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From: Center for American Entrepreneurship

Re: RFI Response: Federal Technology Transfer Authorities and Processes

The Center for American Entrepreneurship (CAE) respectfully submits this letter of comment in response to the Request for Information in the Federal Register on May 1, 2018 by the National Institute of Standards and Technology (NIST) seeking comment on federal technology transfer (tech transfer) authorities and processes.

CAE is a nonpartisan, Washington, DC area-based 501(c)(3) research, policy, and advocacy organization. CAE's mission is to engage policymakers in Washington and across the nation regarding the critical importance of entrepreneurs and startups to innovation, economic growth, and job creation – and to pursue a comprehensive policy agenda intended to significantly enhance the circumstances for new business formation, survival, and growth.

CAE believes the following key priorities should guide NIST's effort to reform tech transfer policies and practices across federally-funded research entities:

- **Increase market-readiness:** Expand on existing pilots and develop proof-of-concept programs that ready promising innovations for commercialization.
- **Align incentives:** Ensure that federal actors and federally-funded researchers have the right incentives to invest in commercialization and focus on outcomes.
- **Facilitate commercialization of patented innovations:** Reduce search costs and facilitate ease of access, licensing, and use for federally-held and -funded patents through greater standardization of agreements, especially across federal labs.
- **Open facilities:** Increase utilization of federally-funded research facilities by making it easier for entrepreneurs and innovators to gain access to facilities, equipment, and researchers' expertise.

- **Expand entrepreneurship education:** Ensure that federal and university researchers who seek to commercialize innovations have access to entrepreneurship education and relevant private sector expertise.
- **Better leverage existing programs:** SBIR/STTR, I-Corps, Small Business Vouchers, and other programs can be powerful vehicles for commercialization activities, but would benefit from key reforms, or, in the case of I-Corps and Small Business Vouchers, significant expansion.
- **Expand university-based translational activities:** At universities, encourage commercialization activities as well as industry collaboration among post-doctoral fellows.
- **Improve evaluation:** Encourage long-term tracking and evaluation of tech transfer and commercialization policies and programs.

Background: The Importance of Commercializing Federal Research and the Fundamental Role of Startups

Promising innovations resulting from federally-funded research too often face a slow and uncertain path to commercial viability. And discoveries with significant social benefit take an especially circuitous and uncertain path to reach the commercial marketplace. It is not hyperbole to assert that improving the number of discoveries translated into products and services may have more impact on the American economy and quality of life of its citizens than any other research and development (R&D) strategy. From federally-funded university research that helps bring to market a breakthrough drug to federal lab-developed battery technologies that power electric vehicles, more efficient and effective commercialization brings world-changing innovations to market sooner.

Regardless of whether research insights are brought to the marketplace by new or established firms, tech transfer can falter at key transition points. Amid funding, technology, scale, and regulatory hurdles, many promising innovations never reach the marketplace. In the process, they need to make the leap from intellectual property (IP) residing within the university or federal research lab into the hands of a commercial party such as a startup, small- or medium-sized entity, or large corporation.

CAE invites NIST to examine, in particular, the unique challenges and barriers facing those who seek to commercialize federal research by way of a new business. New entrepreneurs need entrepreneurship training, mentoring and advice from experienced industry veterans, proof-of-concept capital, connections to technical and business talent, and access to venture investors. Given the central importance of innovation-fueled entrepreneurship to productivity gains and economic growth, these challenges deserve special attention throughout NIST's tech transfer review.

Responses to RFI Questions

What follows is a detailed response to the RFI's four questions that highlight important steps that NIST and the Return on Investment Initiative can take to improve the commercialization of federal research.

- 1) *What are the core Federal technology transfer principles and practices that should be protected, and those that should be adapted or changed?*
- 2) *What are the issues that pose systemic challenges to the effective transfer of technology, knowledge, and capabilities resulting from Federal R&D? Please consider those identified in the RFI as well as others that may have inhibited collaborations with Federal laboratories, access to other federally funded R&D, or commercialization of technologies resulting from Federal R&D.*
- 3) *What is the proposed solution for each issue that poses a systemic challenge to the effective transfer of technology, knowledge, and capabilities resulting from Federal R&D? Please consider the approaches identified in the RFI.*

The following issues and proposed solutions address the three questions above by identifying key barriers, along with proposed practices to adopt or change. The RFI's fourth question is addressed further below.

Issue: Need to Implement Metrics that Capture Desired Outcomes

Despite efforts by NIST to develop and implement metrics that reflect a broader range of sought economic outcomes, significant challenges remain. First, too many federal labs still focus on licensing revenue as their primary metric of tech transfer success, despite the inadequacy of licensing revenue in capturing many successful commercialization outcomes, including successful startups. Second, NIST collects far more granular data – including, for example, the number of startups spun out of individual federal labs – than it makes publicly available, leaving unused a potentially powerful tool for accountability. Agency-level commercialization metrics – as currently reported by NIST – are not meaningful indicators of lab-level performance. Finally, much of the discussion about metrics focuses on finding consensus around the right measures that capture the full range of desirable commercialization outcomes. While achieving consensus and pursuing additional research into specific outcomes are both important goals, in the meantime NIST should encourage agencies and federal labs to make granular tech transfer performance data open and publicly available by default, or NIST should publish the data collected from other agencies.

Proposed Solution: Begin by immediately making publicly available federal lab-level data for a range of commercialization outcomes, including startup activity catalyzed. For federal labs, more granular public data is a starting point for improved accountability and effective prioritization of tech transfer.

Issue: Need to Prioritize Tech Transfer at Federal Labs as a Core Mission Priority

With some notable exceptions, federal lab directors do not view tech transfer as central to their core mission. In fact, since some federal labs support tech transfer through overhead budget lines, tech transfer is in direct competition for funding with operational expenses including security, IT, training, and infrastructure upgrades. Additionally, federal labs are encouraged and rated on their ability to keep their overhead low, so increasing funding for tech transfer within the overhead budget line is often discouraged. Commercialization performance at federal labs will continue to lag universities until lab leaders are directed, funded, and incentivized to place greater emphasis on commercialization outcomes, including through accountability to meaningful metrics.

Proposed Solution: Helping to make tech transfer a priority for lab leadership starts with ensuring it is central to their mission. Accountability can work through a Lab-to-Market Cross Agency Priority Goal that tracks lab-specific outcomes on key commercialization metrics while also encouraging experimentation with promising new models. Within labs and research agencies, “designing in” tech transfer activities and open campuses should also be encouraged and incentivized. Beyond recognizing that commercialization can play an important role in labs’ scientific and national security priorities, commercialization outcomes should factor into performance management at labs – including through performance reviews, promotions and funding allocations – to an extent that reflects its standing among core mission priorities.

Issue: Need to Orient Commercialization Around Customer Needs

Those responsible for commercializing research breakthroughs typically operate under a set of incentives, assumptions, and expertise that diverge from those found within the research community. Yet some research institutions fail to design their commercialization programs around the need of these “customers,” whose efforts typically will be required for new innovations to reach the marketplace. The National Science Foundation’s (NSF) Innovation Corps (I-Corps) Program – and its offshoots in other agencies – disciplines researchers aspiring to commercialize new breakthroughs through entrepreneurship to test their assumptions with actual customers and orient their commercialization activities around this demand signal. The same customer-oriented approach should apply to the entire suite of tech transfer activities, from IP and licensing agreements to proof-of-concept activities that can unlock critical funding. Disciplines such as design thinking and lean startup can provide useful frameworks for reexamining and redesigning commercialization processes at federally-funded institutions.

Proposed Solution: Support interested federal labs – and other research organizations – to undertake a design process to yield a customer-oriented commercialization pipeline. Federal agencies have done this with success in other domains: for example, the Department of Labor’s Employment and Training Administration has put over a thousand of its nonprofit workforce development providers through Human-Centered Design training that helped them identify dozens of ways to redesign their programming to more effectively meet the needs of their clients. One promising place for research agencies to start is with unexplored opportunities where the federal government can be an important first customer for new firms commercializing technologies out of federal labs and, where appropriate, universities.

Issue: Need to Scale Promising Federal Lab Tech Transfer Models

While not every federal lab is effectively engaging the entrepreneurial community, a growing list of promising experimental practices represent creative attempts to eradicate barriers to effective commercialization and engagement with outside innovators. Examples include:

- **I-Corps:** A program to put teams of startup founders commercializing federal research through an entrepreneurship “boot camp” that has delivered promising early results and begun to achieve broad adoption across research agencies from NSF to the National Institutes of Health (NIH).
- **Small Business Vouchers:** Department of Energy (DOE) labs have piloted a voucher program that provides funding for small businesses to access lab facilities, expertise, and technology, and early evaluations of the program provide support for its impact.
- **Blanket Cooperative Research and Development Agreements (CRADAs):** Some federal labs have experimented with blanket CRADAs – contracts for collaboration on joint R&D that span use cases and firms, allowing for reduced transaction costs among those hoping to develop and commercialize new technology with a lab. One successful example is Lawrence Berkeley National Laboratory’s CalCharge partnership focused on energy storage.
- **Open Campus:** Lab personnel, equipment and IP are valuable to entrepreneurs and small businesses, even if lab leadership does not always prioritize it. For example, through CRADAs and Educational Partnership Agreements, the Army Research Lab has brought outside researchers, entrepreneurs and industry experts into the lab to work hand-in-hand with lab research staff on projects of common interest. The 2019 National Defense Authorization Act will likely include language directing DoD to scale this approach based on its impact.
- **Cyclotron Road:** Designed to fill a critical gap, Cyclotron Road provides a home for entrepreneurial researchers “outside the fence” at Lawrence Berkeley National Lab, but with access to facilities and expertise that can help advance new energy technologies until they are ready to succeed outside of the lab.

Proposed Solution: Each pilot has a corresponding set of barriers and enablers, but most suffer from a lack of awareness and effective knowledge sharing across federal agencies. In some cases, a federal-wide mandate with common tools and templates would help spur broader adoption. At the same time, despite promising initial results, these approaches would also benefit from systematic evaluation and feedback to the practitioner community regarding their effectiveness as well as when and how to deploy them optimally. With the support of such activities, giving lab directors the freedom and mandate to experiment with new models can ensure that what works is proliferated.

Issue: Under-adoption of Existing Federal Laboratory Personnel Exchange Authorities

In 2016, NIST updated the list of pathways for personnel exchange with outside organizations, which can be an important tool to advance commercialization. These include entrepreneurial leave programs, which permit lab researchers to take sabbatical in order to commercialize a

technology developed in the laboratory, and entrepreneur-in-residence programs, which can be effective vehicles for bringing entrepreneurs and commercialization experts into a federal laboratory to share expertise and develop new approaches to commercialization. Yet while some laboratories have established such programs, uptake remains below its potential.

Proposed Solution: A focused OMB/OSTP/NIST campaign to drive adoption, and a process to identify and eliminate key barriers. For example, the transaction costs required to establish lab-specific entrepreneur-in-residence (EIR) programs could potentially be mitigated through an agency-wide or multi-agency program, as with Schedule A (R) fellowship programs. Additionally, a coherent agency-wide or federal-wide communications and marketing strategy can help bring highly-qualified EIRs into federal labs, as evidenced by the success of programs like the Presidential Innovation Fellows and Department of Health and Human Services' IDEA Lab Entrepreneurs-in-Residence. One high-impact place where entrepreneurial fellows could immediately play an important role is with lab economic development teams responsible for industry relationships.

Issue: Limitations on Federal Researchers' Ability to Engage in Commercialization Activities

Seemingly straightforward issues like a lack of billing codes for commercialization activities can present significant barriers to researchers at federal labs spending time on tech transfer activities. At a minimum, funding tech transfer out of overhead expenses – as some agencies do – puts it in direct competition with other core activities. To our knowledge, these barriers have not been adequately explored, defined and addressed.

Proposed Solution: OMB regulatory revisions, or possibly, Congressional action are needed to address these issues.

- 4) *What are other ways to significantly improve the transfer of technology, knowledge, and capabilities resulting from Federal R&D to benefit U.S. innovation and the economy? What changes would these proposed improvements require to Federal technology transfer practices, policies, regulations, and legislation?*

While the following challenges and proposed solutions may be beyond NIST's authority, CAE includes them here because they represent powerful opportunities for action:

Issue: Transaction Costs Associated with Licensing Federally-Funded Intellectual Property

High transaction costs surrounding IP terms are a significant barrier for a new firm attempting to build a business model around the products of federally-funded research. Particularly at federal labs, there is an opportunity for a more standardized approach to licensing technologies.

Proposed Solution: Encourage adoption of a standardized and startup-friendly licensing approach across federal lab tech transfer offices, as many universities have already begun to do. Additionally, because most entrepreneurs do not realize that they can license valuable federally-

funded technology, additional communications and marketing as well as user-oriented activities to reduce search costs would be valuable.

Issue: Challenges Associated with Public-Private Use of Tax-Exempt R&D Facilities

Many research universities use tax-exempt bonds to finance the construction of research infrastructure. Restrictions on the private use of these facilities can present barriers to industry collaborations, notwithstanding the Internal Revenue Service's clarification (Revenue Procedure 2007-47) that research conducted in such facilities that leads to licensing does not constitute private use.

Barriers remain for a host of tech transfer and licensing activities as well as industry-funded research. For example, the difficulty of calculating fair market value (FMV) of potential research outcomes can thwart flexible collaborative university-industry research agreements that include provisions to license the products of the research in advance. These deals, which are valuable to industry partners, can falter because universities often interpret the rules governing private use to require that FMV be charged, even though it is only an uncertain estimate of potential value down the road once significant investment and risk have been undertaken.

Proposed Solution: Work is needed to develop and administer a more feasible test that could be applied to industry-university collaborative research to police (and charge for) private use of research facilities constructed with tax-exempt bonds.

Issue: Inadequate Incentives and Models for Industry Research Collaborations with Universities

In 2016, industry provided only 5.9 percent of academic R&D funding, according to data collected by the National Science Foundation. These figures are far higher at some postsecondary institutions, such as Wichita State University, which draws upon a number of industry partnerships for almost half of its research budget. Because industry-university collaborative research is particularly fertile ground for promising commercialization opportunities, finding ways to clear barriers that prevent such collaborations is especially important.

Part of the challenge is incentives. Industry research conducted with universities is typically more fundamental than industry-performed R&D, with results usually disseminated widely through publications. As a result, firms are less able to capture and appropriate corresponding research breakthroughs, reducing their incentive for funding such research – even below other kinds of R&D. The tax code should more strongly incentivize companies to engage in such collaborative research given the significant societal benefits.

Transaction costs also pose a challenge. Better models are needed to de-risk industry partnerships and provide options to connect global firms to multiple universities under umbrella arrangements. For example, through BioCrossroads in Indiana, several leading pharmaceutical firms based in the state have collectively supported university faculty at the state's universities, along with pre-competitive equipment and personnel. To date, the organization has seeded

almost \$200 million in applied, market-ready research in the state, 90 percent of which is from non-governmental sources.

Proposed Solutions: Revise the tax code to strengthen incentives for industry-university research. This could be done by establishing a dedicated collaborative credit, as the Information Technology and Innovation Foundation has proposed, or by increasing the generosity of the existing Research & Experimentation Tax Credit when applied to industry research expenses paid to universities: for such expenses, firms currently receive only 65 percent of the credit they would receive for research conducted in-house – a discount that could be eliminated to more effectively incentivize such collaborations.

To de-risk industry partnerships, developing and brokering additional models for collaborative research activity could help seed additional collaborations.

Issue: Market Readiness of Many Federally-Funded Innovations

A well-documented gap in the innovation process is the need for additional development to help federally-funded breakthroughs become market-ready. In addition to translational research to help such innovations cross the “valley of death,” a suite of activities can help to de-risk promising but unproven new technologies in preparation for the marketplace. For example, like a number of other research institutions, Columbia University has developed a network of industry-specific Lab-to-Market accelerators and related programs that provide funding, education, technical assistance, mentorship, and connections to experienced potential CEOs to interdisciplinary teams. The program aims to serve as a bridge to commercial investment, bringing promising technologies through the so-called “valley of death” to a successful commercial launch.

Proposed Solution: Replicate at universities and federal labs proven university-based accelerators that help promising innovations cross the valley of death by facilitating access to prototyping capital, industry mentoring, access to talent and VC funding, and entrepreneurship training. Additionally, agencies that fund both fundamental science and applied R&D should also seek to expand on existing collaborative funding models that support the transition of new technologies to the market, such as DOE’s Energy Frontier Research Centers.

Issue: Lack of a Federal Funding Pathway for Recent Graduate Students to Engage in Entrepreneurial Commercialization Activities

Postdoctoral research fellowships provide a pathway for recent graduates to undertake further academic research. No analogous federal funding pipeline supports recent PhD graduates hoping to translate academic research into a startup – either at an academic research institution or a federal laboratory. Absent such funding, the commercialization potential of some promising early innovations may go unexplored.

Proposed Solution: Establish a federally-funded Entrepreneurial Science Fellows Program to replicate at universities and across federal labs the kind of “entrepreneurial research” that Cyclotron Road has fostered at Lawrence Berkeley National Laboratory.

Issue: Absence of a Place-Based Commercialization Strategy that Rewards Researchers for Leveraging Local Innovation Assets

Successful commercialization outcomes do not occur in a vacuum. Local innovation assets, from accelerators to funding and mentorship networks, can play an important role in the ultimate fate of a promising new innovation. The ability of principal investigators to leverage these assets should factor into late stage R&D award decisions. For example, the NIH funding review processes for translational and clinical research might consider whether a given proposal has the support and participation of a local life sciences accelerator.

Proposed Solution: For relevant federal funding merit review processes, include consideration of how proposals leverage local innovation assets. In addition, delivering additional commercialization funding to regions with a high aggregation of federal research grants could help them more effectively translate this critical mass of research activity into commercialization outcomes.

Issue: Lack of Entrepreneurship Preparation for SBIR Awardees

Many SBIR awardees win on the strength of their research capabilities – not their ability to commercialize technology and launch a high-growth startup. Improving the entrepreneurship preparation of these awardees – especially for Phase II awards – could significantly improve the growth potential of SBIR-supported firms.

Proposed Solution: Pair every Phase II SBIR award with Lean Startup entrepreneurship training, such as that found in the I-Corps curriculum.

Issue: Inadequate Focus on Commercialization Potential in SBIR Award Decisions

Agencies differ considerably in the level of emphasis they place on private-sector commercialization potential when making SBIR awards. Particularly at agencies that use SBIR to fund technology for non-exclusive governmental use, consideration of private-sector commercialization should factor into decisions, with industry experts participating in merit review panels. Such considerations are more important in Phase II award decisions than Phase I awards, when proposed private-sector commercialization plans are typically more speculative.

Proposed Solution: Revise merit review criteria to place greater emphasis on private-sector commercialization potential, particularly for Phase II awards. Include industry experts – such as those with relevant technology or industry expertise as well as private-sector commercialization expertise – on merit review panels.

Conclusion

CAE is grateful for the opportunity to submit this comment letter. Should you have any questions about this letter or any of the information or arguments contained herein, please contact us at dan@startupsusa.org.