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Addressing the National Science Foundation

My name is Dr. Christopher Lawson, I am the Executive Director of the Alabama Experimental program to Stimulate Competitive Research (EPSCoR) and a member of the Board of the Coalition of EPSCoR/IDeA States. I am also a professor of physics at the University of Alabama at Birmingham (UAB) and Director of the Alabama Graduate Research Scholars Program.

Federal investment in research dates back to World War II. The cooperation between the Federal government and the research community is credited with helping the U.S. and our allies achieve victory -- a victory against an opponent that was similarly taking advantage of scientific and technological advances. According to the 2014 Science and Engineering Indicators, academic R&D remains a key component of the US R&D enterprise with the federal government providing about $38.9 billion of the $62.3 billion of academic spending on S&E R&D in FY 2012. Go to any research university and they will tell you that they are highly dependent upon the federal research support system. And, while the $38.9 billion may sound substantial, we all know that there is much more that needs to be done – to support our economy, our international competitiveness and our individual well-being.

Consequently, I would first like to support a robust federal research base that will allow us to address more effectively and more quickly the many issues facing our nation.

Secondly, I encourage the support of a national research community that utilizes the talents and expertise of all of our talented researchers regardless of where they may reside and provides the benefits of a strong research base to all states. The state-based land grant institution has been the bulwark of our higher education system for more than a century and it should be supported by a healthy research capacity throughout the nation. Innovation is essential for us all and the research base is key to that innovation.

Today, some 25 states and 3 territories do not fully participate in the national research community. These states are often referred to as the EPSCoR/IDeA states because of their participation in EPSCoR/IDeA programs in federal research agencies. These states have about 20% of the nation's population, close to 25% of its doctoral research universities and 25% of its scientists and engineers, but receive only about 10% of all federal research funding.

The EPSCoR program originated in the National Science Foundation (NSF) as a way to compensate for geographical imbalance in research funding. Today, any state or territory that receives 0.75% -- three-quarters of one percent or less -- of NSF research funding over a three-year running period qualifies as an EPSCoR state, with eligibility calculated each year. In fact, most of the eligible states receive less than half of a percent of such research funding annually.

The original NSF EPSCoR program was a response to the directive in the original NSF authorizing legislation that NSF avoid an “undue concentration” of research and education in science and engineering, thus its legal beginnings. However, it is also a matter of basic fairness. The benefits of a strong research capacity are so great that all states not only deserve but require a research infrastructure if they are to meet the needs of their people. And, beyond that, there are simply practical reasons for a widespread research community that leads to innovation and economic activity.

A recent study of the EPSCoR/IDeA programs, conducted by the National Academy of Sciences made several pertinent comments:

One, "science and engineering talent can be found among young people in every state and the long-term health of the U.S. research enterprise depends on providing opportunities for these young people to develop their talents no matter where they may live or attend college."

Two, "participation in research is an essential component in science and engineering education. Consequently, students in all parts of the country must have the chance to participate in high-quality research, and it is in the national interest that federal funding be provided to universities in every state to ensure that these research opportunities are available."

Furthermore, a study undertaken by the Science and Technology Policy Institute (STPI) for NSF reported in December 2014 that, among other things, the EPSCoR program had "contributed meaningfully" to eligible jurisdictions' increased competitiveness for NSF funds.

However, the report also noted that EPSCoR funding was limited. The STPI report stated, "the resources available to EPSCoR are limited. Thirty-one jurisdictions compete for approximately $150 million in annual funding (which currently represents approximately 20% of NSF R&RA funding to the EPSCoR states, 2.5% of total NSF R&RA budget, and approximately 0.1% of all federal R&D funding.) As a result, the investment in any one activity or institution in each jurisdiction is limited." (NOTE: those numbers have changed slightly since the report was prepared – 28 jurisdictions now participate and the FY 2015 appropriation was $159.6 million -- but the conclusion remains.)

Add to these such factors as the following:

* Faculty who remain current in their fields produce better students who can move quickly and seamlessly into the workforce, especially in science and engineering. For faculty to remain current they must continue involvement in research and participate in their respective scientific organizations. This means they must have research support.
* Technology driven companies tend to cluster in areas where they have access to a trained workforce, expertise (faculty and graduate student), and facilities. Equipment, laboratories and clean rooms at universities are attractive both to existing and start-up companies. Most states, including the EPSCoR/IdeA ones, find that clusters and corridors develop around their research institutions.
* The EPSCoR/IDeA states have a long tradition of promoting economic development, job creation and innovation in their areas. Many have assisted with SBIR and STTR development. Several operate Manufacturing Extension Partnership (MEP) programs. Almost all have healthy business incubators that not only support local businesses but also help their faculty and students develop emerging startup companies.
* The EPSCoR/IDeA states are geographically located in the areas of strategic importance to our nation. Many are involved in food production and security, which in turn evoke challenges related to water, weather and natural resource use. Others are major energy producing and energy exporting states. Still others are coastal states, facing issues of oceans and litoral consequence. Several share borders with other countries or are main transit points. Several contain national laboratories. National and international issues that demand innovation and creativity arise and are addressed in the EPSCoR/IDeA states on a daily basis.

The conclusion, it seems to me, is obvious. There is a two-way street here. The EPSCoR/IDeA states have much to offer in terms of talent, expertise and response to a diversity of issues. But, the

EPSCoR/IDeA states also have much to gain, especially economically, from the benefits of a strong research base which will enhance their competitiveness and enable them to make greater contributions to their own well-being.

In testimony before the Senate Committee on Commerce, Science and Transportation in November 2013, National Science Board vice chair Kelvin Droegemeier, also from an EPSCoR/IDeA state, talked about the "research capacity-building" impact of the programs. The NAS report also noted the importance of the "core elements" of the programs -- "to enhance research excellence through competitive processes" and "to enhance capacity for postsecondary training in STEM fields". This is what forms the base for innovation in about half the states.

Like the NSF EPSCoR program, NASA EPSCoR focuses on developing research capacity. First authorized in 1993, the program helps states and the nation in areas of importance to the NASA mission – including space science, earth science and aerospace technology. For many of the eligible states, NASA EPSCoR is a primary nexus for NASA research in the state, and helps build workforce development for NASA as well as local and regional technology companies.

For these reasons, I am requesting a FY 2016 appropriation of $180 million for NSF EPSCoR and $25 million for NASA EPSCoR. We are especially interested in seeing robust funding for the Track 1 awards, which are the center of the NSF program; increased co-funding; additional efforts to ensure full EPSCoR jurisdiction participation in major new NSF initiatives such as the Nexus of Food, Energy and Water and the BRAIN initiative; and increased outreach to states.

Now, let me turn briefly to several examples of the impact of EPSCoR/IDeA on innovation in Alabama. I truly believe that EPSCoR/IDeA has been a catalyst for these developments and that without the programs, my state would not have these same levels of accomplishment.

At my own university, EPSCoR federally-funded research has seeded the innovation in the development of a new type of ultra-sensitive laser based sensor for olfaction, an “optical nose”, which can be used to detect and characterize (“sniff”) environmental toxins from spills caused by natural disasters. The same technology could ultimately be used for medical diagnosis of diseases such as lung cancer by the rapid analysis of the breath of patients during routine visits to the dentist. This innovative technology has led directly to the creation of a new multi-million dollar startup company in Alabama.

Federal funding of scientists at the Auburn College of Veterinary Medicine has developed an alternative, synergistic approach for the same goal of ultra-sensitive olfaction by using zinc nanoparticles to improve canine detection of explosives that threaten public safety.

Federal investment has also spurred innovation at UAB to develop synthetic diamond technology for industrial and biomedical applications. Nanostructured diamond coated orthopedic and dental implants could extend the lifetime of these joints to over thirty years as compared to the ten-year lifetimes of current joint replacements. Similar technology innovations are providing nanostructured diamond coated cutting tools. These innovations are being commercialized by Vista Engineering, a spin-off company.

As another example, current composite materials are petroleum based with synthetic fibers that require large amounts of energy to produce. NSF EPSCoR funded research at Tuskegee University has led to advanced green composites that use plant oil based polymers and fibers. These materials will lead to reduced dependency on fossil fuels, and because they are biodegradable, they will not have to end up in landfills like traditional composite materials.

Federal investment in Auburn research has produced innovation in the form of a new drug delivery system involving DNA. This system enables precise, timed release of drugs and represents a novel advance in nano medicine that could lead to improved targeting of cancerous tumors. Complementary advances in ribonucleic acid (RNA) engineering produced a new microfluidic technology for 'instant' detection of RNA degrading agents. This detection platform should revolutionize our ability to detect and monitor contaminated food, which could significantly improve food safety and decrease food poisonings.

Federal investment in Cyber Security research at UAB has led to a number of important technical innovations and inventions. UAB researchers created a data-analytics based method for identifying the possibility of infection outbreaks in hospitals. This method could reduce hospital patient days due to secondary illnesses, which can have profound health and economic benefits. This technology has been commercialized by MedMined, now part of CareFusion. Federal investment at UAB has also led to innovative methods to identify cyber threats and thwart emerging e-mail attacks on organizations across the United States and worldwide, and this technology has led to another start-up company, Malcovery.

It is clear that in my state, federal research investment has led to numerous important technical innovations. This research investment has kept Alabama at the "cutting edge" of research and enabled students to encounter the type of research experiences that have been proven to be crucial for both undergraduate and graduate education. Federally funded technology innovations in Alabama have proven to be a crucial growth engine for the development of high technology spin off companies as described before. Finally, federal investment in EPSCoR states makes sense in order for the USA to maintain its technology edge and maintain its standard of living in the face of stiff global competition. We simply cannot afford to be training bright students and developing innovation in only a few states or institutions, we need to be training and utilizing ALL of our nation's brainpower, and EPSCoR has proven to be an effective means to achieve that goal.

Thank you for allowing me to provide this testimony.