Nanotechnology Advisory Committee
Wednesday, October 20, 2004 1:30 p.m.
General Assembly Building, House Room D
Richmond, Virginia

The Nanotechnology Advisory Committee, charged with examining nanotechnology opportunities and obstacles for the Commonwealth, met for the third time on October 20, 2004. Dr. James Kadtke led a discussion of federal initiatives and general issues surrounding the advancement of nanotechnology in the Commonwealth.

Delegate Purkey thanked the members for sharing their expertise on this important issue. While JCOTS formed this one-year study committee as a result of HJ 120 (2004), he wrote a letter to the Speaker of the House and Chairman of JCOTS urging them to continue this Advisory Committee as a resource, and to advise the General Assembly on the next steps in this area.

Federal Initiatives

Dr. James Kadtke, Science Advisor for United States Senator John Warner, addressed federal issues and initiatives relating to nanotechnology. He began his career as a physicist for the University of California - San Diego before moving to a technology company that evaluated defense technology. Dr. Kadtke joined the government as part of the Science and Technology Policy Institute at the White House, and then worked with a Committee of the House of Representatives before joining Senator Warner's Office. He has a background in identifying economically viable technology. His presentation fostered a great deal of discussion amongst the Committee as to nanotechnology needs in the Commonwealth.

Nanotechnology is revolutionary and has the potential of transforming society by generating new classes of products. It involves manipulating atomic structures to create new materials with new properties. Scientists build these materials from the bottom up and not the top down, as in other disciplines. Experts project that this market will reach $1 trillion in 10 to 15 years. However, job growth is a current problem, as there is no assured process to generate jobs in the industry.

Attempts to coordinate federal work on the nanoscale began in November 1996, when staff members from several agencies decided to meet regularly to discuss their plans and programs in nanoscale science and technology. The group produced two relevant background publications in late 1999: "Nanostructure Science and Technology: A Worldwide Study," a report based on the findings of an expert panel that visited nanoscale science and technology laboratories around the world; and "Nanotechnology Research Directions," a workshop report with input from academic, private sector, and government participants. These documents laid the groundwork and provided the justification for seeking to raise nanoscale science and technology to the level of a national initiative. Subsequently, in its 2001 budget submission to Congress, the Clinton administration raised nanoscale science and technology to the level of a federal initiative, officially referring to it as the National Nanotechnology Initiative (NNI).

After the government established the NNI, it established the Nanoscale Science, Engineering and Technology Subcommittee and gave it the responsibility for coordinating the federal

government's nanoscale research and development programs. The Subcommittee is a component of the National Science and Technology Council's (NSTC) Committee on Technology, which is composed of senior-level representatives from the federal government's research and development departments and agencies. It provides policy leadership and budget guidance for this and other multi-agency technology programs.

The National Nanotechnology Coordination Office, which was established to serve as the secretariat for the Subcommittee, serves as the point of contact on federal nanotechnology activities for government organizations, academia, industry, professional societies, foreign organizations, and others. It maintains the NNI website (www.nano.gov). Over the years, NNI has grown from five agencies coordinating their activities to 15. Currently, 12 state and regional nanotechnology initiatives also work with the National Coordinator providing seed money for infrastructure.

Foreigners are gaining on the United States in terms of education. Fewer Americans are training in science and technology and fewer foreigners are staying. Whereas foreigners used to remain in the United States, now, they are taking their education and going home for opportunities. One member noted that even the President of U.C.-Berkeley resigned and moved to Taiwan to work on their initiatives.

Taiwan is a remarkable example of what countries can do in such a short period of time. In seven years, Taiwan transitioned from an agrarian to a technology economy. It adopted a cluster model and created clusters of development and growth in four cities with the largest bringing in $20 billion. Each of these cities has over 200,000 scientists most of whom were trained in the U.S. While U.S. degrees are highly valued, both China and Taiwan has taken the educational expertise developed by its citizens in the United States and used it to build their own homegrown institutions to train new graduates.

The United States in not sitting still. In the defense bill for fiscal year 2005, Congress designated $2 million for a Virginia-based pilot project with the Navy to promote science and technology among students. Small grants of $1,500 to $2,000 will entice high school students to work in a national lab in Virginia during the summer. If successful, this program could expand into a national program. The cost per student is relatively low, but private sector matching grants could become available if the program is successful. In addition, Senator Warner introduced the 21st Century Federal Pell Grant Plus Act (S. 2462) to double the amount available for those students who pursue programs of study in engineering, mathematics, science, or foreign languages. Congress has not acted on the bill. The programs, and money for them, do exist; however, they are critically underfunded.

Dr. Kadtke's remarks sparked a lengthy discussion amongst the Committee members concerning the importance of education in nanotechnology development. Dr. Kadtke noted that the development stage -- between research and commercialization -- is the piece that the United States is currently missing. He characterized this as the "engineering side," and indicated that intellectual property development is currently moving offshore. He explained that the Koreans, Japanese and Taiwanese now fear the Chinese who are training engineers to transition intellectual property into products.

The educational issue goes deeper than just engineering and intellectual property conversion, and affects the technical workforce as well. The Commonwealth needs a formal sub-B.S. education program that includes K through 12, community college programs and technology school training. The lack of such a comprehensive education system deters foreign investment.

Penn State University (PSU) and the Pennsylvania Community College System (PCCS) developed such a program that combines their expertise to train a nanotechnology-skilled workforce. Students study for two years at a community college and two years at PSU before moving on to a Master's or Ph.D. program. The program consists of two large buildings filled with laboratories and equipment. They collaborated with the private sector, which provided the equipment for this program. PSU and PCCS needed the equipment and the companies need a trained workforce.

Another key issue is how to interest younger people in nanotechnology. Outreach initiatives such as demonstrating that nanotechnology is a legitimate and exciting career path, is the only way to being attracting younger people. Even if students are interested in nanotechnology at the K-12 level, they will not continue at the community college and undergraduate level if the incentives are not apparent to them. Dr. Varshney from the National Science Foundation (NSF) explained that NSF has a program that places high school teachers in a nanotechnology center for three months during the summer for training; they incorporate what they learned in their class teachings during the school year. Members of the Committee suggested that the Commonwealth needs to tap into those funds. NSF currently offers about $40 million to promote K-12 teaching in nanotechnology and other sciences. For such programs to be successful, however, the education system must emphasize higher math and sciences at a young age.

One member reminded the Committee that kids used to learn about science by fixing cars and farm equipment. With this method quickly declining, another one needs to replace it. In addition to showing kids a career path, an opportunity for hands-on experience must exist. Given the cost of advanced education, they must also have the ability to work and gain experience while working toward a degree.

Other members noted that while education is important, it presents a "chicken and egg" issue. Students must see that jobs exist to encourage them to study in this area; however, businesses want to see an educated workforce in a locale before they will locate there. Seed money could be one way to solve this problem. There are generally two approaches to this problem -- a top down approach that would involve bringing in big companies, and a bottom up approach, focusing more on encouraging small start-up companies. Luna Industries in Danville created a business model around using research and intellectual property from universities, and building a facility around that need. For this model to be successful, policy and tax incentives must be in place. In that case, federal, state, and local government as well as the universities worked together.

One member suggested a way to train people without having the necessary industry in place by training people in industries with like technologies. The Commonwealth could use this trained

workforce to attract nanotechnology-based businesses. Once businesses establish themselves in the Commonwealth, these trained workers easily could migrate to those businesses.

The Committee concluded by discussing the wide range of possible actions that could encourage nanotechnology development, ranging from seed money and tax incentives to educational and technology transfer efforts. While the Committee made no formal recommendations, there was general consensus that discussion in this area must continue. The Committee was generally in favor of having a more permanent group to foster communication and the exchange of ideas.