



Public Meeting of the
President's Council of Advisors on Science and Technology (PCAST)

January 19, 2023

Meeting Minutes

MEETING PARTICIPANTS

PCAST MEMBERS

- | | | |
|------------------------------|--------------------------|-----------------------|
| 1. Frances Arnold, Co-Chair | 11. Sue Desmond-Hellmann | 21. William Press |
| 2. Arati Prabhakar, Co-Chair | 12. Inez Fung | 22. Jennifer Richeson |
| 3. Maria T. Zuber, Co-Chair | 13. Andrea Goldsmith | 23. Vicki Sato |
| 4. Dan E. Arvizu | 14. Laura H. Greene | 24. Lisa Su |
| 5. Dennis Assanis | 15. Paula Hammond | 25. Kathryn Sullivan |
| 6. John Banovetz | 16. Eric Horvitz | 26. Terence Tao |
| 7. Frances Colón | 17. Joe Kiani | 27. Phil Venables |
| 8. Lisa A. Cooper | 18. Jon Levin | 28. Catherine Woteki |
| 9. John O. Dabiri | 19. Steve Pacala | |
| 10. William Dally | 20. Saul Perlmutter | |

PCAST STAFF

1. Lara Campbell, Executive Director
2. Reba Bandyopadhyay, Deputy Executive Director
3. Bich-Thuy (Twee) Sim, Assistant Director for Transformative Medicine and Health Innovation
4. Kevin Johnstun, Research Analyst

INVITED SPEAKERS

There were no invited speakers.

START DATE AND TIME: THURSDAY, JANUARY 19, 2023, 11:10 AM Eastern Time

LOCATION: Virtual Meeting via Zoom.gov

WELCOME

PCAST Co-chairs: Frances Arnold, Francis Collins, Maria Zuber

The PCAST co-chairs— Frances Arnold, California Institute of Technology; Arati Prabhakar, Assistant to the President for Science and Technology; and Maria Zuber, Massachusetts Institute of Technology—called the public session to order. Arnold noted that Penny Pritzker, founder and chair of PSP Partners, stepped away from PCAST so she could focus on her many other commitments. On behalf of the co-chairs, Arnold thanked Pritzker for her work and sage advice during her time on PCAST.

SESSION: DISCUSSION AND CONSIDERATION FOR APPROVAL OF A PCAST REPORT TO THE PRESIDENT ON “MODERNIZING WILDLAND FIREFIGHTING TO PROTECT OUR FIREFIGHTERS”

Zuber introduced the session by noting that the *Modernizing Wildland Firefighting to Protect Our Firefighters* report prepared by the Wildfires Working Group benefited from considerable input from the firefighting community, federal agencies, and President Biden, who made it clear to PCAST how much he cares about the professionals who bravely protect life and property. Zuber pointed out that wildfire events are occurring with increasing frequency because of the changing climate. She then introduced the working group's co-leads, John Dabiri and Kathy Sullivan, who summarized the report's findings and recommendations.

Kathy Sullivan

Sullivan listed the members of the working group, including the recently-passed Ash Carter. Sullivan said that the question of how science and technology can make wildland firefighting safer and more effective drove the working group's efforts, and led to these findings:

1. Situational awareness on the scene of active fires is an urgent and unmet need.
2. The nation lacks a dedicated science and technology organization to develop technologies that can make wildland firefighting safer and a path to bring new devices and technologies into play that could help firefighters on the ground.
3. A wealth of untapped data from satellites could enable predictive models of active fires if those data were more widely available to the research community.
4. Robotics could be integrated with remote sensing to support firefighters with autonomous, semiautonomous, or human-directed systems.

Sullivan discussed the working group's recommendations. Recommendation 1 called for immediately assessing, adapting, and fielding available commercial technologies to address the vulnerabilities and shortfalls in wildfire firefighter communications. Establishing interoperability of communications and data display devices among fire companies on the ground will be key. Some county and state fire companies are already using these technologies, and this recommendation's goal is to bring those tools into the federal firefighting workforce. Carrying out this recommendation will require leadership from the National Interagency Fire Center (NIFC), with support from the National Aeronautics and Space

Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), Federal Communications Commission (FCC), and Federal Aviation Administration (FAA), and funding above current base levels dedicated to wildlife fire response, principally in the Department of the Interior (DOI) and U.S. Department of Agriculture (USDA).

Recommendation 2, said Sullivan, proposes reversing the current trend of rapidly growing wildfire suppression costs by establishing a joint-agency executive office that can accelerate enterprise-level development and deployment of new technologies that enhance situational awareness and initial attack capabilities. This joint-agency office would have Cabinet-delegated decision-making authorities and a mandate and budget to develop, execute, and accelerate deployment of a unified technology roadmap. Once established, the joint office would lead implementation of the following three recommendations.

John Dabiri

Dabiri said Recommendation 3 goes beyond increasing situational awareness and calls for strengthening the full operational sequence of wildland firefighting—detection, alert, response, and suppression—by assessing existing technologies available within the federal arena, private sector, and allied nations that could be integrated at each stage of the operational sequence. The report provides examples of this existing technology. This assessment should include a prioritized roadmap for testing these technologies and transitioning them into operations across all the relevant federal agencies. The report recommends that the U.S. Fire Administrator take the lead in this effort, with support from other U.S. government agencies such as NASA, until the joint office from Recommendation 2 is operational.

Recommendation 4, said Dabiri, calls for accelerating improvement of predictive wildfire modeling tools by expanding research community access to defense satellite observational data. This recommendation aims to give firefighters earlier and more accurate projections about where the fire they are fighting is about to go by leveraging modeling tools such as artificial intelligence. Since 2000, there have been more than 1.5 million wildfires in the United States, and tens of millions of fires occurring overseas in diverse conditions, that could be used to train and validate modeling tools. Archives of U.S. space-based assets and contemporary satellite observations could be useful here, so this recommendation calls for the Department of Defense (DoD) to review the classification level of those data to expand access while balancing national security considerations. There have been conversations with the Fire Administrator and Space Command to achieve similar classification/declassification of other space-based data.

Dabiri explained that Recommendation 5 proposes expanding the nation's wildfire response capacity by encouraging development and field demonstration of prototype autonomous detection, assessment, and containment systems for wildland fire. This recommendation seeks to enable public-private partnerships that would leverage new technology and regulatory frameworks to augment conventional wildland firefighting tools. NASA's Aerospace Mission Research Directorate could provide initial leadership for this effort given its expertise in the underlying technology and ongoing collaborations with fire services. There are significant challenges to overcome regarding potential airspace conflicts, managing communications with firefighters, and finding sites within the United States to conduct demonstration tests of such technologies. This will be a long-term effort.

ZUBER MODERATED THE Q&A AND DISCUSSION BETWEEN PCAST MEMBERS AND SULLIVAN AND DABIRI

Zuber asked Sullivan and Dabiri to discuss who the working group consulted with during its fact-finding activities. Consultations included the former Supervisor of Fires in California; key leaders and members of the U.S. Forest Service, the Department of Interior's firefighting forces, the U.S. Fire Administrator; and ground-level troops and coordinators who represent the agencies at NIFC. The key message, particularly from engine company commanders at NIFC, is there is virtually no attention being paid to complementary technologies and the role those could play in augmenting existing capabilities, and that they have no pathway, budget, or expertise to bring those technologies on board. Sullivan explained this is why the working group's recommendations focused on complementary technologies not being used today.

Arati Prabhakar remarked that the most powerful technologies in the world are of no use without the training and concepts of operation that enable people to know what to do with those technologies. Dabiri replied that the importance of training—and having the time to engage in training—is something the working group heard in its conversations. Sullivan noted that the recommendation about field tests gets to the same point that technology without training and field trials is not useful. In that regard, there is no regulatory framework or interagency operational framework unified enough for different agencies to collaborate on using some of these new technologies.

Eric Horvitz asked how the nation can live with wildfires as a part of the natural ecosystem, one where fire suppression is unnatural, and apply these technologies to managing the fuels and interface between population centers and the expectation that fires should happen as a part of the natural ecosystem. Dabiri said he would start with the concept of controlled burns and prescribed fires and develop technology that can provide better situational awareness about prescribed fires so they become more effective and less likely to escape containment. A goal, then, should be to give firefighters the tools to make decisions about prescribed fires more effectively and avoid escaped fires and fast-moving fires near the urban interface. Sullivan added that getting more refined weather data in near real time to crews on scene would be a tremendous boon for decision making regarding controlled burns or whether to allow a natural burn to continue.

Horvitz also asked if the federal government should be more involved in decisions and guidance about where to put new housing. Sullivan said that would be a big ask because zoning and development decisions are city- and county-level actions. Insurers might get involved through provisions as to where they will issue insurance.

Cathie Woteki commented that this report's focus highlights an important gap: the lack of a coherent, cohesive approach for bringing science and technology to bear on improving firefighter safety and effectiveness. In that regard, she wondered if the recommendation to establish the joint office with Cabinet-delegated decision-making will require providing additional statutory authorities to the Cabinet Secretaries who will designate them to the joint office. Sullivan replied that from her knowledge of the Department of the Interior and USDA, she believes they have the sufficient authorities if they use them in that way given their mandate to fund wildlife fire science and technology. She noted that the current proportion of funds allocated to prescribed burns and long-term resilience treatments versus those allocated to wildfire technologies is not a function of mandates and prescriptions but is an elective decision.

Sullivan also said there is no one person at NIFC who can review all the available technologies, demonstrations, and tests and decide which fill the highest priority need, which is why the working group recommends standing up a new office that would provide a joint, unified command structure. Dabiri notes that NIFC is an effective organization in which agencies work well together on the operational side to put out an existing fire. Given the appropriate staffing and resources, a similar joint effort on the science and technology side that closely connects with the operational side would enable technology development to occur in close coordination with the operations side.

William Press, a member of the working group, said Recommendation 2 is important because while there are many mechanisms for interagency coordination and cooperation, they vary greatly in their effectiveness because in general they can coordinate but they cannot do much else. A joint office that carries authorities delegated by the Secretaries of Interior and Agriculture could translate coordination into action.

Andrea Goldsmith suggested broadening the request in Recommendation 1 regarding commercially available technologies to include defense, police, and emergency medical technician technologies. She noted that wireless technology developed for commercial use may not be resilient enough or work in areas where the firefighter needs them. She also thought the report needed to clarify how the proposed joint office in Recommendation 2 would spend money allocated to technology development. In the same vein, she suggested that the report, per Recommendation 4, could clarify how the development of modeling would be driven, how to engage academics to use the data to develop better models, and how a research program on modeling would be formulated, funded, and evaluated.

Dabiri said the report highlighted some DoD technologies that could prove useful to firefighters. He acknowledged that the word commercial was narrower than intended and that the working group would revise the report to clarify that it meant to include anything currently existing in some sphere of operations today. As for spending and ensuring that funds are not supporting incremental work, the report focused on addressing the needs of firefighters, not on a particular solution to that need. Sullivan added that spending would be informed by the type of rigorous, end-to-end technology assessments for which DoD is famous, one that delves into the operational drivers and limitations at each stage of an operational chain. The technology team at NIFC has started such an assessment.

For modeling, Dabiri explained that the National Science Foundation, private sector, and universities have become active in this modeling space. He explained that a key bottleneck is a lack of access to data that the researchers developing these models can use to further their work. The plan is to plug into efforts already underway. Sullivan added that the working group decided deliberately to not specify too exactly the programmatic mechanisms that could engage the academic community, in part because that would hinge on the level of declassification DoD determined it would give to these data.

Jennifer Richeson noted that technologies developed for wildfire firefighters would likely benefit the larger firefighter community. Dabiri agreed and said the U.S. Fire Administrator would be a key point person in dissemination efforts. He also suggested that the recommendations for wildfires could serve as a template for approaches to bring science and technology to bear across the federal government in a more cohesive manner.

Dennis Assanis wondered if the report could be more explicit about relational time frames for the recommendations. Dabiri said the order of the recommendations is an implicit timeframe, and the report provides some target date for accomplishing various parts of the recommendations: the end of fiscal year (FY)24 to start training firefighters on these tools, for example, and FY27 for field demonstrations of robotics and semiautonomous technology.

Dan Arvizu wondered if there was a connection between research on reforestation and wildfire firefighting. Sullivan notes that there hasn't been much perspective at the leadership levels of department responsibilities, which has inhibited intra-organization coordination between reforestation and firefighting. Modeling work using data from low-Earth-orbiting satellites to help firefighters might also provide a better understanding of where afforestation and reforestation efforts should be prioritized, replied Dabiri.

Terrence Tao asked if there was a role for state and local firefighting agencies in carrying out the recommendations. Sullivan said there could be a role for some forward-looking fire captains. She noted that state and county firefighters are aggravated when a fire crosses a boundary that puts them in the same fire as federal firefighters who do not have the same quality of gear or interoperability. NIFC brings some state and local agencies to the table.

Lisa Cooper asked if the stakeholders spoke about how they intend to attain new funding or use existing funding and whether there are any specific procedural or congressional barriers to getting the needed funding. Dabiri said the Forest Service has had a long-standing challenge of being properly funded to handle suppression, and those costs have been escalating enormously to the point of well over a billion dollars annually for suppression. While there is budget flexibility to allocate some of those funds to the recommended activities, the Forest Service's perspective that it needs to keep spending that money on the most immediate need is reasonable. A more effective approach, he said, would be for future federal budget requests to have funds for these activities be separate from the larger pot of funding and be protected. Sullivan added that the Forest Service has allocated \$2 to \$4 million at the beginning of the fiscal year to these activities, but those funds get reallocated to suppression in active fire seasons. She noted, too, that the funds needed for the first two recommendations is small compared to the current billions of dollars spent on fire fighting. A couple of tens of millions of dollars could produce good progress on the recommendations.

With the discussion concluded, PCAST voted unanimously to accept the report. Zuber said that the report should be ready for release in mid-February and will be available on the PCAST website.

PUBLIC COMMENT

No verbal public comments were presented.

CLOSING COMMENTS

The three co-chairs thanked the working group for handling such a hard topic. Arnold noted that crafting this report required a great deal of thought to determine which levers can be pulled to use science and technology to benefit the American people. Given that wildfires are an exponentially growing problem

that will continue to occur and cause damage in the face of climate change, these interventions in the recommendations are important, said Arnold. Zuber then adjourned the public session.

MEETING ADJOURNED: 12:05 PM Eastern Time

I hereby certify that, to the best of my knowledge, the foregoing minutes are accurate and complete.

Frances Arnold, Ph.D.
Co-Chair
President's Council of Advisors on Science and Technology

Arati Prabhakar, Ph.D.
Co-Chair
President's Council of Advisors on Science and Technology

Maria Zuber, Ph.D.
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