US Defence Industrial Policy

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This article urges the US Government to take the lead in engineering a transformation of the US defence industrial base through a focus on net-centric systems-of-systems; insisting on materiel superiority *and* affordability; adequate funding of 'disruptive' innovations; competition on a 'best value' basis; capturing the benefits of globalization; up-skilling the government acquisition workforce; replacing the defence logistic system with a world class supply chain, and encouraging greater integration of civil and military industrial plants.

With the end of the Cold War, and the subsequent dramatic reductions in the US defence budget (for example, a reduction of 70 percent in the procurement account), it was obvious that a significant change was required in the structure of the US defence industrial base. Through both speeches and financial incentives (such as allowance for consolidation costs in overhead) firms were encouraged to consolidate—and they did so with a vengeance! What had been over 50 major firms at the beginning of the1990's, were down to only six large defence firms by the end of that decade. The consolidation was both horizontal (such as Boeing buying McDonald Douglass, and Raytheon acquiring Hughes) and vertical (such as Lockheed's acquiring G.E.'s Space Operations, and Northrop Grumman acquiring Westinghouse's defence systems). In most critical defence sectors, where there had previously been a significant number of suppliers—and thus a relatively free market in operation—there now were only two or three remaining (for example, in military ground vehicles the consolidation resulted in moving from 11 firms to only two). While competition could still be maintained, with only two firms in a sector (as had been the case, for many years, in jet engines, between General Electric and Pratt and Whitney), now, unlike in the past, the monopsony buyer (i.e. the government) could no longer take a hands-off position in market operations (as it could with many suppliers in each sector) it was now clear that the government had to play a significant role in maintaining even minimal competition—in both the horizontal, prime-contractor level and in the make-or-buy decisions of the prime contractor, in the vertical supplier area.

By the turn of the century, there was growing concern about the "health of the defence industry"—with a significantly-declining overall budget, reduced corporate profits, considerable excess capacity in the defence plants, a lack of capital investments by the firms, and a reluctance by scientists and engineers to move into, or remain in, the defence industry. Then came the terrorist events of 9/11—and everything changed! Suddenly, money was no longer the issue (in fact, many believed that the defence industry was living

in a "rich man's world", where the issue was simply how fast could you spend the money).

The government workforce—which had also consolidated dramatically during the post-Cold War drawdown—was prohibited, by Congress, from expanding to meet the increased budget dollars; so they found it much easier to simply go to the existing, major prime contractors with their money, and have them either spend it, or pass it on to their subcontractors. In fact, in the five years from 2001 to 2006 the amount of money awarded by the Department of Defense (DoD) to the prime contractors more than doubled—from US$144B to US$294B; and the size of individual contractor awards, in many cases, were exceeding the total defence expenditures of other nations around the world. (For example, the awards to Lockheed Martin in 2006 were US$26.6B). As would be expected, in this environment the costs of individual weapon systems rose dramatically (as had been the case during the Reagan build-up of the latter portions of the Cold War Era). For example, the cost of an aircraft carrier was growing from around US$5B each toward US$15B each—and that doesn't include the aircraft, or the 5,000 people on board. Yet, in spite of the mushrooming defence budgets, because of the extended war conditions in Afghanistan, and particularly, Iraq (which, in fact, has exceeded the duration of the conflict in World War II), combined with the high cost of manpower in the large, deployed forces, and the costs of maintenance and operation of the equipment (which was receiving eight to ten times more use than in peace time), the US was forced to go to the practice of annual budget "supplementals"—where US$100B, or so, was being added annually to the budget. to help pay for the "war costs". Naturally, in this environment, not only were the sales of the large defence firms skyrocketing, but also their profits were reaching record heights. Yet, there was growing concern, on the part of the government, that this money was not being used to invest in capital equipment, or research and development, but rather, to continue to buy-up the smaller firms (i.e. increasing vertical integration) and to reward the corporate executives with huge annual bonuses. And, as a result, there was increasing concern as to whether or not there was adequate competition taking place within this consolidated defence industrial structure—in order to provide the desired innovation and lower costs that competition could bring.

This leads us to the current state of the US defence industry, and to the need to project its future in a significantly different world. Essentially, while it was recognized, at the turn of the century, that the government needed to achieve a significant restructuring of its industry[1]—focused on the new world of information-based warfare (at that time referred to as the "revolution in military affairs")—the events following the attacks on 9/11, and the subsequent war in Iraq, resulted in putting off this needed "transformation"

[1] In fact, in early 2001, Secretary Rumsfeld announced the need for a major "transformation" of the DoD.

(of DoD and the supporting defence industrial base). Now, it is time to readdress that issue.

Essentially, the world of "security" has changed dramatically; requiring a more holistic view—from worldwide terrorism through pandemics, weapons proliferation, rogue nuclear states, energy dependence, insurgencies, cyber-warfare, and chemical/biological/radiological/nuclear warfare—with the "battlefield" not only elsewhere, but also domestic; and with the probability that future conflicts will combine these various elements. Yet, rather than a dramatic restructuring of the US defence industry (to meet this new, 21st Century environment) in the period since the end of the Cold War we have essentially seen a consolidation of the 20th Century Defence Industry; rather than a transformation to the 21st Century required structure.

The Future

In the United States, there is a growing realization that, in the next few years, things are going to have to change within the defence area (both on the demand and on the supply side). Perhaps, first and foremost, is the likelihood that the defence budget will no longer continue to grow, and will more likely see significant reductions (e.g. elimination of the large "supplementals").

There is also a growing recognition that the world outside the DoD is changing rather rapidly, and significantly. For example, technology change—in the information arena, the biological arena and the nano-technology arena—is not only going to have a profound impact on military operations, and on warfighting equipment for the future, but also will require a much more responsive defence industry; one that can keep up with these changes. In contrast to the current defence acquisition cycles of 15 to 20 *years,* the technology cycles will now be required to be measured in *months*). Additionally, advanced technology is spreading globally; and the US will no longer be the leader in many critical technology areas. Consistent with this, of course, is the fact that most commercial firms are now globalized; and that many, in both Congress and the Executive Branch, are still being pushed (by the defence industry and its labour force) to maintain a position of self-sufficiency—which, rather than helping either our security or our economic competitiveness, is actually harming us in both areas; as will be discussed below.

Perhaps one of the most significant factors driving changes in the requirements for the future defence industry is the fact that future needs are so much less predictable—as a result of the changed, and greatly-uncertain, security environment. This means that the industry must not only be rapidly responsive, but that it also must be very agile and resilient (again, characteristics which are not typical of the defence industry today). Finally, it is clear that the technologies and products coming from the defence industry

in the next few years need to be very different than in the past. Independent studies (for example, by the Defense Science Board)[2] have all identified areas requiring emphasis, for the 21st Century—such as: intelligence, unmanned systems, systems engineering, advanced information systems, etc. They do not list new ships, planes, and tanks as the highest priority. In fact, these "mission oriented," broad-area requirements move away from the "platform-centric" thinking of the past to much more "network-centric" thinking—in terms of integrated systems-of-systems (with large numbers of inexpensive, distributed, sensors and shooters; all interlinked with complex and secure command, control and communication systems).

Recognition of the need for this "transformation of the US defence industrial base" has been present for some time. In 1997 there was a study (by the Defense Science Board) of the growing concerns with regard to vertical integration of the industry; and a second study in 1999 on the need for recognition of the new, global environment, and for a dramatic change in US export controls and trade regulations.[3] Then, in 2003, there was a report issued by DoD on *Transforming the Defense Industrial Base: A Roadmap,*[4] which emphasized the need to think of the US defence industrial base in terms not of its traditional platforms and programs, but in terms of its "operational, effects-based sectors" (e.g. combat support, power projection, precision engagement, homeland and base protection, integrated battle-space). Finally, in recognition of the fact that, for the industrial base to truly change there needs to be a dramatic change in how the DoD does its weapons acquisition, there was a major study done of the defence acquisition process, by a group of outside experts commissioned by the DoD (known as the "Defense Acquisition Performance Analysis")[5]; and, most recently, there was a report (in response to a Congressional mandate) issued by the Office the of Secretary Defense, on *Defense Acquisition Transformation* (in February of 2007)[6] which recognized that even the budget process would have to change, in order to focus on broad mission areas—so funding could be done at the system-of-systems level, rather than at the individual platform and system level.

These are truly "cultural changes" in the way that the government does its business; and in the way the supporting industrial structure is organized. If implemented, such changes would result in the needed transformation. But they have not been implemented. The most obvious reason is the war in

[2] Defense Science Board, *Technology Vectors for the 21st Century*, Washington DC, Department of Defense, 2006.
[3] Defense Science Board, *Defense Science Board Report on Globalization and Security*, Washington DC, Department of Defense, 1999.
[4] *Transforming the Defense Industrial Base: A Roadmap*, Washington DC, Department of Defense, February 2003.
[5] *Defense Organization Performance Analysis (DAPA) Report*, Washington DC, 2006.
[6] Secretary of Defense, *Defense Acquisition Transformation Report to Congress,* Washington DC, Department of Defense, February 2007.

Iraq; and the need for DoD to, almost exclusively, focus on this. (Recall that when the new Secretary of Defense, Robert Gates, was appointed; he said that his three highest priorities were "Iraq, Iraq, and Iraq"). And, with the huge increase in the budget, to pay for these urgent needs, there was little emphasis on preparing for the future; or even in trying to control the costs and direction of the industry. Finally, again as would be expected, there was little "stomach" for change from the industry, the military, the Congress, or the unions. So with enormous political pressure to not change, and with adequate resources, there was no recognition of any urgency to begin the process of transformation. Today, there is growing recognition of the need for that change!

Many believe that the critical driving function for change will be the coming "fiscal crisis" in the United States. The rising costs of medical care, of social security, of debt servicing, of the weakening dollar, and of homeland security and DoD costs, are reaching a breaking point. Hard decisions are going to be required; and it is very likely that (as the polls show) when the American public is given the choice between, for example, universal health care and more money for defence, defence is likely to suffer. There is also growing recognition that the US is starting to "fall behind" in many critical technology areas, and that innovation must be stimulated—both in terms of support for small firms (which have historically been a source of much innovation); as well as in stimulating the next-generation US labour force to focus on science and engineering; and, through increased DoD investments in research and innovation, to make the field exciting and challenging (so that these new scientists and engineers will choose to come into the defence firms and into the DoD).

A 21st Century Defence Industry Structure

As we move from the "mature" 20th Century Defence Industrial Structure in the US to the new structure of the 21st Century, there are certain characteristics which stand out. Specifically:

1. It must satisfy the very broad range of mid-21st Century national security needs *within the resources available.*

2. In order to maintain the US's historic defence posture of "technological superiority", it must be *technology advanced,* (in the rapidly-changing world of software, hardware, and systems).

3. It must be *highly innovative* (in architectures, products, processes, and applications) with an appropriate focus on "game changers"; and prototype demonstrations of these "disruptive" approaches.[7]

[7] Joseph Bower and Clayton Christensen 'Disruptive Technologies: Catching the Wave', *Harvard Business Review* (January–February 1995).

4. In order to take full advantage of the technological advances that are rapidly taking place in the *commercial* world, and that are spreading *globally*, the barriers that now exist to civil/military integration, and to globalization of the defence sector, must be removed (while still, of course, recognizing that there are a few critical areas that need to be protected).

5. In order to be able to afford the quantity of equipment that will be required for adequate coverage of the wide range of potential future military scenarios (from the domestic to the world-wide) it is essential that the unit costs of the equipment be dramatically reduced. The current costs of single ships, planes, etc. are simply prohibitive (in order to get the quantities required in the future). Thus, *lower costs*, through both product and process designs, must be a firm military "requirement", for all future weapon systems, and systems-of-systems.

6. In order to achieve the innovation and low cost required, while still increasing the performance of each weapon system, it is essential that the industry be *highly competitive*, *at all levels*—thus, there must be at least two firms in every critical area—however they need not all be domestically based.

7. To meet the great uncertainties of the future national security environment, the industry must be *agile* and *highly responsive*; thereby, being capable of keeping up with the adversary's changes (which they can acquire rapidly off of the global-technology market).

8. Finally, in order to deal with the many forms of "vulnerability" that exist in today's environment (from physical and cyber attacks, through natural disasters, fires, strikes, to changing geopolitical environments) the industry must be extremely *resilient*.

Achieving these eight, desired industrial structure characteristics—which will truly represent a rather dramatic transformation from the current defence industrial structure—must begin by a clear recognition that, in this unique market structure (of a monopsony buyer and a few oligopoly suppliers, in each sector) transforming the industry to this new structure, and maintaining it in that form, must be the responsibility of the government. In fact, the industry will respond to what its customer asks for; and how it asks for it. Thus, for an industrial transformation to take place, the DoD must transform its business model; and, in doing this, it must have some "vision" of where it is trying to go.

Department of Defense Actions to Achieve Transformation

> *It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage, than the creation of a*

> *new system. For the initiator has the enmity of all who would profit by the preservation of the old institutions and merely lukewarm defenders in those who may do well under the new.*
>
> Niccolo Machiavelli, *The Prince*, 1513

Making change in government is extremely difficult—yet, to transform the defence industry it is necessary to transform the way the government does its business. Overcoming this resistance requires strong leadership, with a clear vision, and a leadership team that makes this transformation a high priority. Eight specific actions are required by the DoD to transform its business model; and, thus, its industrial base, in response. Obviously, each of these broad actions will require specific sub-actions for their achievement. Consider, then, what needs to be done in each of these eight, interrelated, areas of government action.

FOCUS ON NET-CENTRIC SYSTEMS-OF-SYSTEMS

In order to focus on net-centric systems-of-systems (rather than continue the current "platform-centric" approach) it is necessary to *shift resources* (from platforms) to provide adequate funding and top people in order to optimize the complex, system-of-systems—within available resources. This is actually a total change in outlook—which will affect the budget process, the requirements process, the acquisition process, and the organizations and management processes throughout the DoD. It will require that the government have a "systems architect/systems engineering manager" in all major areas, and that the government provide experienced, government program management and systems engineering oversight on the systems-of-systems design and evolution. This structure must be established early (in the proposal process) so that it is well understood by industry. A key element in this regard is the utilization of an *independent* "systems architecture/engineering" firm, that will optimize the system-of-systems; and will accept hardware and software exclusions, in order to avoid any potential conflicts of interests (with regard to the selection of their own systems, or subsystems, within the overall architecture).

When it comes to testing of any new equipment, it is essential that "interoperability" be a critical performance parameter, and that it be tested on a system-of-systems basis. (Recognizing that interoperability is not primarily a technical issue, it is a "governance issue"; and that the only way to instill it into the contractors' culture is to have them realize that their system will fail its operational testing if it doesn't meet the interoperability requirements).

Then, to assure that, as the system evolves, it will not be vulnerable to any unanticipated problems introduced by an adversary—using global technology in an asymmetric fashion—it will be necessary to establish small "red teams" (combining both government and industry personnel) that independently attempt to counter the system in non-traditional fashions.

Finally, because this new "culture", and focus on net-centric systems-of-systems, is incompatible with the current budget and program approaches of the DoD and the Congress (which are platform-oriented) it will be necessary to move to "mission capabilities portfolio management", with the focus on specific mission areas (e.g. battle- space awareness; joint command and control; etc.). This is the direction advocated by the DoD in the *Road Map for Transforming the Defense Industrial Base* (in the February 2003 version). However, for it to be effective, the other changes described above are necessary, i.e. an integrated, overall shift from "platforms" to "net-centricity."

ACHIEVE LOWER COSTS AND FASTER-TO-FIELD, WHILE STILL ACHIEVING BETTER PERFORMANCE

This is a paradigm shift, from the old model of thinking that "you must pay more in order to get more". Clearly, we have learned from the computer world that you can get higher and higher performance at lower and lower costs, if you apply modern product and process technologies toward this objective. It requires the acceptance of the fact that *we can have superiority and affordability simultaneously*.

Achieving this begins with a needed change to the weapons systems' "requirements" process. Cost and schedule must be part of a systems analysis effort that precedes a firm set of "requirements", (from the Joint Requirements Oversight Council). In this way, fixed unit cost, and "time-definite acquisitions", are equal partners with the "desired military performance"—as overall design challenges for the contractors. This technique has been used effectively in the past, on programs such as the Joint Direct Attack Munitions; but only rarely has it been attempted, and even more rarely has it been held to.

One way to achieve a better understanding of the performance required from a system is to utilize extensive "experimentation" up-front; with extensive user feed-back on the prototypes—which will then yield "firm requirements" for the development of the first "block" of the system. Then, all weapons' developments should utilize true "spiral development"—with a five year cycle for each block (from the time of commitment to system development, to its initial operational capability). This requires that each block of the system (beginning with block one) utilize only fully-proven technologies; but that research and development (R&D) is being funded, in parallel, for subsequent blocks. Thus, once the new technology is proven out, it can be phased in to the next block. It is important to note that, when properly implemented, such "spiral development" will not only get higher-performance equipment more rapidly into the field, but (on average) at a savings of approximately 30 percent—and with much lower risk.

Finally, it must be noted that there are some systems—particularly in war-time—that must rapidly respond to requirements that the Combatant Commanders turn up on the battlefield. These require responses in weeks

or months, not years. Today, this is done through a wide variety of *ad hoc* organizations, that are thrown together every time there is an emergency situation that requires a new piece of equipment (such as armouring the Humvees in Iraq). But there is no institutional memory to these organizations; and they constantly require approved deviations from the "standard" acquisition practices. To address this need—which is likely to grow in the environment of 21st Century security—the 2006 Defense Science Board Summer Study[8] recommended the creation of, and adequate funding for, a "Rapid Fielding Organization" (combining the current, *ad hoc* organizations and their US$3B annual funding).

FOCUS ON "STAYING AHEAD" BY ADEQUATELY FUNDING "ENGINES OF INNOVATION"

Over the last 60 years DoD has taken as its strategy for national security "maintaining technological superiority"; however, in spite of the large DoD budget increases since 9/11, the dollars going to research have declined. Additionally, with the rapid changes in technology taking place in the world today, no organization can afford to solely focus on "incremental change". Rather, they must also devote some of their resources to "disruptive" technologies that will result in "game changers" in the way military operations are conducted in the future. And, the resources devoted to this must be adequate to cover not only the research and analysis that goes into such non-traditional technologies and applications, but it must also provide adequate resources to prototype and demonstrate these new ideas—in order for them to gain acceptance. So, not only must the budget for basic research be increased; but, it is also suggested that, through the Office of the Director of Defense Research and Engineering, a significant amount of money (perhaps six percent of the total RDT&E budget, i.e. around US$4B per year) be set aside for "disruptive systems demonstrations."

As a complement to this, and to encourage the defence firms themselves to continue to do more innovation, DoD is now moving to reestablish an allowable overhead expense for company-initiated Independent Research and Development (IR&D). This prior practice had deteriorated, because of Congressional legislation that allowed a mixing of IR&D with Bid and Proposal expenses (B&P). This encouraged companies to devote all of their resources to trying to win the next proposal (through elaborate B&P efforts) and to ignore the longer term IR&D efforts. Returning to this separation of IR&D from B&P, and providing government visibility into the companies IR&D efforts, should stimulate the firms to focus on the importance of "staying ahead."

Additionally, steps are being considered, by both the Congress and the Executive Branch, to provide higher limits on the size, amount, and duration of DoD Small Business awards (particularly through the Small Business

[8] Defense Science Board, *Technology Vectors for the 21st Century.*

Innovative Research program).[9] This will encourage more small business firms to contribute to the innovation from DoD's Science and Technology program; and they are encouraged to include a product-cost/manufacturing orientation to their efforts.

Finally, the US is missing a very significant opportunity by not taking full advantage of the scientists and engineers who are not US citizens, for use in the security arena. When one considers that a third of all US Nobel Prizes have been won by people who were not originally US citizens; and that Silicone Valley was largely formed by people who had not been originally US citizens; and that current graduate schools in top US universities are heavily populated by non-US citizens in the science and technology area (over half of them) it is clear that we are missing a significant bet as visa restrictions, and other constraints (such as "deemed export control") continue to pile up, on the use of non-US citizens in the defence arena.

ACHIEVE FAR GREATER USE OF "BEST VALUE" COMPETITIONS

The empirical data overwhelmingly demonstrate that in a monopoly environment there is very little incentive for achieving either lower cost or higher performance. Thus, it is essential that DoD make far greater use of "best value" competitions (i.e. competitions not based on the lowest cost or the maximum performance, but on the combination of these variables).

The primary objective of such competition must be to achieve innovation; and, secondarily, costs savings—at both the prime and the critical lower-tier elements. It is not necessary to have two firms in production at all times, in order to maintain a competitive industry in every sector of the defence area. Rather, it is necessary to have at least two *design teams* in all critical areas, and to have each of them at least going through funded prototyping—so that they are addressing not only technical feasibility, but also affordability, producibility, and supportability. On the other hand, if the quantities are sufficient, then it makes sense to have continuous production competition (such as was held in "The Great Engine War", for the engines on the F-15 and F-16—where the presence of continuous production competition yielded higher performance and higher reliability, yet with significant cost reductions).

Competition should not be a firm requirement—beyond the competitive prototype phase, where it always should be utilized—rather, as long as the current producer is continuously improving performance and lowering costs, they should be rewarded by a continuation of their contract. However, it is essential that a credible option must always be present. An inexpensive way to maintain this option (and to encourage continuous innovation) is to fund a

[9] National Research Council, *The SBIR Program: A Reassessment*, Washington DC, National Academy Press, (Forthcoming) 2007.

second source for interchangeable, yet next generation, lower cost/higher performance prototypes (at either the system or subsystem level).

Finally, because historically the overwhelming share of the regulations and practices used in defence procurement were written in order to buy "things", and in view of the fact that today over 60 percent of the DoD acquisitions are for "services", it is essential that the DoD develop, and fully utilize, new regulations and practices that focus on procurement of "services" (particularly associated with professional services, and for "contractors on the battlefield").

UNDERSTAND AND REALIZE THE BENEFITS OF GLOBALIZATION

It is generally accepted that, for geopolitical reasons (perhaps even more than military reasons), future military operations are extremely-likely to be in a coalition environment. Thus, we must learn to share technologies and to train together, in order to be prepared for such events. The needs in this area are for "national sovereignty" and "military superiority"—not for autarchy (i.e. self-sufficiency). Buying from foreign sources, or co-developing systems with them, need not mean "vulnerability" (and, of course, each nation must take the necessary actions to assure that this is the case). Similarly, the extensive use of Commercial, Off-The-Shelf systems (COTS)—especially software—must be carefully tested to assure that it is secure (and further research is clearly required in this area, in pursuit of new tools and techniques). However, the main change required in this area is a dramatic set of changes in ITAR,[10] export controls, Berry Amendment, specialty metals clause, etc. to recognize the global defence market (again, with appropriate risk-based consideration of security and vulnerability concerns).

In general, there will be only a very few areas for which controls should be applied in this new, globalized world; and the DoD must aggressively, and actively, take the lead with State, Commerce, and Congress in this critically-important (but politically difficult) security area. The United States cannot afford to fall behind in the security area because of the "unintended consequences" of the laws that exist to "protect" US current technology. No matter what laws are passed, the US cannot prevent the globalization of technology and of industry. Rather, it must learn to gain the benefits of such globalization—for both the nation's security and its economy.

STRESS THE IMPORTANCE OF A HIGH-QUALITY, HIGH-SKILL GOVERNMENT ACQUISITION WORKFORCE

All of the changes—both in process and structure—will be largely ineffective unless the government also focuses on the importance of a high-quality, high-skill, government acquisition workforce. The combination of the dramatic reductions in the workforce in the post-Cold War period, along with the large retirement wave coming up (over 50 percent of the workforce being

[10] International Traffic in Arms Regulations.

eligible to retire within the next five years) make it essential that the DoD focus on acquiring, training, and developing the very "best and brightest" that they can—particularly, in the areas related to acquisition management (and, here, as with all other discussion of "acquisition", the term is treated in the broadest sense—including everything from the requirements process through finance, personnel, management, procurement, logistics, engineering, production, finance, etc.).

In order for the DoD to compete with industry for the "best and brightest" there will have to be some revisions to its salary policies. The current "pay for performance" initiatives are clearly in the right direction, but there must be further steps taken; for example increases in starting pay for engineers, in order to compete with industry. In addition, the DoD must develop, and implement, a personnel training and career development program for the government civilian workforce; one that is comparable to the military program (where funds, time, and additional positions, are allocated to provide for training and development). An added step that will be necessary—particular due to the retirement of the senior people within the DoD acquisition core—is to increase the rotation from industry to government (and visa-versa).

Additionally, for all those functions which are not inherently governmental (many of which are currently being done by either civilian or military government personnel) these should be subjected to "competitive sourcing"—between the public and private sectors. Whenever this has been done, on average, the costs have gone down by over 30 percent—no matter who wins (public or private sector)—while the performance has gone up significantly (since the "measurement" of performance now becomes an important consideration.)

TRANSFORM THE DOD LOGISTICS SYSTEM TO A MODERN, WORLD-CLASS, INFORMATION-BASED SUPPLY CHAIN

When he was Chief of Staff of the US Army, General Rick Shinseki stated "we cannot achieve a DoD transformation without a DoD logistics transformation". The current logistics system is not only the most expensive of the DoD acquisition processes (in 2005 it was budgeted for US$90B, but actually costs over US$126B—including the supplemental), but it is also the most critical for sustained war fighting—since it affects readiness, responsiveness, and (in the long run) the capability to carry on the fight. Yet, today, in spite of the fact that there are more people in the logistics area than there are in combat positions, and in spite of the huge inventory of over US$67B, and in spite of the annual expenditure for logistics of over US$100B, the current DoD logistics system is far from "world-class". In fact, world-class systems measure their response in hours, while the DoD (at best) measures it in weeks. Clearly, it has been improving. In fact, from the first Persian Gulf War, when the average response, from shelf to soldier, was 36 *days*—with a large uncertainty (so parts were ordered three times); the

average for the second Persian Gulf encounter moved down to 21 *days*—again with a large uncertainty. By contrast, world-class systems deliver domestically in 12 hours and internationally in 24 hours; with 99.99 percent probability. Additionally, world-class operations provide "total asset visibility", at all times; while the DoD is far from achieving that—particularly in the "last mile", to the war-fighter, who needs it most critically.

The data are overwhelming; if the DoD were to shift to Performance-Based Logistics (PBL), or warranties, on all its systems (legacy and new) it would significantly drive up the equipment availability while lowering the support costs dramatically. (For example, in three Navy programs, the material availability for the F-18 stores management system improved from 65 to 98 percent after PBL was introduced and the logistics response time was reduced from 42.6 days (average) to seven days world wide, and two days domestically. In the same way, for the auxiliary power unit the availability was improved from 65 to 90 percent and the logistics response time was reduced from 35 days to 6.5 days, utilizing PBL; and, finally, for the F-14 Lantirn System the material availability went from 73 to 90 percent, and the logistics response time from 56.9 days to five days, utilizing PBL—and, in all three cases, the costs were significantly reduced, including the cost of inventory). Obviously, if the results of utilizing PBL, or warranties, don't show a continuous performance improvement, at continuously reduced costs, then one should be prepared to compete the support work among other contractors.

Finally, in the logistics area the traditional DoD approach has been to spend all of the money that is annually allocated to simply perform the current logistics support work—leaving none available for improving the system. Therefore, it is strongly recommended that a new fund be established that would take a small share of the overall support budget (perhaps one percent, or around US$100M per year) and use it for research and development on "logistics transformation implementations." Since the commercial world has demonstrated that this is not a technological challenge, it is clear that this is simply another area where cultural change must be achieved through determined leadership.

SPECIFY AND ACHIEVE THE DESIRED 21ST CENTURY INDUSTRIAL STRUCTURE.

And last, while many of the above-noted changes can be done independently, it is essential for DoD—working closely with the Department of Homeland Security and with the new Director of National Intelligence (since all three of these organizations will be drawing on the same industrial base)—to have a clear "vision" of where the 21st Century Security Industrial Base needs to be; and to actively strive to achieve the needed transformation. It is clear that, in this unique environment, of a monopsony buyer and a small group of oligopoly suppliers, that the government has no

choice but to play a significant role in achieving the industrial structure that it desires.

Because the commercial world has moved so far ahead in not only technology but in production processes (e.g. “flexible manufacturing”), it is now possible to achieve the benefits of an integrated civil and military industrial organization (at the plant level); and thus gain the benefits of the continuous process improvements that the commercial world makes (in increasing performance and lowering costs) and also to gain the benefits of the economies–of-scale that are often present when the small volume of defence goods are mixed with the high-volume of commercial. However, there are significant regulatory and legislative barriers to such integration, that must be removed (for example, special, government-unique cost-accounting requirements, and/or specialized military specifications and unique government procurement regulations—often written for protectionist or socio-economic considerations, but not applicable to the commercial world).

Additionally, there are needed changes in DoD profit and overhead policies to encourage the structural shifts, the capital investments, the lower cost initiatives, and the incentives-for-entry by new and commercial firms. For example, in DoD profit policy, the regulation guidelines (as revised in 2000) allow added profit percentages for “increased efficiency” (specifically, in areas such as reduction or elimination of excess facilities, cost reduction initiatives, incorporation of commercial items and processes, and contractor investment in cost-reducing facilities). Another mechanism for industry to earn additional profit (which was also added in 2000) was the idea of using the category of “technology incentives” for cost reductions. Firms could receive significant added profit if their improvements resulted in reducing the costs, or improving the reliability, of either existing products or, with new products, of the products they replaced. (Recognizing that improved reliability reduces life-cycle costs). Unfortunately, these added profit incentives, for lower cost equipment, have not received significant attention; so the contracting personnel should be encouraged to make full use of them in the future.

In the same way, the government should be encouraged to create incentives for reduced vertical integration, by getting more involved in the prime contractors’ “make–or-buy” decisions. (In the case of the Future Combat System, the Program Manager has insisted on playing a significant role in the prime contractors’ make-or-buy process, thereby assuring that suppliers, other than the divisions of the prime contractor, have full access, and are fairly treated in the evaluation.) In future programs, the request-for-proposal should assure that the government will have access and visibility into such decision making.

In the same way that the government should encourage civil-military plant integration, the government needs to remove the barriers (e.g. cost accounting standards and other defence-unique requirements) to commercial firms supplying their technology and equipment to the DoD directly.

Additionally, a major barrier to the DoD achieving efficient and effective business operations is the fact that, today, it has over 4,700 different, independent, and non-interoperable business information systems. (In contrast to all world-class corporations that have an "integrated enterprise system", that not only ties together all of its own business systems, but also links directly to its customers and suppliers.) A new DoD organization (the Business Transformation Agency) has been created to address this need. It will be fiercely resisted, but it is essential!

To implement the new, DoD "integrated enterprise" system, they should work with the National Institute of Standards and Testing to establish interface standards (as contrasted to "common systems"); security procedures, protocols, etc. that would allow and require full, enterprise-wide (i.e. government and industry, at all tiers) network-centric industrial operations – fully utilizing COTS software. And this should be applied to all phases of the life cycle, so as to provide all of the needed information for management decision-making—again with the objectives of high performance at lower costs, and more rapid fielding.

Finally, at least every three years, the DoD should perform a detailed "sectoral analysis" of each critical sector of the defence industrial base. This analysis should focus on the ability to have R&D competition in each sector; the potential for civil and military integration; and the potential for establishment of a global market place in each area. Such analyses are not required when there are a large number of potential domestic suppliers for a critical technology (or even a large number of foreign suppliers, from multiple countries and multiple firms). But, in many critical defence sectors, where there are only two or three firms, such analyses by the government are absolutely essential—in order to maintain a highly-competitive, innovative, low-cost, advanced technology, industrial base—for the nation's long-term security.

In general, the problems of the needed defence industry transformation cannot be solved simply by moving organizational boxes around, and they certainly cannot be solved by increased regulation (which will undoubtedly slow down the acquisition process, and make it even more unique and inefficient). However, there is one organizational change that would be highly desirable, in view of the great emphasis being placed (by a number of the above-noted areas), on information technology—both within and among the weapon systems area (and, particularly, in the systems-of-systems arena), as well as internally (within the government and between the

government and its suppliers). Specifically, the Congress has legislated, in the Clinger-Cohen Bill, that there be a "Chief Information Officer" (CIO) in every agency, who reports directly to the Secretary of that agency. Thus, DoD has established an Assistant Secretary for Networks and Information Integration (NII), reporting directly to the Secretary. However, the Goldwater-Nichols Bill mandates that there be a "Single Acquisition Executive", responsible for all of an agency's acquisition activities; and, in DoD, this responsibility rests with the Undersecretary for Acquisition Technology and Logistics (USD (AT&L)). These two pieces of legislation, thus, are in conflict; and, while it can be worked out in a "cooperative fashion", between the two individuals, the critical importance of information technology, for both war fighting and business operations, would indicate that it would be highly desirable to declare the Acquisition Executive, i.e. the Undersecretary, to be also the CIO. Then, not only would it be desirable to put the Assistant Secretary for NII within the organization of the USD (AT&L)—who is the third ranking person in DoD already—but to actually change the title of the Undersecretary to USD(IAT&L), in order to emphasize the importance of information in the overall acquisition process. Such a change could have a significant impact on both the effectiveness and the efficiency of the overall DoD.

Conclusion

In summary, for an industrial transformation, there must first be a DoD business transformation. The direction of this transformation is clear (as described above), but in order for it to happen, both the DoD and the Congress must shift from a posture of "maximum risk avoidance" (through over-regulation, protectionism, etc.) to an objective of truly achieving effective and efficient defence acquisition management. The "model" for this transformed industrial structure should be a "government/industry partnership, in a continuously competitive market"; striving for an industry that is flexible, adaptive, agile, innovative, resilient, low-cost, high-quality, and can simultaneously satisfy the wide variety of 21st Century security needs. Achieving such a "partnership" will require frequent (at least semi-annual) meetings between the CEOs of major defence firms (as well as some of the lower tier suppliers) and the Secretary/Deputy Secretary and Service Chiefs (a practice which used to exist, but has not taken place with much frequency in recent years).

In general, strong leadership is going to be required in order to overcome the significant, and expected, institutional resistance to the needed changes. Only by making this a very high priority will the needed transformation take place. None-the-less, it can and must happen. When US commercial firms recognized the crisis that they were in, due to foreign competition, they were able to transform themselves. Clearly, it is essential that the government (Congress and the Executive Branch) recognize that they are, in fact, facing a significant crisis; and that national security is becoming "unaffordable,"

unless all other areas (such as health care, social security, etc.) are forsaken. With recognition of this coming crisis, and with strong leadership—along with a clear vision of the future direction that's required—it is believed that the needed transformation can, in fact, take place over the next few years. The nation requires it, and the taxpayers deserve it.

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