Association of American Universities
America's Leading Research Universities

TO: **The Department of Energy Office of Science**

FROM: **The Association of American Universities (AAU)**
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RE: **Response to RFI: Mobilizing Talent for the Genesis Mission and Developing an American Workforce to Advance Artificial Intelligence (AI) for Science and Engineering**

AAU appreciates the opportunity to respond to the Request for Information on Mobilizing Talent for the Genesis Mission and Developing an American Workforce to Advance Artificial Intelligence (AI) for Science and Engineering. Our responses to specific questions are provided below.

1. How can DOE catalyze research collaborations between DOE National Laboratories, universities, and industry to meet the goals of the Genesis program?

Reduce frictions in IP. Intellectual property-related frictions in DOE's technology transfer processes create real barriers to sustained, productive collaboration. For universities, the challenge often begins with misalignment between Bayh-Dole's intent of enabling institutions to retain title to federally funded inventions and license them for commercialization, and the practical realities of negotiating Cooperative Research and Development Agreements (CRADAs) and other agreements with National Labs. When lab IP policies conflict with university patent policies, or when negotiations over background IP and publication rights drag on for months, faculty engagement stalls, and students and postdocs who could be driving Genesis-relevant research are left in limbo.

- DOE should develop standardized, pre-negotiated agreement templates tailored to university-lab partnerships that protect academic freedom, reserve publication rights, and provide clear, predictable licensing pathways to reduce the legal back-and-forth that currently consumes time and resources on both sides of the negotiation.
- A Genesis-specific IP ombudsman or liaison function, operating across the national labs system, could provide a consistent point of contact for resolving disputes and harmonizing practices, lowering transaction costs for all partners, and signaling that DOE views IP clarity as a prerequisite for the cross-sector collaboration the Genesis program envisions.

Take advantage of geography. Research universities and national labs are often anchor institutions in regional economic ecosystems, and this creates natural linkages between talent, research, production, and entrepreneurship (see, for instance, the University of Rochester's prominent place within the western New York optics hub). DOE should consider a place-based approach – including one that leverages existing authorities like the Energy Program for Innovation Clusters (EPIC) or the Regional Clean Energy Innovation Program authorized in CHIPS and Science – to foster AI research and education activities that take advantage of these linkages across technology sectors. Such an approach could facilitate partnerships with state and local economic development agencies, community colleges, independent research institutes, chambers of commerce, non-DOE federal facilities, and other stakeholders.

However, place-based approaches should exist alongside more open opportunities with maximum national mobility, allowing students, institutions, and companies to pursue the best opportunities wherever they may be located.

Convene research roadmapping exercises. Organizing domain-specific workshops to identify research roadblocks, goals, and opportunities can help to generate interest and contribute to a shared vision for success. DOE has extensive experience in such exercises through its Basic Research Needs activity, which over the years has laid the groundwork for successful use-inspired research programs like the Energy Frontier Research Centers and the Bioenergy Research Centers.

Joint roadmapping exercises can also help universities, national labs, independent institutes, and companies better understand each other's respective needs, competencies, expertise, and values, thus contributing to the familiarity and trust necessary to form partnerships.

Leverage SBIR/STTR. DOE should also leverage the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program as a targeted mechanism for fostering AI workforce development in support of Genesis. The STTR program is uniquely suited to this purpose as it requires formal collaboration between small businesses and research institutions, creating a natural bridge between university AI research talent and the commercial sector. However, when research universities cannot protect faculty inventions or guarantee student and postdoc career pathways, there could be a reticence to participate.

DOE should develop Genesis-specific SBIR/STTR topic areas explicitly designed around AI workforce development, funding projects that embed graduate students and postdocs in small business environments, support joint university-industry AI tool development relevant to DOE mission areas, and require meaningful technology transfer plans as part of the award. This approach would cultivate a pipeline of AI-trained researchers who have hands-on experience bridging academic and commercial contexts, which is exactly the workforce profile the Genesis program will need to achieve its long-term goals.

2. *How can DOE incentivize partnerships between universities, DOE National Laboratories, industry, and philanthropic organizations to 1) establish new training paths for bachelor's and master's degrees focused on dual competencies in AI and scientific/engineering disciplines and 2) provide innovative experiences to prepare doctoral students and post-doctoral associates for careers in AI for science?*

Build partnership and training requirements into RFPs, and fund them. DOE should build and fund opportunities that explicitly call for collaborative dual competency education and training, designed in consultation with the stakeholders involved. This could be achieved through the existing Workforce Development for Teachers and Students program or by creating new fellowships or other funding instruments. In so doing, DOE should also consider a more expansive approach beyond students to include existing faculty and working professionals as there is a need to sustain existing workforce knowledge and skills at all levels, given the speed at which AI is evolving.

It needs to be stressed that none of this will work without significant new funding. DOE should be working closely with the Office of Management and Budget and Congress to ensure that all aspects of the Genesis Mission are fully funded, while avoiding cannibalizing necessary research funds from other vital programs.

Co-design learning pathways. DOE should offer incentives and support for co-design and development of curricula, embedded research experiences, and co-mentoring with research university, lab, and industry stakeholders. This approach would ensure students acquire the knowledge and skills in demand by future employers – including the ability to operate in academic and industry scientific teams – along with the scientific domain expertise provided by academic education. Experiential learning should seek to expose both undergraduate and graduate students to real-world scientific workflows, equipment and instrumentation, and research projects with both public and private funding. Learning activities should come with built-in industry credentialing to validate the program of study.

One model for this work is provided by the University of Chicago's AI-enabled Molecular Engineering of Materials and Systems for Sustainability (AIMEMS) program. The program integrates materials science, computer science, and professional skill education with co-mentoring from national lab and industry partners.

As mentioned above, using local geography as a frame could provide one advantageous approach. For instance, a student at a research university could develop foundational knowledge initially through coursework, including some taught by visiting industry experts, followed by research rotations in nearby lab or company partners with university co-mentoring throughout. This would allow students, trainees, and educators to develop deeper knowledge of and relationships with the innovation ecosystem in which they operate.

3. *What attributes might attract undergraduates to programs that offer dual competency degrees?*

Authentic benefit. The opportunity to gain exposure to authentic real-world scientific workflows, projects, and infrastructure is a powerful draw for talented young students and researchers. This is doubly so when experiential learning comes with engaged faculty, clear curriculum pathways to ensure it counts toward degree or certificate credit, and defined and credible hiring commitments. Employers are more likely to hire graduates who participated in "high-impact practices" and other applied, hands-on experiences while in college.

Career readiness and mobility. Participation in dual competency degrees will help students strengthen core skills – computational thinking, scientific reasoning, ethics of technology, data interpretation, and AI-enabled learning competencies – necessary for the current and future workforce. In addition, graduates' possession of micro-credentials or ePortfolios that communicate attainment of skills and experiences has been found to provide a hiring advantage.

Embrace the mission. National missions in science and technology are encoded in the Genesis DNA. Education and training opportunities should lean into this branding, creating excitement and giving early career scientists and engineers the sense that they are working with America's best and brightest to tackle society's biggest challenges. Research demonstrates that mission-oriented careers are a draw, and motivation for a full range of domestic talent.

Ease of locating opportunities. Substantial opportunities do exist for students looking for national lab or industry experience, but these can be difficult to find and are often localized to particular regions or institutions. DOE would do America's students a service by creating a centralized, easily accessible, online portal for Genesis-related talent programs of all kinds to maximize their visibility in a one-stop shop.

4. *Beyond funding, what other opportunities could DOE, including its National Laboratories and user facilities, bring to these partnerships?*

DOE and National Lab contributions could include exposure to the mission culture that characterizes the labs, and access to real-world high-performance computing infrastructure, scientific workflows, curated data, simulation codes, and collaborative research opportunities with lab experts. The labs could also participate in instructional activities that bring their scientific expertise and perspectives into the classroom.

5. *In addition to classroom and research training, what other contributions could universities make to support these partnerships?*

Research universities offer deep scientific expertise across domains, as well as unique scientific data resources and secure computing environments. In addition, universities can:

Operate test beds to accelerate technology transitions. Testing new AI-powered technologies in simulated real-world environments is a critical step in technology transitions, and research universities have high competency in such work. For example, Indiana University's TOPSAIL provides evaluation of AI tools for education, while the University of Michigan's Mcity facility is geared toward connected and autonomous vehicle evaluation. The Genesis Mission should seek to leverage research universities' expertise in designing, building, and operating test beds across technology areas to advance mission goals.

Serve as regional on-ramps, off-ramps, and bridges. As mentioned above, research universities are typically hub institutions in larger ecosystems. This creates natural relationships with community colleges, local chambers, nonprofits, and companies. Universities are also powerful sources of spinoffs and startups, and their networks can be leveraged to achieve Genesis Mission goals. In addition, universities are well situated to pursue public-facing efforts that advance AI literacy and public engagement on the ethical and security issues surrounding AI.

Identify the best and brightest, and focus on learning outcomes. Some institutions have undertaken internal efforts to identify promising undergraduates and encourage them to pursue science, technology, engineering, and mathematics (STEM) graduate programs and experiential learning. In time, AI tools may also help research universities identify and address additional factors that influence STEM student retention.

Pull in the world's scientific talent. DOE should welcome top scientific scholars and professionals from all over the world to catalyze the Genesis Mission's research. Universities are magnets for highly skilled foreign-born talent. In the past, the United States has been able to take advantages of this international scientific talent to advance U.S. S&T and other economic interests. The Genesis mission should seek to continue to provide incentives that help America attract and retain international talent to advance U.S. AI leadership.

6. *Beyond funding, what types of contributions could industry and philanthropic organizations make to enhance these partnerships and enrich the experiences of the students?*

Industry experience can provide students with exposure to entrepreneurial business culture outside the academy, while industry experts can participate in classroom instruction. Industry can also provide hiring commitments for students that participate in joint DOE/university education and training initiatives, and in-kind contributions like hardware or data access. One good example of government-industry partnership in this space is the announced partnership between the Micron Foundation and National Science Foundation's Experiential Learning for Emerging and Novel Technologies, or ExLENT, program, which will create experiential learning opportunities in various fields of critical and emerging technology.

7. *In addition to AI, which scientific and engineering disciplines are well-suited for this dual competency training approach?*

In general, disciplines with high computational needs and an overlap with DOE mission areas would benefit highly from this approach. These disciplines include materials science and engineering, computational chemistry, plasma physics, high energy physics, electrical engineering, applied mathematics, and systems biology, among others.

8. *What components are needed for an effective dual competency degree program to best prepare students for successful careers at the bachelor's level? At the master's level?*

Effective dual competency degree programs have students develop disciplinary knowledge along with durable skills – creative and critical thinking, information literacy, inquiry and analysis, oral communication, problem solving, quantitative literacy, teamwork, written communication, ethical reasoning, lifelong and global learning, and intercultural knowledge. These cross-cutting capacities and complementary workforce capabilities are essential to the advancement of critical and emerging technologies as well as the ability to translate these technologies into measurable societal benefit. For instance, at the University of Arizona, applied humanities courses provide students interested in science and engineering with a transdisciplinary education combining the disciplinary knowledge with the cognitive, creative, international, interpersonal, and intercultural skills and competencies that only the humanities can offer. Programs that combine STEM and humanities education offer a vital edge in AI and other rapidly changing professions.

10. *How could partnerships between DOE, universities, and industry provide new training opportunities for students to best prepare them for private and public sector jobs?*

In addition to the recommendations above, Genesis stakeholders could collaborate to develop AI tools and data resources to facilitate large-scale analysis of employment, skill, and technology trends at various geographic granularities. These analyses could identify emerging skill needs or predict new critical technology clusters, which could provide useful contextual information for strategizing around education and training opportunities. This information would, in turn, feed back into evolving curricula co-designed by Genesis, universities, and other partners in an adaptive system responsive to market demands.