Second Annual Karles Invitational Conference
Department of Defense Labs as Technology Incubators
Honorable Zachary J. Lemnios' Opening Keynote Speech
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Introduction: Dr. Jerome Karle and Dr. Isabella Karle

As I enter the Pentagon every morning, I pass the Oath of Office, the Preamble to the Constitution, the Declaration of Independence and..... the second floor exhibit honoring Department of Defense career civilian employees.

Dr. Jerome Karle and Dr. Isabella Karle are among those remarkable individuals that dedicated their careers to civil service and national security. The Department and the Nation have benefitted greatly from their research, and I am most honored to be speaking at their conference.

The rich history of Jerome and Isabella is a great American story of science, innovation, and service. They have combined 127 years of commitment to our nation that began with the Manhattan Project and resulted in the highest recognition for their research. In 1985 Jerome Karle received the Nobel Prize in chemistry for his work in X-ray diffraction which remained an important part of his research in the years to follow.

Isabella is a 1993 Bower Award Laureate and 1995 recipient of the National Medal of Science from President Clinton. She was a trailblazer in the field of physical chemistry and crystallography. Together, these remarkable individuals are the embodiment of American ingenuity.

As the Assistant Secretary of Defense for Research and Engineering it's my goal to create an environment across the Department that encourages future researchers like Jerome and Isabella to open new technology horizons and future capabilities for our nation. And, they must do this in a world where technology development is more global than ever before, the pace of development is rapid, and the threat of a technology surprise is growing.

Technology Development – Global and Rapid

We are witnessing an increase in the pace of technology development and innovation, fueled by increases in global R&D spending, global partnerships, and easier access to technical information.

Indeed, the science and technology world is flattening, on what seems to me a daily basis. America remains the world's largest single investor in research and development, spending approximately $427 Billion[1] last year. A large sum, but as a percentage of the world's overall investment in research and development it is decreasing with each passing year. Nations with strong GDP growth – think China, Russia, South Korea - are using their increased wealth to bolster investments in basic science, applied research, and advanced technology development. And, these investments are increasingly focused.

For example, the Chinese National Medium-to Long-Term Plan for the Development of Science and Technology (2005-2020), aims to make a China an "indigenous innovator" by 2020, and to do this they are investing in 16 goal-oriented basic research "megaprojects," one of which is quantum research.

In terms of the overall value of R&D investments, China ranks second only to the US, but they have clearly stated their ambition to reach for a leadership position. They now spend approximately 1.6%, of GDP, or a $200B, on R&D and intend to increase the investment to 2.5% of GDP by 2020. This means China would invest as much as $615 billion[2] if their GDP continues to grow along current trajectories.

Not only are we seeing an overall rise in global investment in research and development, the barriers that have traditionally limited access to advanced technology and limited the pace of technology development are eroding quickly.

Multi-national joint ventures, where scientists and engineers collaborate globally on research projects and technology moves across borders are the new norm for the commercial world. This is being driven by a shift in customer bases – increasingly, US firms are gaining a majority of their revenues from overseas operations; for example Texas Instruments draws 89 percent of its revenues from overseas operations and for Intel, it's 79 percent[3]. The Intel China Research Center (ICRC) in Beijing, specializing in microprocessor, communications, and systems technology is just one of many examples of industry-led collaborative research centers. [4]

[1] Battelle 2012 Global R&D Funding Forecast
[2] http://www.forbes.com/sites/kenrapoza/2011/05/26/by-2020-china-no-1-us-no-2/
[3] Financial Times; Global Shift in US Business Confounds Washington; 12 August 2012
[4] http://www3.intel.com/cd/corporate/icrc/apac/eng/170371.htm

Nations are supporting new strategies to spur tech development by creating "innovation centers". For example, Russia has built the Skolkovo Innovation Center which claims to have a partnership of 450 companies and a $210 billion USD investment.

The world we live in is now a place where the flow of information and technology across national borders is accelerating and providing states and non-state actors alike access to advanced technology and opportunities to develop new military capabilities.

Just a few short years ago Unmanned Aerial Vehicles, or UAVs, were expensive and used by only by a few states. Today, there are literally hundreds of UAV variants in use across a number of foreign armed forces, and even some non-state actors. The microelectronics revolution, which is foundational to these systems, has spread globally, spurred by the availability of leading edge components like multicore processors, advanced imagers and field programmable gate arrays.

Admiral Matt Klunder recognizes the significance of these global trends and that's why he's strengthened and increased resources for ONR Global. I applaud Matt's leadership, and we will all stand to benefit from it.

The Defense Laboratories – Innovation Incubators

Given this technology globalization, I see a critical role for the Service Research Laboratories, Development Centers, Warfare Centers and Warfighting Laboratories as innovation incubators and rapid transition paths for new capabilities.

The footprint of our lab enterprise is extensive, impressive, and the envy of nations around the world. The labs comprise approximately 60 facilities dispersed across 22 states with a total workforce of over 60,000 employees. Of these, 35,400 are degreed scientists and engineers, who conduct research leading to key technology demonstrations and annually publish thousands of reports and peer-reviewed technical papers. Among the data I review to assess the impact of this enterprise, several numbers caught my attention earlier this year.

In FY2009 (the last year for which I could find complete data), the Department's laboratory staff filed 800 invention disclosures, 650 patent applications, and were issued 470 patents and licenses for 58 new inventions.

The labs can lay claim to more than 6,400 patents, and generate approximately another 1.5 patents per day, on average, with a majority produced by the Navy and NRL.

The labs are also driving innovation at the system's level. For example, ONR's portfolio of projects in discovery, future naval capabilities, and disruptive capabilities ensure that *today's* S&T investments are properly aligned to the warfighters needs of *tomorrow*. A few examples come to mind.

The rail gun. Just this past February, Naval engineers successfully fired the first industry-built electromagnetic rail gun. This long-range weapon will give the Navy the capability to operate more effectively against surface, air and ground targets. And, we plan to leverage the Navy's great work in exploring how to use the railgun for a very low cost base protection against complex threats.

Unmanned Underwater Vehicles: Last month ONR transitioned the MK18 UUV system to the Fifth Fleet. These versatile and expeditionary systems will dramatically enhance Naval mine countermeasure (MCM) capabilities. And, ONR's research into large, long endurance UUVs will lead to innovative new capabilities to operate effectively in an increasingly contested domain. Work like this is directly aligned with the Department's new strategy.

Challenge for the Department Laboratories

This past January, the President released new strategic guidance for the Department. The strategy builds upon developing partnerships and global alliances and rebalances our global posture and presence. The Strategy sets a new path for the Joint Force of the future - a force that will be smaller, leaner, agile and flexible- a force that relies upon advanced technical capabilities for mission success.

The strategy directs a renewed focus in the Asia-Pacific Region, and this will drive an emphasis on new capabilities that will enable global operations where anti-access/area-denial capabilities are being employed. This requires new technical concepts and new operating principles for all domains – space, air, land, sea, undersea, and cyber.

The important question before us is … what role will the labs have in supporting the new strategy? I see the labs as having a central role, as innovation incubators

In a world where the pace of innovation is accelerating, both in technology development and in military capabilities, the Department needs it's laboratories as its A-Team to accelerate the transition of new concepts from basic and applied research into industry, and into new capabilities.

Only the labs can fill this role – they've done this in the past, but it is even more important, and needed, today. Let me explain why. Recently we visited 8 of the Department's major defense contractors to learn about their independent research and development, or IR&D, investments.

We discovered that the vast majority of their IR&D investments are focused on efforts to mature technology to the prototype stage. They are responding to a Department requirement that our acquisition programs must have technical concepts well matured at Milestone B. This requires demonstrated performance of the technology in a relevant environment. Since system development and engineering to reach this maturity is expensive, they have few resources left to invest in early stage research.

As a result, the laboratories are absolutely critical in providing the Department with new concepts from early stage research. The labs have robust connections to the best researchers in universities, federally funded research centers, and industry. They often bring these performers together in focused efforts. I see that happening here today by the amazing collection of talent being brought together to work in a very promising, and challenging area.

For example, not too far from here the NRL Autonomy Laboratory was recently opened as a state-of-the-art venue for warfighters and scientists to work together testing new technology and concepts in autonomy.

I see a similar model within the Air Force Propulsion Directorate where Laboratory Staff are working side by side with industry and academia on the Adaptive Versatile Engine Technologies Program, or "ADVENT," – to develop a new jet engine with far greater fuel efficiency and a much broader range of optimal operating conditions.

With the Department strategic pivot, the Service Laboratories have an opportunity to be a major force in developing the needed capabilities for the focus areas identified in the new strategy. They are uniquely suited to couple basic research concepts to early-use military applications, and indeed they are who the Department will rely upon.

This is a role the Service Laboratories have had in the past, but which some have forgotten, and one we now need to strengthen. Resources will be required to implement the new strategy, and the President and the Secretary are providing the resources.

Despite the challenging fiscal environment, the FY 2013 Department-wide S&T budget request of $11.9 billion maintains a strong S&T posture. The S&T budget request maintains Basic Research at $2.1 billion; funds DARPA at $2.8 billion to develop strategic concepts for the Department; funds Counter WMD S&T at $1.0 billion; and maintains S&T funding in each of the Military Departments at approximately $2.0 billion.

As we move to finishing the President's budget request for FY 2014, science and technology will remain an important and well-supported program element in the President's request.

Summary:

The Department is relying upon the labs and their performer base to serve as innovation incubators. The rapid pace of technology development is not showing any sign of abatement, in fact it's accelerating.

Access to advanced technology has never been easier, increasing the possibility of a technology surprise to our forces.

I believe the labs will play a pivotal role in reducing the risk of technology surprise. As innovation incubators it will be critical to rapidly test new concepts and set the path for technology superiority for the future. And by future, I don't mean 20 or 30 years out…We need new innovation models and a technology pipeline that refreshes in months, not decades. The Department has made considerable progress in responding to new realities of the operational environment and the strategic guidance of the Department.

With your help…this laboratory enterprise will continue to open new technology horizons and future capabilities our nation

As an American…I'm humbled by the remarkable work taking place in these halls and I have enormous respect for the great capabilities of our defense labs.

As an ASD…it is my pledge to you that I will continue my commitment to ensure that our laboratories are structured and supported to keep the United States the dominant global force in defense innovation.

Thank you.