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**"DOD Acquisition and Flexible Manufacturing"**

**Address of  
The Under Secretary of Defense for Acquisition and Technology  
Honorable Paul G. Kaminski**

**to the  
Government Microcircuit Applications Conference (GOMAC)  
Hyatt Orlando Hotel, Kissimmee, Florida**

**March 19, 1996**

It's a great pleasure to be with you and discuss some of my views on where I think the Department of Defense is headed to affordably modernize America's defenses for the coming century.

Predictions about where we're going remind me about the story of the late Supreme Court Justice Oliver Wendell Holmes, who once found himself on a train, but couldn't locate his ticket. . .

. . . While the conductor watched, smiling, the eighty-eight-year-old Justice Holmes searched through all of his pockets without success.

Of course, the conductor recognized the distinguished justice. . . So he said, "Mr. Holmes, don't worry. You don't need your ticket. You will probably find it when you get off the train and I'm sure the Pennsylvania Railroad will trust you to mail it back later."

The justice looked up at the conductor with some irritation and said, "Mr. dear man, that is not the problem at all. The problem is **not where my ticket is**. The problem is, **where am I going?**

Our frame of reference is changing. . . and like Justice Holmes -- it is sometimes difficult to know where one is going in a period of great change. I'll take a stab at that this morning.

**NATIONAL SECURITY ENVIRONMENT**

In the post-Cold War world, the United States no longer faces a single galvanizing threat such as the former Soviet Union. Instead, there is increased likelihood of our forces being committed to limited regional military actions--coalition operations--in which allies are important partners.

I would sum up our current national security environment in statistical terms by saying that the mean value of our single greatest threat is considerably reduced. But the irony of the situation is that the variance of the collective threat that we deal with, plan for, and must counter is up.

In addition, today's global economy allows, everyone, including our potential adversaries, to gain increasing access to the same commercial technology base. To the extent that commercial technology can enhance military capability, the military advantage will go to the nation who has the best cycle time to capture technologies that are commercially available; incorporate them in weapon systems; and field new operational capabilities first.

For these reasons, America is changing the way it fights. We are seeing a big shift in emphasis towards enhancing the performance of delivery platforms--ships, aircraft, and tanks--with off board information and highly lethal, extremely accurate weapons.

This shift is driven by to a large extent by the Department's access to leading edge semiconductor technologies at affordable costs. It is the reason why the conference theme of "flexible manufacturing" is an important and timely topic.

In this environment, the strategic focus of the defense acquisition and technology program remains on fielding superior operational capability and reducing weapon system life cycle costs.

We have maintained this focus since the Gulf War. As impressive as our military accomplishments were against Saddam Hussein, our forces are qualitatively superior today. We received an inkling of what combat will look like in the 21st century in our support of the NATO combat Operation DELIBERATE FORCE in Bosnia.

In DESERT STORM, only two percent of the weapons expended during the air war were precision guided munitions (PGMs). During the NATO combat Operation DELIBERATE FORCE in Bosnia, PGMs accounted for over 90 percent of the ordnance expended by U.S. forces. We have employed these weapons with great precision.

The bomb damage assessment (BDA) photographs in Bosnia bear no resemblance to BDA photos of past where the target, often undamaged, is surrounded by craters. The Bosnia BDA photos show one crater where the target used to be and virtually no collateral damage.

We are moving to a situation of one target, one weapon -- actually more than one, but less than two weapons per target in Operation DELIBERATE FORCE. This has been the promise for the past 20 years, now it is becoming a reality. Given one target

one weapon, commanders need to have Dominant Battlefield Awareness to know where all the targets are on the battlefield. Sensor systems like JSTARS and UAVs will figure prominently in providing an awareness of the battlefield. To close the loop, though, commanders will need C3 to achieve Dominant Battle Cycle Time—the ability to act before the enemy can react. In Bosnia, we are spending about \$80 million on an information-communications initiative to provide improved C3 to Operation JOINT ENDEAVOR.

## MICROELECTRONICS MARKETS

While we are implementing this revolution in military affairs, we are witnessing equally breathtaking changes in the industrial base supporting our weapon systems and new military capabilities. These changes are being increasingly driven by the commercial market—no where more evident than in the microelectronics industry.

For example, many of the so-called “horizon” technologies presented in this conference will become embedded in mainstream commercial technologies during the next decade.

The US semiconductor industry is well postured for this explosive market. Let me offer a few of the key statistics that lead me to this conclusion. . .

- The domestic semiconductor industry has regained a leading position in the world, with revenue growth over 40 percent this year--this on the heels of two years of sustained 30 percent annual growth.
- US merchant semiconductor companies increased world market shares for the third consecutive year to 42 percent.
- US semiconductor companies amassed revenues over \$40 billion in 1995.
- About 87 percent of US semiconductor production is being driven mainly by data processing and telecommunications applications--continued market strength is anticipated in these sectors.
- Capital expenditures are averaging about 20 percent of sales for the industry.

## DUAL USE STRATEGY

In aggregate terms, commercial industry surpassed the DOD in R&D spending back in 1965. The disparity between DOD and commercial sector investment in R&D has been growing wider ever since. This difference means that this nation's technological momentum is driven to a greater extent by commercial market forces.

In this environment, we have no choice but to move from separate industrial sectors for defense and commercial products to an integrated national industrial base. Leveraging commercial technological advances to create military advantage is critical to ensuring that our equipment remains affordable and the most advanced in the world.

The Department's dual use strategy remains one key to ensuring our military forces will have affordable access to the world's best technology.

The Department's dual use strategy consists of three pillars.

The first pillar is leveraging the commercial sector's base of research and technology to foster militarily useful technology. The second involves leveraging the commercial sector's low cost production capabilities by manufacturing commercial and military items on the same production lines. And the third pillar requires creating the incentives and management approaches inside the DoD necessary to facilitate using these dual use, "dual produced" items in military equipment.

One of the principal objectives of our acquisition reform program is to open the defense market to commercial companies and technology – not only the primes, but sub-tier suppliers as well. The Department's Single Process Initiative is significant in that it is aimed at changing existing contracts to address a very real problem in many of our contractor's facilities – the requirements that impose different processes to manufacture similar product lines.

For example, in just one factory, a defense contractor was forced to use eight different soldering specifications – five for the government and three for commercial clients purchasing similar types of products. This meant the workers had to be trained on all eight soldering and inspection techniques. It also meant that the contractor had to maintain eight different types of production documentation. This cost him more. In turn, he passed those costs on to us. That is fair, but it is expensive. It is expensive for the Department and the taxpayer.

With this single process initiative--starting on existing contracts--we will reduce the number of processes used. This will save dollars, give us a better product, and lead to a more competitive industry.

### **ROLE OF FLEXIBLE MANUFACTURING**

With regard to microelectronics, the Department has a fundamental need for rapid access to leading edge semi-conductor technology in scaleable volumes at affordable costs. Flexible manufacturing is a key approach.

Agile manufacturing approaches will allow the commercial manufacturing base to affordably support unique DoD requirements like the requirements for radiation hardened parts and the need for components qualified in military temperature/mechanical shock environments.

Flexible manufacturing can break volume/price dependence and help insure that the Department can support weapon systems over the long-term through greatly improved acquisition and logistics affordability as well as providing a sustainable path for future system upgrades.

### **G-I-U RESEARCH INITIATIVE**

Innovation is needed to bring the promise of flexible manufacturing and advanced microelectronics technologies into being. A long term focus will be needed as well. This is causing the Department to look at new basic research and exploratory development approaches.

In the U.S. today, universities are becoming the principal performers of long-term research. Industry and government are the major sponsors--with industry tending to become more near term oriented. Yet, the DoD and other government agencies have continuing mission-driven reasons to seek long-term research advantages in relevant technologies.

As such, the Department must find a way to fund and execute long term research and to leverage the strengths of government, industry, and the universities. The Department is sponsoring a new initiative. . . a "three-corner bank shot" . . . that calls for a three way partnership between the government, industry, and universities.

In this arrangement, funds are to be provided by both the government and industry for competitive awards to university centers. Government would insure that research remained long term in nature. Industry would insure that the research had promise for delivering research products that could be used by industry to enhance their objectives.

A modest test case is currently underway at the Defense Advanced Research Projects Agency in the area of advanced lithography. We are exploring others.

### **INDUSTRIAL CHANGE**

Advanced processing and telecommunications are driving changes in the industrial base that supports our defense forces and the larger commercial economy. I believe industry must continue to make a cultural change—already under way today—

by shifting from serial to integrated processes for product development and support. Integrated Product and Process Development (IPPD), also known as concurrent engineering, stresses cross-functional evaluations and a shared vision of the system.

Use of standard, relatively inexpensive computer equipment, virtual prototypes and simulations helps to bring together a shared vision of the system and provides a means for understanding the complex interactions among the configuration items in the system design.

The real power of a computer based modeling and simulation system lies in the connection and coordination between the tools and functional users. These systems leverage the national information infrastructure and provide a seamless environment for geographically distributed teams and a diverse set of functional users.

The bottom line is that integrated product and process development, backed up by a strong commitment to computer based modeling and simulation tools, can provide a dominant competitive edge in the commercial marketplace and a clear warfighting edge on the battlefield. It enables consideration and development of alternate paths for getting to market first and at a lower cost. In the process, quality is improved. Products are customized.

Let's look at two commercial examples. The first is Boeing's use of Computer Aided Three Dimensional Interactive Applications—CATIA software—for the development of the 777 aircraft. Boeing's management made the decision to change the culture of the company and invest \$100 million in a computer aided development capability. The bigger "investment" was in the total corporate commitment to this approach. . . there was no fall back approach in place.

As a result, there is no physical mock up for an aircraft with 85,000 components and over four million parts. The goal is to achieve the same number of manufacturing hours as the 767--for an aircraft with 57% greater empty weight--by reducing the number of design changes to at least one-half of that experienced on the 767. To date, Boeing is reporting a 93% reduction in the number of design changes.

My second example illustrates the point that computer assisted integrated product development is not just for large corporations. In this case, Kohler's Engine Division is a producer of small 5-25 horsepower 4-cycle lawn mower engines. This company is a small player in a big field. The business strategy is fairly straightforward--sell engines by offering superior performance and high reliability at a lower cost.

Kohler has been using state-of-the-art CAD/CAM tools to introduce new designs that are radically different from earlier versions—quite a departure from the evolutionary change approach traditionally practiced by this industry. At Kohler,

manufacturing cycle times have been cut by two years. Physical prototypes are no longer necessary. Kohler offers a 2-year warranty – the longest in the industry.

As a result, John Deere selected Kohler for its line of lawn mowers instead of the previous supplier – Kawasaki. Kohler's market share has continued to grow significantly over the past several years. My point is that the technologies for integrated product development, virtual prototypes, and modeling and simulation are widespread and available to smaller corporations. If correctly managed, transition costs should not present an insurmountable entry barrier to smaller, moderate sized corporations.

Another conclusion I draw from these two examples is that world class producers across both ends of the manufacturing spectrum – from 777 aircraft to 25 horsepower lawn mower engines – are being driven by market forces and are finding a way to reduce the cost of fielding increasingly complex systems.

### SUMMARY

In summary, two technologies--advanced processing and telecommunications--are increasing the capability of future military systems, causing us to develop system-of-systems architectures and providing us with the modeling and simulation tools needed to field increasingly complex systems at a more affordable cost on shortened acquisition cycle times.

In this environment, flexible manufacturing approaches are needed to insure the Department has rapid access to leading edge technologies in scaleable volumes at affordable costs.