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**“THE FUTURE OF IDEAS”**

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1:30 PM**

Thank you very much, Tony [Tether, DARPA Director], for that kind introduction. I really appreciate the invitation to speak here today, and I'm not just saying that because it's such a clever way to start a speech.

I truly mean it, because you are the people who are the driving force behind our Nation's technological dominance. And it is you who are the inventors, the creators and the visionaries of our technological future.

Therefore, I believe that you are the right people with whom I need to instill both my optimism and my concern for the future of technology in America.

Throughout my four decades in the military and in industry, and now in government, I have seen the power of ideas. There is no doubt in my mind that America has the brain power, the talent and the drive to generate the next great idea for our warfighters.

What we don't have is a growing pool of scientists and engineers to draw from. And without a growing pool of talent from which competition and inspiration can be drawn, other nations are beginning to overtake us.

Dr. Shirley Jackson, President of Rensselaer Polytechnic Institute, very aptly described what we are facing in the science and technology fields. She called it "The Perfect Storm."

Referring to the private sector, she pointed out that America's need for scientific and engineering talent is increasing, while our current workforce is retiring and the workforce on the horizon is not adequate to take its place.

In the public sector – particularly after 9-11 – we can add to that, the fact that we need American citizens who can obtain security clearances by passing background investigations.

Just last month [July 25 issue] Fortune Magazine reported that, "China will produce about 3.3 million college graduates this year, India 3.1 million – all of them English-speaking, by the way – and the U.S. just 1.3 million. In engineering, China's graduates will number over 600,000, India's 350,000, America's only about 70,000."

But we don't even have to look into the future to see a lack of scientists and engineers. We already are having trouble filling positions. According to an NDIA survey, nine percent (9%) of the openings in industry – openings that are already funded by the federal government – are unfilled because they can't find qualified people who also can make it through the clearance process.

This is of particular concern to our Department because we hire almost half of all federal scientists and engineers outright, as well as being responsible for many of the private sector jobs in science and technology.

Having unfilled positions is unacceptable. We must reverse this trend if America is to retain its technology lead. Science and technology is what keeps our Nation's innovative spirit alive. It keeps America competitive in the world – politically, militarily and economically.

It is an investment in our future. And it is an investment we cannot afford to put off until tomorrow.

What makes this “perfect storm” particularly tragic in America is that, throughout our history, we have been a beacon to the world in science and technology. Our Nation was built on innovation, creativity and competition by an impressive lineage of scientists and technology experts – from Thomas Edison who patented more than 1,000 inventions, to our astronauts who bravely launched into space just a few weeks ago.

But it's not only the ideas these scientists and engineers created, it's also their spirit of innovation that we need. These great thinkers were not only willing to think outside the box, but they also were willing to risk failure to test their ideas.

Thomas Edison, for example, tested more than 6,000 materials for the light bulb filament, meaning at least 5,999 were failures. And the recent shuttle astronauts chose to be on the first launch since the disaster two years ago that killed everyone on board.

I know the great thinkers and innovators are out there, and I know that we can find them, if we just look hard enough. In fact, I am sure many of you in the audience today have just the ideas we need. My question for you all is: How do we find those of you with great ideas, and then nurture those ideas until they are workable?

I believe the answer begins with finding ways to recruit these creative, talented people. But it doesn't end there. We also need to keep them.

And to do that, we must have a plan in place to train them, and we must create an environment of trust, where their imaginations can thrive. Then, of course, we must provide them with the proper incentives to perform.

On top of that, frankly, we need our fellow Americans to identify science and engineering as fascinating areas of endeavor with rewarding futures. We need the next generations' talent and energy to re-invigorate our laboratories, and our civilian workforce, so that we can be in the forefront of technology for the next century.

What we in the federal government have to offer – and I feel especially strongly about the Department of Defense – are satisfying jobs with a uniquely important meaning and purpose.

Generally, I find that removing barriers to education and advancement, more than just dangling money in front of the candidates, is the best way to attract qualified science and engineering candidates.

As we all know, anyone can compete on price, and you ultimately don't win that way. Don't get me wrong, I know that money is important. But more than that, we need to show the bright, young talented students in our colleges and universities – and even as early as middle school – that working for us can change the world.

To that end, we must throw open our doors to everyone interested in science, technology, and foreign language. We must be creative in our approach and find ways to recruit the under-represented groups of women and minorities – because if we don't tap into every single pool of talent, then our future will surely dry up.

But I know those of you attending DARPA Tech wouldn't be here if you weren't already fascinated by the awe-inspiring potential of math, science and engineering. So, let me give you four areas in which the U.S. Department of Defense is in desperate need of ideas.

First, how do we fight a civilian enemy?

We've all heard of Improvised Explosive Devices, or IEDs. And we have a special team of experts addressing this issue, but this is today's tactical problem. The people in this room need to help us start thinking about the strategic problem. In other words: What is the next threat? We need to start now to brainstorm ways to address what comes next, and then what will come after that. I would prefer that we were at least two and three generations ahead of our opponents.

IEDs are just one tactic emanating from the fact that we are fighting an unidentifiable enemy. And that strategic issue is the real issue. What we need from you here at DARPA Tech is to help us figure out what will come next, and how do we combat the core problem, which is tagging, tracking and locating the combatants.

We need more than solutions to today's problem of suicide bombers. What we need is help with whatever the enemy comes up with next – not just answers to today's warfight, but answers that will help us with tomorrow's warfight as well.

Second, let me tell you that the field of logistics is wide open.

It's one thing to put the logistics people in the warfight. It's another to show up in time with a well-placed water bottle or gas can. The issue here is that we do not want to give the enemy a high value target, such as our troops' total month's water or energy supply.

In addition, our warfighters need to keep their footprint small. Therefore, they must carry as little as possible, and leave as little behind as possible. To do that, logisticians need to figure out how to track troop movements and develop a way to deliver along the route. Not to mention that we need to create products that last longer, and have the least amount of waste.

In other words, I need trucks that don't rust. I need fuel efficient generators. I need fork lifts and conveyer belts that get my supplies off the boats, trucks and planes, and into the field and the warfighter's hands much more quickly. Basically, I need faster, more efficient, more creative solutions to my logistical problems.

We also are delving into Radio Frequency Identification, or RFID, to help us monitor the flow of supplies. We are using both active and passive forms of RFID, and are really opening the market for them both. We are busily looking for inventive data solutions to extend this technology beyond its current spectrum.

This is high tech, pushing the state of the art, and the market is broad. This is a key building block for the Department's Knowledge-Based Logistics.

A third area where we need help is in the area of biological threat countermeasures. While the U.S. military has not been subjected to a biological attack to date, it is indeed an area where we cannot afford to be unprepared, as in the case of the letters laced with Anthrax and Ricin that arrived on Capitol Hill.

Bio-terrorism is a relatively inexpensive form of terrorism, and one that is harder to deter or detect than chemical or nuclear weapons development. The ability to protect, warn, identify and de-contaminate quickly and easily is a significant vulnerability.

So, I need your help to find ways to quickly identify and respond to a bio-terrorist event. I need medical counter-measures which can prevent known pathogens or bio-engineered threats from harming our people. And I need the infrastructure to respond to this vulnerability.

Therefore, I would like to hear your ideas on how to keep our warfighters, installations, civilian workforce and families as safe as possible from the effects of a biological attack.

I would like to have a cell-level, multi-valent prophylactic that would reject incoming bio agents. If I can say it, then someone should develop it.

We know this type of protection exists, because we've seen it in some strains of bacteria that have developed enzymes, or special bio-chemicals, which repel or kill other competing bacteria in the surrounding area.

In addition, a small Nebraska firm has patented a breed of non-biotech corn that the company says is resistant to pollination from the biotech pollen that often drifts from neighboring fields.

What lessons can we learn from these examples to help human beings?

Let's go back a step, and see if we can't stop the pathogen before it reaches our warfighters and our citizens. Let's also look at ways to develop surfaces or fabrics so

that the pathogen used by the terrorist is detected or identified or neutralized on contact – and preferably all three.

And in what way can we, or should we, incorporate genetic and biotechnology advances into our countermeasure development to counter multiple threats simultaneously, instead of pursuing a different vaccine for each of the threats?

I think we should, and I challenge the scientific community to find a way to do that.

Now, the fourth area where we need help is finding ways to use technology to combat, confuse, deter and defeat our enemies.

The Department is investing a lot of capital in knowledge enablement. We are developing Knowledge Enabled Warfare, Knowledge Enabled Logistics, and Knowledge Enabled Business Processes.

This change is making the issues we've long faced with things like Internet security, that much more important. We need our best and brightest tech people to help us Internet security. It just astounds me that this is a system that can survive a nuclear attack, but can be brought down by a lone hacker.

I think the next frontier is in stable software development. We also need to explore the idea of building in security as a part of our technology architecture, not as an application to upload later.

And as our technology becomes faster and more people around the world use it and rely on it, we also need to find ways to address the growing problems with encryption and decryption of information.

We currently have encryptors that read information at one gigabyte per second, and we will soon have encryptors that read at 10 gigabytes per second. However, I don't see the encryptors on the horizon that can keep up with the newer speeds of transmission, such as with fiber optics.

And as the information becomes decrypted, we need intelligent agents that can keep up with the amount of information that is available to us. Today, the Department receives volumes of information, information that may help us catch or track terrorists. However, the problem is our ability to turn it into usable, searchable information.

In other words, our bottleneck is not in the gathering of information, but in the speed in which we can use that information. That is where you all come in. We need you to move the Department to the next level.

These are just a few of the areas that I know the Department needs help. And I would also like to point out that the answers to these problems would have far less

technology transfer issues than, say, radar systems. And that means more markets for your products and services outside of the U.S. military.

I ask that you take back to your companies and your agencies these challenges that I've set forth.

Let me reiterate where we at the Department of Defense need your help – we need you to, first, find ways to fight a civilian enemy; second, attack our logistical problems; third, protect our warfighters and our installations against bio-terrorism; and fourth, find new ways to use technology to combat, confuse, deter and defeat our enemies.

As we move forward, the Department needs your help to develop the next generation – no the next two generations, if not more – of scientists and engineers. But not just any scientists and engineers – we need creative thinkers and risk takers...people not afraid to try something new and not afraid to fail.

You all can contribute to encouraging the young people of today to explore the captivating realm of science and engineering through speaking engagements, personal mentorship, or in support of educational programs.

The Department is doing what it can to encourage new talent. I am proud to say that we recently launched a pilot program to provide support to undergraduates and graduates who study defense-critical science and engineering disciplines and commit to work for the DoD. The program is called Science, Mathematics and Research for Transformation, also known as SMART.

We also have reprised the National Defense Education Act of 1958, calling it, with some originality, the National Defense Education Act of 2006. I have met with some very senior talent who currently work in our Labs and our Industry, and what was surprising to me is how many were drawn to this work by the National Defense Education Act of 1958.

However, it is this talent pool that is now ready to retire, in fact many have. But without a doubt, sparked by the shock of Sputnik, these men and women took us to unimaginable heights of achievement. I believe that if we can leave such a legacy from our service as well, it may be the spark that keeps America in the forefront of the world technology.

We believe this is needed to continue to attract bright people to our line of work. The fall-off in science and engineering students at the undergraduate and graduate level has been decried over the past several years.

Yet waiting until the college and university level to provide encouragement and opportunity to students, can be too late for some. So, we are going back even further – to middle school – to encourage students.

Through our Defense Department laboratories, we are sparking interest in engineering and science using the very innovative Northwestern University hands-on science modules. My hat's off to the labs!

I first was introduced to this program, called Materials World Modules, by the late Dr. John Hopps, who was a visionary in the education field. And today, Ray Pawlicki and his boss, Dr. Joe Lannon of Picatinny Arsenal are leaders in the effort to have DoD labs offer these modules to local schools.

I felt strongly enough about it that I induced my brother-in-law to try it. At the time he was a first-year teacher, having made a career change to teaching. He did not get the top tier students, but they all dove enthusiastically into his biology and science course. And, more importantly, they all passed the Standards of Learning Exam on the first try.

In addition to these educational opportunities, we are studying ways to develop the talent that we have worked so hard to recruit and educate. AT&L has hired a workforce coordinator specifically for science, math and engineering talent. Keith Thompson is personally responsible for helping to organize DoD's outreach efforts to produce more scientists and engineers to work for the Department of Defense or in the defense industry in general.

These are just a few examples of the support we at the Department are giving to those of you in the business of attracting, educating and retaining talent.

While I hope this information has been helpful, please don't let my suggestions limit your thinking. I honestly want you to free your imagination.

Two of my favorite creative approaches to idea generation are the Grand Challenge that DARPA is sponsoring. It is a brilliant idea, one that I hope to see expanded to other areas of thought.

And the other is a technique that Dr. Hopps used for people competing for grants. He used to throw out a math problem, and anyone wanting the grants had to solve it!

I would like to see more intellectual challenges such as these that are based on a prize – whether straight prize money, a grant competition, or even rights to technological developments. Because creative competition attracts creative people with creative solutions.

So, bring us your ideas...no matter how small, no matter how outrageous. And don't be afraid to be wrong. As the scientist Dr. Linus Pauling said, "The way to get good ideas is to get lots of ideas, and throw the bad ones away."

And, who knows, maybe that idea we throw out as "bad" today, will be exactly the answer we need to the questions we pose tomorrow.



Again, thank you for inviting me to speak here today. I hope my words inspire you to come back with ideas that will inspire me.

God bless each and every one of you, and may God continue to bless the United States of America.

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