Knowledge Stream Research and Development Office

Prize Competitions

SEPTEMBER 2019

Managing Water in the Wes.

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Message from the Chief

Greetings and welcome to the September 2019 issue of the *Knowledge Stream* magazine! In this issue, the spotlight is on the Science and Technology (S&T) Program's prize competition activities that address some of Reclamation's most difficult technical challenges in water availability, infrastructure, and environmental issues in water and power management.

Topics include:

- Federal prize competition authorities;
- When to implement prize competitions and the general process;
- Topic identification and selection;
- Government and private sector partnerships;
- Maturing competition solutions from concept to use; and
- Lessons learned after five years of prize administration.

Highlights include:

- Partnering with NASA's Center of Excellence for Collaborative Innovation (CoECI).
- Leveraging CoECI's access to multiple global solver communities and private sector competition services; and culminating in the recent launch of two prize competitions: *Rodeo II: Sub-Seasonal Climate Forecasting* and *Rust Busters: Join the Resistance!*
- Teaming with the Department of Energy (DOE) Water Power Technology Office (WPTO) on prize competitions aimed at the challenge of excluding fish from water intakes; as well as plans to support DOE's *Water Security Grand Challenge* by launching a concept-to-prototype competition aimed at improving desalination cost-effectiveness.
- Interviewing "Serial Solvers" who are winners of multiple Reclamation prize competitions addressing challenges related to a wide-variety of topics, while also showcasing how prize competitions are a great way to recruit innovation from talented individuals outside the field.

As always, please enjoy this issue of the *Knowledge Stream* and offer any feedback for continual improvement of dissemination strategies for transferring solutions to users.

Levi Brekke Chief





Jennifer Beardsley, Reclamation's Prize Competitions Program Administrator, served as Content Lead for this issue.

Jen is responsible for administering a portfolio of prize competitions in water availability, infrastructure sustainability, and environmental compliance. This includes developing Federal and non-Federal partnerships to enhance prize competition activities and coordinating efforts to further develop competition solutions into beneficial uses in Reclamation and the water resources management community.

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Community Needs

Prize Competitions: A Unique Tool to Spur Innovation

Working within the traditional solver space usually results in positive outcomes and solutions to difficult issues. There are those occasions where it seems an issue should have an easier or quicker solution. Sometimes, the solution is just too expensive or needs much research before it can be implemented or developed to a point it can be tested or used. Prize competitions put another tool in the professional solver space toolbox in that it taps into a non-traditional pool of thinkers and problem solvers. Prize competitions can jump start research, advance technology at a quicker pace, or reveal a truly transformational way to accomplish an objective.

In March 2010, the Office of Management and Budget issued a memorandum on the use of prize competitions. Shortly following, the America Creating **Opportunities to Meaningfully** Promote Excellence in Technology, Education, and Science (COMPETES) Reauthorization Act of 2010 became law. COMPETES expanded the authority of Federal agencies to conduct prize competitions to further their goals and granted Federal agencies the authority to fund prize competitions through appropriations, gift funds from private entities, and as part of public-private partnerships. In January 2017, the American



Innovation and Competitiveness Act (AICA) was signed into law encouraging greater partnerships and eliminating unnecessary administrative burden, among other changes.

Reclamation uses prize competitions to expand its solver base and achieve a variety of goals in the areas of infrastructure, water availability and environment. While prize competitions are not the right tool for every problem, they can serve as a mechanism for spurring and sourcing innovation. Reclamation competitions are advancing research and development issues that are best addressed through process and technological improvements to achieve more efficient operations of Reclamation facilities and improved management of water and related resources, in contrast to policy development, regulatory compliance, or other approaches. This includes advancements in areas such as eradication of invasive mussels, sub-seasonal forecasting, and protecting structures from corrosion.

As the program grew, a process was developed to identify the key steps and resources necessary to run a competition. This process continues to iterate as Reclamation

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More Information

Prize Competitions https://www.usbr.gov/research/ challenges/index.html

Implementation of Federal Prize and Citizen Science Authority: Fiscal Years 17-18 https://www.whitehouse.gov/ wp-content/uploads/2019/06/ Federal-Prize-and-Citizen-Science-Implementation-FY17-18-Report-June-2019.pdf

Crowdsourcing: a method to obtain needed services, ideas, or content by soliciting voluntary contributions from a group of individuals or organizations, especially from an online community. fine tunes its business model for conducting competitions. The program has increased the number competitions conducted and the complexity of the challenges presented to the solver communities. For the first five years, Reclamation utilized the services of a contractor to assist with formulating competitions, posting and amplifying the competitions, and interacting with solvers to complete verification of winner eligibility. Seeing the successes and emphasis to use the power of crowdsourcing, Reclamation partnered with NASA's Center of Excellence for Collaborative Innovation (CoECI) to tap into their contracting mechanism, thus streamlining procurement of vendors to administer prize competitions and enabling Reclamation to engage the international solver community.

Benefits of Prizes

- Accelerate scientific research
- Increase cost effectiveness
- Connect public to Federal
- science missions

In March 2018, the White House convened a panel of government, industry, and philanthropic thought-leaders. The panel informed planning for prize competitions and grand challenges designed to catalyze innovation in critical water areas, including the *Water Security Grand Challenge*, a White House initiated, Department of Energy (DOE) led effort to use prize competitions and other mechanisms to advance transformational technology and innovation to meet the global need for safe, secure, and affordable water.

Reclamation is partnering with DOE on multiple prize efforts that support the advancement of affordable water and support the goals of the Administration and the White House's Water Subcabinet.

The engagement of the diverse population of solvers and innovators to provide novel solutions helping to advance Reclamation's mission is invaluable. The Research and Development Office is excited about the upcoming competitions and hopeful the solutions presented can be further developed or commercialized for Reclamation use.



Key Perspectives

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More Information

Prize Competitions https://www.usbr.gov/research/ challenges/index.html

Guidance on the Use of Challenges and Prizes to Promote Open Government https://www.whitehouse.gov/ sites/whitehouse.gov/files/omb/ memoranda/2010/m10-11.pdf

Future of Prizes at Reclamation

Since 2015, Reclamation has launched 20 competitions and awarded over \$1.5 million in prizes. It is evident that Reclamation has embraced the potential of using the crowd to solve tough problems, spur innovation, and provide fresh starting points for research. Whether seeking to advance existing technologies or wanting to develop truly transformative ideas, prize competitions are one of the many tools available for accomplishing objectives and advancing Reclamation's mission. Outcomes can be enlightening, expected, or give experts that "Huh. I never thought about it like that!" moment. Prize competitions are a good way to explore new ideas and ways of solving long-standing issues.

Reclamation has learned much about conducting successful competitions, exploring additional issues that may be well suited for engaging the broader solver audience, seeking additional partners and subject matter experts to be involved in these competitive efforts, and leveraging authorities and procurement tools to broaden access to a diverse cadre of vendors experienced in conducting competitions to tap a diverse solver community.

Identifying Topics for Competitions

The portfolio of issues identified for future competitions continually grows and refines. In 2014, the Research and Development Office (R&D) collaborated with the Technical Service Center,

Prizes by the Numbers

- 20 Competitions launched since 2015
- 745 Solutions submitted
- 103 Prizes paid
- \$2.0M Total prize purse offered
- \$1.5M Total prizes paid

Regions, and other members of the Federal family to develop a robust listing of topics for possible prize competitions in the theme areas of Water Availability, Environmental Compliance, and Infrastructure Sustainability. This topic listing has guided the competitions conducted over the past five years with top candidate topics being those that are shared priorities of Reclamation with collaborating Federal agencies.

As Reclamation priorities shift, complex issues are identified in the field, more is learned about the prize tool, and new ideas are presented for possible future competitions. Although the process for identifying new topics has been informal, it has also been effective in keeping the topic list full. Currently, R&D is exploring opportunities to work with Reclamation offices, stakeholders, and other partners to refresh the listing of potential competitions and priorities. Engagement at the Region, Area, and Field offices will help ensure there is a connection with the on-the-ground issues where new thinking or different perspectives could be helpful in finding a solution to a long-standing problem or issue. These offices can also assist in identifying new partnerships (public or private) for competitions or field location opportunities to test proposed solutions.

Leveraging Partnerships

There is great interest in employing unconventional methods to expand thinking and solve problems. There is interest in public and private partnerships working toward positive solutions to advance capabilities, help agencies become more effective in their missions, and expand knowledge. Understanding the solver community and why they put effort into providing ideas and solutions

helps define the need for a competition.

Recently, Reclamation formed a new relationship with National Aeronautics and Space Administration (NASA) Center of Excellence of Collaborative Innovation (CoECI). This partnership aims to advance how Reclamation's prize competitions are conducted by having a streamlined contracting mechanism and access to multiple competition vendors offering differing expertise with greater solver communities, including the international solver space. Reclamation has launched



two new competitions through this relationship: *Rodeo 2: Sub-Seasonal Forecast Rodeo* and *Rust Busters*. There is already great solver engagement and healthy competition in the early stages of both competitions.

Additional partnerships are being formed to build upon some of the work from early competitions to progress toward further development of the solutions in follow on competitions. Reclamation is planning future stages of the *Improving Fish Exclusion from Water Diversions and Intakes* competition with the Department of Energy (DOE) Water Power Technologies Office (WPTO). Reclamation is also engaging with DOE on other grand challenges related to water treatment. These partnerships are essential to experiencing continued prize program success and bringing ideas to the demonstration or implementation stage.

Getting Involved

Prize competitions can be exciting and nearly anyone can be involved. R&D and the Prize Competition Theme leads continually explore new topics, best options for managing upcoming competitions, and additional opportunities for new partnerships. Theme Leads also seek subject matter experts to participate, provide project management,

and assist with evaluations. Interested participants should first suggest topics, explore new ideas, and discuss potential stretch opportunities with supervisors. Contact Reclamation's Prize Theme leads (see p.19) to learn more about prize competitions and explore opportunities to contribute.

Have an idea for a prize competition? Email PRIZE@usbr.gov

Partnerships

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Connie Svoboda Improving Fish Exclusion from Water Diversions and Intakes csvoboda@usbr.gov

Ken Nowak Rodeo I: Sub-Seasonal Climate Forecasting knowak@usbr.gov

Yuliana Porras-Mendoza Desal Prize yporrasmendoza@usbr.gov

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Arsenic Sensor - Stage 1 https://www.usbr.gov/research/ challenges/arsenicsensor.html

Pathogen Monitoring - Stage 1 https://www.usbr.gov/research/ challenges/pathogen.html

Improving Fish Exclusion from Water Diversions and Intakes https://www.usbr.gov/research/ challenges/fishexclusion.html

Rodeo I & II: Sub-Seasonal Climate Forecasting https://www.usbr.gov/research/ challenges/forecastrodeo.html

Desal Prize

https://www.usbr.gov/ newsroom/newsrelease/detail. cfm?RecordID=49201

Leveraging Research with Partnerships

Prize Competitions encourage partnerships with both the public and private sectors. Partnerships are essential to competition success. Through these collaborations there is greater access to subject matter experts, facilities to test solutions, additional funding, and potential commercialization.

Reclamation works with private sector partners to address common problems. For example, Xylem Inc., a global water technology provider and leader in digital water, collaborated with Reclamation on the *Arsenic Sensor - Stage 1* and *Pathogen Monitoring - Stage 1* prize competitions. Xylem contributed funds towards the prize purse of each competition, along with subject matter experts that provided insights on the design, manufacturing and operation of water quality sensors.

During the Department of Energy's (DOE) Hydropower Environmental Research Summit of 2018, Reclamation found common interest with DOE's Water Power Technologies Office (WPTO). Reclamation partnered with WPTO on the theoretical prize competition *Improving Fish Exclusion from Water Diversions and Intakes* in 2019. WPTO and Reclamation plan to partner on a larger follow-up prize competition on fish exclusion to encourage further development of ideas awarded during the first round of testing.

Reclamation's robust partnership with the National Oceanic and Atmospheric Administration (NOAA) on *Rodeo I: Sub-Seasonal Climate Forecasting* was an important ingredient to the competition's successful search for innovative sub-seasonal precipitation and temperature forecast methods in the western United States. This partnership involved multiple NOAA programs and offices: Climate Prediction Center (CPC), Office of Atmospheric Research Earth System Research Laboratory (OAR/ ESRL), National Integrated Drought Information System (NIDIS), and Office of Weather and Air Quality (OWAQ). NOAA's input and expertise helped to effectively structure and execute the competition. NOAA is also the leading agency to potentially adopt and integrate these solutions into forecasts that could be used by Reclamation to better manage water supplies. Reclamation is continuing to partner with NOAA to conduct a second forecast rodeo to access a broader international solver community and raise the bar of success.

Reclamation also collaborates on prize competitions led by others. The U.S. Agency for International Development (USAID), the Swedish International Development Agency, the Ministry of Foreign Affairs of the Kingdom of the Netherlands, and Reclamation administered the *Desal Prize* in 2015. The competition was a three-phase, incentivized competition that challenged innovators throughout the world to create cost-effective, energy-efficient, and environmentally sustainable desalination technologies to provide potable water for humans as well as crops. Reclamation provided technical expertise for this second "call" under the *Securing Water for Food Grand Challenge for Development* to assist with the design and judging of the competition and hosted the *Desal Prize* finalists at its Brackish Groundwater National Desalination Research Facility (BGNDRF) in Alamogordo, New Mexico in the spring of 2015.



Dr. Malynda Cappelle competes with her University of Texas at El Paso team at the Desal Prize event from April 2015. Reclamation partnered with the U.S. Agency for International Development (USAID), the Swedish International Development Cooperation Agency, and the Ministry of Foreign Affairs of the Kingdom of the Netherlands.

The competition was Reclamation's first experience with leveraging prizes to challenge innovators throughout the world to create cost-effective, energy-efficient, and environmentally sustainable desalination technologies to provide potable water for humans and water for agriculture, especially in developing countries. Five finalists competed at the agency's Brackish Groundwater National Desalination Facility (BGNDRF) in Alamogordo, New Mexico for \$200,000 in prize funds for head-to-head demonstrations. Expert judges selected two winning teams for grant funds totaling \$400,000 to implement pilot projects with small-holder rural farmers in a USAID mission region.

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Rick Bearce Rodent Burrows rbearce@usbr.gov

More Information

Eradication of Invasive Mussels in Open Water - Stage 1 https://www.usbr.gov/research/ challenges/mussels.html

Pathogen Monitoring - Stage 1 https://www.usbr.gov/research/ challenges/pathogen.html

Preventing Rodent Burrows in Earthen Embankments https://www.usbr.gov/research/ challenges/rodentburrows.html

R&D Technology Transfer Cooperative Agreements https://www.usbr.gov/ research/technology_transfer/ partnerships.html

Maturing Ideas into Usable Technologies

Prize competitions generate innovative ideas on how to approach important issues facing Reclamation. After subject matter experts determine that a particular submission should receive a prize, the idea needs to be matured into a usable technology or product. There are several options for maturing solutions of interest depending on the involvement of the solver and opportunities available within Reclamation and its partners.

Reclamation is working to advance prize competition solutions in the areas of environmental compliance, water availability, and infrastructure sustainability. Reclamation seeks internal and external interest in further maturing winning submissions from prize competitions.

By performing idea maturation in-house, ideas can be cultivated into products or techniques that account for the unique infrastructure and water delivery problems facing Reclamation's facilities. In most cases, solutions received through prize competitions are available to be further advanced through research and development. Reclamation subject matter experts can champion efforts to secure funding and further these solutions.

Eradication of Invasive Mussels in Open Water

In 2017 and 2018, Reclamation ran the *Eradication of Invasive Mussels in Open Water* prize competition. One of the winners proposed a theoretical, innovative solution to induce genetically-modified disseminated neoplastic cells to eradicate invasive mussels. It is anticipated that several years of research and development will be needed to provide proof-of-concept. Reclamation initiated a multi-year cooperative agreement with Biomilab, LLC in 2019 to support a collaborative research partnership where technical expertise is shared. The cooperative agreement is being funded by Reclamation's Research and Development Office and the Office of Policy. Biomilab is also seeking grant opportunities and additional partnerships with other Federal and non-Federal agencies.

Pathogen Monitoring

Other Reclamation programs provide funding to mature concepts identified through prize competitions. For example, the *Pathogen Monitoring – Stage 1* prize competition sought improved methods to sample and monitor for pathogens to support indirect and direct water reuse. A team from the University of California-Davis proposed a winning solution. This same team also submitted a proposal through Reclamation's Desalination and Water Purification Research Program (DWPR). They were competitively selected for approximately \$150,000 in funding through a cooperative agreement for a laboratory-scale project titled "Flow cytometric monitoring of waterborne pathogens to facilitate water treatment and direct potable water reuse."

Preventing Rodent Burrows in Earthen Embankments

The 2016 *Preventing Rodent Burrows in Eathern Embankments* prize competition solicited ideas for deterring animals from burrowing into canal embankments and awarded prizes to five "ideation" solutions.

A plan for developing two of these winning solutions was submitted to and funded through the Fiscal Year 2019 Science and Technology Program (S&T) competitive proposal process. The team includes Rick Bearce, Geotechnical Engineer in the Technical Service Center (TSC) and Principal Investigator, and Jim Dean, Civil Engineer in the Pacific Northwest Region and prize competition Team Lead.

The team is currently building a wind-powered, subsurface, acoustic deterrent device (see image, right). They are also researching various rodentproof, metal mesh, canal embankment liners that can be placed in combination with noxious native plant species. The team hopes to field-test their findings in summer 2020.



competition.

Tapping Other Agencies: Crowdsourcing with NASA CoECI

The Center of Excellence for Collaborative Innovation (CoECI) was established by the National Aeronautics and Space Administration (NASA) in November of 2011 at the request of the White House Office of Science and Technology Policy (OSTP). OSTP encouraged NASA CoECI to assist other federal agencies in the use of crowdsourced challenges to solve tough, mission-critical problems. Since its inception, research into the use of crowdsourcing has been at the heart of NASA's effort, and that research has provided data-driven analysis to validate the value of the tool as well as enabling strategies to support more effective operational implementation.

After five years of working with a single contractor and seeing the potential of prize competitions, Reclamation recognized the potential of engaging a larger solver

community to access more creative and out-ofthe-box ideas. In 2018, Reclamation established a collaborative relationship with CoECI to cast a wider net in finding potential solvers for Reclamation's water and water-related challenges. Within the first year, Reclamation launched two competitions under this Interagency Agreement: Rodeo II: Sub-Seasonal *Climate Forecasting* followed by Rust Busters: Join the Resistance!

Reclamation's prize teams engage with CoECI to develop requirements that lead to the selection of a contractor. This contractor, with CoECI, works with Reclamation on all aspects of implementing a competition - from problem definition and incentive design, to post-submission evaluation and selection



All CoECI challenges are managed under the umbrella of the NASA Tournament Lab (NTL) which recently expanded its capabilities beyond software and algorithm development. The NTL now offers a variety of open innovation platforms that engage the crowdsourcing community in challenges to create the most innovative, efficient and optimal solutions for specific, realworld challenges being faced by NASA.

of solutions. This end-to-end service enables Reclamation to rapidly experiment with competition methods and innovate its own capabilities.

Overall, crowdsourcing and citizen science is particularly well suited for projects that require human effort but can be carried out with minimal training. The Reclamation-CoECI partnership is integral to furthering successes of the prize competition program and ensuring the greatest positive impact and outcomes.

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More Information

NASA Center of Excellence for Collaborative Innovation https://www.nasa.gov/offices/ COECI/index.html

Reflecting on Five Years of Prizes

Since 2014, Reclamation has focused on bringing the prize competition tool into practice. Reflecting on five years of program development and implementing initial competitions, several areas of learned lessons have emerged.

Intellectual Property (IP) – To Seek or Not Seek a License to Use

New ideas or technologies presented in submissions to competitions may include potential inventions, patentable ideas, or intellectual property (IP). While many solutions would require significant research and development to mature a solution from concept to use, Reclamation may seek a license from the solver to use their IP to internally develop, research, or use their solution. Reclamation intentions to seek - or not seek - such license impacts the quantity and quality of solutions submitted to a competition. In some cases, solvers do not want to share their potentially patentable idea, thus they are not interested in competing where a license must be issued to receive a prize. Conversely, some solvers have great ideas and want to see their solutions advance, thus they are willing to provide a license to use. Typically, Reclamation sees greater solver response in competitions where a license to use is not a stipulation for receiving a prize.

Reduction-to-Practice Competitions

A reduction-to-practice competition is intended to advance solutions beyond just an idea on paper. Ideally, these competitions result in a developed prototype or concept application to show it can resolve the issue presented. Reclamation conducted a few of these competitions and quickly learned they take careful planning and attention over a much longer time period. Specific reduction-to-practice lessons learned:

- *Pay Larger Awards Early*. Larger first-phase prizes with some strings attached can help solvers cover costs to develop their ideas and keep them competing.
- *Engage*. During the innovation-phase of the competition, have subject matter experts engage with the solvers. Feedback provides valuable data points and keeps solvers focused.
- *Establish Clear Timeframes and Expectations*. Clear expectations help solvers determine their willingness to participate in a competition. The resulting solver pool will be serious and want to complete the longer competition.
- *Plan and Commit.* Think through all the aspects of the competition and make as many decisions about testing and facilities to help smooth the flow of the competition. Securing facilities, partners, and subject matter experts' time contributes to successful end results.
- *Offer Non-Monetary Awards*. Creative recognitions throughout the competition help keep the solver and community interested.

Other Observations

- Recognize partners are key to competition success.
- Use professional networks and social media as an effective tool for competition amplification.
- Develop specific solution requirements and remain open to non-traditional approaches.
- Secure staff and financial resources early on to right-size the competition.
- Explore opportunities for solutions early and often to advance development.
- Engage a broad team with varied experience and knowledge to foster team diversity and keep minds open.
- Use a catchy competition title over one heavy with technical detail.

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More Information

Prize Competitions https://www.usbr.gov/research/ challenges/index.html

Serial Solvers

Interviews with Repeat Winners

The premise of the prize competition tool is to get solutions to long-standing issues from non-traditional solvers and Reclamation has experienced just that! Some solvers provide solutions on multiple competitions across different fields. These solvers think broadly, identify new ways to accomplish work or solve issues that have been elusive, and have a desire to collaborate for the greater good.

Reclamation reached out to these "Serial Solvers" to learn about:

Q1: What drives you to compete?

Q2: What do you believe makes you successful in competing?



Edem Tsikata, Ph.D., Information Technology Consultant

Prize Competitions Won Detecting Leaks and Flaws in Water Pipelines - Stage 1 More Water, Less Concentrate - Stage 1 Preventing Rodent Burrows in Earthen Embankments Quantifying Drift Invertebrates in River and Estuary Systems

A1. I enjoy solving multi-disciplinary problems. It is also personally rewarding to find solutions that benefit the environment and make the work of individuals and agencies safer and more effective.

A2. I am genuinely curious about the topic areas, so I imagine the optimal way implementing the ideas I propose. This leads me to inexpensive solutions that address the competition requirements. Federally supported open innovation has expanded

research vistas, catalyzed cross-fertilization between scientific disciplines, and fostered public engagement with important environmental and ecological issues.



Larry Kearns, FAIA, Principal Wheeler Kearns Architect

Prize Competitions Won Sediment Removal Techniques for Reservoir Sustainability - Stage 1 More Water, Less Concentrate - Stage 1 Preventing Rodent Burrows in Earthen Embankments

A1. In the past five years, I've won twelve different challenges out of thirty-three I have entered. That's a decent batting average. Even when I lose, I end up learning lots of new things. I try to push myself to solve problems outside my comfort zone and expertise. Most innovative solutions aren't created from scratch. Most are clever recombinations of existing ideas and technologies. I try to bring an outsider perspective and recombine technologies from adjacent disciplines to solve difficult problems.

A2. My interests are pretty broad, and I am equally left- and right-brained. Unlike a lot of people, I don't like doing crossword puzzles or solving problems that have known answers. I love to learn new things. I was introduced to crowdsourcing challenges through our work for entrepreneurial educators. They personalize education because they know no two students are alike. Individuals or groups are more likely to solve difficult problems if they are cognitively diverse. The more different perspectives and skills you can bring to a problem, the better the results.



David Orlebeke, Research Scientist

Prize Competitions Won

More Water, Less Concentrate - Stage 1 Sediment Removal Techniques for Reservoir Sustainability - Stage 1 *Long-Term Corrosion Protection of Existing Hydraulic Steel Structures - Stage 1 Detecting the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and their Foundations Preventing Rodent Burrows in Earthen Embankments *Team with Yury Bodrov and David Espinosa Duran

A1. As an avid submitter to not only the Bureau of Reclamation, but other agencies and private entities challenges, I appreciate the manner and formulation of Reclamation's challenges. The agency is straight forward in what you are seeking, open to "outside the box" solutions, and provide all the relative information necessary

to allow for submitting a viable solution. This helps increase my chance at winning an award.

A2. I write plainly and don't try and bury my solution in unnecessary scientific terminology. I attempt to address multiple issues within the solution, not just those of the immediate challenge question(s). I specifically reference supporting the solution and providing actual copies of supporting documents. And I utilize existing technology from other industries or applications and apply them to the solution.



Philip Ebben, Eric Hinterman Barret Schlegelmilch, Steven Link

(clockwise from top left)

Team of Massachusetts Institute of Technology (MIT) Engineers

Prize Competitions Won Detecting Leaks and Flaws in Water Pipelines - Stage 1 Sediment Removal Techniques for Reservoir Sustainability - Stage 1

A1. We are drawn to prize competitions because we enjoy the challenge of creatively solving real problems in the world. There is no doubt that the prize money and sense of accomplishment we get from winning are nice rewards. However, we truly enjoy these competitions because they force us to think about problems in industries that we would never otherwise interact with on a professional level. This broadens our horizons and gives us a new perspective on the world, which is valuable to us.

A2. The reason we are successful is because we work as a team. We brainstorm solutions together, refine each other's ideas, and generally work as a group towards a common goal. Because of this, we are able to take our diverse set of skills and combine them into winning solutions. We have

participated in over thirty prize competitions in the past three years and have been a winner in nine of them. The practice we have gotten from participating in this number of challenges has also helped us streamline our proposal process and be efficient with our time.

Current and Upcoming Prizes

Rodeo I Wrap - Sub-Seasonal Climate Forecasting Challenge

After a year of competitive forecasting, Reclamation selected three winning teams to share \$525,000 in the *Sub-Seasonal Climate Forecast Rodeo* (now known as *Rodeo I*), which sought advancements in the three-to-six-week



Ken Nowak, Reclamation Water Availability Coordinator, presents at the Rodeo I prize competition symposium hosted by NOAA in Silver Spring, Maryland.

known as *Rodeo I*), which sought advancements in the three-to-six-week sub-seasonal forecast time frame. Each of the three teams demonstrated novel approaches and outperformed the baseline forecasts.

The challenge of sub-seasonal forecasting is that it encompasses the time frame where initial state information becomes less important and slowly varying long-term states become more important to prediction skill.

"We are very excited with the outcome of this competition," said Reclamation's Science Advisor David Raff, Ph.D., P.E. "The innovative American public is demonstrating that we can improve sub-seasonal forecasts for temperature and precipitation which will allow water managers to better prepare for shifts in hydrologic regimes, such as the onset of drought or occurrence of wet weather extremes."

Rodeo I required teams to develop temperature and precipitation forecasts for three-to-four week and five-to-six-week periods every two weeks for a year.

The teams also submitted an 11-year hindcast for the same categories. The goal was to develop systems that perform better than the existing baseline forecasts. To be eligible for prizes the solvers also needed to provide their code for testing and supporting documentation.

To punctuate the conclusion of *Rodeo I* and provide a forum for discussion on advancing sub-seasonal prediction, Reclamation and the National Oceanic and Atmospheric Administration (NOAA) Office of Weather and Air Quality (OWAQ) hosted a symposium with the winners of Reclamation's *Sub-Seasonal Climate Forecast Rodeo I* on June 17, 2019 in Silver Spring, Maryland. The symposium featured presentations from the winning teams, a panel discussion on sub-seasonal prediction, and a recognition ceremony for winning teams by Department of Commerce and Department of Interior leadership.

Rodeo I Winning Teams Team Salient

Ray Schmitt, Stephen Schmitt, Eric Schmitt

Team StillLearning

Lester Mackey, Judah Cohen, Jessica Hwang, Ernest Fraenkel, Paulo Orenstein

Team Iupoa13 Anthony Lupo, Joseph Renken, Joshua Herman



Members of winning Rodeo I teams are honored at the symposium with NOAA and Reclamation leadership. L-R: Gary Matlock, NOAA Deputy Assistant Administrator for Science; Lester Mackay; Ernest Frankel; Judah Cohen; Ray Schmitt; Joseph Renken; and David Palumbo, Reclamation Deputy Commissioner.

Rodeo II Launch

Based on the success of *Rodeo I* and the desire to further improve skill of sub-seasonal forecasts, Reclamation has launched a second competition called *Rodeo II:Sub-Seasonal Climate Forecasting*, hosted by TopCoder and HeroX. The goals of the *Rodeo II Challenge Series* are creating algorithms to enhance sub-seasonal forecasting, reducing risks to water systems, and helping water managers efficiently manage hydrological regimes.

Teams first compete in a hindcast challenge (using historical data to "predict" past conditions) from July 22 - August 24 with \$80,000 in prizes available across four competition categories. The solutions developed in the hindcast competition provide a foundation upon which teams can build methods for the year of real-time forecasting, which will span Water Year (WY) 2020.

The year of real-time forecasting will be comprised of 26 forecasts issued as one every other week. To be eligible for prizes, teams must outperform an existing dynamical sub-seasonal forecast from NOAA as well as winning *Rodeo I* forecast methods. Prizes will be awarded based on performance in each of the 26 forecast exercises and over the course of the year. In total, \$720,000 in prizes will be available for the year of real-time forecasting. A leaderboard for the WY 2020 real-time component of *Rodeo II* will be hosted by that National Integrated Drought Information System (NIDIS).

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More Information

Rodeo I & II: Sub-Seasonal Climate Forecasting https://www.usbr.gov/research/ challenges/forecastrodeo.html

Follow Rodeo II https://www.topcoder.com/lp/ rodeo2



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topcoder

Rust Busters: Join the Resistance!

Reclamation maintains an extensive network of hydraulic steel structures to control water and generate power, and longer lasting corrosion protection materials or methods are needed to preserve these structures. Traditional corrosion protection methods, like coatings, require occasional replacement to restore their protective nature. The coatings



applied to these structures at the time of construction fell out of favor due to health and human safety risks or adverse affects to the environment. Alternative coatings are available but have greatly reduced service lifetimes, which sharply increases the incurred costs.

Reclamation and partners, U.S. Army Corps of Engineers (USACE), U.S. Naval Facilities Engineering Command (NAVFAC), and the National Institute of Standards and Technology (NIST), launched stage one of this prize competition on June 6, 2017 to spur innovation around this age-old issue of corrosion

protection for valuable steel structures. The competition sought ideas to protect structures for 50 years with minimal maintenance and a low cost of installation, which resulted in five winning individuals being awarded a total of \$47,500.

HeroX will host the next stage of the corrosion competition as innovators are asked to turn their rust-busting ideas into functioning prototypes or demonstrable solutions, which launched in the summer of 2019. Participants will submit their ideas along with a development strategy to be considered in the first phase of the stage two competition. Five winners will be selected to mature their solution for laboratory and field testing along with a \$50,000 prize each. Their solutions will then compete for several unique opportunities, including a \$100,000 final prize purse, a "best laboratory performance award," extensive testing results, and presentation of the findings at a corrosion conference.

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More Information

Rust Busters https://www.usbr.gov/research/ challenges/corrosion.html

Follow Rust Busters https://www.herox.com/ RustBusters

More Water, Less Concentrate - Stage 2

When inland communities are evaluating potential sources for a new water supply, desalination is often overlooked or not considered due to its perceived high cost. A major contributing factor to the cost of inland desalination is the additional handling and/or treatment required to manage concentrate streams, where desirable additional water resources are also lost.



In this upcoming prize competition, Reclamation will again be seeking innovative solutions to increase the amount of usable water supplies produced by inland desalination plants in an affordable, environmentally sustainable, and efficient.

Solutions can be novel technologies or approaches that build upon existing technologies, and the competition is envisioned to culminate in lab or field demonstrations of the proposed technologies.

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More Information

More Water, Less Concentrate https://www.usbr.gov/research/ challenges/morewater.html About the

Knowledge Stream

The *Knowledge Stream*, published by the Bureau of Reclamation's Research and Development Office, is a quarterly magazine bringing mission-critical news about the agency's research and science, as well as the many challenges associated with managing water and generating power in the West, including: projects, tools, methods, practices, results, innovation, prize competitions, publications, and more.

Prize Team Theme Leads





Infrastructure Sustainability

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Environmental Compliance

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Prize Competition Theme Areas



Water Availability

Help water managers facing current and future water demands from agriculture, municipal, industrial, Native American, rural, recreation, power generation, and ecosystem needs.



Infrastructure Sustainability

Support safe, well-maintained, and reliable inventory of dams, pipelines, hydropower generation facilities, canals, and levees.



Environmental Compliance

Aid operations to ensure watersheds are healthy, continue producing water, and support compliance with State and Federal laws requiring protection of aquatic species.

See Current and Past Competitions:

https://www.usbr.gov/research/challenges/current/index.html https://www.usbr.gov/research/challenges/past/index.html