September 29, 2021

Re: RFI Response National AI Research Resource

Dear Ms. Parker and Mr. Gianchandani,

On behalf of the Center for Data Innovation (datainnovation.org), we are pleased to submit comments in response to the White House Office of Science and Technology Policy (OSTP) and National Science Foundation (NSF) on their Request for Information (RFI) on an implementation plan for a National Artificial Intelligence Research Resource (NAIRR).[1]

The Center for Data Innovation is the leading think tank studying the intersection of data, technology, and public policy. With staff in Washington, D.C., and Brussels, the Center formulates and promotes pragmatic public policies designed to maximize the benefits of data-driven innovation in the public and private sectors. It educates policymakers and the public about the opportunities and challenges associated with data, as well as important data-related technology trends. The Center is a non-profit, non-partisan research institute affiliated with the Information Technology and Innovation Foundation.

OVERVIEW

As explained in the RFI, the "NAIRR is envisioned as a shared computing and data infrastructure that would provide AI researchers and students across scientific fields with access to a holistic advanced computing ecosystem. This would include secure, privacy-preserving frameworks; high-quality, representative datasets; and appropriate educational tools and user support mechanisms."[2] Congress has directed the NAIRR Task Force to develop an implementation roadmap for the NAIRR.

If successful, the NAIRR would serve to bolster innovation and U.S. competitiveness in AI. We support the goals of the Task Force and offer comments on the questions below to inform the work of the Task Force.

[1] "Request for Information (RFI) on an Implementation Plan for a National Artificial Intelligence Research Resource", Federal Register, July 23, 2021, https://www.federalregister.gov/documents/2021/07/23/2021-15660/request-for-information-rfi-on-an-implementation-plan-for-a-national-artificial-intelligence.
[2] Ibid.

Please find our responses to the relevant questions in the document below.

Sincerely,

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1. What options should the Task Force consider for any of roadmap elements A through I, and why?

[A] Goals for establishment and sustainment of a National Artificial Intelligence Research Resource and metrics for success.

There are two broad goals the Task Force has already rightly identified a NAIRR can help achieve: More AI innovation and bolstered U.S. competitiveness in AI.[3] However, it is important for the Task Force to recognize that even though many use these terms interchangeably, AI innovation and competitiveness mean different things and optimizing the NAIRR implementation roadmap to maximize for one can lead to different solutions than maximizing for the other.

First, consider how these terms differ. Competitiveness refers to the ability of an economy to compete effectively in global markets for traded goods and services in the absence of subsidies and government protections.[4] By enabling an economy to export more in value added terms than it imports, competitiveness increases a nation's standard of living. In contrast, innovation refers to developing an improved product, production process, or organizational method. If this innovation occurs in traded sectors, a nation's economy will become more competitive. But innovation in non-traded sectors will have less impact on competitiveness because by definition their output is not sold outside local borders.

These distinctions matter for implementing, operating, and administrating a NAIRR. To see why, consider two AI researchers, one of whom is pursuing research into AI models for construction and the other for manufacturing. Both research pursuits support AI innovation but only the latter would bolster U.S. competitiveness in AI because manufacturing is a traded sector from the perspective of the U.S. economy while construction is not. A NAIRR whose primary goal is to promote AI innovation should seek to support both types of research equally whereas a NAIRR whose primary goal is to bolster U.S. competitiveness should prioritize AI research for manufacturing over construction.

To be clear, boosting access to research tools can serve as means to both ends. But the Task Force should consider having well-articulated and distinct mechanisms to achieve each. One way to do this is by implementing separate support mechanisms for academic

[3] The White House, "The Biden Administration Launches the National Artificial Intelligence Research Resource Task Force," news release, June 10, 2021, https://www.whitehouse.gov/ostp/news-updates/2021/06/10/the-biden-administration-launches-the-national-artificial-intelligence-research-resource-task-force/.
[4] Robert D. Atkinson, "The Competitive Edge: A Policymaker's Guide to Developing A National Strategy," (ITIF, December 2017), https://www2.itif.org/2017-competitive-edge.pdf.

researchers and private sector researchers to access the NAIRR. For instance, one mechanism could provide support for—and only for—eligible academic and government researchers who are conducting AI research that promotes AI innovation in any field, with research proposals reviewed through a competitive process. Another mechanism could provide eligible firms with innovation vouchers they can use to “buy” AI compute time and expertise at certain supercomputing centers, with the size and type of the voucher determined by its relevance to a national competitiveness strategy (e.g., focused on solving specific challenges and facilitating commercialization breakthroughs).

The role of government in increasing access to AI resources for academic and private sector researchers are different. Academic researchers typically conduct crucial early-stage AI research that provides foundational, generic knowledge that everyone—including industry—can draw on for ideas and innovation. However, only well-resourced institutions provide access to expensive AI resources, such as powerful AI compute. The government’s role is to ensure as many qualified academic researchers as possible have access to AI resources in order to expand the pool of general AI knowledge for the benefit of everyone. Private sector researchers typically conduct later-stage R&D, which is important in bringing innovations to market. The private sector already has incentives to invest in AI resources. The role for government is to ensure the private sector’s incentives to invest in R&D for AI are sufficient to maximize overall economic welfare.

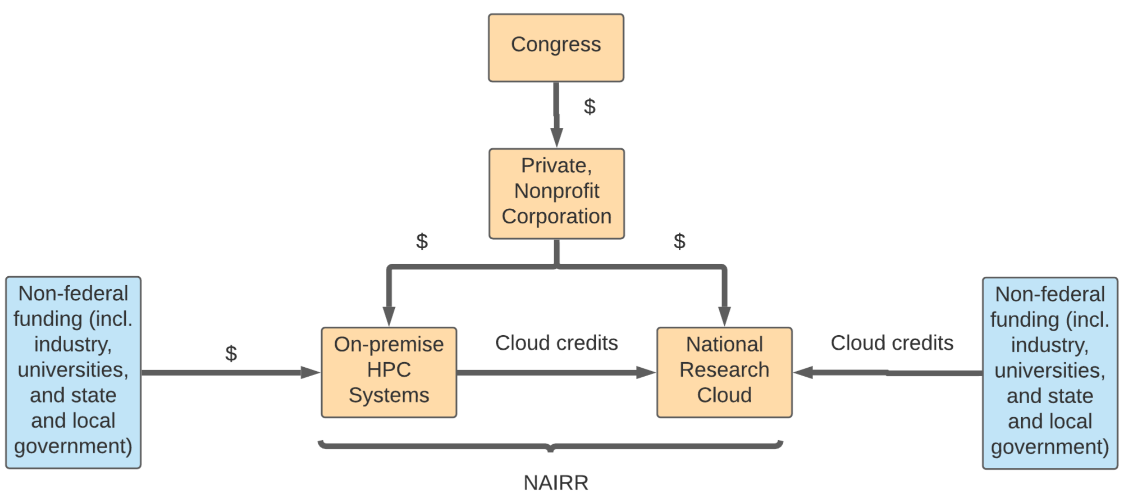
The Task Force has also rightly recognized that democratizing access to AI compute for academic researchers can help ensure all individuals have equal opportunity to succeed in becoming the next generation of AI researchers. The Task Force could introduce a third support mechanism that specifically supports the allocation of resources at Minority-Serving Institutions (MSIs) that include Historically Black Colleges and Universities, Hispanic-Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs) to help achieve this end.

[B] On a plan for ownership and administration of the National Artificial Intelligence Research Resource.

One option the Task Force should consider is for a private, non-profit corporation to allocate federal funds to the NAIRR. This entity would be created by Congress and act as a steward of the federal government’s investment in national AI research resources. To see how this might work, consider the Corporation for Public Broadcasting (CPB), a private, non-profit corporation established by the Public Broadcasting Act of 1967 to act as a steward of the federal government’s investment in public broadcasting. The mission of the CPB is to “ensure universal access to non-commercial, high-quality content and telecommunications services."[5] It does not produce or distribute programs, nor does it own, control, or operate any broadcast stations. Instead, CPB allocates federal funding to local radio stations in each of the 50 states, which broadcast national content to their local communities and broadcast local programs they create themselves too.

We propose the Task Force consider a comparable model for the administration of the NAIRR. Through the appropriations process, Congress would enact federal payments to a private, non-profit corporation, just as it does for federal agencies that fund high-performance computing (HPC) at supercomputing centers and universities (see Figure 1). The corporation would not own, operate, or control any HPC systems itself but instead be charged with facilitating geographic diversity of AI compute, the development and expansion of HPC for AI, and providing funding to local HPC systems.

Figure 1: Proposed model for the NAIRR.



The activities of the corporation could be twofold: 1) to allocate federal funds to local, on-premise HPC systems at universities, colleges, and research institutes across the country; and 2) to provide funding for nationally accessible resources such as a National Research Cloud.

Regarding the former, local systems could be owned and maintained through public-private partnerships, which is discussed further in section 4. And to understand the latter, let us

[5] "About CPB," last accessed September 10, https://www.cpb.org/aboutcpb.

return to the example of public broadcasting. National programming producers like NPR, APM, and PRI are independent entities that are funded through a number of sources including corporate sponsorships, funds from CPB, and fees from locally owned and operated radio stations that pay to be their members and distribute their programming. A similar set up could work for nationally accessible HPC as part of the NAIRR. For instance, one nationally accessible resource could be a National Research Cloud (NRC), set up as publicly and privately funded non-profit with member institutions across the country. The members (both public and private) would make some level of AI compute available in the cloud and gain access to government datasets and other incentives from the NRC in return. Because it would be a public-private non-profit, the NRC could partner with private companies to obtain cloud services from existing vendors for AI researchers, which would be particularly valuable in the short-term as it gets established. In addition, local institutions would have a choice. They could choose not to participate in the NRC and exclusively provide local, on-premises AI compute, which will be important for some researchers who require on-premises resources for reasons such as data security, application performance, or teaching purposes.

Such a set-up would be adaptable, allowing for the incorporation of new resources and novel computing capabilities. One important and related question the Task Force raised in a recent workshop was which regions should it prioritize for on-premises systems?

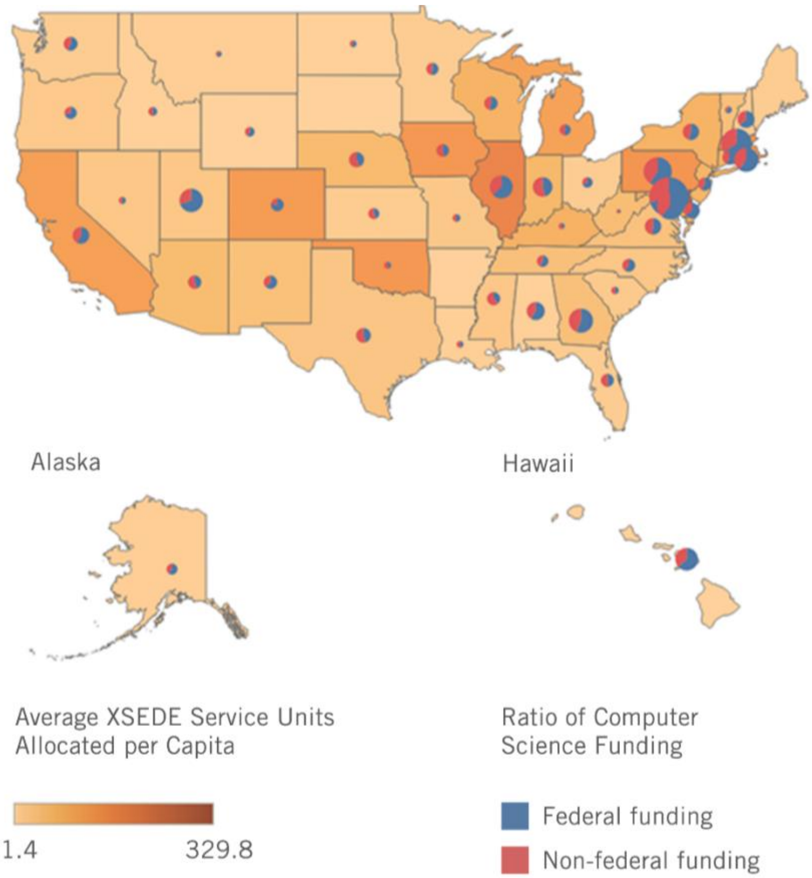
Which regions should the Task Force target for providing local systems?

The NAIRR should prioritize providing local resources in regions wherein the gap between AI compute demand and supply is greatest.

Some communities, institutions, and regions already have high access to HPC availability while others are conducting high levels of AI research but have little access to powerful systems. In our 2020 report *How the United States Can Increase Access to Supercomputing*, we provided an estimate of access to HPC resources per capita across the United States. We used data on compute time researchers requested in 2017, 2018, and 2019 from NSF's Extreme Science and Engineering Discovery Environment (XSEDE), a platform that coordinates the national sharing of supercomputing, as well as data on the researcher's organization and the state in which the organization is located (see Figure 2).[6]

[6] Hodan Omaar, "How the United States Can Increase Access to Supercomputing," (Center for Data Innovation, December 2020), https://www2.datainnovation.org/2020-how-the-united-states-can-increase-access-to-supercomputing.pdf.

Figure 2: Proportion of XSEDE service units allocated per capita and size of research funding from high-research institutions in computer science per capita in each state.



The key insight from this figure is more access to powerful HPC resources is found in states like Massachusetts, Pennsylvania, and Illinois that have leading academic institutions, which can either stand up their own HPC centers or partner with other leading research institutions in their state to create multi-institutional centers.[7] Federal investments in more HPC resources in regions where HPC availability is already high will not be the most effective way to close the gap between HPC demand and supply because institutions either already have baseline AI compute and are using it for research, or they don't have research funding which means access to HPC is not the problem, research funding is.

[7] Top institutions are defined by whether they are ranked among the top 500 research institutions. The data is limited to R1 (very high research activity) and R2 (high research activity) universities.

By contrast, little access to powerful HPC resources is found in states like South Dakota and Utah that have few leading research academic institutions that have the capacity to support HPC systems.

What is important though, is that all regions that lack access to HPC are not the same. Some are doing more AI research than others. For example, while Utah's academic supercomputers are neither particularly large nor particularly powerful, the state is home to the Scientific Computing and Imaging (SCI) Institute, a research institute that focuses on conducting application-driven research in new scientific computing and visualization techniques and tools. The SCI Institute's faculty and alumni are recognized around the world for their contributions to scientific computing and research. South Dakota also has few HPC systems. But unlike Utah, South Dakota has no research facilities identified as conducting high-level research in any field.

The point is, there should be demonstrable evidence that providing access to AI compute in a community, institution, or region will result in an increase in AI research because as explained earlier, democratization is a means to an end, not an end in itself. In cases wherein HPC availability and AI research is low, the Task Force should consider requiring institutions to first increase funding for AI research, prove that they have sought partnerships with industry, or that increasing resources will support AI education and training for underrepresented groups, because there is a risk that investments in AI compute may not return increases in AI research.

We acknowledge that this map is limited because it only shows demand for a subset of academic researchers, not for all researchers. However, as several individuals in the Task Force's workshops have noted, there is little literature on what level and type of compute AI researchers need. Our report offers a starting point, but the Task Force should seek to work with federal agencies and private sector companies, where possible, to obtain additional data on HPC supply and demand.

[C] A model for governance and oversight to establish strategic direction, make programmatic decisions, and manage the allocation of resources.

Governance, oversight of strategic direction, and the allocation of federal funds should be made centrally by the private, non-profit corporation. It could have a board of directors appointed by the President of the United States which, after confirmation by the Senate, could serve a fixed length term. In turn, the board would appoint roles for leadership of the corporation, such as president and chief executive officer.

The National Research Cloud could have its own board of directors that oversees day-to-day operations and manages the NRC budget, which could be elected by its member institutions and organizations. Similarly, if the Task Force decides to coordinate the sharing of on-premises systems, this could be governed by a collaborative partnership of participating institutions just as XSEDE is.[8]

[F] An assessment of security requirements associated with the National Artificial Intelligence Research Resource and its management of access controls.

The NAIRR will have a number of distinctive attributes that will make its security somewhat distinct from general-purpose computing architecture.

First, the primary purpose of the NAIRR is to provide researchers with access to advanced, high-performance computing systems, and obtaining time on these systems will be highly valuable. However, stakeholders are likely to disfavor security protocols that impede collaboration or usability.

Second, because the NAIRR may bring together disparate computing systems and distributed data with varying levels of reliability and provenance, there is a risk that the responsibility of cybersecurity will be left to institutions, resulting in a patchwork of security protocols across the country. At the same time, computer security is context- and mission-dependent. A security mechanism designed to enforce a particular policy considered essential for security by one site might unnecessarily block legitimate users of another site.

Fortunately, there are several security solutions that can overcome these constraints and several groups have been thinking about them for a long time. In a 2021 paper titled "Trustworthy Scientific Computing," Sean Peisert, who leads computer security R&D at Lawrence Berkeley National Laboratory, proposed a model called hardware-based trusted execution environments (TEEs). As Peisert explains, TEEs increase HPC security at a minimal cost to performance by isolating computation and "preventing even system administrators of the machine in which the computation is running from observing the computation or data being used or generated in the computation."[9] This paper is part of a larger project that Peisert leads at the Berkeley Lab Computational Research Division, a national laboratory operated by the University of California, to take a broad look at several aspects of security and scientific integrity issues in HPC systems. Since this project has already begun testing and identifying the security requirements of national HPC resources, the Task Force should

[8] "XSEDE Governance," last updated May 17, 2021, https://www.xsede.org/about/governance.
[9] Sean Peisert, "Trustworthy Scientific Computing," *Communications of the ACM*, 64(5), (May 2021), DOI: 10.1145/3457191.

seek to work with this group and others like it to get a fuller understanding of what the security requirements of the NAIRR will likely involve.

2. Which capabilities and services provided through the NAIRR should be prioritized?

The Task Force should prioritize the development of a service-oriented architecture, which would integrate widely divergent components in the NAIRR by providing users with a common interface and a set of standard protocols for them to efficiently access the tools they need.

On one hand, the distributed framework we have proposed for the NAIRR offers an operating model that is flexible enough to adapt to new scenarios, resources, and computing capabilities. Resource diversity is important to ensure AI researchers can remain competitive. Indeed, research and advisory firm Gartner predicts that by 2025, "traditional computing technologies will hit a digital wall, forcing the shift to new computing paradigms such as neuromorphic computing."[10] There is also already a growing market for emerging AI chips that are specialized to best support different AI capabilities and services. For instance, field programmable gate arrays (FPGAs), which are AI chips mostly used to apply trained AI algorithms to new data inputs, and application-specific integrated circuits (ASICs), which can be used for either training or inference tasks, have seen considerable adoption recently.[11]

However, a single resource made up of heterogenous computing systems and data with different architectures, interconnects, memory, and authentication policies presents practical challenges to researchers trying to execute services on the NAIRR and technical developers of the NAIRR who will need to create portals, gateways, and workflow engines for it. Fortunately, many of these problems are not new—just more difficult to solve at scale. XSEDE presents a promising example of how to enhance interoperability and cross-platform functionality. As a "single virtual system that scientists can use to interactively share computing resources, data, and expertise," XSEDE uses service-oriented architecture to guide users through the different services and capabilities NSF's resources offer, enabling them to efficiently access their desired functionality.

A tougher problem with heterogenous computing systems that was raised in a recent Task Force workshop is that it will be more difficult for very computationally intensive problems to be executed because users will have to deal with load balancing over different systems,

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[10] Kasey Panetta, "Gartner Top 10 Strategic Predictions for 2021 and Beyond," *Gartner blog*, October 21, 2020, https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-predictions-for-2021-and-beyond.
[11] Saif M. Khan, "AI Chips: What They Are and Why They Matter," (CSET, April 2020), https://cset.georgetown.edu/publication/ai-chips-what-they-are-and-why-they-matter/.

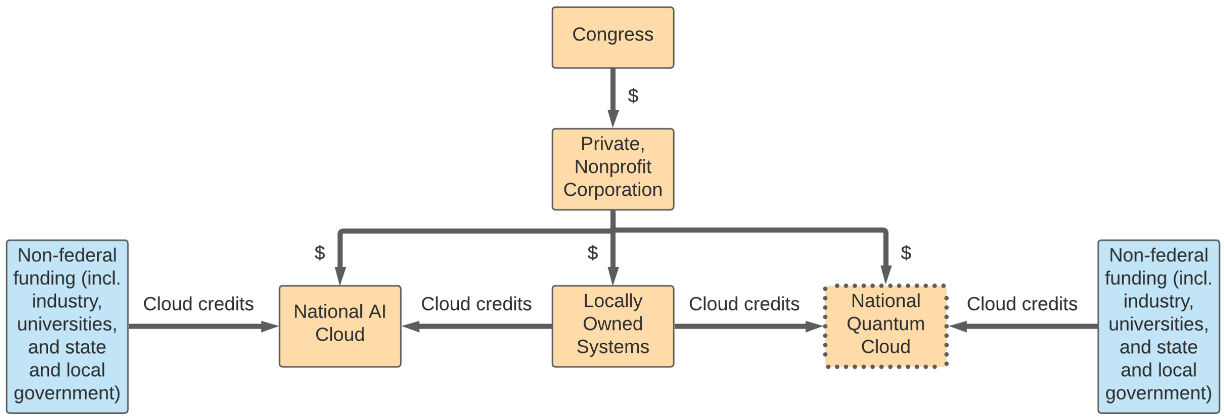
interoperability, resource selection, among other challenges. However, the Task Force should consider that the ultimate goal of the NAIRR is to democratize access to spur AI innovation, bolster U.S. competitiveness in AI, and bridge the "compute divide." The "long tail" of AI researchers that have more modest computational needs represent, in aggregate, the majority of AI researchers and a significant portion of AI advances. The NAIRR should therefore prioritize capabilities and services that meet the majority of AI researcher needs.

In the long run, a distributed framework could also enable the NAIRR to expand to include different technologies. Most importantly, the Task Force should consider in its roadmap how such a resource could incorporate resources for quantum computing. Because quantum computers are very specialized and expensive to develop, few universities provide access to these systems to support research activities. Instead, most academic researchers access these systems through quantum clouds—services that provide remote access to quantum systems through existing Internet infrastructure. Companies such as Amazon and Microsoft have already begun to make access to quantum computers available through their quantum computing-as-a-service (QCaaS) offerings, which are fully managed services that enable researchers and developers to begin experimenting with systems from multiple quantum hardware providers in a single place. Even with declining computing costs though, the costs and know-how for using advanced computing, including QCaaS solutions, will remain out of reach for many academic researchers.[12]

While AI and quantum computing differ, the crux of the problem is the same: How can the United States provide academic researchers with affordable access to high-end computing resources in a secure environment? Rather than reinventing the wheel, Figure 3 below illustrates how the scope of the NAIRR could be adapted to include additional resources to support quantum computing research.

[12] Hodan Omaar, "The Case for a National Quantum Computing Research Task Force in the United States," June 9, 2021, https://datainnovation.org/2021/06/the-case-for-a-national-quantum-computing-research-task-force-in-the-united-states/.

Figure 3: Expanding the scope of the NAIRR to include quantum computing.



3. How can the NAIRR and its components reinforce principles of ethical and responsible research and development of AI, such as those concerning issues of racial and gender equity, fairness, bias, civil rights, transparency, and accountability?

The ethical considerations regarding the NAIRR fall into two main buckets. One is how to ensure the allocation of resources in the NAIRR are fair and the other is how to ensure those resources are used to advance ethical and responsible AI research.

The first question is essentially a cake cutting problem, which is the challenge of allocating a single divisible, continuous, resource in a fair and equitable manner.[13] The "cake" in this case is the NAIRR and individuals have different preferences over difference pieces (because they will be pursuing different types of research and different systems within the NAIRR will be better suited to their needs). How should one split the cake so that it is fair in the sense of distributional fairness, understood as maximizing everyone's utility, and in the sense of not having disparate impact across protected groups?

Such practical problems are studied in mechanism design, a field of economics that studies the mechanisms through which a particular outcome or result can be achieved. Mechanism design can help bring analytic clarity to policy goals. Consider the statement: "The NAIRR should provide AI compute to the greatest number of AI researchers." This directive could be operationalized multiple ways. One way would be to minimize the total number of AI researchers that have less than some threshold of AI compute. Another way would be to first

[13] Rediet Abebe et al., "Fair Division via Social Comparison," AAMAS '17: *Proceedings of the 16th Conference on Autonomous Agents and MultiAgent Systems*, (May 2017), pages 281–289, DOI: 10.5555/3091125.

provide the AI researchers who have the least access with as many resources as they need, then move on to the next, until the resource is exhausted. Both of these objective functions may seem reasonable but the consequences of choosing one over another can create different outcomes. The Task Force would benefit from working with mechanism designers to explore how its goals translate into optimization problems and what the impacts of different decisions would be.

To address the second question of how the NAIRR can help reinforce principles of ethical and responsible AI research, it is first important to elucidate what those principles are and what role the NAIRR plays in reinforcing them in research practices.

Ensuring integrity in research for any technology—be it AI, quantum computing, or gene editing—is dependent on the research practices of the research ecosystem. As the National Academies of Science, Engineering, and Medicine (NASEM) explains in a 2017 report:

> "The integrity of research is based on adherence to core values—objectivity, honesty, openness, fairness, accountability, and stewardship. These core values help to ensure that the research enterprise advances knowledge. Integrity in science means planning, proposing, performing, reporting, and reviewing research in accordance with these values."[14]

The purpose of the NAIRR is to provide tools to support the research process. Considerations about what types of AI research should be pursued, how they should be reported, and how they should be reviewed are outside of the purview of the NAIRR. Given its scope, the Task Force can best support ethical and responsible AI research by ensuring the data it provides is representative and complete, there are minimal barriers to using its resources by underrepresented groups in AI research, and the AI computing systems it provides are secure.

The NAIRR should not add additional layers of ethics requirements to AI research. Myopically focusing on ways to foster ethical and responsible AI research, as opposed to considering how to boost ethics in all research, does not make sense when similar ethical questions arise for both AI and non-AI research.

In the 2007 America COMPETES Act, Congress directed NSF to introduce several Responsible Conduct of Research (RCR) requirements for institutions obtaining NSF

[14] National Academies of Sciences, Engineering, and Medicine (NASEM), Fostering Integrity in Research, (Washington, DC: The National Academies Press, 2017), DOI: 10.17226/21896.

funding.[15] These included requiring institutions to have a plan for providing adequate RCR training for undergraduate students, graduate students, and postdoctoral researchers; to designate a person to oversee compliance with the RCR requirement; and to employ mechanisms to ensure they can verify the necessary people are being trained. These requirements apply to the breadth of research disciplines, including AI. In the latest review by the NSF Office of Inspector General in 2017, 30 percent of institutions did not have any formal RCR plans when first contacted nor did they have a designated person to oversee compliance with the requirement.[16] Worse, few had sufficient tracking in place to ensure students received their required RCR training. The report reads, "the fact that there were so many noncompliant institutions in the group we examined indicates that NSF may have an implementation problem with this tracking requirement."[17]

NSF also identifies on its website that some institutions would like guidance about content for training in responsible conduct of research but that it believes "the research community, encompassing both individual researchers and institutions, is best placed to determine the content of RCR training without a need for NSF-specified standards."[18]

If NSF believes it needs to address shortcomings with fostering responsible and ethical research, it should do so holistically and consistently rather than creating unique rules for research involving specific technologies.

4. What role should public-private partnerships play in the NAIRR? What exemplars could be used as a model?

Public-private partnerships can play an important role in helping fund and sustain the NAIRR. To see how, the Task Force should look at the European High Performance Computing Joint Undertaking (EuroHPC JU), a joint initiative between the EU, European countries, and the private sector to develop a high-end HPC ecosystem in Europe.[19] The goal of the initiative is to coordinate and pool public and private resources to fund high-end systems in a number of designated sites across Europe. These systems are then made available to researchers all over Europe. In total, the initiative has an €8 billion budget for

[15] America COMPETES Act of 2007, H.R. 2272, 110th Cong.
[16] NSF Office of Inspector General, "OIG Review of Institutions' Implementation of NSF's Responsible Conduct of Research (RCR) Requirements", July 25, 2017, www.nsf.gov/oig/_pdf/RCR_MIR_Final_7-25-17.pdf.
[17] Ibid.
[18] "RCR Frequently Asked Questions (FAQs)," last updated August 16, 2010, www.nsf.gov/ubs/policydocs/rcr/rcrfaqs.jsp.
[19] EuroHPC website, accessed September 17, 2021, https://eurohpc-ju.europa.eu/.

the period 2021-2027, €3.5 billion of which will be funded by the EU, €3.5 by member states and associated countries, and €1 billion from industry.[20]

First, EuroHPC JU decided on the number and type of supercomputers it wanted to deploy and also the site locations. Then, it put out requests for tenders for the procurement of the systems. For example, one petascale supercomputer will be in Sofia, Bulgaria and in its request for tender, EuroHPC JU says it is looking for an "…economic operator in order to build, deliver, install and maintain a supercomputer…Therefore, the prospective contractors should have proven experience of building, delivering, installing and maintaining similar environments."[21]

The Task Force should consider something similar to fund the NAIRR. First, it could identify the sites where it wants to deploy these systems based on the regions where access is needed the most and the return on investment is high (as described earlier). Then, it could put out a call for bids as part of a reverse-auction program. Using a reverse-auction format could enable the Task Force to find those willing to build and maintain computing systems for AI at the lowest cost, though the specifics of the auction process should be scrutinized to ensure the appropriate conditions are in place to enable successful execution of deployment funding. The Task Force could even accept bids from consortium groups, where bidders are partnerships that include a university or research institute, private companies, and state or local government. But the Task Force does not need to restrict bidders to only consortia groups; the United Kingdom's largest supercomputer for researchers is Cambridge-1, which is owned and maintained by a private company, Nvidia.[22]

5. Where do you see limitations in the ability of the NAIRR to democratize access to AI R&D? And how could these limitations be overcome?

As we've noted, democratizing access to AI R&D through the NAIRR is a means to an end rather than an end in itself, and therefore it is more valuable to consider the limitations in the ability of the NAIRR to achieve those ends—more innovation, competitiveness, and equitable access—and how they might be overcome.

[20] Goda Naujokaitytė, "Commission to boost 2021 - 2027 investment in supercomputers to €8B," *Science Business*, September 28, 2020, https://sciencebusiness.net/news/commission-boost-2021-2027-investment-supercomputers-eu8b.
[21] TED Supplement to the Official Journal of the EU, Tender for Supercomputer - Bulgaria (CNECT/LUX/2020/OP/0040), https://ted.europa.eu/udl?uri=TED:NOTICE:275559-2020:TEXT:EN:HTML.
[22] "Cambridge-1," Nvidia website, accessed September 17, 2021, https://www.nvidia.com/en-us/industries/healthcare-life-sciences/cambridge-1/.

First, data is a key enabler of AI innovation. The Task Force has already identified that the NAIRR will seek to disseminate high-quality government datasets to AI researchers, but a lack of mechanisms to address barriers to international data and encourage private and non-profit sectors to provide voluntary access to high-quality data will detract from most effectively fueling AI research. Most importantly, the NAIRR should enable cross-border data flows, which are increasingly integral to addressing important global problems such as the spread of COVID-19. The Task Force should prioritize the development of technical confidence-building measures for the NAIRR, such as encryption, that demonstrate how logical software controls can keep cross-border data flows secure.[23] It could also encourage international data-sharing in the NAIRR by creating a large-scale data demonstration project. For example, a demonstration project could focus on a priority public need such as a "life sciences-health care" data cloud as part of the COVID-19 response, which would pool public data from organizations and government agencies within and outside the United States.

Second, if moving the competitiveness needle is truly a goal of the NAIRR, the Task Force will have to go beyond expanding basic research in AI and consider how the NAIRR can support applied research linked to the needs of the nation's traded-sector firms. As mentioned earlier, innovation vouchers for businesses are one way to do this but the question is, which businesses should be prioritized? Which traded sectors are most important for AI? As we argue in our report *Why the United States Needs a National Artificial Intelligence Strategy and What It Should Look Like*, OSTP should help answer these questions in a comprehensive national AI strategy that among other things, charges federal agencies to work with industry on creating sector-specific AI strategies.[24]

Finally, the NAIRR's ability to address barriers women and minorities face in becoming the next generation of HPC-enabled AI researchers will be limited in part by the focus placed on providing support for expertise. After all, users of the NAIRR will likely need in-depth HPC training and practice, and using the extensive functionalities the Task Force has identified will require a firm understanding of the architecture and engineering involved, in addition to significant domain expertise. While many well-resourced academic institutions have a central body responsible for acting as a port of contact for HPC expertise, minority-serving institutions typically do not. In fact, researchers at MSIs are oftentimes unaware of what

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[23] Bill Whyman, "Secrets From Cloud Computing's First Stage: An Action Agenda for Government and Industry," (ITIF, June 2021), https://itif.org/publications/2021/06/01/secrets-cloud-computings-first-stage-action-agenda-government-and-industry.

[24] Joshua New, "Why the United States Needs a National Artificial Intelligence Strategy and What It Should Look Like," (Center for Data Innovation, December 2018), https://www2.datainnovation.org/2018-national-ai-strategy.pdf.

resources are available to them.[25] As part of its roadmap, the Task Force should prioritize marketing strategies and consider implementing the XSEDE practice that permits researchers to request an allocation of staff time along with HPC time across all HPC systems. Like XSEDE, these staff experts would be from partnering sites whose time is devoted to working with allocated projects to accelerate progress toward research objectives.

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[25] Hodan Omaar, "Event Recap: How The Federal Government Can Increase Access To Supercomputing Across America," (Center for Data Innovation, February 2021), https://datainnovation.org/2021/02/event-recap-how-the-federal-government-can-increase-access-to-supercomputing-across-america/.