One submission per contestant is allowed. Contestant certifies through entering the submission that they are currently full-time undergraduate or graduate student enrolled in an accredited architecture, landscape architecture, urban design, or related program. Contestant certifies through entering the submission that they are a citizen or permanent resident of the United States of America."

Evaluation of Submissions: The jury convened in person to evaluate the proposals based on the following evaluation criteria: (1) Creativity: The Guiding Principles for Federal Architecture state that the government should produce facilities that reflect the dignity, enterprise, vigor, and stability of the Federal Government, emphasizing designs that embody the finest contemporary architectural thought; that avoid an official style; and that incorporate the work of living American artists. With these Guiding Principles in mind, submissions that demonstrated greater creativity, coherence, and clarity of vision in achieving the goal of activating the plaza were considered more favorably. (2) Context: GSA recognized that good design is responsive to context. Special attention was paid to the general ensemble of streets and public places of which Federal buildings formed a part; and that, where possible, buildings should permit a generous development of landscape. Submissions that addressed and responded to the physical context of climate and the built environment were considered more favorably. (3) Community: GSA strived to leverage its real estate activity to support community goals. Submissions that demonstrated a superior understanding of local issues and community goals, and which addressed those issues and goals in compelling ways, were considered more favorably. (4) Feasibility: Designs should have adhered to sound construction practice and utilized materials, methods and equipment of proven dependability, and should be economical to build, operate and maintain, and should be accessible. Submissions that were technically feasible to implement were considered more favorably. (5) Value: Part of GSA's mission is to deliver the best value in real estate services to the Federal Government and the American people. Submissions that represented a high-value intervention that could be implemented more cost-effectively were considered more favorably.

Results: Of the 63 entries submitted between August 28 and November 22, 2017, three prizes were awarded to three prize winners and one honorable mention award-winner was announced.

Budget and Resources: GSA allocated one project manager who devoted approximately 8-16 hours per week over a period of 4 months to develop the Challenge, coordinate the evaluation of proposals, and administer the close-out process. In addition, GSA allocated one communications officer to develop communications material and manage communications. The communications officer devoted between 8-16 hours per week for 3 months. Personnel resources amounted to 0.125 FTEs across FY17 and FY18. Agency funding provided in FY17 was $1,750 and $599.74 in FY18.

Partnerships: The U.S. Department of Health and Human Services (HHS) and the Central Market Community Benefit District each provided one person for the two-day proposal evaluation process, equal to approximately 16 manhours each.

Advancement of Agency Mission: The mission of GSA is to deliver the best value in real estate, acquisition, and technology services to the Federal Government and the American people. GSA also has an obligation to reach out to communities to discuss how GSA can support community goals. Holding a design competition for architecture, landscape architecture, and urban design students supported and advanced GSA's mission in two ways. First, the local community at the building were engaged in the entry evaluation process and communicated to GSA ideas that supported community goals. Second,

the competition stimulated innovation by rewarding ideas for the scoping of a plaza intervention which GSA might not have thought of otherwise and which resulted in the best value for the Federal Government and taxpayers. These ideas included a broad range of solutions such as design and construction solutions, programming a new function for the plaza without changing it, and others.

Solution Types: Creative (design & multimedia); Ideas

Plan for Upcoming 2 FYs: GSA considered this process a success and is evaluating other design-related opportunities throughout the country that could benefit from a challenge under the America COMPETES authority, but no specific opportunities have been identified that would occur within the next 2 fiscal years.

A.12 National Aeronautics and Space Administration (NASA)

A.12.1 Earth & Space Air Prize

Lead Sponsoring Agency: NASA

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

Competition Goals: NASA's long-term technology roadmap calls for improvements to the technology for monitoring particles in the air to enable future long-term human space missions. This competition serves to catalyze the aerosol community and accelerate development of highly innovative approaches that may otherwise take years to achieve. The NASA Earth & Space Air Prize, with support from the Robert Wood Johnson Foundation (RWJF), focused on identifying solutions that can catalyze the development of easy to maintain, small, and affordable aerosol sensor technology that has the potential to be useful in spaceflight as well as on Earth anywhere outdoors in a community where pedestrians may be exposed to airborne particle matter.

Goal Types: Solve a specific problem; Develop technology

Justification for Using Prizes and Challenges: A concept scan identified numerous communities pushing to build and enhance nascent community air quality sensor capabilities. This prize competition was launched to incentivize the relevant community to submit ideas and prototypes for solutions that would be beneficial to NASA and the Robert Wood Johnson Foundation (RWJF) goals in detecting particulates in the air on Earth and in space applications.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $250,000. $150,000 was awarded to three finalists, and the $100,000 grand prize was awarded in November 2018. Non-monetary incentives included a reception and demonstration event at the Glenn Research Center.

Solicitation of Submissions: The prize administrator, The Common Pool LLC, focused efforts on both primary and secondary outreach and communicated directly with potential participants and key influencers and organizations in science and technology. Outreach efforts kicked off on September 19, 2017 with an announcement of the launch of the Earth and Space Air Prize at the Udvar-Hazy facility of the National Air and Space Museum in conjunction with an event sponsored by Future Engineers. Efforts also included recruitment of potential submissions at the yearly meeting of the professional society of aerosol specialists. NASA used the NASA Solve website (www.nasa.gov/solve), which lists NASA's participatory opportunities, to market this challenge. NASA also published a Web feature that was amplified by the RWJF through social media.

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

Outreach conducted by commercial prize administrator, and NASA Solve website (www.nasa.gov/solve)

Participation Requirements: Individuals must be U.S. citizens or permanent residents of the United States and be 18 years of age or older. Organizations must be an entity incorporated in and maintaining a primary place of business in the United States. Teams must be comprised of otherwise eligible individuals or organizations, and led by an otherwise eligible individual or organization. U.S. government employees may participate so long as they rely on no facilities, access, personnel, knowledge or other resources that are available to them as a result of their employment except for those resources available to all other participants on an equal basis. U.S. government employees participating as individuals, or who submit applications on behalf of an otherwise eligible organization, will be responsible for ensuring that their participation in the Competition is permitted by the rules and regulations relevant to their position and that they have obtained any authorization that may be required by virtue of their government position. Failure to do so may result in the disqualification of them individually or of the entity which they represent or in which they are involved. Foreign citizens may only participate as (i) employees of an otherwise eligible US entity who reside in the US, (ii) full-time students at an otherwise eligible US university or college who reside in the US, or (iii) owners of less than 50% of the interests in an otherwise eligible US entity who reside in the US.

Evaluation of Submissions: Submissions were evaluated using a set of criteria available at https://www.earthspaceairprize.org/#scoring. Additionally, the prize administrator uses a trait scoring rubric to ensure fairness in the evaluation process that prevents a tie in the scoring. Final testing occurred in the testing lab at the Glenn Research Center in November 2018 where the instruments must meet specified criteria along with final evaluation by the judging team.

Results: Of the 20 entries submitted by 544 participants in Phase I between September 19, 2017 and January 31, 2018, three finalists were awarded $150,000 total. In Phase II, prototypes were developed and tested and the grand prize winner received $100,000. The three solutions named as finalists were AirSpeQ's Gravimetric PM Monitor Employing Thermophoresis; Applied Particle Technology's Optical particle speciation and counter; and the Volckens Group/Colorado State University's Mobile Aerosol Reference Sensor (MARS).

Budget and Resources: The RWJF provided the bulk of the funding for this challenge inclusive of prize administration and the prize purse for the three finalists. NASA provided funding for the final award. NASA FTE/WYE resources along with RWJF personnel supported development of the challenge, selection of the prize administrator, and judging of the submissions. Agency resources in FY17 was estimated at 0.4 FTE and 0.2 WYE, and 0.3 FTE and $100,000 in prize funding in FY18. The prize administrator was selected through the NASA Open Innovation Services Contract. Funding supported RFP development and award.

Partnerships: RWJF provided financial support, estimated at $350,000 for prize purse ($150,000) and prize administration ($200,000). RWJF also supported the prize with 0.2 FTE of their own personnel. This partnership was an incredibly positive relationship setting a framework for how public-private partnerships can be used to accelerate technology development. NASA entered into a formal agreement which clearly specified roles and responsibilities. NASA now has in place a template for future partnerships. Additionally, NASA laid the groundwork for the financial system that will support intake of funding from private partners. This allowed the acquisition of a professional prize administration team that has been a tremendous bonus to effective conduct of this competition.

Advancement of Agency Mission: NASA has identified particulate monitoring as a gap in its technology roadmap to enable future long-term missions. Current technology does not provide the level of sensitivity, the longevity, or the ability to operate in a reduced-gravity environment. In working with

RWJF, NASA has the opportunity to close this gap. The added bonus of the outcome of this technology demonstration competition is the potential benefit to human health on Earth as well.

Solution Types: Technology demonstration and hardware

Plan for Upcoming 2 FYs: N/A

A.13 National Science Foundation (NSF)

A.13.1 2017-2018 Community College Innovation Challenge[102]

Lead Sponsoring Agency: NSF

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

Competition Goals: The primary goal of the Community College Innovation Challenge (CCIC) was to create seats for community college students, often underrepresented in the research community, at the innovation table and cultivate confidence and skills. CCIC provided community college students with an opportunity to begin using science to make a difference in the world by transferring knowledge into action through the latest entrepreneurial and strategic communication techniques.

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

Justification for Using Prizes and Challenges: NSF's traditional mechanism of crowdsourcing innovation, advancing STEM research, and developing a STEM workforce via solicitations and grants tends to attract a more established research community from four-year institutions and often leaves community colleges untapped. The modest prize money and all-inclusive four-day professional development boot camp helped attract students to participate in the CCIC. Participants gained greater awareness of opportunities in the sciences and developed an array of important scientific and professional skills. CCIC alumni have gone on to secure venture capital funding, launch start-ups, enter graduate school to pursue degrees in STEM, speak on National Science Board panels, land prestigious industry internships and apprenticeships, and launch local innovation competitions at their schools inspired by CCIC.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $81,700. Non-monetary incentives, including a four-day Innovation Boot Camp experience for the ten finalist teams and a plaque for all finalist schools, came to $219,000.

Solicitation of Submissions: Submission were solicited via social media (Twitter and Facebook posts); direct, targeted outreach (telephone calls); email (listservs); a press release; day-long event(s) prior to the competition; partnerships with outside organizations (including private companies, non-profit organizations, and other Federal agencies); sessions/announcements at appropriate conferences/workshops; promo toolkit on the website; and mailing materials (postcards, posters).

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

Participation Requirements: The target audience for this Challenge was community college students 18 years old and older. Participants were required to be U.S. citizens, nationals, or permanent residents

[102] The website for the 2017-2018 Community College Innovation Challenge can be viewed at www.nsf.gov/communitycollege.

enrolled in and in academic good standing at a two-year, degree-granting institution. Teams were comprised of three to five students, one faculty mentor, and one community/industry partner. Students who previously advanced to finalist status and participated in a past Innovation Boot Camp were not eligible to re-enter.

Evaluation of Submissions: NSF recruited different populations for three rounds of judging. Preliminary judging was conducted online by American Association for the Advancement of Science Policy Fellows and Science Assistants at NSF. Semifinal judging was also conducted online by NSF Program Officers with thematic scientific expertise. Final judging was conducted in person by high-profile academics, industry representatives, and entrepreneurs with broad STEM knowledge. Evaluation was based on three categories: (1) innovation and impact, defined as the proposed solution's use of science to address a problem and its potential to be transformative in the areas of national security, economy, quality of life, education, and environment, among others; (2) feasibility, defined as the likelihood that the solution is technically feasible as well as economic, political, and social constraints; and (3) clarity of communication, defined as the team's adherence to the entry guidelines, grammar, structure, organization of facts and data, and clarity and consistency of message.

Results: Of the 41 entries submitted by 234 participants between October 18, 2017 and February 14, 2018, 53 participants each received $500 for making it to the final round and an all-expense paid trip to the Innovation Boot Camp. Of the 10 finalist entries, five received 1st-place prizes of $1,500 each and five received 2nd-place prizes of $1,200 each.

Budget and Resources: Funds totaling $416,000 were allocated in FY17, and 1.5 full-time equivalents (FTEs) managed and supported aspects of the competition in FY17 and FY18. Third-party vendors (including the American Association of Community Colleges) were funded using FY17 money that came from NSF's Education and Human Resources Directorate (Division of Undergraduate Education). Entry platform company Skild received $139,000 for platform development and customization, client services support, creative design services, strategic consulting/oversight, engineering, QA testing, prize distribution, and direct outreach. The American Association of Community Colleges (AACC) received $219,000 to support the Innovation Boot Camp, including all logistics costs (travel, lodging, food, per diem, etc.) for student finalists and judges as well as providing essential curricula and other outreach material. Ninja Communications received $42,000 for developing curriculum, conducting pre-boot camp webinars, providing four days of on-site instruction for finalists, and managing the judging process, score sheets, and deliberation. Grant Warner, I-Corps Instructor, received $8,000 for developing curriculum, conducting pre-boot camp webinars, and providing four days of on-site instruction for finalists. MDR received $8,000 for listserv distribution.

Partnerships: NSF has partnered with AACC to run the CCIC competition since the program's inception four years ago. AACC provided expertise with the community college population in challenge development and theme identification as well as recruitment of judges, outreach efforts, and in developing materials and curriculum for the Innovation Boot Camp. AACC coordinated logistics and travel for the Innovation Boot Camp, as well as arranged the finalists' reception, which involved interactive displays and was hosted by the White House's Office of Science and Technology Policy and the Office of American Innovation at the Eisenhower Executive Office Building on June 13, 2018.

Advancement of Agency Mission: CCIC advanced NSF's mission by aligning with NSF's strategic plan. Specifically, CCIC helped: (1) build the capacity of the Nation's citizenry for addressing societal challenges through science and engineering; and (2) prepare and engage a diverse STEM workforce motivated to participate at the frontiers. In addition, the competition served NSF's strategic goal for open innovation.

Solution Types: Software and apps; Ideas; Technology demonstration and hardware; Business plans; Scientific

Plan for Upcoming 2 FYs: N/A

A.13.2 Engineering Research Centers (ERC)-Wide Perfect Pitch Competition[103]

Lead Sponsoring Agency: NSF

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

Competition Goals: The objective of the ERC Perfect Pitch Competition was to help engineering students develop the communication skills critical to expressing their ideas in a clear, concise, and compelling manner. This competition was modeled after the elevator pitch competitions popular in business schools; however, in addition to stressing the importance of concise and persuasive communication, the judging criteria emphasized a culture of innovation and entrepreneurship and empowered students to lead.

Goal Types: Engage new people and communities; Build capacity

Justification for Using Prizes and Challenges: A cash prize provided a way to get students' attention while simultaneously sending a message about the importance of good communications skills. It was meant to generate an atmosphere of excited anticipation within the ERC community, both among students and the center leadership teams. It also provided a climactic focal point during regular ERC biennial meetings.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $8,000 (1st Prize $5,000; 2nd Prize $2,000; 3rd Prize $1,000). Non-monetary incentives included a Perpetual Trophy awarded to the ERC Home of the 1st place winner.

Solicitation of Submissions: Perfect Pitch Guidelines and the Competition scoring templates were posted on a website dedicated to the Perfect Pitch competition on August 16, 2017. On the same date, an email notification was sent to ERC Education and Outreach Directors and ERC Industrial Liaison Officers.

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

Participation Requirements: In FY17, the ERC Program mobilized all 15 ERCs that had active student leadership organizations to compete. Four ERCs had just begun in the month prior to the competition and did not participate. The competitions engaged their entire leadership teams, especially the Centers' Education Directors, Industrial Liaison Officers, and the ERC community. All ERC students (both graduate and undergraduate) engaged in research at one of the actively funded NSF ERCs were eligible to compete. A total of 129 students participated in local competitions, of which 78% were graduate students, 5% were undergraduate students, and 5% were post-doctoral students, who were allowed to compete in some local competitions to enlarge the pool of contestants. Since each ERC held its own competition to determine who would represent it in the ERC-wide competition, the quality of the finalists was quite impressive. Fifteen students represented fifteen ERCs from universities located around the country and across a wide spectrum of advanced technology fields. The contestant pool at the national level included seven women and eight men.

[103] The website for the Engineering Research Centers(Erc)-Wide Perfect Pitch Competition can be viewed at http://erc-assoc.org/programs/pitch and http://erc-assoc.org/content/perfect-pitch-guidelines.

Evaluation of Submissions: Each judging team consisted of one academic with entrepreneurship experience, a previous Perfect Pitch judge, two investment bankers, and one venture capitalist. Contestants in the ERC-wide competition were expected to pitch a compelling problem or opportunity connected with the ERC strategic vision in a clear, articulate, compelling manner within a 90-second window. Evaluation criteria considered the proposed solution, its potential impact, the broader impact of technology, call to action, visual design of slide, and poise/style. At the ERC-wide competition, contestants presented their pitch to the judges one by one; a moderator introduced each speaker and kept time. After each presentation, each judge had 1.5 minutes to enter their score and notes on a spreadsheet. Following the presentations, the judges met to complete their notes and scoring, and a video of the entire competition was available for review to allow the judges to refine their scores and provide more detailed feedback. They then discussed and finalized their decisions, which were conveyed to the program organizer. After the awards ceremony, copies of the ballots with the judges' feedback were given to the students.

Results: Of the 15 participants in the ERC-wide competition on November 2, 2017, three prizes were awarded. A total of 129 students competed locally to represent their home ERCs on September 29, 2017.

Budget and Resources: Total expenses were $13,600, which covered judges' expenses ($3,500), prize purse ($8,000), and overhead ($2,100) to the American Society of Engineering Education, which sponsored the meeting where the final competition took place. In FY17 and FY18, 0.1 full-time equivalent (FTE) was allocated to plan and manage the competition. In FY18, three American Association for the Advancement of Science Fellows also supported the competition.

Partnerships: N/A

Advancement of Agency Mission: The goal of the ERC Program is to integrate engineering research and education with technological innovation to transform national prosperity, health, and security. At the National-level, the Perfect Pitch competition generated excitement within the ERC community as well as interest in ERC innovations and their student champions among venture capitalists and angel investors. Stemming in part from the Perfect Pitch competition, some ERCs have begun to invest resources into improving their student's communication skills.

Solution Types: Creative (design & multimedia)

Plan for Upcoming 2 FYs: N/A

A.13.3 Generation Nano: Superheroes Inspired by Science[104]

Lead Sponsoring Agency: NSF

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

Competition Goals: Generation Nano challenged middle school and high school students to research science and technology advancements and then creatively apply those ideas to empower or drive a unique superhero. The competition was an opportunity to generate an early interest in and excitement for STEM topics among students as well as provide reputable resources to guide their research.

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

Justification for Using Prizes and Challenges: NSF's traditional mechanism of advancing STEM research and developing a STEM workforce is via solicitations and grants. Unfortunately, this method is not a readily available option for K-12 students. NSF uses prizes as a way to attract this younger audience and

[104] The website for the Generation Nano: Superheroes Inspired by Science can be viewed at Nsf.gov/GenNano.

incentivize them to participate. The modest prize money and the trip to DC for the USA Science & Engineering Festival has helped attract students and teachers, raising awareness of NSF and its mission as well as building confidence and skills that will help propel their future.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $14,880 ($12,000 in cash prizes, $2,880 for final event logistics). Non-monetary incentives included travel to Washington, D.C. to participate in the USA Science & Engineering Festival for the first place high school and middle school winners. First place received $1,500 per team member, second place received $1,000 per team member, and honorable mention received $500 per team member. In addition, $500 was awarded to teacher(s) who mentored the first place teams / individuals.

Solicitation of Submissions: Entries were solicited through email outreach via listserves and MDR (a paid service); press release; social media (facebook/twitter/Instagram/etc.); social media advertisements; postcards distributed at various events; sessions/talks at various events; and a promo toolkit on the website.

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 - Sessions/announcements at appropriate conferences, promo toolkit on the website, mailing materials (postcards, posters) to appropriate contacts

Participation Requirements: All entries had to be received during the competition submission window. Each submission had to be made by an individual. All students had to be enrolled in and be in good standing at a middle or high school or be home-schooled in the U.S., including U.S. territories and possessions, at the time of entry. Students had to be U.S. citizens, nationals, or permanent residents. Each entrant certified, through submission to the contest, that the entry was his or her own original creative work and did not violate or infringe the creative work of others, as protected under U.S. copyright law. Each entrant had to submit a Parental/Guardian Permission Form and Photo Consent Form.

Evaluation of Submissions: Preliminary judging was done online by Fellows across agencies. Semifinal judging was also online by science researchers and members of the comic/entertainment community. Final judging was in person by high-profile science researchers and prominent education and entertainment leaders. Evaluation was based on three categories: (1) creativity (25 percent), defined by the originality and quality of both the superhero and the story, as well as the application of science and technology; (2) use of science and technology (50 percent), defined as how accurately the entrant incorporated science and technology into the story to address the chosen societal mission; and (3) artistic and technical quality (25 percent), defined as the visual appeal and refined execution of the comic or video.

Results: Of the 388 entries submitted by 1100 participants between September 18, 2017 and January 10, 2018, nine entries (14 students) and two teacher honoraria received awards.

Budget and Resources: Funding for FY17 and FY18 totaled $58,000. Of the total funds, $53,000 went to Skild for platform development and customization, client services support, creative design services, strategic consulting/oversight, engineering, QA testing, prize distribution, and direct outreach. The remaining $5,000 went to MDR for marketing via listserv distribution. A total of 1.5 full-time equivalents (FTEs) were used to manage and help support aspects of the competition.

Partnerships: NSF partnered with the National Nanotechnology Initiative, benefiting from its technical knowledge base. NSF also reached out to State Science Teacher Associations and posted the competition on numerous websites, including NASA, The Connectory, and Johns Hopkins Center for Talented Youth. Prominent comic creator Stan Lee promoted the competition on social media. His

support, and that of other science and pop-culture celebrities, helped NSF reach new populations and encourage their participation.

Advancement of Agency Mission: The competition advanced NSF's mission by aligning with its strategic plan. Specifically, Generation Nano helped: (1) build the capacity of the Nation's citizenry for addressing societal challenges through science and engineering; and (2) prepare and engage a diverse STEM workforce motivated to participate at the frontiers. In addition, the competition served NSF's strategic goal for open innovation.

Solution Types: Creative (design & multimedia)

Plan for Upcoming 2 FYs: N/A

A.13.4 NSF Wireless Innovation for a Networked Society (WINS)[105]

Lead Sponsoring Agency: NSF

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

Competition Goals: The NSF WINS Challenges sought practical, new wireless solutions to help people connect to the internet in challenging circumstances, either after a disaster or in areas without sufficient connectivity, as wireless technology innovations should make the internet more accessible, resilient, and healthier. Two challenges were at stake: the Off-The-Grid Internet Challenge and the Smart-Community Networks Challenge: The Off-The-Grid Internet Challenge sought wireless solutions for communication that can be rapidly deployed in post-disaster situations where internet access is unavailable or compromised, while the Smart-Community Networks Challenge sought wireless solutions for communication that can be built on top of existing infrastructure to enhance internet connectivity in communities that need greater access.

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

Justification for Using Prizes and Challenges: The prize competition was selected to draw from the large community of entrepreneurs and small business developers who could develop the solutions to this challenge but are not generally attracted to NSF's traditional mechanisms (grants, contracts, cooperative agreements, etc.).

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $2,000,000. For Phase 1 (Design Concept Stage), first place received $60,000, second place received $40,000, third place received $30,000, and seven honorable mentions each received $10,000. For Phase 2 (Working Prototype Stage), first place received $400,000, second place received $250,000, third place received $100,000, and fourth place received $50,000.

Solicitation of Submissions: The NSF WINS Challenges were open to all U.S.-based entrants, including non-profit and for-profit organizations and individuals ages 18 and over. Each participant had to fill out and submit an Intent to Apply form through the NSF WINS website at wirelesschallenge.mozilla.org between June 15, 2017 and October 15, 2017. Entrants then received information via email on how to register for an account at mozilla.fluxx.io. By submitting a full submission, each team's leader accepted the challenge rules and all decisions of the organizer and judges as final and binding.

[105] The website for the NSF Wireless Innovation for a Networked Society can be viewed at https://wirelesschallenge.mozilla.org; https://www.Challenge.gov/challenge/nsf-wins-wireless-challenges/.

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: Participation was open to teams of one or more members with no maximum number of participants per team. Individual participants may be a member of more than one team. Participants must be individuals who are U.S. citizens or permanent residents, or organizations (whether nonprofit or for-profit) that are incorporated in and maintain a primary place of business in the U.S. Designated team leaders, responsible for sending and receiving communications on behalf of their team, had to be at least 18 years of age. Participants between the ages of 13 and 17 were permitted as long as they were not team leaders and obtained written permission to participate from their parent or legal guardian. Only teams that were selected to proceed at the end of the Design Concept Stage could participate in the Working Prototype Stage.

Evaluation of Submissions: Each phase of the competition had a set of judges who evaluated each of the entries submitted in that phase.

Results: Of the 20 entries submitted in Phase 1 between June 1, 2017 and November 15, 2017, eight prizes were awarded at the end of Phase 2 on September 26, 2018.

Budget and Resources: The competition budget for FY17 and FY18 totaled $250,000 in each fiscal year. Funds were used to hire a dedicated program staff, and 0.2 full-time equivalents (FTEs) from the Mozilla Foundation helped with community outreach events, website development, recruitment of judges, and arranging the demonstrations. The $2 million in prize money was paid out in FY18, with $400,000 paid out in January 2018 (Phase 1) and the balance paid out at the end of FY18.

Partnerships: Mozilla Foundation was recruited to help plan and run the Challenge, including outreach, recruitment of judges, and building the website to manage the communications and submission process.

Advancement of Agency Mission: The NSF-WINS Challenges helped identify a broad set of wireless technology solutions to increase access to the internet, bringing together the outcomes of many research activities funded by NSF into solutions that immediately impact society. This aligns with the agency's mission to advance scientific understanding to benefit society.

Solution Types: Software and apps; Technology demonstration and hardware; Business plans

Plan for Upcoming 2 FYs: N/A

A.13.5 NSF-Hearables Challenge[106]

Lead Sponsoring Agency: NSF

Status: This competition was completed in FY17.

Competition Goals: This challenge sought to generate ideas for design concepts or technologies (including algorithms) that might be used to allow a person with a hearable technology to have an understandable conversation at normal volume within a noisy setting, such as a busy restaurant. This challenge sought solutions that are the most broadly accessible to the population.

[106] The website for the NSF-Hearables Challenge can be viewed at https://ninesights.ninesigma.com/web/hearables/innovationcontest.

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; Stimulate a market

Justification for Using Prizes and Challenges: The prize competition was selected to attract a wide range of non-traditional participants, as the traditional mechanisms (grants, contracts, cooperative agreements, etc.) were not seen as attractive to a large community of students, entrepreneurs, and small business developers capable of developing solutions to this challenge. Since challenges go to the public and are broadly shared on social media and other media outlets, NSF decided to use a challenge to move research in the area of hearables forward.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $145,000 and the total amount awarded was $146,000 ($80,000 for first place, $60,000 for second place, and $3,000 for third and fourth places). Non-monetary incentives included a presentation at the IEEE UbiComp Conference.

Solicitation of Submissions: The NSF Hearables Challenge was open to all U.S.-based entrants, including non-profit and for-profit organizations and individuals ages 18 and over. Each participant had to fill out and submit an Intent to Apply form through the NineSigma website between April 25 and June 22, 2017. A sample audio file was provided at the challenge launch to help competitors develop and train their proposed approach. The final test audio was available for download one week before the June 30 deadline, and participants received information via email on how to register for an account at mozilla.fluxx.io. By submitting a full submission, the team leader formally accepted on behalf of the team the challenge rules and all decisions of the organizer and judges as final and binding. It was a very open competition that attracted entries from a diverse range of individuals and organizations as well as heightening awareness in the computing research community of the potential value of hearing 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: Participation was open to individuals or teams whose leader was a U.S. citizens or permanent resident.

Evaluation of Submissions: All submissions were evaluated for accuracy, defined by the number of words correctly identified from the audio sample. The processed samples were also reviewed by a panel of four judges for clarity, latency, and understandability. Proposals with the highest overall ranking were awarded prizes.

Results: Of the seven entries submitted between April 25, 2017 and June 30, 2017, four prizes were awarded.

Budget and Resources: In FY17, 0.2 full-time equivalents (FTEs) were used to provide oversight of the competition process and review submitted entries. In FY16, NSF entered into and funded a memorandum of understanding with the NASA Challenge Center of Excellence to use their contract with NineSigma to manage the competition. This included community outreach events, website development, recruitment of judges, arranging demonstrations, and paying out prizes. NSF paid out slightly more in prizes than originally planned. The additional funds resulted from budget efficiencies.

Partnerships: The NASA Challenges Center of Excellence supplied technical assistance and expertise in addition to managing the NineSigma efforts.

Advancement of Agency Mission: The prize competition was selected to attract a wide range of non-traditional participants, since the traditional mechanisms (grants, contracts, cooperative agreements, etc.) were not seen as attractive to a large community of students, entrepreneurs and small business

developers who were envisioned as capable of developing solutions to this challenge building upon the outcomes of prior NSF-sponsored research.

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

Plan for Upcoming 2 FYs: N/A

A.14 Small Business Administration (SBA)

A.14.1 InnovateHER 2017 Challenge[107]

Lead Sponsoring Agency: SBA

Status: This competition was completed in FY17.

Competition Goals: InnovateHER provides an opportunity for entrepreneurs to showcase products or services that have a measurable impact on the lives of women and families, have the potential for commercialization, and fill a need in the marketplace. The goal of the InnovateHER competitions is to empower women entrepreneurs to pitch their products, to create local visibility for them, and to make sure that entrepreneurs connect with our resource partners for assistance in starting and growing their businesses.

Goal Types: Find and highlight innovative ideas; Solve a specific problem; Engage new people and communities; Build capacity

Justification for Using Prizes and Challenges: The purpose of the InnovateHER Challenge is to create local visibility for SBA and to make sure that entrepreneurs connect with our resource partners for assistance in starting and growing their businesses. Also, we were aiming at a combined total of at least 100 or more events nationwide during this competition, and the cash prizes were used as incentives for the participants.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and awarded was $70,000. The first place cash prize was $40,000, second place was $20,000, and third place was $10,000.

Solicitation of Submissions: Building on the success of the inaugural 2015 InnovateHER Business Challenge, SBA and OWBO received the offer from the Sara Blakely Foundation to donate and support the initiative. The initial round of the InnovateHER Challenge took the form of local competitions that ran across the country beginning December 29, 2016 and ended June 3, 2017. The host organizations running the local competitions selected and submitted one winner from each local competition to SBA, along with a Nomination package by June 23, 2017. Winners were announced during the live pitch competition held on October 26, 2017, in Washington, D.C.

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: Partner organizations wanting to host a local competition as part of the initial round of this Challenge sent requests to the SBA at womenbusiness@sba.gov. SBA evaluated all requests to host a local InnovateHER competition under its sole discretion and confirmed a host's participation in writing. Each host organization was responsible for determining the type of local competition, and ensured it was conducted in a manner consistent with the Challenge Rules. At a

[107] The website for the InnovateHER 2017 Challenge can be viewed at sba.gov/InnovateHER.

minimum, however, each application was required to contain a business plan covering the contestant's proposed product or service and must satisfy the Challenge criteria. The local competitions were administered solely by the local host organizations and were judged by individuals selected by each host in their sole discretion. Host organizations selected and submitted only one winner from the local competition along with a Nomination Package to SBA. This Challenge was open only to: (1) citizens or permanent residents of the United States who were at least eighteen (18) years of age at the time of their submission of an entry (or teams of such individuals); and (2) private entities, such as corporations or other organizations, that are incorporated in and maintain a primary place of business in the United States. Individuals submitting on behalf of corporations, nonprofits, or groups of individuals (such as an academic class or other team) were required to meet the eligibility requirements for individual contestants. An individual could belong to more than one team submitting an entry in this Challenge. SBA employees were not eligible, nor were Federal entities or Federal employees acting within the scope of their employment. Individuals or organizations that were at the time suspended or disbarred by the federal government were not eligible for this Challenge.

Evaluation of Submissions: All business plans were reviewed based on the same Scoring Matrix and rated numerically from 1 to 5 with 5 being the highest possible score in any given segment. The evaluation of each package was the same at the local level where the judges were external to the federal government, SBA level where the judges were internal and at the final pitch where the judges were from the private sector. The criteria were scored as follows: The specifics of the product or service having a measurable impact on the lives of women and families (30%). How the product or service will potentially be commercialized (40%). The specifics of the product or service filling a need in the marketplace (30%).Each finalist was offered the opportunity to participate in the InnovateHER Final Challenge where they made a live marketing pitch to a panel of expert judges drawn from the private sector. The panel of judges selected the three finalists whose pitches, in their sole judgment, best satisfy the Challenge criteria and present the greatest potential for success and rank them in descending order. SBA found this evaluation to be effective.

Results: Of the 120 local competitions held nation wide between December 29, 2016 and June 23, 2017, $70,000 in cash prizes (1st Place - $40,000; 2nd Place - $20,000; and 3rd Place - $10,000) prizes were awarded to three winners.

Budget and Resources: The competition was possible through a generous donation from the Sara Blakely Foundation; SBA did not obligate any appropriated funding for this initiative, and limited agency resources were used to conduct the Challenge. Approximately 3 ½ SBA staff members collaborated with Sara Blakely Foundation and an event planner to plan and execute the event. Several other staff members attended and helped execute various portions of the challenge, including the final event.

Partnerships: The final competition was possible through a generous donation from the Sara Blakely Foundation, in the form of cash prizes of $70,000. The foundation also donated $30,000 for the final event, used to pay an event planner.

Advancement of Agency Mission: The InnovateHER Chellenge creates an opportunity for SBA to be more visible and engaged locally with women entrepreneurs. We promoted our resources and leveraged our partners, creating new public and private partnerships that benefit the small business community.

Solution Types: Creative (design & multimedia); Ideas; Business plans

Plan for Upcoming 2 FYs: In FY 2019, SBA is planning another InnovateHER challenge, following the same goals and format.

A.14.2 Growth Accelerator Fund Competition[108]

Lead Sponsoring Agency: SBA

Status: This competition was completed in FY17.

Competition Goals: The Growth Accelerator Fund Competition aims to stimulate markets that are not being served by traditional venture capital and investment hubs. By infusing operational capital into qualified accelerators and incubators, these entities in turn provide resources to boost the startup and entrepreneurship communities around them. For the 2017 competition, SBA strengthened its previously funded accelerators from all over the country including rural areas and areas outside traditional venture capital hubs. Similar to previous years, SBA sought applications from women and other underrepresented groups. In addition to providing funds to underserved groups and geographic areas with less access to capital, the 2017 competition had an emphasis on accelerator models supporting STEM/ Small Business Innovation Research (SBIR), women-owned or minority-owned small businesses, rural communities, and veteran communities.

Goal Types: Engage new people and communities; Build capacity; Stimulate a market

Justification for Using Prizes and Challenges: The utilization of prize competitions was the preferred method over contracts, grants, and cooperative agreements because it allowed SBA to be more nimble. Various options were reviewed but upon consultation with the prize and challenge community of practice, SBA determined prizes as the most appropriate method for implementation. Prize authority held fewer restrictions, which allowed more diverse models of accelerators and incubators to participate (NGOs, Private, individual-led, etc.). This allowed the Agency to test supporting riskier emerging accelerator and incubator ecosystem efforts that might have a valid chance at developing their local driven venture, while lowering risk due to the relatively small prize awards ($50,000 apiece).

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered was $1,000,000 and the total amount awarded was $1,000,000. The FY17 GAFC competition awarded $1,000,000 in FY17 dollars as cash prizes to 20 entities ($50,000 each). GAFC does not offer non-cash prizes. The entire sum originated from SBA's Entrepreneurial Development appropriations.

Solicitation of Submissions: The 2017 Growth Accelerator Fund Competition was limited to previous winners. As such, previous awardees were notified of the new prize competition via email. A press release was also sent out to announce the competition.

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

Participation Requirements: The 2017 prize pool was limited to prior winners of the Growth Accelerator Fund Competition.

Evaluation of Submissions: Judging consisted of three rounds. For the first two rounds, two reviewers were assigned for every one application. The first round consisted of internal SBA cross-agency judges who evaluated 10-slide PowerPoint decks. Of the 63 initial applicants, 54 were chosen to advance to the next round. Applicants were notified of their semi-finalist status on August 15 and were given directions to create a two minute video pitch highlighting their organization, accomplishments to date, and goals they hoped to achieve with the prize money. The second round consisted of external judges with expertise in entrepreneurial ecosystems and promoting innovation who received both the slide deck and then a two minute video pitch. The second round judges recommended 30 finalists to the Office of

[108] The website for the Growth Accelerator Fund Competition can be viewed at https://www.sba.gov/accelerators.

Investment and Innovation's Director of Innovation. The final round consisted of the Director of Innovation and program staff who evaluated the external judge's recommendations to select the 20 prizes of $50,000 that were ultimately awarded.

Results: Of the 63 entries submitted between June 23 and July 21, 2017, 20 prizes were awarded.

Budget and Resources: SBA's Office of Investment and Innovation does not have a full-time FTE designated primarily to the Growth Accelerator Fund Competition. In FY17, two employees each contributed 0.2 FTEs to collaborate on the competition. These employees also managed a preliminary evaluation of the program in partnership with the Library of Congress Federal Research Division.

Partnerships: N/A

Advancement of Agency Mission: The mission of the U.S. Small Business Administration lies within helping Americans start, grow, expand, and recover their businesses. One of its core strategic objectives is to build healthy entrepreneurial ecosystems and create business friendly environments. The Growth Accelerator Fund Competition fits directly into this goal as it stimulates markets in rural and other areas outside of venture capital and investment hotspots.

Solution Types: Other - Solutions to stimulate innovation with tech-based startups, to include SBIR funding and underrepresented groups.

Plan for Upcoming 2 FYs: SBA decided to roll the FY18 funds into the FY19 competition. To ensure GAFC aligns with the needs of entrepreneurs and the innovation ecosystem, SBA is reviewing the results of the competition through its first four years, while also evaluating potential changes.

A.14.3 #SmallBusinessWeek Hackathon[109]

Lead Sponsoring Agency: SBA

Status: This competition was launched and completed in FY18.

Competition Goals: The National Small Business Week Hackathon Challenge sought to develop a Solution that will help small businesses improve their operations by combining Visa or U.S. Government APIs (Federal, State, or Local) with other technology and other open APIs.

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

Justification for Using Prizes and Challenges: The purpose of the Hackathon is to promote SBA's services to the public and to foster cooperation between the public and private sectors for the benefit of small business.

Cash Prize Purses and/or Non-Cash Prize Awards: The total prize purse offered and the total amount awarded was $24,000. Visa provided cash prizes in the follwing amounts: $10,000 first prize, $7,000 second prize, $5,000 third prize, and $2,000 specialty Visa API prize.

Solicitation of Submissions: The Hackathon event was hosted in Washington, DC on April 27-29, 2018.

[109] The website for the #SmallBusinessWeek Hackathon can be viewed at https://smallbizweek.hackathon.com/.

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: The Challenge was open only to citizens or permanent legal residents of the United States who are above the age of majority in their state of legal residence (including the District of Columbia) as of April 27, 2018; and who register to participate in the Hackathon. The maximum team sizes was five people.

Evaluation of Submissions: At the conclusion of the Hackathon, each team had three minutes to demonstrate the Solution that Participants have developed for the panel of judges, followed by two minutes of Q&A. Demonstration time limits could be shortened or lengthened under Visa and SBA's sole discretion depending on the number of teams. Participants chose how to present their Solution, but were encouraged to explain and demonstrate how their Solution meets the judging criteria. Participants acknowledged that the panel of judges could ask them questions regarding their Solution. The order of demonstrations was decided by the judges in their discretion. Visa and SBA awarded prizes to National Small Business Week Hackathon Challenge teams that, in Visa and SBA's sole determination, best meet the following criteria: [1] Innovation - Is this Solution different and unique from what is already on the market? (30 points); [2] Market Potential - Will this Solution have viable reach, and market potential for small business owners and entrepreneurs? (30 points); [3] Technical Execution - How effectively are the available APIs used? Is your Solution viable and easy to navigate? (20 points); [4] Challenge Fit - Does this Solution effectively respond to the National Small Business Week Hackathon Challenge? (20 points).

Results: Of the entries submitted by 75 participants on April 27, 2018, four prizes were awarded to winners.

Budget and Resources: Limited agency resources were used to conduct the Hackathon. Approximately three SBA staff members collaborated with Visa to plan and execute the event. Several other staff members attended various portions of the event to participate.

Partnerships: Pursuant to SBA's Cosponsorship Authority, Visa serves as a cosponsor of National Small Business Week. They provided the cash prize for the Hackathon winners, assisted with promotion of the event and other elements of event planning, and made their APIs available to participants. The estimated value of partner contributions was $24,000.

Advancement of Agency Mission: Small businesses are critical to local economies and communities throughout the United States. Their owners are passionate about their trades, but they often don't have enough time for the day-to-day financial elements of running a small business, such as making payments efficiently, building and accessing, business credit, optimizing, cash flow, payroll & accounting, and processes. The hackathon aims to help business owners focus more on their true passion by reimagining small business financial management by making use of API's from Visa, the U.S. Government, and third parties to build a game changing new tool.

Solution Types: Software and apps

Plan for Upcoming 2 FYs: In FY19, SBA plans to conduct a second Small Business Week Hackathon with the specific theme of disaster recovery and preparedness for small business.

A.15 United States Agency for International Development (USAID)

A.15.1 Sign on For Literacy Prize[110]

Lead Sponsoring Agency: USAID, All Children Reading: A Grand Challenge for Development (ACR GCD)

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

Competition Goals: Of the estimated 32 million deaf children around the world, 80 percent do not have access to education, and only two percent receive education in sign language. Without early access to language, children fail to develop social and cognitive skills at the same rate as their peers, hindering their ability to learn to read and write and isolating them from society over the course of their lives. The Sign On For Literacy Prize, seeks technology-based innovations that will provide greater access to local sign languages, sign language supported early grade reading materials, and/or reading instruction by engaging families, schools, and communities. Through these solutions, the goal is that parents, educators, and communities will be better prepared to support the early childhood language outcomes of deaf children, access to and the usage of local sign languages will increase, and the literacy outcomes of deaf children will improve.

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

Justification for Using Prizes and Challenges: We were seeking 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 One experience: despite the numerous proposals received, very few focused on these thematic areas. Smaller prize awards structured around these 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 we've 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 $500,000 and the total amount awarded was $125,000. Prizes were awarded to five finalists ($25,000 each) to further develop their solution prototypes in alignment with the feedback provided by the judges. The awards were granted as a one-time lump sum. Non-monetary incentives included promotion by ACR GCD and the prize parnters via social media and other digtial platforms, as well as an invitation to present at events.

Solicitation of Submissions: The competition was announced at the 3rd International Conference of World Federation of the Deaf (WFD) during a session streamed live on Facebook. At the same time, a communication package, outlined below, was shared by ACR GCD and all links to the competition site went live. InnoCentive Listed the Sign On For Literacy Prize in five editions of its Challenge Bulletin, which is sent weekly to approximately 150,000 Solvers. It was also promoted through InnoCentive's social media accounts (Facebook >12,000 likes, Twitter >11,000 followers, LinkedIn >6,400 followers). World Vision circulated a communications package at launch and throughout the competition to the prize partners, encouraging them to promote the Sign On For Literacy Prize to their networks, which included: social media content, a prize announcement video, flyer ad, website banner, press release, Sign on For Literacy infographic and promotional videos. All prize partners continued to promote the prize on social media and other communication channels throughout the competition. As a result, large

[110] The website for the Sign on For Literacy Prize can be viewed at https://allchildrenreading.org/challenge/sign-literacy-prize/ ; also see https://www.innocentive.com/ar/challenge/9934006.

geographical reach was achieved, with many registrations from developing countries. Potential applicants registered from all over the world, from six continents and 61 countries. Applications were submitted from 39 countries and six continents.

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 prize targeted global solvers including individuals, teams and organizations with innovative technology-based solutions that demonstrated the ability to increase access to sign languages and literacy interventions for children who are deaf in low-resource contexts. Entrants were required to submit a written description in English of the proposed innovation and project plan explaining the methods, resources, potential technology platform(s), personnel, existing partnerships (if any), evidence of collaboration with the local deaf community in product design and implementation, and preliminary schedule to implement the proposed innovation. It was also noted that entrants must be able to work with ACR GCD partners and other collaborative organizations for prototype development in Phase 2 and implementation of the innovation in Phase 3. 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 were ineligible for award. Geographic code 937 currently excludes Cuba, Iran, Libya, and North Korea.

Evaluation of Submissions: The evaluation was conducted over five stages. The first two stages were prescreening first by InnoCentive and then by ACR GCD to remove entries that did not meet key requirements. Judging was conducted over three rounds. In the first round of judging 53 entries were scored against judging criteria by a panel of 10 expert judges that included a mix of the prize partners and external technical experts. Each entry was reviewed by 3 judges and the 19 top scoring submissions moved to the next round of judging. In the second round of judging, the 19 remaining entries were scored against the judging criteria by a panel of nine expert judges. This resulted in 8 top scoring submissions. These top 8 applicants were asked to provide written response to questions that surfed during the judging process. These submissions and questions were then reviewed by a steering committee consisting of representatives from the prize partners. Based on the scoring throughout the judging rounds, answers to the questions, and the recommendations of the steering committee members, the prize partners selected five entries to receive an award of $25,000 each and were moved to Phase 2 of the competition. Overall, this evaluation method was found to be very comprehensive and effective in identifying innovative solutions. It was however a very lengthy process.

Results: Of the 104 entries submitted by participants between November 8, 2017 and February 16, 2018, five prizes have been awarded to the Phase 1 winners. Final winners have not yet been determined.

Budget and Resources: A prize design and administration firm, InnoCentive, was contracted to develop the prize requirements and administer the prize. A design-thinking consultant was hired to lead the prize parnters and technical experts through a collaborative process to identify the challenge statement and parameters of the prize. The five prize winners of Phase 1 of the competition were awarded $25,000 each. In 2017, the project funding was $88,855 and two ACR staff members comprised approximately 50% FTE status. In 2018, the project funding was $169,965 and three ACR staff members comprised approximately one FTE staff time.

Partnerships: Partnerships with World Federation of the Deaf (WFD), Deaf Child Worldwide (DCW), and Nyle DiMarco Foundation (NDF) have been critical to the success of this prize. Each provided credibility to the competition and enhanced communications with the global deaf community many of which competed in the competition. In the future, ACR GCD will seek to engage such technical partners such as these. WFD provided technical expertise throughout the design of the competition by attending the

design workshop and providing subsequent reviews and feedback on the prize design. They announced the prize live and streamed it on Facebook at the 3rd International Conference of the WFD which has received over 14,000 views. They also promoted the prize through their social media and other communications channels. WFD also nominated judges that supported the review of the prize submissions. DCW contributed 20,000 GBP to the prize purse and provided technical expertise throughout the design of the competition by reviewing and providing feedback on the prize design. They promoted the prize their their social media and other communications channels and nominted judges that supported the review of the prize submissions. NDF provided technical expertise throughout the design of the competition by attending the design workshop and providing subsequent reviews and feedback on the prize design. They announced the prize through their social social media channels and nominated judges to support the review of the prize submissions. ACR GCD is a partnership of the United States Agency for International Development, World Vision, and the Australian Government. The estimated value of partner contributions for this prize was $77,600 from USAID:, $77,600 from World Vision, $77,600 from the Australian Government:, $26,000 from DCW, and an estimated $10,000 in-kind communications and technical support from WFD.

Advancement of Agency Mission: Of the estimated 32 million deaf children around the world, 80 percent do not have access to education, and only two percent receive education in sign language, the most natural and accessible language for a deaf child. Early acquisition of a first language and access to education in sign language has been proven to greatly increase literacy outcomes in children, both hearing and deaf. However, children who are deaf often have limited access to local sign language, learning resources, or adults that are fluent signers. By providing children, parents, educators and communities a resource for learning the local sign language; children will have a greater opportunity to acquire language as a building block for learning to read and a first step in the child's educational journey. True education for all depends upon inclusive education interventions and systems for people with disabilities and by sourcing new and inclusive approaches, this competition advances the ACR GCD partners' goals of inclusive education and the learning outcomes of all children. The Sign On For Literacy prize also provided an opportunity to profile the lack of education and learning opportunities for children with disabilities around the globe.

Solution Types: Software and apps; Technology demonstration and hardware

Plan for Upcoming 2 FYs: All ACR Prize Activities will depend on the new strategy to be developed by the ACR Partners in Q1 FY2019.