MITRE's Response to the ICAMS RFI to Help Inform the Advancement of Federal Meteorological Services

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About MITRE

The MITRE Corporation is a not-for-profit company that works in the public interest to pursue solving difficult problems that challenge the safety, stability, security, and well-being of our nation. We operate multiple federally funded research and development centers (FFRDCs); participate in public-private partnerships across national security and civilian agency missions; and maintain an independent technology research program in areas such as artificial intelligence, intuitive data science, quantum information science, health informatics, policy and economic expertise, trustworthy autonomy, cyber threat sharing, and cyber resilience.

MITRE's 9,000-plus employees work in the public interest to solve problems for a safer world, with scientific integrity being fundamental to our existence. We are prohibited from lobbying, do not develop or sell products, have no owners or shareholders, and do not compete with industry. Our multidisciplinary teams (including engineers, scientists, data analysts, organizational change specialists, policy professionals, and more) are thus free to explore and analyze problems from all angles, with no political or commercial pressures to influence our decision making, technical findings, or policy recommendations.

Questions Posed in the RFI

1. ***Background information*: Please describe the role that you/your organization has in meteorological services. If relevant, please describe how you/your organization engages with underserved communities.**

MITRE has multi-decadal research and development relationships with the U.S. Department of Defense (DoD), the Federal Aviation Administration (FAA), and the National Oceanic and Atmospheric Administration (NOAA)—along with various other Federal agencies—specifically targeted at a wide array of analysis and prototyping activities centered on meteorological data sets and services, often for supporting the evolution of instrumentation or networks or expanded utility and use of their products. MITRE operates across the meteorological services spectrum—research, engineering, and application—but is especially well versed in applied meteorology and climatology. Additionally, because MITRE partners with agencies throughout the government, we are adept at breaking down and connecting silos of excellence both intra- and inter-departmentally.

2. *Engagement with Federal Government*: Has your organization successfully collaborated with the U.S. Federal Government on meteorological services in the past? If successful, please describe what you think contributed to this success (e.g., the partners involved, the partners' roles, the scope/time period of the collaboration). If relevant, please describe any metrics used to evaluate the success of this engagement. If engagement and collaboration did not work, why not? (e.g., legal, regulatory, or policy requirements; differences in work culture; lack of expertise; or any other hurdles that limited or otherwise prevented effective collaboration with Federal meteorological services.)

As described in the previous section, MITRE has a continuing history of specific engagements and collaborations for meteorology and climatology with DoD, FAA, NOAA, and other Federal agencies, often partnering with the National Center for Atmospheric Research and Massachusetts Institute of Technology Lincoln Laboratory. A MITRE employee also currently chairs the American Meteorological Society Aviation, Range, and Aerospace Meteorology committee and co-chairs the Friends and Partners in Aviation Weather association. In all the above meteorological and climatological endeavors, MITRE leverages its extensive cross-disciplinary knowledge and expertise to bring the right resources to bear in solving challenging problems.

3. *Prioritizing Existing Activities: Are there any specific meteorological services that you think are currently only partially met by the Federal Government? Are there any that are currently completely unmet? How would you/your organization benefit from the prioritization of these services or the activities that advance them?*

Atmospheric Measurements. Increasing the density and the frequency of atmospheric measurements provides richer data sets of observations, thus potentially leading to more robust meteorological products with potentially greater accuracy in modeling and forecasting. Currently, high-density networks are limited to—for the most part—staging of atmospheric measurement instrumentation clusters at airports, heliports, and seaports that have operational levels that justify the expense of these systems. Although there are some variations, for the most part these instrumentation clusters are Automated Surface Observing Systems (ASOS), which are costly to install and maintain. An overlay of 2020 U.S. Census population density on top of an ASOS density map will show areas of obvious data gaps for characterizing meteorological conditions near urban areas. Adding further complexity to this issue will be the ongoing expansion of uncrewed aerial vehicle and urban air mobility operations to the planetary boundary layer. Additionally, with regard to frequency, the time between measurement periods is sometimes too long, which represents yet another axis of data gaps. As technological advances lead to lower costs of legacy capabilities (which are sufficient for the collection of fundamental meteorological data), efforts should be made to engineer and manufacture less expensive instrumentation clusters such that their installation could easily be expanded to off-airport locations, filling in data gaps in areas where there are too many miles between airports. As cloud computing and large data centers continue to evolve and provide lower processing and storage costs to Federal agency customers, explorations can be conducted to pursue mitigation of frequency data gaps, which are often the effect of intentional limiters implemented to control costs.

Weather Translation. Meteorological data is often an influential input into a range of important decisions—decisions that are often not made by meteorological experts. Meteorologists can sift through complex meteorological data sets and quickly convert this raw data into a meaningful interpretation that will inform their own decision. Non-meteorological decision makers are instead masters of entirely different tradecrafts, and thus may not be able to perform instantaneous interpretations of raw meteorological data. This requires the production of "weather translation" products created by meteorologists for decision makers that convey the needed information in ways that the decision maker can understand and that properly calibrates their thinking so that they can make proper evidence-based decisions. (Doing so is also aligned with a scientific principle produced by the White House Scientific Integrity Task Force, which calls for "widespread training for agency scientists so they can communicate scientific findings effectively to nonscientists in their agencies and to lay audiences, with the idea of helping ensure that policies and actions are based on an accurate understanding of the science."[1]) MITRE, for example, previously supported the FAA's air traffic management activities by engineering weather translation products for use in this highly weather-dependent environment.

Relationship between Earth Science and Socioeconomic Data. The relationship between earth science and socioeconomic data needs to be researched to help mitigate environmental challenges in vulnerable and underserved communities. This would include assessing environmental justice engagements, barriers, gaps, and opportunities affecting those communities. Organizations could focus on environmental justice and grow potential partnerships to develop a targeted strategy. The goal would be to help to make data, products, and services for weather, water, and climate accessible and useful to underserved communities for agriculture, forestry, drought, water resources,

[1] White House Office of Science & Technology Policy Releases Scientific Integrity Task Force Report. 2022. Executive Office of the President, https://www.whitehouse.gov/ostp/news-updates/2022/01/11/white-house-office-of-science-technology-policy-releases-scientific-integrity-task-force-report/. Last accessed September 28, 2022.

health and air quality, disaster preparedness and recovery facilitated by exploiting technology, applied research, data analysis, and user applications.

De-siloing Meteorological Data. Meteorological data that NOAA (and others) collects and distributes needs to be "de-siloed." MITRE utilizes many different data sets generated by, managed by, and provided by siloed units within the National Weather Service. In many cases, these meteorological data sets are so separated and use such different architectures that it can either slow—or in some cases stop—certain research and development activities. Upon quick glance at a random assortment of these data sets, one might not realize that they all came from the same agency. It is very common in any large organization with so many separate units to be faced with the challenge of needing data consistency and data centralization, and yet this is so important that it quite often leads to an executive decision to proceed as long as the cost is within reason. When meteorological data sets live side-by-side and are structured in a consistent manner, this often leads to analysts and researchers discovering data relationships that would not have been noticed in siloed data sets. These discoveries have the opportunity to potentially contribute to the advancement of meteorological services.