

Statement for **Senate Committee on Commerce, Science, and Transportation**

February 15, 2006

Professor Timothy M. Swager
Institute for Soldier Nanotechnologies
Massachusetts Institute of Technology
Cambridge, MA 02139
Tel: 617-253-4423
e-mail: tswager@mit.edu

(Slide 1)

The Institute for Soldier Nanotechnologies (ISN) is dedicated to the development of nano-enabled technologies to protect dismounted soldiers. The ISN mission is to increase capabilities while simultaneously decreasing the weight soldiers must carry. Present day soldiers, like the one shown in this picture from Iraq, often carry in excess of 100 pounds of equipment, which reduces their effectiveness and survivability in the field.

(Slide 2-3)

Our vision is to design from the ground up a new battlesuit with a number of integrated systems that activate automatically on-demand, much in the same way as airbags deploy in automobiles. It will include sensing subsystems to detect chemical and biological threats as well as perform physiological monitoring. It will further provide mechanical performance enhancements, integrated power, and informational systems.

(Slide 4)

Nanotechnology will help us to integrate these many functions into the uniform. One materials platform we envision is the fabric of the uniform itself wherein a diversity of functional nanocoatings will be developed which provide massive new capability to the soldier with an insignificant increase in weight. The ISN has over 30 active research projects, but today I will focus on two examples of new sensory systems for enhanced situational awareness.

(Slide 5)

New nanostructured optical fibers have been developed to detect specific kinds of light such as that coming from targeting lasers. These fibers are produced by a drawing process and contain metal electrodes interfaced with semiconductors. When illuminated with light, electrical currents are generated between the electrodes.

(Slide 6)

The optical fibers display selective responses to different colors of light due to a photonic coating. Grids of fibers can be used to determine the point of illumination, and extensions of this technology will eventually be able to tell a soldier the direction from which the light originated.

(Slide 7)

We have also developed networks of photonic molecular wires for the detection of explosives. These materials are electronic plastics that absorb and emit light and have a high sensitivity to explosives like TNT. These materials have the unusual ability to self-amplify their own sensory responses due the transport of energy packets throughout the network. This process behaves similarly to a string of holiday lights wherein only one light need be broken to cause the entire system to become dark. In a similar way one molecule of TNT can provide a massively amplified response.

(Slide 8)

To transition our technologies to the military, the ISN works with partner companies, both large and small, distributed throughout the United States. MIT has licensed our explosives detection technology to Nomadics, a small company based in Oklahoma, which has developed ultra-sensitive explosive detectors. I am a paid consultant of Nomadics and actively assist them in extending this technology.

(Slide 9)

The Nomadics sensor, known as FidoTM, detects vapors of explosives as they pass through a capillary containing a nanocoating of our electronic plastic. These systems can detect explosive vapors at distances more than 2 meters away from the source. Only trained dogs are capable of similar detection limits, and hence Fido represents an important new capability for our soldiers.

(Slide 10)

Fido sensors have been fielded in Iraq both as hand held systems and on robotic platforms. I show here Fido mounted on a PackBot, which is a robotic platform developed by iRobot. As shown in the photograph, this integrated system can be used at checkpoints for vehicle interrogation at safe distances. It can also be used for investigating potential roadside bombs and identifying individuals who have recently handled explosives. The feedback from soldiers has been very promising.