U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

HEARING CHARTER

STEM in Action:
Inspiring the Science and Engineering Workforce of Tomorrow

Tuesday, September 13, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Tuesday, September 13, 2011, the Committee on Science, Space, and Technology will hold the second in a series of hearings to highlight Science, Technology, Engineering, and Math (STEM) education activities across the Nation, their role in inspiring and educating future generations, and their contribution to our future economic prosperity. The purpose of this hearing, *STEM Education in Action: Inspiring the Science and Engineering Workforce of Tomorrow*, is to showcase a variety of public/private partnerships and initiatives that are successfully inspiring the future STEM workforce.

2. Witnesses

Mr. Tony Norman, President and CEO of Innovation First International, Inc.

Mrs. Nancy Conrad, Chairman and Founder of the Conrad Foundation

Mr. Michael D. Gallagher, President and CEO of Entertainment Software Association

3. Overview

- In the U.S, student mastery of STEM subjects is essential for 21st century jobs. Finding ways to improve STEM education activities beyond the scope of the federal government, including using best practices derived from non-federal sources, is key to the future prosperity of the Nation.

- The Administration's FY12 Budget request includes $3.4 billion in spending for STEM education efforts.

- A growing number of partnerships between industry, foundations, non-profits, and local and regional governments recognize the importance of having an educated and skilled STEM workforce and are creatively motivating and inspiring future generations of scientists and engineers with little or no federal funding.

- Innovation First International began by producing electronics for autonomous mobile ground robots and is now a leader in educational and competitive robotics products, and a growing developer of consumer robotics toys. Through Innovation First International, VEX Robotics motivates students in the classroom with its VEX Robotics Classroom competition as well as a number of other competitions around the Nation.

- The Conrad Foundation is a non-profit, 501(c) (3) organization built upon astronaut Charles "Pete" Conrad's history of innovation and entrepreneurship. The Spirit of Innovation Awards, a competition founded by the Conrad Foundation, challenges teams of high school students to create innovative products to solve 21st century, real-world problems.

- The Entertainment Software Association (ESA) is the U.S. association dedicated to serving the needs of companies that publish computer and video games for video game consoles, personal computers, and the Internet. ESA is one of the annual sponsors of the STEM Video Game Challenge which aims to motivate interest in STEM learning among America's youth by tapping into students' desire to play and make video games.

4. Background

STEM Education and the Federal Government

A consensus exists that improving STEM education throughout the Nation is a necessary condition for preserving our capacity for innovation and discovery and for ensuring U.S. economic strength and competitiveness in the international marketplace of the 21st century. The National Academies *Rising Above the Gathering Storm* report placed major emphasis on the need to improve STEM education and made its top priority increasing the number of highly qualified STEM teachers. This recommendation was embraced by the House Science, Space, and Technology Committee following the issuance of the report and was included in the 2007 *America COMPETES Act*. The 2010 *America COMPETES Reauthorization Act* continues this priority.

Beyond activities authorized in *America COMPETES*, President Obama has called for a new effort to prepare 100,000 STEM teachers with strong teaching skills and deep content knowledge over the next decade. As a component of achieving this goal, the FY12 Budget Request proposes an investment of $100 million through the Department of Education and the National Science Foundation (NSF) to prepare effective STEM teachers for classrooms across America. This proposal also responds to a recommendation by the President's Council of Advisors on Science and Technology (PCAST) to prepare and inspire America's students in STEM.[1]

[1] White House Office of Science and Technology Policy, *Winning the Race to Educate Our Children,* STEM Education in the 2012 Budget, p.1

In addition, the FY12 Budget Request proposes $90 million for the creation of an Advanced Research Projects Agency – Education (ARPA-ED) with the mission of driving transformational improvement in education technology.[2]

The President's new "Educate to Innovate" campaign leverages federal resources with over $700 million in private-sector resources. The goals of the program are to increase STEM literacy so that all students can learn deeply and think critically in science, math, engineering, and technology; move American students from the middle of the pack to the top in the next decade; and expand STEM education and career opportunities for underrepresented groups, including women and girls.

With specific regard to K-12 STEM education funding beyond what has already been identified, the FY12 Budget Request calls for $206 million for the Department of Education's proposed Effective Teaching and Learning in STEM program; a $60 million (28 percent) increase for NASA's K-12 education programs; $300 million for an "Investing in Innovation" program (expansion of a Department of Education American Reinvestment and Recovery Act program); and $185 million for a new Presidential Teaching Fellowship program.

In total, the FY12 Budget Request devotes $3.4 billion to STEM education programs across the federal government.[3] The 2010 *America COMPETES Reauthorization Act* called for the creation of a National Science Technology Council (NSTC) Committee on STEM Education to coordinate federal STEM investments. The first-year tasks of the Committee are to create an inventory of federal STEM education activities and develop a 5-year strategic federal STEM education plan. The inventory, as well as a similar Government Accountability Office (GAO) survey requested by the Committee on Education and Workforce, is currently underway and results are expected before next year.

In the 112th Congress, the Science, Space, and Technology Committee will continue to hold oversight hearings and briefings on STEM education activities across the federal government and will closely monitor the scope and findings of both the NSTC and the GAO federal STEM education inventories.

Public-Private Partnerships and STEM Education

In the U.S, student mastery of STEM subjects is essential for 21st century jobs. As other nations continue to gain ground in preparing their students in these critical fields, the U.S. must continue to explore a variety of ways to inspire future generations. Finding ways to improve STEM education activities beyond the scope of the federal government, including using best practices derived from non-federal sources, is key to the future prosperity of the Nation.

A growing number of partnerships between industry, foundations, non-profits, and local and regional governments recognize the importance of having an educated and skilled STEM workforce and are creatively motivating and inspiring future generations of scientists and engineers with little or no

[2] White House Office of Science and Technology Policy, *Winning the Race to Educate Our Children,* STEM Education in the 2012 Budget, p.1

[3] White House Office of Science and Technology Policy, *Innovation, Education, and Infrastructure: Science, Technology, STEM Education, and 21st Century Infrastructure in the 2012 Budget*, p. 2.

federal funding. Such partnerships can provide alternative options for education activities outside the scope of public financing and delivery. When designed, implemented and run effectively, a successful partnership can increase efficiency and choice and expand access to educational activities not necessarily found in the classroom. Oftentimes, public-private partnerships allow state and local governments to leverage the specialized skills offered by certain private organizations. Likewise, industry seeks a substantial return on its investment with a highly skilled, highly motivated workforce.

Innovation First International and Vex Robotics Competition

Innovation First International began by producing electronics for autonomous mobile ground robots and is now a leader in educational and competitive robotics products, and a growing developer of consumer robotics toys. Incorporated in 1996, Innovation First International is a privately held corporation that was founded on the belief that innovation is necessary very early in the design process to produce simple and elegant product designs.

Through Innovation First International, the VEX Robotics Design System is the leading classroom robotics platform designed to nurture creative advancement in robotics and knowledge of science, technology, engineering and math (STEM) education. The VEX platform is expanding rapidly and can be found in middle schools, high schools and university labs around the globe. VEX Education works to help schools focus on practical, affordable and accessible ways of delivering dynamic hands-on STEM educational experiences to as many students as possible. VEX addresses current educational and societal needs by its mixing of competition and the real-world applications of mathematics and science concepts through the engineering design process.

VEX Robotics[4] has found a way to motivate students in the classroom with its VEX Robotics Classroom competition. The co-curricular program is specifically tailored to bring robotics competition into the classroom. Robotics can provide an engaging way to integrate all facets of STEM education into the classroom, and head-to-head competition is a natural way to capture students' attention. The VEX Robotics Competition is the largest and fastest growing middle and high school robotics program globally with more than 3,500 teams from 20 countries competing in more than 250 tournaments worldwide. In the U.S., VEX Robotics Competition events are held in numerous states. The Technology Student Association (TSA) and VEX have also partnered to spread the word about STEM education and competition. There are currently three available TSA VEX competitions around the country.

Innovation First and Vex Robotics partners include the REC Foundation, Autodesk, NASA, BEST, Project Lead The Way, Northrop Grumman, Technology Student Association (TSA), SkillsUSA, EMC Corporation, Carnegie Mellon University, Intelitek, Microchip, the United States Coast Guard Academy, iD Tech Camps, Automation Direct and the CREATE Foundation.

[4] http://www.vexrobotics.com/competition

The Conrad Foundation and the Spirit of Innovation Awards

The Conrad Foundation is a non-profit, 501(c) (3) organization built upon astronaut Charles "Pete" Conrad's history of innovation and entrepreneurship. His legacy continues through the Conrad Foundation's programs that combine science, education, and entrepreneurship in a revolutionary model of incentivized competition.

The Spirit of Innovation Awards[5], a competition founded by the Conrad Foundation, challenges teams of high school students to create innovative products using science, technology, and entrepreneurship to solve 21st century, real-world problems. Eligible students may compete on teams in any of three challenge categories: aerospace exploration, clean energy, or cybersecurity.

In each category, students create a team with a maximum number of five students, find and consult a mentor in the community to help provide expert guidance and feedback, and create a proposal. After judging, each team is matched with a set of three mentors who are experts in the field and with whom they collaborate. Each team must then create a next step plan video including an executive summary, budget, and timeline. The public then votes on each team in a people's choice voting process. Each winning team is recognized as Pete Conrad Scholars for that year. Winners receive a $5000 cash grant to continue the development of their product as outlined in their Next Step Plan. Finalists then have the chance to attend the Innovation Summit which is the culmination of the Conrad Foundation's Spirit of Innovation Awards program and is the launch pad for breakthrough technologies from high school innovators. Leading entrepreneurs, government officials, and scientists join the top young innovators and their teachers in a collaborative, social forum to help build the progressive technologies and the next-generation workforce of the 21st century.

The Conrad Foundation, through the Spirit of Innovation Awards, attempts to create a collaborative community focused on scientific innovation, education, and entrepreneurship. The program creates life-long opportunities for all students and teachers participating in the program. The "Portal" was created to provide an opportunity to help teams with market potential achieve commercialization. It serves as an advisory group to the team and provides intellectual property, legal, business, and technical guidance. It is not limited to just the winners of the competition. Past winners and finalists have formed an Alumni Committee to help increase the exposure of and opportunities for all students participating in the program. As a result, students are provided a life-long, collaborative community of support.

The Conrad Foundation partners include Lockheed Martin, PepsiCo, Kraft Foods, American Institute of Aeronautics and Astronautics, American Society for Nutrition, the William James Foundation, NASA, National Institute of Health, Sigma Xi, museums and science centers, *Popular Science Magazine* and Space Ref.

[5] http://www.conradawards.org/competition

Entertainment Software Association

The Entertainment Software Association (ESA) is the U.S. association exclusively dedicated to serving the business and public affairs needs of companies that publish computer and video games for video game consoles, personal computers, and the Internet.

Video games are no longer simply a form of entertainment for children and young adults. The industry, its customers, and its technology have significantly advanced in the past three decades. Entertainment software is now one of the fastest growing industries in the U.S. economy, and video games are driving technological and societal advancements that serve gamers and non-gamers alike.

Educators are increasingly recognizing the impact of entertainment software and utilizing games as a teaching device in a growing number of classrooms and business settings. In doing so, they are embracing the cultural and technological shifts of the 21st century and expanding the use of a favorite leisure activity, computer and video games, into a critical and still-emerging educational resource. More than just play, entertainment software is now being used to impart knowledge, develop life skills and reinforce positive habits in students of all ages. In addition to being a great way to keep students engaged, researchers have found that video games have real potential as next-generation learning tools. Games use new technologies to incorporate principles crucial to human cognitive learning.

The ESA is working in cooperation with the Information Technology Industry Council (ITI), Sony Computer Entertainment America (SCEA), Microsoft Corporation, and the MacArthur Foundation to harness the excitement surrounding computer and video games through a series of STEM-related video game design competitions.

One such competition is the National STEM Video Game Challenge, sponsored by the ESA, Microsoft, and the AMD Foundation, in partnership with the Joan Ganz Cooney Center at Sesame Workshop and E-Line Media. This competition was partly inspired by the White House *Educate to Innovate* campaign. The first National STEM Video Game Challenge[6] featured two complementary competitions, a *Youth Prize* and a *Developer Prize*.

The *Youth Prize* engaged middle school students (grades 5 through 8) in STEM learning by challenging them to design original video games. The Youth Prize design challenge was open to middle school students from any U.S. school with a special emphasis on reaching students in underserved communities. Twelve winners were selected from a group of over 500 entries for their ability to use STEM concepts to design engaging, innovative and well-balanced games. Each winner received a lap-top computer, and $2,000 for their school or non-profit organization of their choice ($3,000 if the school is a recipient of Title 1 funding from the U.S. Department of Education).

The *Developer Prize* challenged emerging and experienced game developers to design mobile games, including games for the mobile Web, for young children that teach key STEM concepts and foster an interest in STEM subject areas. The grand prize winner received $50,000 for their game that teaches children about the physical structure of bacteria and viruses, as well as how they are spread.

[6] http://www.stemchallenge.org/Default.aspx