

Mr. Brian Stone, Chief of Staff, Office of the Director
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Response to Dear Colleague Letter: NSF Intent to Restructure Critical Weather Infrastructure

The Department of Atmospheric Science (ATS) at Colorado State University (CSU) responds with extreme concern to the proposal to disband the NSF National Center for Atmospheric Research (NCAR). ATS is one of the world's premier atmospheric science departments, and it works closely with a NOAA Cooperative Institute at CSU, the Cooperative Institute for Research in the Atmosphere (CIRA). ATS emphasizes that disrupting the unique and critical services that NCAR provides to our Nation will trigger a cascade of negative impacts on our national security and economic prosperity, essentially gifting our scientific lead to international rivals.

NCAR is the beating heart of the entire atmospheric science field. It enables the university community and other public and private interests to accomplish things at scales otherwise unachievable, thus benefitting the entire nation. Progress on prediction of weather extremes, droughts, floods, wildfire, air quality, climate variability and change, and aviation risks will be degraded without the centralized structure and capabilities provided by NCAR, all but ensuring that the United States will fall behind the capabilities of our international competitors. A breakup of NCAR would set the whole field back for decades due to loss of vital infrastructure, the diaspora of capabilities that are now tightly integrated for maximal efficiency, and perhaps most tragic of all, loss of some of the greatest minds and most dedicated people in the community—many of whom will likely leave to more receptive academic and government homes abroad. This loss of human capital would represent a permanent transfer of American intellectual property to our global competitors.

We find no compelling rationale to break up this world-class center. To the contrary, it appears as an overt, rash, and irreversible act of self-harm. Dismantling NCAR will diminish the United States' leadership in atmospheric science. Both through the work directly done at NCAR and the work it enables across the community, NCAR is essential for safeguarding our Nation's public safety, economy, food resources, and national security. NCAR is not merely an academic asset; it is a vital engine for the American economy. There are many examples speaking to these benefits:

- NCAR scientists have developed wind shear detection systems that have dramatically improved the safety of commercial aviation, and developed novel GPS dropsonde measurements that demonstrably improve hurricane track forecasts in the Caribbean, Gulf, and West Pacific.
- Multi-week weather prediction systems developed by NCAR are improving our ability to anticipate and understand extreme weather events in places like Greenland and other parts of the Arctic that have important implications for national security.

- NCAR works with agricultural stakeholders to develop accurate point forecasts of the soil moisture and temperature conditions that can be used to optimize planting, irrigation, and pesticide application.
- The NCAR Weather Research and Forecast (WRF) model underpins essentially all operational weather prediction in the US, and the fact that it serves as a community resource means that the private sector can tailor it to customer needs and advance their businesses.
- To support the administration's mandate to reestablish the country's global dominance in weather and climate prediction, NCAR is providing the scientific and technological bones of the Model for Prediction Across Scales (MPAS) that is being developed through collaboration with NOAA.
- NCAR provides state of the art software for ensemble data assimilation (DART), which is a stalwart of modern weather forecasting.

These are just several examples, and NCAR produces enormous economic value for the U.S. by providing and enabling better daily/weekly/monthly forecasts that protect commerce, mitigate losses from disasters, and benefit energy production, insurance, and logistics. NCAR enables thousands of scientists around the nation to address such societally-relevant topics for the places they live because of the research infrastructure and support that it provides—the literal “so what” of scientific research is realized by NCAR every day. The prospective loss of such capacity places us at the precipice of a National tragedy. Critically, the university ecosystem lacks the financial and logistical capacity to absorb these functions; what is “restructured” by the NSF will, in many cases, simply cease to exist.

Atmospheric science research and education in the university ecosystem is enabled in large part by NCAR. Colorado State University's ATS Department and other universities around the country rely daily on NSF-NCAR's infrastructure as an indispensable pillar of their graduate and undergraduate research and education programs. Beyond providing and supporting open-source community models, like the Community Earth System Model (CESM) and the WRF model, NCAR performs and hosts massive community simulations—such as the CESM Large Ensemble and high-resolution WRF CONUS runs—that are made freely available for students to access and analyze. These datasets allow graduate students across the country to conduct sophisticated research that would otherwise be computationally and financially impossible at the university scale. For example, CSU/ATS students and postdoctoral fellows are using NCAR models to understand the formation of hurricanes in the east Pacific, Gulf, and Caribbean, understand and predict extreme weather events, such as severe thunderstorms across the U.S. and the globe, examine the effect of decadal variability on extremes in future projected climates, and estimate people's exposure to wildfire smoke across the US. NCAR's supercomputing resources, currently provided by the NCAR-Wyoming Supercomputing Center, are also central to the ability of CSU students and researchers to run the weather and Earth System prediction models that form the fundamental basis of their research.

Furthermore, NCAR maintains the Geoscience Data Exchange, an essential library of observational data collections used extensively to validate models and study atmospheric

phenomena. These simulations and observations are the global gold-standard for our field, and proficiency in them is a prerequisite for careers in federal agencies, the private sector, and academic research. Supporting these resources is a direct investment in NSF's mission of workforce development. Dismantling NSF-NCAR would sever the data pipeline required to train the next generation of atmospheric scientists and stall the research output of one of the nation's leading graduate programs. Doing so will put our Nation in an immediate competitive disadvantage vis-à-vis the international community.

NCAR's observational facilities that are available to the community also facilitate CSU's atmospheric research. CSU faculty and students have used NCAR's C-130 aircraft to track the evolution of wildfire plumes and urban air pollution, and examine the consequences for public health, ecosystems, and agriculture. Faculty and students from CSU have been involved in field programs in the Caribbean and east Pacific using the NCAR GV aircraft to study the origin of hurricanes. And the NCAR S-polKa radar has been employed in a field experiment led by CSU scientists to study extreme rainfall in Taiwan associated with strong daily convection, mesoscale convective systems, and typhoons. Extensive aircraft and engineering support staff is needed to facilitate maintenance and deployment of these platforms and integrate instruments developed by the university onto aircraft, challenges that cannot be handled successfully by academic institutions. For example, cutting edge atmospheric chemistry research requires a suite of sophisticated instrumentation to be deployed together. Academic teams, local governments, and private entities typically have a small set of instrumentation, but not a large fleet of options needed to fully characterize the composition of the atmosphere. NCAR provides this broader suite of instruments, allowing University- supported measurements to be leveraged and contextualized.

This proposal directly hurts the talented scientists and dedicated staff at NCAR who are doing cutting-edge science for the benefit of society. The Nation cannot afford to lose these talented people to other fields or countries. Students at CSU regularly work with NCAR scientists who serve as committee members, coauthors on papers, and both unofficial and official mentors. They also serve as some of the most valuable collaborators to the ATS department. NCAR provides an invaluable connection between students at CSU and the broader weather forecasting, air quality, and Earth System prediction communities, and has been essential in launching many of their careers. Because NCAR is located within about an hour's drive from CSU, face-to-face interactions with NCAR scientists are frequent – they give guest lectures in our classes and departmental seminars, and we can attend and give seminars at NCAR. NCAR scientists also provide technical expertise and support to enable trainees to do work that would have been beyond their skillsets without appropriate mentoring. NCAR represents a tremendous research-enabling resource for CSU, and our field in general.

Students at CSU directly benefit from the educational and professional development programs at NCAR. The Advanced Study Program (ASP) conducts a graduate visitor program and summer colloquium series that fosters advanced scientific education opportunities and connects students to NCAR scientists and the broader community. NCAR serves as an "attractor" for the best and brightest atmospheric scientists, who regularly visit NCAR for workshops or extended

collaborative stays. The ASP program also has a postdoctoral fellowship program that provides a major career path for our graduates and emphasizes professional development in addition to advanced scientific education. The undergraduate internship programs provided by NCAR related to parallel computing, Earth System science, solar and space physics, and engineering research are major pipelines for bringing talented and highly motivated graduate students into our program. This benefit is symbiotic, and our graduates often aspire to gain permanent employment at NCAR and contribute to its mission after they leave CSU.

In closing, CSU sees absolutely no practical or moral value in disbanding and restructuring NCAR's capabilities in such a sudden and haphazard way. NCAR provides capabilities that are tightly integrated for maximum efficiency that enables the university community and other public and private interests in a force-multiplying way, benefitting the entire Nation. In the interest of our Nation's ongoing prosperity, we adamantly urge NSF to reconsider their current proposal.