OFFICE OF THE PRESIDENT
1111 Franklin Street
Oakland, California 94607-5200

January 15, 2026

RE: NSF TIP Workforce Development in Emerging and New Technologies Request for Information (RFI). Submitted on behalf of Theresa Maldonado, vice president for research and innovation at the University of California, via NSF's electronic portal.

1. **How might NSF TIP collaborate with critical and emerging technologies industries to best prepare future workers and reskill current workers?**

The University of California (UC) system appreciates the opportunity to respond to this RFI. We strongly support NSF TIP Directorate's efforts to support and develop the current and future U.S. workforce. The following responses represent input from across the UC system, including from campus Graduate Deans, campus Vice Chancellors for Research, and the Office of the President.

- **Industry Advisory Board:** The NSF TIP Directorate should establish an industry advisory board, if it does not have one already, to discuss and formalize common skills sets, both technical and non-technical (soft skills), required for the dynamically changing industry climate.

- **Interagency Coordinating Office:** The NSF TIP Directorate should consider leading the formation and execution of an interagency office that would include agencies like the Department of Commerce, Department of Energy, Department of War, etc., with input from OSTP. Industry should be at the table, including startup companies, and should be required to participate and contribute to its success. (The National Nanotechnology Initiative (NNI), launched in FY2001, was successful largely because the NSF masterfully led the interagency council for over 20 years.) This office could also help coordinate across government when laws, regulations, and policies that make it difficult to work with international collaborators, both abroad and here in the U.S., result in less collaboration.

- **List of technical and nontechnical skills needed by industry:** A regularly updated list of industry-required job skills would help universities align training with workforce needs and address skill gaps more efficiently. We encourage NSF TIP to map technical competencies that are common across technologies in related industries (e.g. biotechnology within the materials, agricultural, and pharmaceutical industries) as an organizational principle for training. Equally important is the development of soft skills across technology sectors, including the ability to adapt to a rapidly changing technical and manufacturing environment. Without such a mapping, there may be a tendency to train for the specific skillsets needed by specific industries (vocational training) as opposed to those needed to build an adroit workforce. Additionally, NSF TIP could help the

community by projecting future workforce needs as they align with national priorities such as critical minerals, fusion, quantum, AI, etc.

- **Tech workforce indicators**: NSF TIP should regularly publish real-time industry indicators that show the state of technology areas and their associated workforce needs. NSF TIP can continue to convene groups of experts to prepare and distribute such dynamically updated content, especially in emerging technology areas. These indicators should contain conditional scenarios given the uncertainty with long-term financial support of various fields. For example, the reports could offer high-funding and low-funding situations for emerging industry and the associated workforce needs. And partnerships with the Department of Labor and Department of Commerce could help NSF develop and distribute the information more quickly.

- **Support for structured industry-university partnerships:** Universities are already working to bridge the training gap by offering a range of programs aimed at preparing both undergraduate and graduate students for industry careers. Grants, staffing support, and formal industry partnerships would help these institutions scale their impact. Structured industry-university partnerships— including collaborative internships, industry-funded research positions for graduate students, industry leader visits, and faculty training programs—would strengthen curriculum relevance and bring current practices into the classroom.

- **Strengthen regional skill sets:** While national workforce challenges (i.e. AI impacts or science literacy) are well known, universities and other grant recipients often lack insight into regional gaps. Programs promoting collaboration to address local needs would be valuable. NSF could incentivize this through targeted grants and workshops and encourage state-level engagement.

- **Cyclic training models:** Current trends are shifting toward a cyclic education system in which technology workers are continuously being retrained. NSF TIP should seek to incentivize industry/academic partnerships that develop programs focused on retraining industrial scientists on new and emerging technologies — perhaps based on the already popular Intensive Executive Education models used by business schools or the "Summer School" models used by other directorates of the NSF.

- **Vouchers for access to facilities:** Programs that link entrepreneurs to university laboratories and shared facilities accelerate commercialization while providing hands-on workforce capacity building. The CalTestBed [https://caltestbed.com] between UC and the state of California illustrates this model through a voucher-based approach that offers early-stage companies the opportunity to validate and refine their technologies at scale, offering access to 70 critical testing facilities at nine UC campuses and Lawrence Berkeley National Laboratory. By connecting entrepreneurs to testing capabilities and a broad network of partners, CalTestBed

advances technology commercialization while also supporting workforce development.

2. **How might NSF TIP leverage local, state, and tribal, including regional, efforts in workforce development to help provide all Americans with the skillset(s) required for careers in critical and emerging technologies or closely aligned fields?**

   - NSF TIP can leverage local, state, and tribal efforts with financial assistance and collaborative grants. UC has identified three areas in need of support:
     - **Incentivize partnerships:** NSF TIP should partner with industry and structure its partnerships to incentivize workforce training. For example, industry could co-fund summer schools branded by NSF (via the NSF's rigorous merit review process) or NSF could consider how to build upon the IUCRC model, which does a masterful job providing seed funding while participating companies pay membership fees.
     - **Virtual programming & wrap-around grants:** Many potential workers—especially parents and caregivers—face financial and time barriers that limit access to training. Grants covering tuition, childcare, and basic needs would help remove these obstacles. NSF TIP should consider funding the development of virtual programs to help those who need more flexibility to gain additional skills in emerging technology areas.
     - **Collaborative grants & consortia:** Collaborative grants between campuses and local industries or government could strengthen regional workforces and, in turn, the nation. NSF TIP could begin by supporting partnerships with major regional industries through the establishment of paid internships for students, postdocs, and faculty. NSF could help begin such programs with co-funding, but industry should assume financial responsibility. Additionally, NSF could fund more consortia, like the NSF Engines program, at differing levels to facilitate engagement between universities, industry, and Tribal, nonprofit, and local organizations.

3. **Beyond questions 1 and 2 above, are there specific sectors, organizations, or groups that NSF TIP must especially engage to fully address the goals articulated in the workforce roadmap and this RFI? If so, which ones, why, and how?**

   - **Accelerate to Industry (A2i)** [https://grad.ncsu.edu/professional-development/careers-outside-of-academia/a2i/], based at North Carolina State University, is a strong example of a program already serving more than 40 university partners, including UC Irvine. A2i offers high-quality, industry-aligned training modules that could be expanded or adapted through partnership with NSF.
   - Additionally, the **University-Industry Demonstration Partnership (UIDP)** [https://uidp.org/] which focuses on strengthening university-industry

collaboration, offers promising models and tools for building sustainable partnerships that support workforce development.

- The **University of California's Degree Plus** [https://www.ucop.edu/academic-affairs/initiatives/degree-plus.html] initiative could serve as an example for NSF TIP as it develops its workforce roadmap. Degree Plus strengthens workforce readiness by integrating a UC bachelor's degree with skills-based certificates and paid internships at no additional cost to students. Launched as a two-year pilot at UC San Diego and UC Santa Barbara, the program is designed to help undergraduates stand out in a competitive job market while supporting California's long-term economic and talent development needs. Funded by the Lumina Foundation, Strada Education Foundation, UC's Office of the President, and campus partners, Degree Plus will serve 480 students across both campuses from 2025–2027.

- Workforce development programs which provide critical hands-on training in key emerging industries can help create a skilled statewide workforce that can support companies. The **Semiconductor Manufacturing Program Pilot** co-led by California NanoSystems Institute at UCLA, UCLA Samueli School of Engineering, and Pasadena City College [https://cnsi.ucla.edu/september-11-2024-new-semiconductor-pilot-program-at-ucla-prepares-community-college-students-for-jobs-in-growing-industry/], is one such innovative program, established in Fall 2024 to train California students for the growing semiconductor industry. With support from federal and state programs and donors, the program places students in summer internships with industry partners, addressing the need for training that aligns with the needs of high-tech employers.

4. **As technology impacts nearly all economic sectors, a full range of technology-enabled roles will require a wide range of skills. Where should NSF TIP emphasize its investments in workforce development in the near and long-term?**

- **Investment in higher education is essential across all levels of training.** Without continued support for education and skill building, our national capacity for innovation, research, infrastructure, and workforce strength will decline. Most universities already offer a variety of training programs that prepare students for industry careers, but these programs need stable funding, dedicated staff, and strong ties to industry partners to meet the scale of workforce needs. NSF TIP could perform a rigorous review of how graduate students are funded and ensure that graduate students are prepared for a career in industry. NSF could consider establishing a funding opportunity to prepare professors of practice, who could be put in charge of such programs. For example, moving away from models that emphasize a career path best suited for academia to a model that emphasizes internships, traineeships, and fellowships which are better suited for a transition into industry. Supporting and expanding these existing efforts would have both immediate and long-term impact.

- **Discipline-specific training for the existing workforce**. Higher education will be able to adjust to evolving needs and train undergraduate and graduate students for current challenges. However, working professionals should also have opportunities to expand their knowledge to new technologies and impacts. Thus, there should be incentives for universities and/or local industries to engage in exchange programs, certificate programs, or to create tracks within established NSF opportunities like GOALI to meet the moment. NSF should provide funding to support ongoing education and training in emerging science and technology fields to the existing workforce. This upskilling or reskilling training could occur through professional internship opportunities, professional certificates or micro-degrees, and encouraging collaborations or programming at local universities nationwide. Additionally, NSF TIP could offer continuing education (certificates, MS, etc.) for people in industries most likely to be negatively impacted by automation/AI/technology.
- **Communicating scientific impacts.** Programs that focus on how to communicate the impacts of science and engineering should be expanded and normalized so students/postdocs can participate without disrupting their research progress.
- **Scientific/technology literacy**. We must ensure that our country understands science and technology. This could be achieved with incentivized partnerships between K-12 and universities, as well as between local industries and universities. The Research Experiences for Teachers (RET) program, run out of the EEC Division, should be updated for today's purposes to include industry partnerships, including K-6. Training teachers in critical and emerging technology fields would be impactful. Student exposure to industry would be impactful, too.

5. **Which of the critical and emerging technologies specified in Section 10387 of the CHIPS and Science Act of 2022 (CHIPS Act - Public Law 117-167) will have the greatest workforce needs in the next five years? The next decade?**

- The emerging technology areas with the greatest workforce development needs in the next five and ten years are listed below:

  (1) Artificial intelligence, machine learning, autonomy, and related advances.
  (2) High performance computing, semiconductors, and advanced computer hardware and software.
  (4) Robotics, automation, and advanced manufacturing.
  (7) Biotechnology, medical technology, genomics, and synthetic biology.
  (8) Data storage, data management, distributed ledger technologies, and cybersecurity, including biometrics.
  (9) Advanced energy and industrial efficiency technologies, such as batteries and advanced nuclear technologies, including but not limited to for the purposes of electric generation

6. **What may be the most effective strategies to address workforce gaps as critical and emerging technologies are introduced into a range of industries?**

- **Pathways to train the trainer:** Preparing the future workforce matters but preparing the educators who will train that workforce is equally important. Industry partners and universities need a clear and supported pathway for collaboration so they can jointly design training, share expertise, and respond quickly to emerging technological needs.

- **Train today's workforce for tomorrow's jobs:** Appropriate training for the existing workforce would be an effective way to address workforce gaps. This training could be through short-term exchange programs (between local industry and universities), certificate/educational programs, and longer-term, project-based partnerships between universities and industries.

- **Best practices for building successful cross-sector collaborations:** The federal government could help strengthen collaborations across disciplines and industries by requiring grant recipients to abide by documented best practices for team effectiveness and project success as a condition for continued funding.

- **Problem-solving and critical thinking:** In a world where most workers will change areas five to six times, bolstering problem-solving skills is essential for building an adaptable workforce.

- **Universities as primary engines of STEM workforce development:** Universities rely on sustained federal support and partnership, both of which are both essential to building and maintaining a strong national workforce.

- **Foreign nationals and research security:** Multi-faceted approaches to ensure research security should be established in accordance with funding source requirements, including policy development, physical security, access controls and compliance monitoring. Through an interagency office (proposed in response to question 1), NSF TIP could work with other agencies and industry leaders to develop a shared vision about international talent and offer jointly-prepared policies and recommendations.

- **Outreach efforts:** Creating opportunity and access is essential, but they must be paired with intentional outreach efforts so individuals know these opportunities exist.