

Submitted Testimony of Kent A. Murphy, Ph. D.

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**To the United States Senate Committee on Commerce, Science, and
Transportation**

**Regarding S. 189, the 21st Century Nanotechnology Research and
Development Act**

May 1, 2003

Mr. Chairman, and Members of the Committee, thank you for the opportunity to testify today regarding the 21st Century Nanotechnology Research and Development Act. I am the Founder and CEO of Luna Innovations, a research and development company located in Blacksburg, Virginia. I also serve on Governor Warner's Virginia Research and Technology Advisory Commission.

Luna Innovations is an industrial leader in the area of nanotechnology, and technology transfer. I would like to recognize the support of the Virginia congressional delegation, especially Senator Allen, the Commonwealth of Virginia, the Advanced Technology Program at NIST, and Small Business Innovative Research (SBIR) programs from multiple agencies for helping Luna to achieve the level of success we have in our rural location in southwestern Virginia. It is these agencies that will benefit greatly from this legislation, giving them the ability to propel our country's leading researchers in nanomaterial-related science and applications to great discoveries.

There are two major points I hope to make clear today, 1) the importance of our investments in university and government labs and moving their ideas into the commercial sector, and 2) the importance nanotechnology will play in our future.

Future economic growth around the globe will be led by collaborative research, development and commercialization efforts across university, government labs and industry both large and small. Investment in university and government research labs has placed the United States in a global leadership position in science and technology. We must recognize the importance of these strategic alliances and maximize the enormous investments made in our university and government labs by bringing their intellectual properties to the marketplace in the most efficient way possible. The Bayh-Dole Act has been a great start, and the work to facilitate technology transfer must continue to improve to utilize one of the greatest assets of our country.

Every facet of human life will be touched by advances in nanomaterial development. These areas include medical, homeland security, power generation and distribution, telecommunications, transportation and applications never before conceived. To realize this potential, this country must improve the transfer of technology from our universities and federal laboratories to the commercial world. Our internal threat is not transferring great discoveries made in the U.S. from the laboratory to commercial products. These discoveries are far too important to leave on the shelf. And, we must do it now to protect our competitive advantage from external threats, as other countries continue to make even larger investments in nanotechnology.

Luna strongly believes this proposed legislation will help secure the country's position as a leader in the nanotechnology field. By funding basic research, and technology transfer programs we will move the results of our nation's greatest researchers in nanotechnology to the market place creating higher quality jobs here in the U.S.

While there may be revolutionary discoveries in the nanomaterial world, it is most likely to be evolutionary progress that requires extensive collaborative efforts working over

extended periods of time to truly utilize the capabilities of nanotechnology to address the problems of the world.

Nanotechnology is not any specific technology or discipline; instead it is a broad term used to define work conducted on the nanometer scale. True breakthroughs are often accidental discoveries while the majority of progress towards problem solving is incremental work done in a collaborative effort across many different fields of expertise. Try to imagine the different areas of scientific and business expertise that will be required to bring the following products from laboratory to consumer in a timely fashion:

Health

- Radio-pharmaceuticals which allow never before seen cell targeting giving “magic bullets” for cancer therapy,
- Less toxic photo-therapy agents for advanced cancer treatment,
- Contrast media for greatly enhanced diagnostic imaging,
- Super sensitive detection systems for drug discovery tools, reducing time to market and costs of drugs,

Homeland Defense

- Nanotube-based sensing devices allowing single molecule/cell detection of chemical/biological warfare agents,
- Lightweight, durable protective materials for soldiers, and military vehicles,

Power Generation and Distribution

- Next-generation fuel cells with improved efficiencies for household, and handheld devices use,
- Solar cell improvements with increased efficiency,

Communication and Computing

- Quantum computing for future generation systems that calculate on a never-realized-scale for defense systems,
- Molecular electronics for next-generation computing; single molecule transistors and storage devices,
- Optical devices using nano-structured materials for higher rate communications,

Transportation

- Superconducting compounds for higher strength magnets for transportation and medical imaging,
- Fuel cell improvements and safe hydrogen storage for automobiles,
- Catalysts for higher- efficiency, cleaner-burning, fossil-fueled engines, and

Other Applications

- Exotic teflon-like nanomaterials which provide a new class of lubricants for today’s applications and tomorrow’s nano and micro machinery.

Luna Innovations has recognized the enormous value of discoveries made at our research institutions and is continually improving the technology transfer process to move these innovative ideas from the laboratory setting to the marketplace. Through this business model, Luna has licensed valuable patents from universities, government labs and large industries and has created competitive products in telecommunication, power generation and distribution, transportation, manufacturing, and pharmaceutical industries. Luna currently has a significant focus on several nanomaterial-related technologies and applications. For example, Luna has licensed patents and transferred intellectual property from a major discovery made by Dr.'s Dorn and Stevenson both at Virginia Tech, and are beginning to produce revenues from sales of these novel nanomaterials.

Virginia is a leader in this country in collaborative nanotechnology research and development. Virginia is one of the first states to establish a state-wide technology organization, the Center for Innovative Technology (CIT), focusing on the support of collaborative efforts and the creation of high-tech jobs. Also, Virginia was the first state to create the position of Secretary of Technology directly reporting to the Governor in order to enhance the climate for technology within the Commonwealth. Other Virginia organizations, such as INanoVA and VRTAC, complement this infrastructure allowing nanotechnology-specific communication to the upper levels of the state government.

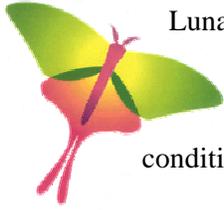
The federal government must take the leadership role in funding nanotechnology research and the coordination of technology transfer for our nation. The creation of a National Nanotechnology Coordinating office and National Nanotechnology Advisory Panel, under the proposed legislation, will facilitate collaboration between federal and state government agencies, research universities and industry.

The 21st Century Nanotechnology Research and Development Act, with new vision and leadership, will ensure the U.S. a leading position for growth in the nanotechnology sector, thus creating high quality jobs, increasing the tax base, while solving significant problems in our society. It will allow us to not loose ground to foreign competition seeking to overtake our current advantage. The economic success of our nation is at stake. We must remain in the leadership position. This legislation is necessary for the United States, to ensure our future health, well being and safety in this rapidly advancing global economy.

Again, I would like to thank Senator Allen and the Committee for this opportunity to address you today.

LUNA - *ideas taking flight*

Luna Innovations' mission is to identify market opportunities, develop new technologies and provide the launch pad to fully develop their commercial potential.



Luna Innovations is an employee-owned company that is driving innovative technologies through the development cycle to fully-functioning, independent spin-off companies in biotechnology, nanomaterials, telecommunications and instrumentation, process control and condition-based maintenance as well as other key future technologies.

Drawing upon a strong team of over 120 scientists, business professionals and engineers from diverse technical backgrounds, Luna has built a unique set of core capabilities and a diverse array of technologies. Posting over a decade of consecutive annual growth, Luna Innovations actively transitions basic research and development into cost-effective products for industry, defense, communities and the environment. Luna's commitment to commercialization runs deep, raising more than \$50 million in non-government funds to bring a variety of products to market in the areas of fiber optic sensors, integrated systems and advanced materials. In the past year alone, Luna has generated \$6 of private sector funding for every \$1 of government funding.

With the aid of many successful SBIR programs, Luna has been able to spin out five companies since 1999.

- ◆ **Luna Technologies** focusing on instrumentation and fiber-optic measurement devices. Its revolutionary new product, the Optical Vector Analyzer provides several advances in optical component measurement allowing suppliers to increase production and improve component characterization.
- ◆ **Luna Analytics** is initially targeting instrumentation for the proteomics field-- the study of protein location, interaction, structure and function. This new company is developing and marketing bioanalysis instruments that will revolutionize the way protein interactions are assessed, ultimately leading to disease diagnostics, treatment and drug discovery.
- ◆ **Luna nanoMaterials** is a pioneer in the new field of nanotechnology-- the manipulation of individual atoms and molecules. Its top priority is making nano Trimetaspheres, hollow molecules of carbon atoms that enclose various metal and rare earth elements. Nano Trimetaspheres can be used to improve communications devices, produce electricity, increase the sensitivity of MRI scans, and simultaneously identify and attach individual cancer cells.
- ◆ **Luna Energy** is focusing on development and commercialization of sensors for the oil and gas industry. Among the first products to be offered by Luna Energy will be an "intelligent well monitoring system," a combination of optical pressure and temperature sensors for downhole deepwell monitoring. This initial device will provide a real-time field management tool to enhance production and safety while lowering costs.
- ◆ **Luna iMonitoring** is focusing on enhancing enterprise efficiency through remote real-time/near real-time data monitoring via the Internet. The product family is targeted to a variety of markets using advanced sensor technology including fiber optics integrated with wireless communications.

Luna Innovations was presented the prestigious Tibbetts award during a ceremony in Washington, D.C. on October 3, 2003. These national awards are presented annually by the U. S. Small Business Association to small businesses working in research and development to recognize them as "models of excellence" in high technology. The Tibbetts award winners are selected based on the economic impact of the technological innovation, overall business achievement and demonstration of effective collaborations, among other accomplishments. Last year alone, Luna Innovations generate as much federal tax revenue as dollars awarded for SBIR contracts. This created 44 additional jobs --proof that the SBIR program coupled with Luna's business model is working.