Annual Industrial Capabilities Report

To Congress

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Office of Under Secretary of Defense
Acquisition, Technology & Logistics

Office of Manufacturing & Industrial Base Policy

Preparation of this study cost the
Department of Defense a total of approximately
$78,000 dollars in Fiscal Years 2010-2011

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Annual Report Requirements

Section 2504 of Title 10, United States Code, requires that the Secretary of Defense submit an annual report to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives, by March 1st of each year. The report is to include:

> "(1) A description of the departmental guidance prepared pursuant to section 2506 of this Title.
>
> (2) A description of the methods and analyses being undertaken by the Department of Defense alone or in cooperation with other Federal agencies, to identify and address concerns regarding technological and industrial capabilities of the national technology and industrial base.
>
> (3) A description of the assessments prepared pursuant to section 2505 of this Title and other analyses used in developing the budget submission of the Department of Defense for the next fiscal year.
>
> (4) Identification of each program designed to sustain specific essential technological and industrial capabilities and processes of the national technology and industrial base."

This report contains the required information.

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1. Foreword

In February 1997, as required by Section 2504 of Title 10 of the U.S. Code, the Department published its first Annual Industrial Capabilities Report to Congress. This report, and the subsequent reports that followed, required that the Department report on the kind of analysis that was being conducted on the defense industrial base. Specifically, Section 2504 of Title 10 of the U.S. Code requires that the Secretary of Defense submit to Congress an annual industrial capabilities report to include:

- A description of departmental guidance providing for the integration of technological and industrial capability considerations into the Department's budget allocation, weapons acquisition, and logistics support decision processes.

- A description of industrial capabilities assessments and analyses used in developing the budget submission of the DoD for the next fiscal year.

- A summary of each program or action designed to sustain specific essential technological and industrial capabilities.

During the past decade the Department relied on market forces to create, shape, and sustain the industrial, manufacturing, and technological capabilities in the industrial base intervening only when absolutely necessary to sustain essential defense capabilities. As the wars in Iraq and Afghanistan continue to evolve, and our nation continues to recover from the worst economic recession since the Great Depression, the Department faces significantly greater constraints on resources. These constraints will have significant impacts on the defense industrial base. The Department must work closely with our partners in the defense industry to ensure that we are better stewards of the taxpayers' money in these fiscally austere times. Our policies have changed to fit this environment.

The fundamental starting point is the understanding that we in DoD do not make our weapons systems. They come from our defense industry. And these weapons systems are, second only to our superb men and women in uniform, what make our military power unrivaled and what provide the buttress of national and international security. A strong, technologically vibrant, and financially successful defense industry is therefore in the national interest. In this respect the warfighters' and taxpayers' interests are fundamentally aligned with those of the industry shareholders.

Next, the government's interest is not short-term, but long-term, like that of long-term investors. The Department will promote policies and actions that provide for long-term innovation, efficiency, profitability, and productivity growth.

We will follow seven guideposts in considering our industrial structure in the era we are entering.

First, in the main the Department will rely on normal market forces to make the most efficient adjustments to the defense industrial base. This is not only in accordance with good economic theory, but necessary to prevent the defense industry from becoming further distanced from the main currents of 21st century technology, creativity, and capital markets. These forces will doubtless lead to an uptick in the volume of mergers and acquisitions and other industry adjustments in the coming period, and this is normal. The Defense Department welcomes needed adjustments that lead to greater overall efficiency but will require transparency with respect to all contemplated transactions. These transactions will be examined to ensure that the Department's long-term interests in a robust and competitive industrial base dominate any near-term or one-time proposed savings, that potential organizational conflicts of interest are avoided or carefully mitigated, and that the Department has full visibility into restructuring costs and the potential for continuing capital investment and R&D. The interests of the taxpayer and the warfighter will be in the forefront as the Department reviews proposals that may result in the creation of weaker stand-alone firms less likely to thrive without the necessary capital structure that their larger parent company is able to provide. In such cases transparency will be essential so that the Department is confident the value created largely by the Department over the years is not lost to the detriment of the taxpayer or the warfighter. The Defense Department would not want to see its industrial base experience what has happened in some other sectors of the economy: poor risk management, unnecessary leverage, and excessively short-term behavior at the expense of long-term health. Transparency allows all these things to be addressed early in the process, which is in the interest of all involved.

Second, as President Obama made clear to all Federal departments and agencies when he took office, competition is one of the key drivers of productivity and value in all sectors of the economy, including defense. Accordingly, the Department is not likely to support further consolidation of our principal weapons systems prime contractors. A number of initiatives are aimed at increasing competition among all our suppliers and throughout our procurement of goods and services. Sometimes competition is provided by having two or more providers of the same thing go head-to-head, but where this is not possible the Department can still harness this power through a wide variety of other competitive strategies that provide real incentives for increased productivity. Where program costs can be reduced, government and industry can share the savings, which will be directly reflected in earnings and profit.

Third, the Department will be looking at our industry sector by sector – from shipbuilding to professional services, and from stealth to space – because the dynamics are different in each sector. Deputy Secretary Lynn has directed a comprehensive sectoral study of our industry which is being led by the Deputy Assistant Secretary of Defense for Manufacturing & Industrial Base Policy. This will not be a one-time snapshot, but rather an ongoing guide to us as the Department seeks to sustain the health, vibrancy, and efficiency of the industrial base upon which our security depends. While we cannot sustain the base in a given sector if it has the wrong size and shape for the new era, once it is right-sized and right-shaped, the government will take an interest in keeping it that way.

Fourth, the Department's interest in the defense industrial base extends throughout its entire spectrum. The industrial base is not made up of only those who receive prime awards. The truth is that perhaps two-thirds to three-quarters of every dollar the Department awards at the prime level is spent for subcontracted goods and services at the so-called "lower tier" of the industry. But while these companies might be "lower tier" in this sense, they are not of lower importance – they are centrally important to a healthy industrial base. They are frequently rich in technology and dynamism. They are also important drivers of program cost – frequently down but sometimes up – and the sources of supply chain efficiencies or, alternatively, disruptions in major programs. So their health and performance are critical to us. Smaller firms, start-ups, and new entrants provide needed new technology, new faces, and new ideas to the defense industry. The nation's small businesses add vitality to our base in both prime and subcontractor roles. Mid-sized companies are especially important and worthy of fostering, as they can grow into new sources of innovation and competition.

Fifth, we will give heightened attention to the increasing importance of the "services" component of the "goods and services" the Department requires – again provided by firms not often considered "defense companies." These services are as essential as weapons systems to mission accomplishment, and we are taking a number of steps to better understand and manage this part of the Department's spend. Currently about half of our prime contract spending is in the services sector – and this does not take into account the portion of services required by traditional procurement programs. The "services" portion of the industrial base is correspondingly growing and changing. Some of the companies that provide these needed services have grown quite large and take an important place in our industrial landscape alongside the more familiar brand names. Others are innovative small businesses. As we improve our approach to services procurement, we will be attentive to its industry foundation.

Sixth, a key part of the Department's defense industrial strategy is to encourage new entrants. They offer competition, renew and refresh the technology base, and ensure that defense is benefitting from the main currents of emerging technology. The Department must accordingly work constantly to lower the barriers to entry. The Department is addressing many of these barriers – such as needless or time-consuming paperwork –because they impose unnecessary costs. But another objective of eliminating non-productive processes is to make it easier for companies to do business with the Department, and we will continue to seek industry feedback and ideas on how to do this.

Seventh and finally, globalization is affecting security and commerce in profound ways, and this trend has implications for the defense industry. In Afghanistan, American troops fight alongside forces from a wide coalition of other friendly nations, and the Department anticipates that in the future it will be rare indeed that we fight alone. In the industry that supports these international security efforts, the Department likewise simply cannot avoid or wall itself off from globalization. Depending on the program, from a few percent to much more of the value-added in defense goods and

services is sourced overseas – mostly to companies that serve as subcontractors to U.S. primes and that provide, for example, a particular specialized part. Sometimes that is where the best technology or best value can be found, and when it is, the Department owes it to the warfighter to do so. Globalization of our market is not an option - it is a reality. Our utilization of, for lack of a better term, "non-heritage" firms is essential for nearly all of the systems upon which the Department relies. The Department is committed to continue opening our markets while at the same time striking the appropriate balance with security concerns. Just as we have opened our markets to the leading firms from around the world, we urge our partner nations to do likewise. Exports obviously strengthen our industry's competitiveness, but they also enhance our security – and international security – when they build the capacities of international partners. DoD is doing its part by implementing President Obama's reforms of our antiquated export control regulations and procedures, and we expect our efforts will result in increasingly open and fair competitions around the globe.

To summarize, the Department's goals in the new era for our defense industry are:

- A strong, vibrant, and financially successful defense industry,
- Structural change largely through market forces but adjusted where the interests of the taxpayer and warfighter require,
- Preserving and enhancing competition,
- Equal attention to the health of smaller and mid-sized companies, spinouts, new entrants, and service providers,
- Encouraging open entry into the defense marketplace, and
- Full advantage taken of the opportunities of globalization.

Each case or transaction will of course be different, and the Department will approach them case-by-case using these guideposts.

In order to adapt to rapidly evolving national security and economic conditions, while simultaneously adhering to our Nation's fiscal constraints, the Department and our industry partners must work together. However, before it can adequately update our current defense industrial policies, the Department must have more insight into the health, size and structure of the defense industrial base.

Realizing our need for more insight into the base, as mentioned already, the Department is conducting a sector-by-sector, tier-by-tier analysis of the defense industrial base. This analysis aims to locate early indicators of risks to defense programs, identify cross-program interdependencies throughout the supply chain, pinpoint areas of limited competition that may drive up costs, and find areas of over-reliance on foreign sources that may exist. The sector-by-sector, tier-by-tier analysis will be conducted annually to ensure that the industrial base which the Department relies upon is healthy, vibrant, and flexible to meet the Department's needs today and well into the future. This analysis will be used to influence the Department's investment decisions.

2. New DoD Policy

New DFARS policy regarding Organizational Conflicts of Interest in MDAPs

It is in the interest for the Department of Defense to address Organizational Conflicts of Interest (OCIs) to ensure the overall integrity, transparency and competitive nature of the entire DoD acquisition system. Addressing OCIs in turn allows the Department and the taxpayers to obtain the best systems for the warfighters at the proper value.

The need to more adequately address OCIs was highlighted in the 2007 National Defense Authorization Act, a July 2008 Defense Science Board Task Force on Defense Industrial Structure for Transformation, and culminated in the May 2009 Weapon Systems Acquisition Reform Act (WSARA) Section 207 of which required DoD to "…tighten existing requirements for organizational conflicts of interest by contractors in major defense acquisition programs." Some of the factors that increased the sensitivity and frequency of OCIs include:

- An increased dependency on contractors for acquisition management, systems engineering, Independent Verification & Validation, budget development, cost analysis, requirements development, and contract oversight; and
- New conflicts that stem from contract wins, evolving work scope, and industry consolidation (firms combining supplies and services).

The Department published a proposed Defense Federal Acquisition Regulation Supplement (DFARS) rule on OCIs in the Federal Register on April 22, 2010. A public comment period was extended to July 21, 2010. Based on public comments and consultation with industry representatives, changes were made to the proposed rule and the final DFARS rule on OCIs was published Dec 29, 2010 as DFARS 209.571 and is now in effect.

The DFARS rule states that it is the Department's policy to:

- obtain advice on Major Defense Acquisition Programs (MDAPs) and pre-MDAPs from sources that are objective and unbiased, and
- seek to resolve OCIs in a manner that will promote competition and preserve DoD access to the expertise and experience of qualified contractors.

Some of the notable provisions in the new DFARS rule include the following:

- Agencies shall obtain advice on systems architecture and systems engineering matters with respect to MDAPs or pre-MDAPs from Federally Funded Research & Development Centers (FFRDCs) or other sources independent of the MDAP contractor.

- If the contracting officer determines that the potential prime is unable to effectively mitigate an OCI, then the contracting officer shall use another approach to resolve the OCI, select another offeror, or request a waiver.
  - For acquisitions exceeding $1B, the Senior Procurement Executive is briefed before determining that an offeror's mitigation plan is unacceptable.

- Systems Engineering & Technical Assistance (SETA) contractors for a MDAP or pre-MDAP and their affiliates are prohibited from participating as prime or major subcontractor for the weapon system under such program.
  - The prohibition cannot be waived, but an exception is allowed if the head of the contracting activity determines that the DoD needs the domain experience and a resolution strategy will enable the contractor to provide objective and unbiased advice.

It should be noted the provision for an exception related to SETA contractors for MDAPs is intended for use only under very exceptional circumstances where the Department needs the domain experience and expertise of the offeror, a resolution strategy is established and, the offeror will be able to provide objective and unbiased advice.

It should also be noted that there is also an effort for consideration of OCIs Government wide under a potential new Federal Acquisition Regulation (FAR) rule. On April 26, 2011, draft FAR provisions regarding OCIs were published in the Federal Register. The public comment period extended to June 27 and comments were considered for the final regulation.

Obtaining Greater Efficiency and Productivity in Defense Spending

On June 28, 2010, the Under Secretary of Defense (Acquisition, Technology, and Logistics) initiated policy to mandate the restoration of affordability and productivity in defense spending by improving the way the Department does business. Our highest priority is to support our forces at war on an urgent basis. We still have a continuing responsibility to procure the critical goods and services our forces need in the years to come. The Secretary and Deputy Secretary have launched an Efficiencies Initiative within the Department of Defense to that end. The initiatives require the Department to reduce funding devoted to unneeded or low-priority overhead, and to transfer these funds to force structure and modernization so that funding for these warfighting capabilities grows approximately three percent annually. Specifically, the military services were directed to find at least $100B in savings that they could keep and shift to higher priority programs over the next five years.

As part of the Efficiencies Initiative, through guidance issued in September 2010, the USD(AT&L) is seeking to obtain greater efficiency and productivity in defense spending by pursuing initiatives in the following five areas:

(1) Target Affordability and Control Cost Growth,
(2) Incentivize Productivity and Innovation in Industry,
(3) Promote Real Competition,
(4) Improve Tradecraft in Services Acquisition, and
(5) Reduce Non-Productive Processes and Bureaucracy.

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3. Industrial and Technological Capabilities Assessments

Methods and Analyses

The U.S. defense industrial base and the global defense market provide the industrial and technological capabilities that support the needs of the warfighter for capable and reliable weapon systems. The Department periodically conducts analyses/assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. It then uses the results of these analyses/assessments to make informed budget, technology investment, acquisition, and logistics decisions.

"DoD-wide" industrial assessments evaluate and address changes in key system, subsystem, component, and/or material providers that supply many programs, and affect competition, innovation, and product availability. DoD Components conduct their own assessments when: (1) there is an indication that industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to a single DoD Component could be lost; or (2) it is necessary to provide industrial capabilities information to help make specific programmatic decisions. These assessments generally are conducted, reviewed, and acted upon internally within the DoD Components. Additionally, the Defense Contract Management Agency supports DoD-wide and DoD Component industrial assessments by utilizing its broad knowledge across industrial sectors and its on-site presence in many contractor industrial facilities.

The following are synopses of comprehensive industrial capabilities assessments, as described above, taken on by the Department and DoD Components.

3.1 DoD-Wide

Solid Rocket Motor (SRM) Industrial Base Sustainment Plan (April 2011)

The Department submitted a combined solid rocket motor industrial base sustainment plan and implementation plan that responds to section 1078 of the National Defense Authorization Act for Fiscal Year 2010, Public Law 111-84, and section 916 of the National Defense Authorization Act for Fiscal Year 2011, Public Law 111-383. Section 1078 directed the Secretary of Defense to submit to the congressional defense committees a plan to sustain the solid rocket motor industrial base, including the ability to maintain and sustain currently deployed strategic and missile defense systems and to maintain an intellectual and engineering capacity to support next generation rocket motors. Section 916 directed the Secretary of Defense to submit to the congressional defense committees an implementation plan to sustain the solid rocket motor industrial base that is based on the recommendations included in section 1078.

The Department's primary objectives for the SRM Industrial Base Sustainment Plan were to: (1) sustain production capabilities for national assets; (2) keep critical design teams in place for future system needs; and (3) to the extent practical, preserve the option to satisfy new government demand in the future. The DoD used pounds of propellant as an indicator of overall SRM industrial base viability. After careful analysis, the DoD concluded that it can achieve its sustainment goals through a combination of initiatives. The Department needs industry's cooperation to make the effort affordable: industry must first take the lead by "right-sizing" its excess capacity to align with projected demand. The DoD will then invest in SRM science and technology (S&T) and research and development (R&D) along with procurements each year of systems that will sustain the base.

The plan identified the resources within the DoD budget that implement the Department's Sustainment Plan for the SRM industrial base. The Defense budget includes funding for SRM S&T activities, the Air Force R&D Propulsion Application Program, and R&D funding for four defense missiles that are developing new SRMs or are modernizing older SRMs over the FYDP. The budget includes funding for production of the Trident II D5 SRM motor sets and for missile defense and tactical missile programs that contribute to sustaining the SRM industrial base. The budget also includes funding for EELV strap-on SRMs that helps stabilize the large SRM industrial base by purchasing a planned number of boosters each year.

Rare Earth Materials Assessment (August 2010)

In April 2010, the Defense Contract Management Agency – Industrial Analysis Center (DCMA-IAC) was tasked to support a Rare Earth (RE) Materials Assessment for the Office of the Deputy Assistant Secretary of Defense for Manufacturing & Industrial Base Policy (ODASD) (MIBP)[1]. The purpose of the assessment was to determine the true domestic capabilities to reduce RE oxides to metals including companies that could reduce RE oxides to metals if necessary. DCMA-IAC's report was used to address vulnerabilities in the RE supply chain including recommendations to mitigate potential risks of supply disruption, as well as material pricing trends.

RE materials (ores, oxides, metals, alloys, semi finished RE products, and components containing RE materials) are used in a variety of commercial and military applications, and their availability worldwide is limited to only a few domestic and global sources. The Department relies on RE materials in the production of many of its weapon systems and needs to ensure their continued availability to meet national security objectives and military superiority.

Currently, China supplies approximately 97 percent of the world's RE, and has been gradually reducing its RE exports to the rest of the world as its own internal demand for RE increases. In spite of increasing RE global demand, export quotas from

[1] As of February 2011, the ODASD (Industrial Policy) is now the ODASD for Manufacturing & Industrial Base Policy (MIBP).

China have reduced by 40 percent since 2009, as China's export taxes have increased from 10 percent to 25 percent in that same period. These changes have led to higher prices for RE material. Faced with increased RE prices and a decrease in China's export quota, the biggest issue facing domestic RE consumer companies is the need for a stable non-Chinese source for rare earth oxides (REO). It is essential that a stable non-Chinese source of REO be established so that the U.S. RE supply chain is no longer solely dependent on China's RE exports. It is also essential to develop non-Chinese RE sources that in total create an RE supply that meets the U.S. demand for both heavy and light rare earth elements (REEs).

The defense market is a small player in the North American market for RE. Typically, the defense market requires approximately seven percent of the overall global market. Yet in some areas, defense usage can be less than one percent. Due to the limits on China's REE exports, REO prices are projected to increase by 30 to 50 percent in 2011, from mid-2010 levels. As capital investment plans for additional non-Chinese capacity become a reality, prices should significantly trend downward on a similar path as in the 1988 - 1993 period, when market dynamics were very similar to what they are today.

There are presently a limited number of domestic companies that process REO to metals, alloys, and magnets. There are two methods used to reduce REOs to metal: the metallothermic reduction method, and the electrolytic reduction method. Of the six domestic RE companies analyzed in this report, only one company currently has the facilities and experience to reduce all 17 REOs to metal using the metallothermic reduction method. Although not currently in operation, this same company also has past experience with the electrolytic reduction method needed to efficiently reduce the light REEs. This company ceased its electrolytic reduction process a few years ago as a result of the diminishing domestic RE market but plans to reconstitute the capability in the future. Of the remaining five RE companies that do not currently reduce REO to metal, two currently are the closest to having the equipment and experience necessary to reduce REO; two additional could also reduce REOs in the future, but gaining capability might be time and cost prohibitive. The last company intends to acquire, either through purchase or partnership, the capability for REO reduction.

The following recommendations are intended to mitigate risk:

- DLA's Strategic Materials activity should develop and implement risk mitigation strategies for the heavier elements, especially dysprosium, yttrium, praseodymium, and neodymium.
- The Department should identify and prioritize RE product applications in order to mitigate/diminish supply and scheduling disruptions to selected DoD systems.
- The Department should develop an RE Defense Priorities and Allocations System (DPAS) communications plan so that throughout the industry it is understood that DoD product applications are to receive higher priority and response than commercial product applications.

- The Department should partner with the domestic RE companies to determine what assistance may be needed to retain or obtain RE processing capabilities (Defense Production Act Title III could be one consideration).

- The Department should continue monitoring the health of the domestic RE companies in the supply chain.

Steel and Specialty Metals Trend Analyses (August 2010)

ODASD (MIBP) requested that DCMA-IAC update the Steel and Specialty Metals Report semi-annually. The purpose of the report is to provide trends and analyses to the DoD acquisition community detailing the short, medium and long-term impacts of steel and specialty metals on the DoD industrial base.

The report is comprised of pricing, lead-time, capacity utilization and other industry factors that influence current and future conditions of the marketplace for steel, titanium, aluminum, copper, nickel, and stainless steel. The intent of the trend analyses is to assist the DoD acquisition community in preparing budgets and program plans in an economic environment of dynamic price movement. The report also identifies major influences on the metal markets, as well as providing near-term, mid-term, and long-term forecasts.

The findings in the 2010 steel and specialty metals pricing trend analyses and industry assessment show mixed but overall market improvements. Metals pricing and capacity utilization commenced a downward trend in September 2008, reached a bottoming phase during the first quarter 2009, and are currently increasing and returning to 2007 levels. In fact, the second quarter capacity utilization rate for fabricated metal products was 72 percent. In addition to global public spending projects, the commercial aerospace industry still has a projected 10-year backlog of over 18,000 aircraft valued at over $2 trillion.

Prior to the dramatic downturn in the economic condition of the United States, metal prices were projected to continue trending upward unimpeded to meet increasing global demand for infrastructure investments. At present, the six primary metals collectively are on a slight correction period – June-August 2010. The markets remain uncertain in 2011, although industry analysts now project a weaker 2010 recovery than was projected back in early 2009.

Domestic Automotive Economic and Industrial Capability Assessment (October 2010)

ODASD (MIBP) and DLA tasked the DCMA-IAC to update the 2006 Domestic Automotive Economic and Industrial Capability Assessment. This 2010 study updates the 2006 Domestic Automotive Economic and Industrial Capability Assessment, and

provides post-2006 economic trend analysis and DoD Tactical Wheeled Vehicle program budgetary analysis. The analytical study addresses economic and industrial base concerns relating to the impacts that the big three domestic automakers have on the domestic DoD ground vehicle contractors and their availability to supply the Department with parts and supplies. The analysis assesses the operational health of a select group of defense suppliers that provide similar parts for both the Department and the domestic automotive, heavy trucking, and construction vehicle industry. The analysis assists senior DoD leaders in assessing current DoD acquisition strategies.

There is limited DoD ground vehicle prime integrator linkage with the domestic automakers; however, significant commonality exists with the heavy truck and off-highway/construction vehicle industries. Limited connectivity between Ground Vehicle prime integrators and significant commonality with heavy truck and off-highway/construction vehicle industries were findings identified in the 2006 study and also in the 2010 study. This level of interdependence is based on the fact that DoD ground vehicles are in the similar weight class as the vehicles in the heavy truck, and off-highway construction vehicle industries.

The 2007-2010 economic down turn did not affect the supply chain for the heavy truck and off-highway/construction vehicle industries as severely as the domestic automotive industry. The recession forced the restructuring of Ford, General Motors, and Chrysler, which required the suppliers of these companies to adapt to the changing marketplace. Most companies implemented cost cutting initiatives such as: employment reduction, facility consolidation, and the refocusing of core business structure. In addition, most companies worked to reduce waste to allow for more cost efficient operations.

Companies identified as being negatively impacted acknowledged a low risk of losing industrial capabilities required to manufacture and supply products for DoD ground vehicles. These companies did not express any immediate concern to obtain parts during the 2008-2010 economic condition.

Many companies reported problems obtaining credit. Credit unavailability, especially at the lower sub-tier supply chain levels, continues even though the economy is recovering. As the economy recovers, the demand forecasts and revenues are slowly increasing for many negatively impacted companies identified in this study. The reduction in fixed and marginal costs, coupled with the potential increase in revenues, is starting to lead many companies towards increased financial stability. According to a Federal Reserve article dated October 15, 2010, entitled: “Monetary Policy Objectives and Tools in a Low-Inflation Environment,” there are positive signs that significant efforts to improve the credit environment for small businesses are underway.

Industrial Sector Summaries

The industry segment-level baseline assessments (aircraft, C4/ICT, ground vehicles, missiles, services, ships, and space) summarized below are the product of the Office of the Deputy Assistant Secretary of Defense for Manufacturing & Industrial Base Policy.

3.1.1 Aircraft Sector Industrial Summary

The aircraft industrial base produces fighter/attack aircraft, vertical lift aircraft, transport/cargo aircraft, large fixed wing aircraft (i.e., aerial refueling tanker; intelligence, surveillance, and reconnaissance (ISR); and multi-mission aircraft), trainers, and unmanned aircraft systems. This sector is projected to remain in good shape despite ongoing market pressures. The vast majority of DoD aviation production programs continue to be supported near term in the budget process. Lockheed Martin and Sikorsky even have production programs projected for the next 20 or more years. However, the impact of top line budget constraints on future procurement and Research, Development, Test and Evaluation (RDT&E) funding levels means that industry design and development capabilities may be at risk.

The Department continues to progress in its recapitalization effort, with the demand for new or upgraded aircraft remaining strong. The impact of airframe corrosion and aging aircraft subsystems on mission readiness has become increasingly problematic for the Services. The Department's military aviation equipment is being used faster and harder than envisioned. Sustaining legacy aircraft has become progressively more expensive and time consuming for maintainers with many aircraft types operating beyond their original design life.

While procurement funding levels are strong, there is a continuing trend to accelerate programs into production to speed the overall recapitalization effort over the need to pay for new development and innovation. Procurement funding shows a steady increase through 2015. Five major prime contractors have procurement orders from the Department of Defense for the next ten years.

In contrast to increases in procurement, aviation has seen significant reductions in RDT&E funding which is projected to continue decreasing across the Future Years Defense Program (FYDP). A major driver for this decrease is the reduction of F-35 (Joint Strike Fighter (JSF)/Lightning II) RDT&E funding as the program transitions from Low Rate Initial Production into Full Rate Production. Additionally, more vertical lift programs are now using non-developmental airframes that install military unique subsystems to meet their mission requirements avoiding the obligation of large amounts of RDT&E funds. The lower-tier supplier base has consolidated as the numbers of military programs reduce over time. Suppliers not associated with future production programs (for example, suppliers not participating in the F-35 or UH-60M) will be

impacted the most. These suppliers will be forced to either exit the business or find new non-DoD programs for their products.

One area that seems resistant to the lack of substantial RDT&E funding is the unmanned aircraft systems (UAS) market. This area is seeing continued sustained growth. UASs have proven themselves an effective tool for the 21st century warfighter. Interest in UASs has grown dramatically during the conflicts in Afghanistan and Iraq. Demand for the capabilities they bring has exceeded the supply. Predator and Global Hawk provide constant imagery and are now virtually indispensable to combatant commanders in theater. Over the last decade, business development of UASs had been left to smaller, startup companies. Large aerospace primes saw little profit in the typically small, inexpensive and short production UASs produced at the time. The early UAS industrial base was made up of a number of small, independent, newly formed companies vying for work in this new and highly competitive market. While things have changed somewhat, the industry still thrives based on the innovation brought to it by these small independent firms. In order to move their ideas into reality, these firms eventually enter into strategic alliances with a larger prime integrator or are bought out. Working through a prime integrator allows the smaller companies to continue to do the innovation and creativity that they do best without the problems associated with learning how to build and develop a fully integrated system. By 2007, U.S. firms controlled more than 60 percent of the UAS market. The leading firms are Northrop Grumman and General Atomics that produce the Global Hawk, Predator/Reaper, Extended Range/Multi-Purpose Gray Eagle, Broad Area Maritime Surveillance UAS, and other UASs. Mergers and acquisitions continue in this field and further consolidation within the UAS industry is expected as the UAS demand continues to expand and larger programs develop. Still the UAS industrial base is large and robust driven by the ever expanding UAS demand.

In general terms, today's greatest risk to the aviation industrial base is not consolidation, but rather atrophy and the potential for loss of key design and development capabilities. Military aircraft design and development workload is at a historic low and RDT&E funding is expected to continue to decrease. Another issue faced by the aviation industry includes an aging workforce and decreased likelihood that a younger engineering workforce will remain in the industry due to the lack of new challenges and interesting things to do. Adequate funding must be identified to encourage innovation and to mitigate risk taking through company sponsored independent research and development (R&D) activities. There is also a growing need to address shortages in specific critical skill sets, such as structural analysis, systems integration, and other critical military unique skills. This is necessary to ensure that a full range of competencies will continue to exist to design, develop, prototype, produce and sustain new platforms and systems needed to explore new concepts and innovate.

Military aircraft and rotary-wing design and development workload is at a historic low with significant skill and experience loss expected as the aging R&D workforce retires thereby increasing the execution risk for new programs in this sector. Preserving and developing unique and highly creative talent, labor skills, and technology is vital to

the aircraft industrial base's ability to continue to produce world-class aviation and rotary-wing products. With the shutdown of F-22 production and imminent shutdown of F/A-18E/F/G production, there is significant concern for the potential loss of essential military unique design and engineering capabilities. Examples of military unique design skills at risk include hypersonic, canopy and cockpit design and integration; stores management; and weapons separation, loads, stress, and aerodynamics.

The U.S. vertical lift industrial base continues to be impacted by limited competition, few new platform contracts, and declining government technology investments. Widespread lack of innovation in the rotorcraft industry could jeopardize the Department's plan to modernize the fleet, leaving us on a path of the status quo; this situation would result in exacerbating the critical skill loss in the rotorcraft sector.

The aircraft sector relies on an extensive network of suppliers, teaming relationships, and partnerships that are heavily integrated with the global commercial aircraft market. The overall outlook for the industry is stable with strong U.S. defense procurement spending, but challenges still remain with respect to foreign competition, foreign outsourcing, changing defense requirements and missions, declining R&D, an aging workforce, and infrastructure consolidation and modernization. Suppliers not associated with future production programs (for example, suppliers not participating in the F-35 or UH-60M) will be impacted the most. These suppliers will be forced to either exit the business or find new non-DoD programs for their products.

Finally, global partnerships continue to increase, as many European contractors have either formed alliances or established subsidiaries in the United States in order to better compete for U.S. defense-related programs. While U.S. defense spending has enjoyed increases in recent years, European and other international defense spending has not increased. This situation, combined with the global downturn in the civilian aviation market has increased European interest in the U.S. defense market. Today, the majority of aerospace suppliers supporting DoD programs are still U.S. suppliers; however, participation from global contractors is increasing, as are the number of foreign subcontractors supporting the primes.

3.1.2 Command, Control, Communication, Computers, and Information and Communications Technology (C4/ICT) Sector Industrial Summary

In the decades immediately following WWII, military requirements drove information and communications technology (ICT) development and spun off commercial products. In later decades, coincident with the Internet revolution, the drivers reversed: commercial requirements now lead ICT development and spin off military products; and military C4/ICT products are now heavily dependent upon commercial technology. This dependency is not expected to change in the foreseeable

future. Nevertheless, given simultaneous military operational requirements for high-mobility, high-security and high-bandwidth, often in areas with no infrastructure, there will still be some defense-specific products. The new paradigm, however, for these defense products is less about technology or advances in science or engineering, but rather meta-technology or the application, software development and systems integration of existing commercial technology into defense products.

ICT is obviously pervasive across the spectrum of defense activities. In addition to command, control and communications products used by operational forces, ICT is used in the development and sustainment of all DoD products, as well in DoD business functions such as personnel, finance, training and management. In these support and business areas, there is much less need for defense-specific products and commercial, or even commercial-off-the-shelf (COTS), products are more and more the rule.

This dependence upon commercial technology and products has both advantages and disadvantages. The Department of Defense represents approximately one percent of the global ICT market. Assuming proportionate research and development (R&D) investment, ninety-nine percent of the world's ICT R&D is focused on commercial products. The advantage is that the Department leverages this vast global R&D investment by focusing more on meta-technology than on advances in science. The disadvantage is that enemies, potential enemies and competitors to the U.S. have the same technology and have potential to exploit the Department's supply chain. The DoD strategy to cost-effectively meet strategic objectives is to maximize the use of commercial technology while emphasizing risk mitigation in design, sourcing and operation. The use of commercial technology in defense products is often misunderstood as a black and white, either/or choice of a COTS product or a made for the military, defense-specific product when in reality it's a very broad spectrum of gray. The reality can range all the way from literally using a commercial product off the shelf, to using a COTS product with some low-tech ruggedization, to the use of commercial parts in a military product, to simply using commercial manufacturing equipment and technology to make a military product. While there are some niche areas of ICT unique to DoD, the foundation of the industrial base is commercial technology.

Although often described as a network, in very simple terms, the C4/ICT industrial base can be thought of in five tiers: tier I system integrators, tier II specialized subsystem suppliers, tier III device, component and piece part suppliers, tier IV design and production tool suppliers, and tier V raw materials. Tier I suppliers are often well known major defense contractors. Sometimes, tier I suppliers do their own tier II work in-house and sometime subcontract to lesser known and/or more specialized suppliers. A core skill for a tier I supplier is successfully operating in the government contracting environment. The focus of tier II suppliers is meta-technology with detailed knowledge of both the customer's environment and state of the art technology. Tier II suppliers are often more of a mix of defense and commercial suppliers and there are many more companies operating at this level than at tier I, perhaps hundreds. Tier III suppliers in the C4/ICT industry are often focused on the more than 99 percent of the global ICT market that is commercial and may not even be aware that they are DoD suppliers. In a

highly innovative global market, there are thousands of tier III suppliers. The state-of-the-art is frequently developed and defined at tier III. At tier IV, the number of suppliers narrows dramatically. For example, nearly all of the world's integrated circuits are designed with software tools (Electronic Design Automation) supplied by only four companies. Tier V also tends to be quite narrow like tier IV. A substantial part of the reason is that raw materials tend to be a very small part of ICT costs, the potential revenues are consequently very small, and thus interest in the market by potential competitors is very small.

Integration of civil and military suppliers at tier I is frequently an issue of a potential supplier's willingness to adopt the government contractor business model. Integration of civil and military suppliers is nearly absolute at tier IV, with almost no identifiable defense-specific suppliers. At tier II and tier III, there are a number of specialties with requirements related to DoD's requirements. Aerospace and its applicable reliability standards, notably the Federal Aviation Administration's DO-254, Design Assurance Guidance for Airborne Electronic Hardware, is an obvious example. The automotive industry has requirements for high reliability ICT in harsh environments, though with less functional complexity, and uses ISO 16949 as a standard. Even the oil and gas exploration industry has requirements for high reliability in harsh environments with electronics packages found in drill bits more than a mile below the earth's surface. The medical and communications industries have very high reliability requirements with some telecommunications and medical devices having a 6-nines or 99.9999 percent reliability requirement. The Food and Drug administration regulates, through several sections of the Code of Federal Regulations, firms manufacturing or selling medical devices in the U.S. Because of the combination of oversight and reliability, many industry suppliers consider medical ICT the closest "cousin" to defense ICT. In terms of cyber-security, close "cousins" can be businesses with hundreds of billions of dollars potentially exposed to cyber-threats: banking, finance, e-commerce and gaming.

A keystone relationship in the C4/ICT industry is the trade between hardware and software. In contemporary electronics, a large portion of hardware is either programmable or requires instructions. During design, a choice can usually be made to develop features in either hardware or software (or firmware[2].) Factors in the trade space include speed, power consumption, production quantity, adaptability, security and standardization with some favoring hardware and others favoring software. In general, particularly given the high costs of small quantities of custom hardware, it would not be surprising to see DoD products using more rather than less software.

Cyber-security will be a major issue for the foreseeable future. Threats can come from anywhere including individuals, organized crime and nation states. The targets include both DoD and its suppliers. Because the adversaries are dynamic, cyber-security must be dynamic and continuously reassessed. Among the many initiatives consolidated under DoD's new cyber-strategy umbrella are Supply Chain Risk Management and Information Assurance of DoD and DoS supplier networks.

[2] Firmware is a microprogram stored in ROM, designed to implement a function that had previously been provided in software.

Globalization is a positive competitive force, but global competitors are often not content to remain at the bottom of the value chain. Other countries, making their own investments, and benefitting from the transfer of U.S. technology to manufacture products for U.S. companies, are rapidly becoming peer or near-peer competitors. DoD's cyber security strategy depends upon "…the U.S. commercial information technology [IT] sector remain[ing] the world's leader" and that requires "continuing investments in science, technology, and education at all levels."

In addition to having the best technology and educational resources, for the U.S. IT sector to remain the world's leader, the U.S. business model must be globally competitive. Of the business factors that DoD directly impacts, export controls are in the most need of reform. Because the portion of commercial or dual use technology in military products is growing, the portion of technology requiring protection is shrinking. Refusing to allow export of a technology from the U.S. that is currently, or soon to be, readily available from multiple sources in global markets only hurts U.S. business and does nothing to protect national security. The Administration has initiated an effort to reform export controls.

Because the pace of innovation in the commercial world is so rapid and the pace of traditional defense acquisition is relatively slow, defense systems can be fielded that are technologically far behind the current state of practice. In 2011, the Department expects to address development of a new acquisition process for IT.

3.1.3 Ground Vehicles Sector Industrial Summary

Ground Vehicles are either wheeled or tracked. The Mine Resistant Ambush Protected (MRAP) and the MRAP All-Terrain Vehicle (M-ATV) are examples of wheeled vehicles, where as the M-1 Abrams Tank and Bradley Fighting Vehicle are examples of tracked vehicles. The differences in mission between tactical and combat vehicles has blurred as a result of the lessons learned in Iraq and Afghanistan. There is increased importance accorded to arming and armoring both types of vehicles to protect against constant and difficult to detect irregular warfare threats in urban and rural environments.

The majority of vehicle suppliers responded extremely well to significantly increased requirements in support of ongoing contingency operations. The Army, USMC and Joint Service ground vehicle research-development and procurement budgets for tactical and combat vehicles were $15B in FY09, $17B in FY10 and $11B in the President's FY11 budget. These figures included programmed and supplemental funding and are in then-year dollars. Supplemental appropriations represented almost 40 percent of this funding. The largest vehicle programs over the three fiscal years were the Joint MRAP Vehicle Program and M-ATV at $14.1B, *High Mobility*

Multipurpose Wheeled Vehicle (HMMWV) at $6.3B, and the Family of Heavy Tactical Vehicles (FHTV), at $4.2B.

In addition to new acquisitions, the Department increased its overhaul and repair of the vehicle fleet due to the severe service experienced in Iraq and Afghanistan. The cost is estimated at $17B to $19B annually for the next several years as compared to $2.5B to $3B per year prior to the war. This work is extremely important for preserving tracked vehicle industrial capability, especially given the cancelation in 2009 of the Manned Ground Vehicle (MGV) portion of the Future Combat System. The pending replacement program called the Ground Combat Vehicle will begin with initial design development contracts worth up to $450M being awarded in FY11, but first vehicle deliveries will not occur until seven years later, which will place a significant strain on the tracked vehicle supply chain.

The major vehicle production programs reported in the Defense Acquisition Management Information Retrieval system have not experienced significant delivery issues. For the most part, program schedule requirements are within the industry's capacity to achieve. The earlier MRAP and now the M-ATV program variant had extremely short and steep production ramp up schedules. Nevertheless, in 2007 and 2008 MRAP successfully transitioned from low to full-rate production and then post production in 2009. In June 2009 the MRAP Joint Program Office (JPO) awarded an initial delivery order for 5,244, M-ATV and with follow on awards the total number on contract at the end of calendar year 2010 was approximately 8,400 vehicles. In 2010, the MRAP JPO produced 421 Special Operations Command M-ATVs, produced over 5,000 rocket propelled grenade net kits and placed 800 Underbody Improvement Kits (UIK) on contract.

Wheeled vehicle component manufacturers are continuing to benefit from the operational requirements of Iraq and Afghanistan. Full-rate production of 1,000 M-ATVs per month, a continued demand for spare parts and upgrade kits for fielded vehicles and increased rates of overhaul and maintenance enable the beneficiaries of this work to remain profitable. For the most part, combat and tactical vehicle manufactures are meeting financial obligations, and reinvesting in their businesses through research and development, acquisitions and capital expenditures. Continued production and spare part demand is also helping subcontractors that support the heavy trucking industry to weather the depressed economic environment.

The significant drawdown of defense budgets in the 1990s reduced the number of major tracked vehicle prime contractors to just two; General Dynamics Land Systems (GDLS) and British Aerospace Engineering (BAE) Ground Systems Division. With the cancelation of the GDLS Marine Corp Expeditionary Fighting Vehicle (EFV), there are no new tracked vehicle programs under development or in production. However, both companies perform a significant amount of tracked vehicle overhaul work in partnership with military depots. In addition, GDLS has production work for the Stryker and reset work for the Abrams. BAE has MRAP, Family of Medium Tactical Vehicles, and FCS

Non-Line-Of-Sight Cannon; BAE also received significant reset and upgrade work for the Bradley Fighting Vehicle.

GDLS and BAE along with Navistar, AM General and Lockheed Martin, have received development contracts for the Joint Light Tactical Vehicle (JLTV). The Army currently plans to eventually procure 60,000 JLTVs and the Marine Corps 5,500. However, these numbers are subject to change as each service refines its tactical wheeled vehicle strategy and anticipated budgetary constraints are addressed.

There are "important" component suppliers for the vehicle industry; examples include tracked vehicle transmissions, armament and military unique forgings, castings; and metallic and composite materials used to make armor. Issues that continue to plague the ground vehicles sector include a continued need for overhaul, maintenance and repair of the vehicle fleet; consolidation of tracked vehicle design and manufacturing supplier base; increased survivability and mobility (protection and lighter/stronger armor); and the impact of future MGV and JLTV requirements and the ability of industry to adapt.

3.1.4 Missile Sector Industrial Summary

Missiles are classified into four segments: tactical missiles, strategic missiles, missile defense systems, and smart munitions. Generally, missile subsystems are categorized in four main areas: propulsion; armament, airframe, and navigation; guidance; and control (NGC). Smart munitions do not have a propulsion subsystem.

For roughly the last decade, missile programs and their associated funding profiles have remained fairly stable. However, this trend has recently started to change. For the strategic missile segment, procurement funding is declining. The funding is declining with the conclusion of the Minuteman III Guidance Replacement Program and the Propulsion Replacement Program. The Minuteman III Propulsion Replacement Program came to an end in August 2009 leaving the Navy D5 as the remaining strategic production program. The Air Force Minuteman III warm-line program that supports the solid rocket motor industrial subsector is expected to end in FY12. In the missile defense segment, the Department cancelled the Kinetic Energy Interceptor program and reduced the Ground-based Interceptor program. The procurement funding for missile defense programs has remained stable in part, due to increased foreign military sales. The procurement funding in the missile defense sector is for the PAC-3 and Standard Missile programs. The remaining missile defense funding is mostly in the Missile Defense Agency research and development line. Tactical and smart munitions funding has remained fairly stable thanks in part to increased foreign military sales. However, the Department cannot rely on this trend to continue.

Research, Development, Test and Evaluation (RDT&E) funding is declining. Most of the research and development funding in the missile sector is associated with legacy program upgrades or modifications which limits competitive opportunities. This is significant for strategic missiles since the skills for a new development may already be below threshold or lost altogether and there is no planned new development effort on the horizon. The Joint Air to Ground Missile (JAGM) is currently the only new missile development program. This lack of new missile program development limits our ability to fully exercise the industrial capabilities necessary in the missile industrial base – from design concept, system development, and production – to meet our current and future national security needs. Both the Air Force and Navy are developing requirements for next generation missiles and there is concern that the industrial capabilities needed for those systems may not be readily available. While many industrial sectors that support our national security requirements are supported by the commercial markets, the missile industrial sector is mostly defense unique.

The significant drawdown of defense budgets during the 1990's reduced the number of missile prime contractors from more than twelve to six. However, the prime contractors are not necessarily equal in industrial capabilities. With the cancellation of the Kinetic Energy Interceptor program, four of the primes only operate in one of the missile segments (Boeing – Smart Munitions, General Dynamics – Tactical Missiles, ATK – Tactical Missiles, and Northrop Grumman – Strategic Missiles). Northrop Grumman, ATK and General Dynamics are prime contractors on only one program – Northrop Grumman the MM III program, ATK the AARGM program and General Dynamics the 2.75" rockets (Hydra rockets).

Lockheed Martin and Raytheon account for roughly 85 percent of the Department's missile procurement funding. This indicates that while there is competition in this sector, it appears mostly limited to two contractors. Raytheon and Lockheed Martin are the prime contractors on the majority of the Department's missile programs and both have a mix of missile segment programs (tactical, ballistic missile defense, etc.).

The Department's missile prime contractors are profitable, able to meet their financial obligations, generally consistent in providing value to shareholders, and willing to invest back into the company via research and development or capital expenditures. For the most part, primes are able to meet the Department's technical performance requirements. However, there is a cost risk in the form of increased overhead rates to the Department as the facility utilization rates for missile prime contractors average in the 45 – 60 percent range. There is a need for prime contractors and their associated subtier supplier base to align company production capacities more in line with expected DoD budget realities in the future while ensuring the industrial capabilities needed for next generation weapon systems are sustained.

"Important" components in the missile industry segment include thermal batteries, solid rocket motors (SRMs), jet engines, inertial measurement units (IMUs), GPS receivers, seekers, fuzes, and warheads. The suppliers that provide these

components are considered “important” because they are used on multiple programs and some of these components require 12 months or more to manufacture.

The strategic missile segment funding is declining. With the MM III Guidance and Propulsion Replacement Programs ended, the Trident (D5) missile is the only remaining program. Currently there is no development or significant levels of R&D programs planned in this area. The Department is developing a plan to better align industrial capabilities in this segment with DoD requirements and ensure adequate technical and production resources for the large SRM industrial base to support the Department’s strategic deterrence mission. The D5 program is producing at minimum viability levels in an over capacity environment.

At this time, the Joint Air-to-Ground Missile (JAGM) is the only major missile program being competed. The Department has established a Prompt Global Strike technology application program and both the Air Force and Navy are projecting a new missile start in the next few years. This small number of new programs is an indication of limited opportunities for industry to maintain their design teams.

As the DoD missiles budgets decline, the Department should expect to identify a growing number of industrial capability risk areas as the subtier supplier base struggles to align its industrial capacities to DoD budget realities. Examples include the solid rocket motor, small turbine engine, and fuze industries.

Declining RDT&E funding coupled with limited competitive opportunities projected in the near-term will make it difficult for the missile sector industry to attract and retain a workforce with the industrial capabilities to design, develop and produce future missile systems.

3.1.5 Services Sector Industrial Summary

In FY10 47.6 percent of all DoD contract spending was classified as supplies, 40.3 percent classified as services, with 12.1 percent classified as Research, Development, Test and Evaluation (RDT&E)[3]. As the dollar value of overall contract spending has increased dramatically, 184 percent since 2000, the percentage of spending in each domain has exhibited noticeable trends that are undoubtedly related to spending on Middle East conflicts. The percentage of supplies increased from 45 percent to 48 percent, the percentage of services remained steady at 40 percent; and the percentage of RDT&E decreased from 15 percent to 12 percent. All DoD contract actions are classified by Federal Supply Class/Service Codes (FSCs), which map to 23 service categories. In order to identify strategic sourcing opportunities, the Office of Strategic Sourcing in the Defense Procurement and Acquisition Policy (DPAP) Directorate consolidated the 23 service categories into eight portfolio groups. These

[3] After correcting for a $13.9B data entry error in Construction Related Services.

include the following, listed in order of largest to smallest total expenditure: Knowledge Based Services (KBS), Research and Development (R&D), Facilities Related (FR), Construction Related (CR), Equipment Related (ER), Electronics and Communications Services (ECS), Medical (Med) and Transportation (Trans).

An examination of data for company cross-participation in multiple service sector groups reveals a breakout into two major categories. One category has high levels of cross-participation in other service portfolio groups by the ten largest DoD contractors while the other category does not. The portfolio groups with high cross-participation include R&D, ER, KBS, and ECS, while those without include Trans, FR, CR, and Med. Defense-specific requirements are the apparent pattern of the category with high cross-participation by top-ten defense contractors.

In addition to cross-participation rates, the members of the two categories share another characteristic. As measured by the share of dollars awarded with sole-source contracts, every member of the defense sector is less competitive than every member of the commercial sector. Given an apparent pattern of defense-specific requirements, it is not a surprising observation.

The share of contract dollars going to mid-size companies is a topic of significant discussion. An analysis of mid-size company share by portfolio group does not share the pattern of defense-specific requirements or exhibit good correlation with competition for contracts. This leads to a conclusion that other factors are in play. Two specific factors that appear to be important but resist quantitative analysis are geographic specificity and business network. For example, a construction project is geographically specific whereas transportation utilizes a large network. A company is defined as being mid-sized if it has less than $1B in annual revenues but is not classified as a small business by government standards.

An important area of growing interest for industrial base analysis is examination and characterization of the supply chain for different sectors. While the supply chain for many types of goods has several layers of active business relationships the supply chain for many types of services is one-deep, consisting only of the employees of the prime contractor. This is sometimes expanded to a second layer of subcontracted specialists. Still, many companies, even large ones, often serve their customers with ‘small’ teams of employees working full time on discrete projects that are often only loosely connected with other projects. Frequently the customer makes the connections, if any, between projects. In these cases, a substantial majority of the intellectual capital of the business resides with the company’s employees who, in at-will employment environments, are free to leave their current employers, start their own businesses with ‘small’ teams of employees and compete for similar projects with relatively low barriers to entry.

Other service sectors are characterized by offerings of on-demand services with diverse expertise or geography, which in turn is characterized by the provider’s prior development of a sophisticated supplier network without the support of the customer.

The offering is also generally available to, and shared by, a large number of customers. Network set-up and sustainment is amortized over a large customer base and each buyer pays only the incremental cost of their services. An example of this concept occurs in transportation services such as package delivery or air travel. In these cases, a substantial majority of the value of the business is the existence and sustainment of an internal or external supply chain, and perhaps a physical infrastructure, able to provide small increments of complex services. A small group of employees could not form a viable business to compete for similar projects such as nationwide on-demand delivery or transportation services. The barriers to entry are relatively high.

Because two-thirds of DoD research and development (R&D) costs consist of manufacturing development, advanced component development and advanced technology development for major weapons systems, it's arguable whether R&D should be considered a service or as a separate intermediate R&D category that's neither a supply nor a service. Regardless of preference, the R&D category has all the characteristics described above of defense industry service sector members.

The biggest area of concern by the services industry is the combined potential for revenue losses due to government in-sourcing, cuts in direct support contractors and defense budget reductions. In reality, some companies will fare better than others, with the diversity of their contract portfolios acting as a key factor in their success.

The DoD Efficiencies Initiative documented in a September 14, 2010, memorandum from the Under Secretary (Acquisition, Technology & Logistics) identifies a number of activities specific to services contracting, among them: 1) each service component will establish a General Officer, Flag or SES senior manager for services contracts; 2) more frequent re-competes of knowledge-based services will occur and 3) competed solicitations for which only one bid is received if the initial advertisement was for less than 30 days.

3.1.6 Shipbuilding Sector Industrial Summary

Shipyard work for the major U.S. shipyards is primarily dependent on U.S. Navy new construction and repair work for the U.S. Navy. This sector has seen a contraction in the defense industrial base reducing competition and inhibiting affordability. The shipyard facilities that make up the defense shipbuilding industrial base consist of two segments: first tier and second tier shipyards. These shipyards produce six functional product segments, including: submarines, aircraft carriers, amphibious ships, surface combatants (cruiser, destroyer, littoral combat ship), sealift, and research/special vessels. Major ship subsystem providers can be categorized as system integrator, mission system integrator, armament, mission systems, propulsion or main engine, and yard/builder providers.

Eight U.S. shipyards build the majority of all of the Navy's ships. The first tier shipyards are Newport News, Avondale, and Ingalls, which together comprise

Huntington Ingalls Industries (HII) which formerly was Northrop Grumman Shipbuilding (NGSB); and Electric Boat, Bath Iron Works, and National Steel and Shipbuilding Company (NASSCO), owned by General Dynamics (GD). The second tier shipyards include Austal USA, whose parent corporation is located in Australia and Marinette Marine Corporation (MMC), whose parent corporation is located in Italy. Some of the first tier shipyards have unique capabilities that affect how the Navy and Congress have allocated new construction contracts.

In 2010, Northrop Grumman announced that it would leave the shipbuilding industry by selling or spinning off NGSB. Additionally, NGSB announced the closing of Avondale shipyard. Having performed due diligence through extensive analysis and protracted discussions, and following appropriate adjustments, the Navy supported Northrop Grumman Corporation's (NGC) spin-off of its shipbuilding business to HII. The decision on the Avondale shipyard closure will ultimately be made by the HII. If HII does close the shipyard and chooses not to sell the facility, the traditional "Big Six" shipyards may downsize to five by 2013. Approximately 5,000 direct jobs and 6,500 indirect jobs could be affected by this closure.

The production of the double-hulled fleet oiler T-AO(X) was accelerated from 2017 to 2014 in the Fiscal Year 2012 budget submission. This would allow the Navy to acquire this important capability three years earlier while bringing greater stability and will promote competition in the shipbuilding industry.

U.S. commercial shipbuilding accounts for approximately one percent of world commercial shipbuilding output; 80 percent of this comes from the mid-tier sector. Of the Big Six shipyards, only NASSCO currently has successfully competed in the commercial shipbuilding industry. However, NASSCO currently, as of March 2011, only has U.S. Navy shipbuilding and repair work at the shipyard. The Navy did sign a Shipbuilding Capabilities Preservation Action (SCPA) agreement with NASSCO and the company is pursuing commercial contracts. The global economic crisis has impacted the commercial shipbuilding industry. World ship production capacity is 50 percent more than the current demand in the order books for commercial vessels of more than 1000 metric tons. The global shipbuilding forecast calls for a positive trend to occur over the next decade with a slow rate of recovery towards the pre-economic crisis levels. The outlook for commercial Jones Act shipping orders and the expected service life of the Jones Act ships do not support shipyards commencing a commercial shipbuilding program for several more years.

While U.S. shipbuilders produce the most capable warships in the world, the number of Navy ships being built each year is very low when compared to the number of ships being produced each year by the leading international shipyards. A low volume of production makes it extremely difficult for U.S. shipyards to match the improvements in technology and productivity seen in the international shipyards. Low capacity utilization determines the economic benefit of investments in productivity-enhancing plant and equipment. Serial production and a stable design are key elements that U.S. shipyards must have to increase productivity and realize efficiencies which in turn

reduce the cost of shipbuilding for the Navy. Two U.S. Navy shipbuilding programs in particular have shown how effective serial production and a stable design are at reducing the costs of shipbuilding – the VIRGINIA class submarine program and the T-AKE auxiliary program. Serial production allows lessons learned from one ship to be transferred to the next ship, which significantly lowers the man-hours of skilled labor required to build successive ships. A stable design allows the shipyards to optimize their facilities and planning to build the ship because the stable design eliminates the risk of having to constantly change facilities from one ship to the next. Both the VIRGINIA and T-AKE program have seen significant cost reductions and production schedule improvements as a result of serial production and a stable design.

The Littoral Combat Ship (LCS) program has recently shifted the acquisition strategy to incorporate both of these elements. By awarding a block of 10 ships to both competing shipyards, the LCS program's two sea-frames will have both serial production and stability in the design as key elements of the acquisition strategy.

The statute governing the Long-Range Plan for the Construction of the Naval Vessels, Section 231 of Title 10, United States Code, was recently amended by Section 1023 of the National Defense Authorization Act for Fiscal year 2011. The primary change to Section 231 is elimination of the annual reporting requirement. Now, the 30-Year Shipbuilding Plan shall be submitted quadrenially, in the same year as the Quadrennial Defense Review (QDR), with reports due in the intervening years if the planned number of ships to be built in the Future Year Defense Program (FYDP) decreases. Pursuant to these revised reporting requirements, the Department of the Navy and the Office of the Secretary of Defense are collaborating on the appropriate response.

Maximizing Efficiencies for Affordability: Each shipbuilding program should be executed based on serial production and design stability to the maximum extent possible. Examples exist in both U.S. Navy shipbuilding and commercial shipbuilding to demonstrate the benefits to both cost and schedule when these two elements are part of the foundation of a shipbuilding program. Recent examples also highlight the failures that occur when these elements are not adhered to in a shipbuilding program. The total workload required to build the ships required for Navy and the U.S. Coast Guard may not be sufficient to support all the shipyards currently doing business with the U.S. government. As the number of ships each shipyard builds reduces, the overhead associated with that shipyard is applied to fewer ships, causing the unit cost for each ship to rise. Low workloads cause peaks and valleys in workforce requirements for shipyards, which in turn cause shipyards to lay-off and then re-hire workers. Without a stable workforce, it is harder to apply lessons learned from ship to ship and the cost savings associated with serial production decreases. Fewer healthy shipyards capable of attracting talent and capital investment will be able to operate at the most efficient levels to realize more affordability for the government. More shipyards operating at excess capacity does not achieve the highest quality end product and maximum cost savings.

3.1.7 Space Sector Industrial Summary

The Space Industrial Base (SIB) consists of three primary segments—space, launch, and ground systems. The SIB supports military, civilian government, and commercial markets. The Space Foundation frames these markets into a $276.52B global space economy of five component areas: commercial satellite products & services ($102.00B), commercial infrastructure & support industries ($87.39B), U.S. Government (USG) space budgets ($64.63B), non-USG space budgets ($22.49B), and commercial space transportation services ($0.01B).[4] The USG outspends all other nations combined, garnering between 72 percent and 75 percent of the global total for government space budgets.[5] Space systems are used for a variety of purposes: communications, Earth observation (imagery, environmental monitoring, and weather), intelligence, missile detection & tracking, research & experimentation, space surveillance, space exploration, and position, navigation, & timing (PNT).

As tracked by the Satellite Industry Association, the satellite industry worldwide continues to grow but has throttled back from its four-year run of double-digit growth. For 2010, the world satellite industry revenue topped $168B, up only 4.5 percent from 2009. The bulk of this revenue was concentrated in satellite services (60 percent) with the remainder in ground systems equipment (31 percent), satellite manufacturing (six percent), and launch services (three percent). From previous years, satellite services increased in revenue by two percent, manufacturing decreased by two percent, and the others were about the same. At $10.8B, world satellite manufacturing revenue dropped by 20 percent from 2009, but the U.S. still captured slightly more than half (52 percent) of this market. Launch services was a different story with the U.S. only garnering 28 percent of a world launch market of $4.3B. Due to the global economic recession, the U.S. satellite industry continued to lose jobs (6,856 jobs) in 2010, just as it had in 2009 (12,219 jobs). In 2010, every segment lost jobs except ground equipment, which grew slightly. As of the third quarter of 2010, the U.S. space industry had approximately 244,000 personnel across all four segments.[6]

Technology & Capability Concerns in the SIB -- Counterfeit Parts: Increasing globalization and obsolescence of systems offer continuing and growing opportunities for introduction of counterfeit parts into DoD systems. The vast majority of counterfeit parts are suspected to originate in countries of East and Southeast Asia. These components not only have increased likelihood of failure but also the potential to house malware. A January, 2010 report by the Department of Commerce (DOC) on counterfeit electronics found that 39 percent of organizations surveyed had encountered counterfeits. Incidents of counterfeit parts more than doubled from 2005 to 2008. This is of particular concern to the SIB due to the need for reliable, radiation-hardened electronics in spacecraft. The DOC survey also found that most DoD organizations do

[4] "The Space Report 2011: The Authoritative Guide to Global Space Activity," The Space Foundation, pg 6.
[5] "Number of Nations with Space Agencies is Rising," *Space News*, 1 March 2010, Vol 21, Issue 9, pg 9 and "The Space Report 2010: The Authoritative Guide to Global Space Activity," The Space Foundation, pg 6.
[6] "State of the Satellite Industry Report," Satellite Industry Association, June 2011.

not have policies to prevent counterfeits from penetrating their supply chain.[7] The GAO had similar conclusions in a March, 2010 report, citing that DoD did not have a standard definition for "counterfeit," a consistent process to detect them, or an effective counterfeit parts tracking system. The USG, commercial enterprises, and industry associations are taking actions to mitigate counterfeits in the supply chain. The National Security Agency has established the Trusted Access Program Office to provide the Department of Defense and Intelligence community access to trusted integrated circuit development capabilities.[8]

Critical Technologies: The Department has several organizations and forums which help to address space industrial base issues and technologies. Several DoD, inter-agency, federal, and industry organizations and forums exist to address space industrial base issues. These organizations and forums include: the *Aerospace Corporation*; the *Space & Missile Systems Center (SMC)*; the *Space Industrial Base Council (SIBC)* {composed of senior leadership from each of the major space agencies and oversees its Critical Technologies Working Group (CTWG), the *Space Supplier Council (SSC)*, which is composed of second and third-tier space supplier base contractors, and the *Space Quality Improvement Council (SQIC)*, which is composed of space prime contractors}; and the OSD *International Technology Security Directorate*, which oversees its Militarily Critical Technologies Program (MCTP) and its Technology Working Group (TWG). Collectively, these organizations assess risks in the space industrial base, develop mitigation plans, and fund projects needed to ensure access to critical technologies and capabilities required to support USG space programs. The CTWG, in consultation with the Aerospace Corporation and SMC, placed priority on the following technologies in 2010 for development/monitoring within the U.S. SIB:[9]

Beryllium, Beryllium Oxide, Beryllium Alloys
Cryogenic Coolers
Diodes
Glass for Optics
Infrared Detectors (HgCdTe)
Lithium Ion Batteries
Precision Machined Parts
Radiation Testing Facilities
Readout Integrated Circuits (ROIC)
Solar Cells and Solar Panels
Solar Cell Coverglass
Substrates for Solar Cells
Traveling Wave Tube Amplifiers (TWTAs)
Visible Sensors

[7] "Defense Industrial Base Assessment: Counterfeit Electronics," Department of Commerce (Bureau of Industry & Security), January 2010, pg 7.
[8] http://www.nsa.gov/business/programs/tapo.shtml
[9] Mayer, Donald C., "Status of Critical Technologies List," The Aerospace Corporation, 10 Jan 2010.

Export Controls: Born out of the Cold War in an attempt to restrict technology transfer to the former Soviet Union, export controls (International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR)) may adversely impact the U.S. national security space (NSS) industrial base today. Some companies try to avoid the challenges of export controls by not bidding on military contracts under the mistaken assumption that export controls do not apply to commercial products, or by not entering export controlled business segments altogether. These actions deprive the NSS industrial base of broader markets, innovation, new technology, and capital. Companies that do sell to the defense sector may sub-optimize their national security products in an attempt to protect their commercial market products. In the vacuum left by U.S. companies in international markets, foreign firms have been energized to fill the void and even create "ITAR-free" products that have no U.S. components that might prevent exporting to third countries. The cost and difficulty of export licensing becomes a competitive disadvantage to lower-tier U.S. firms with fewer financial resources. Specific to the space industrial base, a 2008 study by the Center for Strategic & International Studies (CSIS) stated that the cost of ITAR compliance is about $50M a year, while approximately $600M is lost annually in revenue due to licensing issues. This study also cited that export controls are the top barrier to foreign space markets for the U.S. space companies.[10] The impact of export controls can be more severe in the lower industrial base tiers since smaller firms do not have as many resources to cope with compliance costs. This is of concern since significant research and development occurs in the lower tiers.[11] However, another study stated that there was little evidence to prove conclusively that export controls had decreased U.S. satellite industry competitiveness internationally.[12] There is renewed interest from both the executive and legislative branches to reexamine export controls, including controls on satellites. Changes to controls must balance U.S. space industry health and competitiveness with national security considerations. The Department is participating in the President's export control reform initiative.

Global Competition: The U.S. is still the overall world leader (and spender) in the space arena, but its dominance is eroding. The Futron Space Competitiveness Index (SCI) shows the U.S. SCI ranking has gradually decreased (one to two percent) each year from 2008 to 2010. Foreign countries have targeted space as a strategic industry, as evidenced by the growth in national space agencies from 40 in 2000 to 55 in 2009. In 2009, Russia led the world in successful orbital launches; the U.S. was second, with Europe and China on par in a distant third. Russia has held the lead since 2004. Japan and India also conducted successful launches. In 2009, U.S. spacecraft manufacturing dramatically rebounded, putting it back in first place; Europe and Russia were on par a in distant second while China ranked third. Japan, India, Israel, and South Korea also had spacecraft production. Despite U.S. leadership for total spacecraft in 2009, the U.S. share of announced commercial GEO satellite orders dropped six percent. As the

[10] Center for Strategic & International Studies, "Briefing of the Working Group on Health of the U.S. Space Industrial Base and the Impact of Export Controls," February, 2008, slides 33 & 53.
[11] Dunham, Alan, "Barriers to Entry and Sustainability in the U.S. Space Industry," National Security Space Office, December, 2008, slide 40.
[12] Van Atta, Richard, et al, "*Export Controls and the U.S. Defense Industrial Base,"* Institute for Defense Analyses, January 2007, pg 14.

2010 U.S. National Space Policy acknowledges, there are multiple capable actors in the global space commons, making it essential to expand international cooperation in space.[13]

Liquid Rocket Propulsion Industrial Base (LRPIB): Powerful liquid rocket engines are required to deliver NSS assets to orbit and for civil space operations, such as transportation to the International Space Station and deep space exploration. Space Shuttle retirement and Constellation transition will impact the U.S. suppliers of large, liquid rocket propulsion. NASA's programs (e.g., Commercial Orbital Transportation Services and Commercial Resupply Services, or CRS) to stimulate commercial space transportation will help the LRPIB; however, funding for these programs has been threatened by cuts in the NASA budget. NASA is currently carrying two U.S. vendors in the Commercial Orbital Transportation Services and CRS programs. The DoD Evolved Expendable Launch Vehicle (EELV) program could become the mainstay for NSS equities in the LRPIB for the years to come. The U.S. LRPIB has consolidated to two main suppliers who market three distinct, large, liquid rocket engines. A concern is that two of these three engines are based on Russian design. (The third engine is of U.S. design.) Of the two Russian engines, one is manufactured in Russia; the other is refurbished from a stockpile of discontinued engines. A third U.S. supplier has successfully developed and launched a relatively new liquid engine but of much lower thrust.

NASA Disruptions to the Space Industrial Base: The retirement of NASA's Space Shuttle Program (SSP) and the Presidential transition of the Constellation Program (CxP) could have the largest impact on NASA suppliers and workforce since the retirement of Apollo. This could result in a major loss to NASA in skills and capabilities, as it ends an operational program (i.e., SSP) and ramps up developmental programs in place of CxP. Considering that NASA alone had 29 percent of the entire 2009 U.S. Government space budget, a perturbation in NASA's supply base could have a significant effect on the U.S. space industrial base.[14] In October of 2010, the President signed the NASA authorization bill, which directs NASA to support the International Space Station through 2020, facilitate commercial space transportation, begin work on a heavy-lift launch vehicle, and develop a multipurpose crew capsule.[15] NASA is working with the Department of Commerce to assess NASA's supply chain network.

Solid Rocket Motor (SRM) Propulsion Industrial Base: Launch providers utilize SRMs for additional lift as needed for orbital insertion requirements. The design/production demand for large SRMs in the U.S. is lower than historic levels due to the retirement of the Space Shuttle, Constellation cancellation, lower DoD strategic & missile defense requirements, completion of the Minuteman III Propulsion Replacement Program, and strong foreign competition in the commercial launch market. NASA has been the dominant customer with as much as 70 percent of SRM demand in the

[13] "National Space Policy of the United States of America," 28 June 2010, pg 4.
[14] "The Space Report," The Space Foundation, 2010, p. 51.
[15] Klamper, Amy, "NASA Has New Authorization But Future Remains Uncertain," *Space News*, 11 Oct 2010.

U.S.SIB. The U.S. SIB has downsized to two main suppliers of SRMs. The Trident has been producing at minimum viable levels. Additional detail can be found in the Missiles Sector Summary of this report.

Workforce Issues: Retirements from the U.S. Science, Technology, Engineering and Mathematics (STEM) workforce could significantly impact the aerospace sector in the coming decade. Replacing these professionals could be challenging due to declining interest in STEM as a career field, fewer STEM college graduates, and poor math & science proficiency in secondary education. For NSS programs, specialized skill sets (such as protected military satellite communications and intelligence payloads) make the issue of a declining STEM workforce even more of a concern for the military space industrial base. One report states that by 2013, 70 percent of DoD STEM employees will be eligible to retire.[16] The combined factors of low demand, reduced military spending, workforce retirements, and reduced labor pool entrants could threaten specialized skills. If lost, it could take significant cost and time to rebuild these skills for the military space industrial base. Efforts are underway through the current administration, private industry, and DoD programs to revitalize STEM education.

[16] "National Defense Education Initiative—Meeting America's Economic & Security Challenges in the 21st Century," Association of American Universities, January 2006, pg 11.

3.2 Army

The following are synopses of comprehensive industrial capabilities assessments taken on by the Army during 2010. The Department, including the Services, periodically conducts analyses/assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. It then uses the results of these analyses/assessments to make informed budget, technology investment, acquisition, and logistics decisions.

Fuel Cell Industrial Capability Assessment (January 2010)

The Chief, Army Power Division, Communications-Electronics Research, Development and Engineering Center's Command and Control Directorate (CERDEC, C2D), requested DCMA-IAC to perform an analysis of the industrial base supporting 50 and 300 Watt (W) fuel cell systems. This analysis will assist in determining those areas that potentially require additional government involvement, to ensure that the fuel cells under development will provide the warfighter the most advanced, reliable system at an affordable unit price. In addition, the assessment focused on production capacity, and areas potentially impacting full-scale production of the fuel cells. The assessment includes discussions surrounding production of the fuel canister, with the goal of reducing the costs of these canisters.

A total of ten fuel cell manufacturers (13 sites) were selected and visited to analyze their current capabilities to potentially support the 50 W and 300 W fuel cell programs. Currently, the fuel cell industry is generally comprised of companies that derive their revenue from R&D contracts. With the exception of commercial fuel cell production in Germany, there has been no volume production for fuel cells. The military fuel cell industrial base is still very young. There appears to be sufficient capacity for developing Fuel Cells in the 50W and 300W realm. However, there has been little opportunity to develop manufacturing techniques due to the lack of military requirements. Several suppliers are developing volume production for commercial fuel cells. Upon the conclusion of the 50W and 300W Broad Area Announcements (BAA's), opportunities may exist for military production contracts to be placed with industry.

CERDEC C2D assessed the production of the fuel canister, focusing on cost reduction efforts. Canisters are used for storing fuels to energize the fuel cell; they contain either propane, methanol, methanol/water mixes or chemical hydrides. Several suppliers reported not currently using proprietary fuel canisters, but rather utilizing commercial propane tanks. Propane, presently in the DoD supply chain, has a worldwide distribution system and an international standard for tank interface. Recommendations include using disposable cartridges for their methanol/water mix. Cartridge costs can be reduced by aggressive sourcing, significant reduction in fasteners to reduce labor time, increasing fuel to approximately ½ liter and standardization for all Methanol Fuel Cartridges (MFC) (larger batches). Bulk methanol

fuel, when repackaged into inexpensive Commercial-Off-The- Shelf (COTS) containers, provides an extremely low life cycle cost.

The requisite industrial capabilities to produce 50W fuel cells for Air Force programs and 300W Fuel Cells for Army programs are both considered low risk, since several companies currently possess the requisite capabilities (i.e., skills, facilities, processes, technologies) to research, develop, manufacture, test, evaluate and produce 50W and 300W fuel cell systems. Most of the assessed companies in the fuel cell industry are rated moderate financial risk. The ability to compete successfully in the research and development (R&D) environment depends on a number of factors, including the effectiveness and innovative nature of R&D programs and the companies' ability to offer better program performance than competitors at a lower cost. At this stage, most companies financial condition warrant some concerns. R&D has a special financial significance apart from its conventional association with scientific and technological development. R&D investment generally reflects a government's or organization's willingness to forgo current operations or profit, to improve future performance or returns. Companies in the fuel cell industry are sensitive to market conditions and investor perception of new technology. Fifty percent of the companies assessed are dependent on government funding. A reduction in government contracts could affect the companies' viability. The companies could also be impacted if projected contracts do not materialize. However, the number of individual companies involved in fuel cell development offsets the industrial capability risk.

Chemical, Biological, Radiological and Nuclear (CBRN) Industrial Capability Assessment (April 2010)

The Chemical, Biological, Radiological, and Nuclear Industrial Capability Assessment (CBRN ICA) is an addendum to the Surge and Supply Chain Management Industrial Base Study (December 2009). The report narrative supports the December 2009 study findings, and adds an industrial capability risk assessment of the determined CBRN critical items. Critical Item Risk is based on current program requirements excluding surge capabilities. Surge capabilities are analyzed independently in this report.

DCMA-IAC has performed industrial capability analyses for the Chemical Biological Defense Program (CBDP) community since 1996. The Joint Program Executive Officer-Chemical Biological Defense (JPEO–CBD) uses these assessments to support initiatives of the Joint Logistics Advisory Council for Chemical and Biological Defense (JLAC-CBD) Industrial Base Analysis Working Group (IBWG) (JPEO-CBD JLAC IBWG) to help make critical procurement decisions. DCMA-IAC and the Army Materiel Command (AMC)’s Research, Development, and Engineering Command (RDEC) Industrial Base Analysis (IBA) Team are members of CBDP IBWG and have Memorandums of Agreement with the JPEO CBD to perform industrial base analyses on a recurring basis. To address CBDP visibility of the CBRN industrial base status and the risk associated with the CBRN IB, JPEO-CBD tasked the JLAC-CBD IBWG to

conduct an analysis on certain CBRN systems, a Surge and Supply Chain Management Industrial Base Study, and identify risks and potential mitigation strategies for the JPEO-CBD to accomplish its mission in times of surge and national emergency. Surge capability issues, findings and concerns were identified and assessed. Consideration was also given to utilize and develop additional organic industrial base capabilities to provide sustainment for CBRN systems/items. For the Surge and Supply Chain Management Industrial Base study, the team solicited 17 contractors, from five CBRN sectors, for information on selected programs or items.

The CBRN industrial base is embedded in numerous durable and non-durable manufacturing industries. Research fundamental to these industries is driven by commercial requirements with the Department having little or no influence. Constraints, which vary through this niche industry, include dependence on sole source critical sub contractors; foreign dependency for critical item production; lack of domestic/organic capability for critical items, excessive lead time for critical raw material, testing constraints for critical raw materials; financially questionable producers, and single points of mechanical failure associated with production processes.

There is presently a sole source for all carbon utilized in DoD CBRN filter elements which is also dependent on the DoD organic Laboratories for product certification. It is recommended that DoD establish an alternate source for carbon production, as well as increase capacities at organic laboratories. Another constraint is the use of foreign sources for critical items (DNA/RNA purification extraction kits) for the JBAIDS system. It is recommended that DoD replace current extraction kits with new technology (Platinum Path Extraction Kit). Replacing the current kits with new will relinquish dependency on a critical foreign subcontractor. An additional consideration is to utilize and develop additional organic industrial base capabilities to provide sustainment for CBRN systems/items.

Most contractors can surge with additional manpower and additional shifts. Few contractors require industrial preparedness measures to increase production. Seventy percent of the contractors are currently dependent on government contracts for viability, and are dedicated to sustaining the CONUS CBRN industrial base. Most contractors intend to broaden their commercial industrial production base(s) with sales to other government agencies. DCMA-IAC recommends that the Department closely monitor a sole source producer with the potential single point of failure for several CBRN items.

DCMA-IAC performed an industrial capabilities risk assessment of Chemical, Biological, Radiological and Nuclear industry. For the purposes of this study, industrial capabilities are defined as the skills, facilities, processes, and technologies necessary to research, develop, manufacture, test, and evaluate the specified CBRN critical items.

Of the identified 12 critical items supporting CBRN programs, five are considered low risk, six are considered moderate risk, and one is considered moderate to high risk to their respective programs. The critical items considered low risk have alternate sources available that can be qualified to produce the items within time and cost

parameters without impact to the particular program. The items considered moderate risk have only one reliable source currently providing the requisite capabilities, but with no qualifiable sources available within time and cost parameters. In most cases this is considered acceptable risk. However, one critical item, the Joint Service Lightweight Integrated Suit Technology (JSLIST) fabric which is considered a moderate to high risk. JSLIST Fabric for U.S. military is essential and unique with only one qualified producer in the industrial base. No alternative sources exist. Any reductions in JSLIST demand would jeopardize the ability of the sole source provider to sustain its production capacities. The company is dependent on the JSLIST/JPACE Programs to support its production facility.

In summary, it was determined to maintain a minimum sustaining rate of production at the facility commensurate with requirements of the Joint Requirement Office for CBRN Defense, explore alternative technologies that may provide a substitute CBRN garment fabric meeting the required JSLIST Program capability; and perform a cost-risk-benefit analysis to determine feasibility of regenerating this commodity should the producer go out of business. This would include cost to obtain the Technical Data Package.

Titanium Industrial Base Sector Analysis (August 2010)

The U.S. Army Aviation and Missile Research, Development & Engineering Center (AMRDEC) Industrial Base Group performed a titanium sector analysis to advise their customers within the Aviation and Missile Command (AMCOM) community as to the best utilization of available resources in order to ensure the Warfighter support.

Titanium was chosen due to its importance in Army rotorcraft programs and its history of being a volatile commodity. There are over 150 titanium parts found in the CH-47 Chinook, UH-60 Blackhawk, and AH-64 Apache helicopters. Lead times and rising titanium prices affect AMCOM's ability to provide titanium spare parts in a timely and cost efficient manner. This, in turn, affects back order levels and readiness levels. A perfect example of this occurred in 2006-2007 timeframe. From 2003 to 2006, titanium prices and lead times tripled due to demand outstripping supply in the market. In 2007, the CH-47 aft blade was the number one CH-47 backordered item in terms of monetary value. A study of the CH-47 spare blade supply chain revealed that the lead time and availability of titanium end caps would have to be improved in order to improve the lead time and availability of blades. Further study revealed that titanium lead time and availability was having an adverse effect on the titanium end cap lead time and availability. An analysis of the different pieces of the supply chain revealed how titanium capacity and demand were impacting titanium lead time, price, and availability, which directly affect spare parts lead time, price, and availability. The overall impact resulted in a significant delay, which created a spare part backorders and reduced readiness levels ultimately affecting the warfighter.

Another key finding was the inability of the Department to provide industry representatives with DoD titanium demand forecasts. There were several inputs creating this void, yet the critical input was the lack of guaranteed annual funding. This caused an inability to produce accurate forecasts, ultimately hindering planning for industrial capacity requirements. It is recommended that a Joint DoD/Commercial Industry Titanium Sector Round table be held at least annually to help address this problem.

Joint Air to Ground Missile Industrial Capability Assessment (September 2010)

The Army Program Executive Office Missiles and Space (Redstone Arsenal, Huntsville, Alabama) and the Joint Air-to-Ground Missile (JAGM) Product Management Office requested DCMA-Industrial Analysis Center (IAC) perform an Industrial Capability Assessment (ICA) for the Engineering and Manufacturing Development (EMD) Phase of the JAGM System. The purpose of the ICA was to assess, identify risk, and offer risk-mitigating actions, if required, in understanding the industrial base and its capability to support JAGM's EMD contract. Resultant findings were in support of the Defense Acquisition Board Milestone B review scheduled for the fourth quarter of CY2010.

The JAGM is a follow-on to the Joint Common Missile program, a project that was terminated in December 2004. The requirement remains for a beyond line-of-sight/extended range missile interoperable with fixed wing, rotary wing, and unmanned aircraft platforms. This Army-led Joint Service program will be the next generation air-to-ground missile designed to replace the Hellfire II, TOW 2A, and Maverick missile systems.

The IAC, in coordination with the JAGM PMO, focused on the critical components of the JAGM System and the key subcontractors for the analysis. The Industrial Analysis Center assessed capabilities for work force skills, processes, facilities, technologies, workload distribution, capacity, alternate sources of supply, and for essential and unique industrial capabilities. Industrial capabilities were defined as the experience, knowledge, skills, facilities, equipment, capability, and capacity needed to design, develop, and produce the missile.

Financial viability assessments were completed for both JAGM contractors population as well. The financial assessment population consisted of 13 companies, all of which were assessed for financial viability. None of the companies was rated as a high financial risk.

The Industrial Analysis Center found that the industrial base supporting the JAGM had the requisite industrial capabilities (skills, processes, facilities and technologies) to support JAGM through the EMD Phase. Current capacity utilization levels also indicated that each contractor analyzed could support additional workload to meet future JAGM requirements, with the exception of the Warhead contractor. Important issues identified in the assessment included: competing priorities between

the SDB II and JAGM using the same tri-mode seeker industrial base, a single source for the JAGM Warhead; and solid rocket motor market concerns which could impact the cost of future tactical Solid Rocket Motors.

All of the components assessed were a low industrial capability risk except for two components, which were a moderate risk. The two components assessed as a moderate industrial risk were the Main Warhead and the Precursor Warhead, due to a current limited production capability. None of the components were assessed as a high industrial capability risk.

Joint Tactical Radio System (JTRS) Type-1 Cryptographic Handheld Radio Industrial Capability and Cost Assessment (September 2010)

The Deputy Assistant Secretary of the Army for Acquisition, Policy and Logistics (SAAL-ZL), Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology) (OASA (ALT)), Headquarters, Department of the Army, requested DCMA-IAC to perform an industrial capability assessment and an independent evaluation of product cost of the acquisition strategy for handheld, single channel, National Security Agency (NSA) certified Type-1 radios. Type-1 radios are procured by the JPEO JTRS through the Space and Naval Warfare Systems Command (SPAWAR) Systems Center, Pacific (SSC, PAC) on the Consolidated, Single-Channel, Handheld Radio (CSCHR) contract. One prime contractor was evaluated in this assessment.

The CSCHR award combines all handheld radio purchases for the Department of Defense, which facilitates unit cost reductions through quantity buy discounts by pooling the purchases of these radios across all services. When the Services purchase the radios outside of the JTRS contract, radio prices can be significantly higher.

The CSCHR contract is reaching its completion. The future for handheld radios is in the follow-on procurement and in the eventual product improvements resulting from advances in technology. In the interest of maintaining competition for future procurements, a dual-source award continues to be the recommended acquisition strategy.

The industrial capabilities for producing handheld radios are available either through other military product lines or in the commercial marketplace. NSA Type-1 certification is required for producing Type-1 handheld radios and it belongs to a very limited set of suppliers. Further competition for this product is difficult unless additional NSA Type-1 certifications can be obtained.

Handheld radios are considered a low industrial base risk since there are two viable sources currently providing the requisite industrial capabilities. Both sources currently have the skills and knowledge, processes, facilities, and equipment needed to design, develop, manufacture, and support Type-1 cryptographic handheld radios for DoD JPEO JTRS.

Raw Materials Assessments as a Supply Chain Tool (October 2010)

The U.S. Army's AMRDEC Industrial Base Group's primary goal is assessing the ability of the IB to manufacture affordable Army Aviation and Missile materiel requirements for operations, major theater wars, replenishments, and contingencies. The Raw Materials Assessment project supplements that goal by monitoring raw materials vital to the Army's Aviation and Missile weapon systems.

The Raw Materials Assessment project continually monitors AMCOM relevant raw materials for domestic capacity, import sources, and pricing. Furthermore, it tracks pertinent information discovered through continuous research of private and public sectors supplying and utilizing these materials. Each material is analyzed and assigned a rated using color code of green, yellow, and red (with red requiring the most management), which is monitored and updated each month to ensure a proactive program.

The requirement for this type of intense management became a necessity when aviation lead times for parts began reflecting a steady increase in 2004. For example, the lead time for premium melted steel used in the CH-47 Aft Rotor Hub went from 13 weeks in 2004 to over 70 weeks in 2011. Furthermore, the price of some raw materials has experienced a tremendous increase when compared to stable pricing from late 1990 to 2004. The list of raw materials being tracked will fluctuate depending upon programmatic requirements and overall economic and supply and demand conditions. Presently, AMRDEC is monitoring aluminum, copper, composites, low-alloy and the premium melted steels such as magnesium, molybdenum, nickel, and titanium. As the Raw Material Assessment project matures, there will be a point where the monitoring and reporting system transitions to an automated process drawing upon existing public domain data streams. The yet-to-be- developed system will provide real-time information on material pricing, market trends, and forecasts on each monitored material supplier.

The Raw Material Assessment project has been constrained to AMRDEC supported weapon systems; however, it could be readily expanded to serve as a vital tool for the Army IB community.

3.3 Navy

Copper-Nickel Seamless Tubing Industrial Capability Assessment (January 2010)

Naval Sea Systems Command (NAVSEA) HQ, Director, Cost Engineering and Industrial Analysis requested assistance from the DCMA-IAC to provide an industrial capability assessment on Copper-Nickel (Cu-Ni) tubing, specifically whether a potential sole source exists. NAVSEA identified the domestic company of concern. DCMA was also requested to assess the source's ability to produce seamless Cu-Ni tubing, and investigate the impact and potential industrial base issues that would occur in the defense shipbuilding industry if the source ceased operations.

The MIL-T-16420K Specification, Tube, Copper-Nickel Alloy, Seamless and Welded, covers two compositions of round Copper-Nickel alloy tube (Copper Alloy Numbers 715 and 706) for basic piping systems on surface ships and submarines (seamless, and ultrasonically tested). Industry experts indicate that Cu-Ni tubing is the material of choice for the Navy due to its seamless construction and manufacturing malleability, biofouling, and corrosion resistant properties related to welding and performance in high-temperature seawater applications. Stainless steel tubing is one possible cost reducing alternative material to Cu-Ni tubing; however, certain grades of stainless steel are particularly susceptible to corrosion during welding and/or may form brittle phases in the alloy microstructure when exposed to seawater in high-temperature applications. Considering the higher risk for problems on Navy vessels, Cu-Ni tubing remains the material of choice for the Navy despite the fact that it is more expensive than most stainless steel. There is little commercial demand for this Copper-Nickel tubing product. Commercial vessels opt to use stainless steels with commensurate cost savings.

DCMA-IAC conducted market research to determine who within the Cu-Ni tubing industry has a similar capability and who else may be supplying the shipyards with Cu-Ni tubing. Of the seventeen companies contacted, only three were Cu-Ni manufacturing companies. The remaining companies were either machine shops that redraw, bend, or alter the tubing, or distributors. All three of the Cu-Ni manufacturing companies contacted could only produce tubing with an outside diameter (OD) range of approximately 0.25-2 inches. None of the companies contacted could produce Cu-Ni tubing with an OD greater than two inches.

Limited research concluded that the company identified by NAVSEA is the only qualified, domestic manufacturer of seamless Copper-Nickel tubing, for outside diameter sizes greater than 4.5 inches, that meets the military specification MIL-T-16420K, for naval shipbuilding and submarine applications. The Navy and the prime contractors also buy large diameter tubing from a qualified foreign source; however, there are multiple sources available, both domestic and foreign, for smaller diameter tubing sizes.

Broad Area Maritime Surveillance Unmanned Aircraft System Industrial Capability Assessment (February 2010)

Naval Air Systems Command (NAVAIR) Program Executive Officer, PMA 262, requested DCMA-IAC to perform an ICA of the industrial base supporting the Broad Area Maritime Surveillance (BAMS) Unmanned Aircraft System (UAS) program. The purpose of the ICA was to assess, identify risk, and offer risk-mitigating actions, if required, in understanding the industrial base and its ability to support BAMS UAS program. This analysis will assist NAVAIR as a Post Milestone B review of industrial capabilities to support the eventual acquisition of the BAMS UAS.

NAVAIR study requirements directed a focus on the airframe manufacturers and one long-lead critical component manufacturer. DCMA-IAC visited and assessed a total of seven sites, including the prime contractor and several key subcontractors. DCMA-IAC emphasized assessing industrial capabilities required to successfully obtain products and services required for the approach of Milestone C. Current production requirements are projected to be four units per year. In addition to the prime contractor who manufactures and integrates the BAMS UAS, the industrial base consists of several contractors that currently possess the industrial capabilities required for research, design, development, test and evaluation, and maintenance for a BAMS UAS type vehicle. For the purposes of this study, industrial capabilities are defined as the skills, processes, facilities and technologies necessary to research, develop, manufacture, test, and evaluate BAMS UAS.

Current capacity utilization levels indicate that each contractor analyzed can support additional workloads at this time. Furthermore, this support is projected to be available for future BAMS UAS workloads. Skills resident at the contractor sites visited are not unique and are common throughout industry or considered replaceable within an acceptable amount of time (i.e., less than 12 months). Based on the DoD procurement budget for the next decade, the sub-tier industrial infrastructure supporting the UAS industrial base will most likely increase in size. It consists of numerous subcontractors/vendors, employing the industrial capabilities to support all levels/tiers of DoD UAS programs.

The BAMS UAS industrial base is considered a moderate risk since, for most of the components/systems analyzed (including UAS Manufacture/Integration, Fuselage, Wing Section, Avionics, V-Tail and Empennage), there is only one reliable source currently providing the requisite industrial capabilities (i.e., skills, processes, facilities and technologies) with the exception of the Landing Gear where alternate qualified sources exist. In addition, the analysis revealed additional concerns warranting attention:

- The BAMS/Global Hawk integration area is approaching full capacity. Additional space will be required as the program ramps up and FMS increase. The avionics

assembly area for the BAMS UAS is operating at capacity on a single shift. Additional shifts and test equipment could ease this constraint.

- The BAMS UAS prime contractor identified twelve subcontractors manufacturing critical components, all of which are single sourced with long lead times. It was reported that it will take between 36 – 42 months to qualify alternative sources; however, these timeframes appear extreme and should be further examined.

Advanced Precision Kill Weapons System II (APKWS) Industrial Capability Assessment (March 2010)

Naval Air Systems Command (NAVAIR) PMA 242 requested DCMA-IAC to perform an ICA of the contractors supporting the Advanced Precision Kill Weapon System (APKWS) II program in support of its Defense Acquisition Board Milestone C decision. The purpose of the ICA was to assess, identify risk, and offer risk-mitigating actions, if required, in understanding the industrial base and its ability to support the APKWS II program. DCMA-IAC visited and assessed a total of fourteen sites at the request of PMA 242, including the prime contractor and 13 key component subcontractors.

APKWS II is an Acquisition Category (ACAT) III program managed by the Direct and Time Sensitive Strike Program Office, PMA-242. The program's objective is to quickly produce and field a low-cost, precision, semi-active laser (SAL) guided 2.75-inch rocket. APKWS II production is fully funded across the Future Years Defense Program (FYDP) in the Airborne Rockets Procurement Ammunition Navy, Marine Corps budget line item.

The APKWS II adds a SAL guidance section to the existing unguided 2.75-inch Rocket System for a low-cost, low yield, precision kill capability against soft to lightly armored/hardened targets. The APKWS II All-Up-Round (AUR) consists of three components: a rocket motor (MK 66 Mod 4), a warhead (M151/M423 or MK-152/MK-435 warhead), and an APKWS II Guidance Section (GS). The APKWS II AUR will be assembled in the field and then loaded into a rocket launcher (LAU-61E/A (19-tube) or LAU-68F/A (7-tube) rocket launcher). The APKWS II GS mid-body design is installed between the rocket motor and warhead. No aircraft or unguided rocket system modifications are required for APKWS II.

Based on the analysis of the Prime for the APKWS II, the requisite industrial capabilities (skills, processes, facilities, and technologies) necessary to research, develop, manufacture, test, and evaluate APKWS II are considered a moderate risk because: the prime contractor is the sole source company providing these capabilities, and there are no alternative qualifiable sources available within acceptable time and cost parameters. Regarding the industrial capabilities of the sub-component manufactures; three components supporting the APKWS II program are considered low risk, as each company currently is a qualified source providing the requisite industrial

capabilities to produce their respective products, and there are potential alternative qualifiable sources available if necessary. The industrial capabilities to manufacture the remaining ten components are considered moderate risk because each company is the only qualified source providing the requisite industrial capabilities to produce its respective products, and there are alternative qualified sources available, but not within acceptable time and cost parameters.

Financial reviews were performed at the company corporate and parent level. Nine of the 14 contractors are assessed as moderate financial risk, and two assessed as low financial risk. Although the companies rated as a moderate financial risk are stable, they remain sensitive to market conditions. None were considered to be high financial risk, although it should be noted that three are unrated. At this time, there are no indications of financial risks that could cause significant program impact.

High Altitude Anti-Submarine Warfare (HAASW) Sonobuoy Industrial Capability Assessment (April 2010)

The NAVAIR Air Anti-Submarine Warfare Systems Program Office (PMA 264) requested DCMA- IAC to perform an ICA on the sonobuoy industry as a follow-up to the Advanced Extended Echo Ranging ICA performed in December 2008. PMA 264 was also interested in the industry's ability to incorporate a GPS and a NATO digital communication uplink into the sonobuoys, as well as the feasibility of incorporating meteorological sensing devices in the bathythermograph buoys.

Incorporating GPS ability into sonobuoys provides precise positioning information. Currently, sonobuoys with GPS are being produced primarily for use in scientific experiments or in support of engineering ocean tests by the Navy laboratories and foreign customers. These GPS equipped sonobuoy units are not currently approved for use by the fleet. GPS-equipped sonobuoys are at Technology Readiness Level (TRL) 8 and will take approximately six months to achieve TRL 9. The U.S. Navy has an approved waiver stating that they are authorized to use non-military GPS services on sonobuoys, which makes it acceptable to use the same commercial GPS units for fleet sonobuoys, upon qualification. Additionally, incorporating GPS into the sonobuoy system currently causes some system degradation. Efforts are continuing to eliminate this degradation. Another effect of the GPS is decreased battery operating life; current sonobuoy batteries are designed to meet the operating life requirements without the addition of GPS. Power requirements and the battery design will need to be re-evaluated. NATO uplink provides a digital high bandwidth communication in high Radio Frequency Interference (RFI) environments as well as communication compatibility across the NATO countries. Currently, sonobuoys with a digital uplink capability do not use the NATO uplink. The existing design requires maturing (at TRL 4) in order to realize the NATO digital uplink performance requirements for use in sonobuoys. The NATO digital uplink may also have a negative impact on battery life.

The sonobuoy industrial base consists of two U.S. manufacturing companies. Current sonobuoy production includes passive (AN/SSQ-53F and AN/SSQ-101A), active (AN/SSQ-62E), and special purpose (AN/SSQ-36) devices.

The industrial capabilities required to produce the HAASW sonobuoy system are considered low risk. Data indicates the industry can meet NAVAIR requirements for AN/SSQ 53F and 62E by continuing to produce sonobuoys at the current rate through 2017. Requirements for AN/SSQ101A sonobuoys can be met at the current production rate through 2014. Both companies identified one critical wire supplier for which they have no alternate source. Neither company has experienced quality or delivery problems with the wire producer; however, an interruption of wire supply from this critical source would have detrimental effects on both companies' ability to produce sonobuoys and meet schedules.

Vertical Take Off and Landing Tactical Unmanned Aerial Vehicle (VTUAV) Radar System Industrial Capability Assessment (June 2010)

The Navy's Program Executive Officer, Unmanned Aviation & Strike Weapons (PEO U&W), Unmanned Aerial Vehicles Program Office (PMA-266), requested the DCMA-IAC perform an Industrial Capability Assessment (ICA) of radar systems potentially supporting the VTUAV–ACAT II Block I upgrade. The analysis assessed two prime radar contractors that responded to a request for proposals and their key subcontractors (six). The ICA will determine if requisite industrial capabilities exist in support of the VTUAV program's Defense Acquisition Board Milestone C review.

The Block I upgrade will reconfigure the MQ-8B Fire Scout VTUAV to add an Active Electronically Scanned Array (AESA) multi mode radar system. The radar system upgrade is non-developmental. PMA-266 will procure 131 total radars for the primary deployed VTUAV aircraft. The acquisition profile is estimated to be five per year for the first three to five years, after which production will increase to ten per year.

The RDR-1700B AESA is currently installed on Japanese Coast Guard Helicopters, and the 7500E AESA (similar design to 5000E) is installed on the U.S. Custom & Border Protection's Predator B UA and the U.S. Coast Guard HC-130 aircraft. The RDR 1700B search radar is considered a commercial off-the-shelf (COTS) radar system, and is currently in production at the rate of four units per month. The 5000E search radar is also considered a COTS radar system, and is currently in production at the rate of three units per month.

Each of the prime contractors analyzed possess the full range of industrial capabilities required to research, design, develop, test, and evaluate Active Electronically Scanned Array (AESA) multi mode radar systems for the VTUAV Block I upgrade. Each of the subcontractors analyzed possess the full range of industrial capabilities required to research, design, develop, test, and evaluate their respective radar systems components supporting the VTUAV Block I upgrade. In each case,

several alternate qualifiable sources are currently available in the defense industrial base. In addition, the industrial capabilities identified in this report are not unique to the U.S. radar industrial base. Therefore, the requisite industrial capabilities (skills, processes, facilities and technologies) necessary to research, develop, manufacture, test, and evaluate multi-mode radar systems supporting VTUAV Block I upgrade program, are considered low risk**.**

F/A-18E/F Distributed Targeting System Industrial Capability Assessment (October 2010)

The Naval Air Systems Command (NAVAIR) Program Executive Officer, PMA 265, requested DCMA-IAC to perform an ICA of the industrial base supporting the F/A-18E/F Distributed Targeting System (DTS) program to support its Defense Acquisition Board Milestone C decision in March 2011. The objective of this assessment is to provide an understanding of the industrial base capabilities supporting the DTS production, identify industrial and financial risk, and recommend risk-mitigating actions, if required. This analysis will determine the ability of the U.S. industrial base to support current and future production requirements of the DTS.

The DTS (AN/AYK-29 (V) 1) provides real-time, precision weapon system target location by geo-registering aircraft sensor imagery and producing a precise target location. This system sharpens the accuracy of the aircraft sensors enabling weapons such as the Joint Direct Attack Munitions (JDAM) and the Joint Standoff Weapon (JSOW), to provide a precision strike capability and decrease collateral damage incidents.

There are three companies in the population for the DTS: the integrator, the subcontractor that manufactures the system, and a sub-supplier that provides the Solid State Drive. The current production capabilities and capacity utilization levels indicate that the DTS manufacturers can support the current and projected workload. The current capacity is expected to remain available for future support of the DTS program. The DTS will share the production line with several products currently in production.

DCMA-IAC's research and analysis has shown the current industrial base can support the planned delivery of Low-Rate Initial Production. Currently, the DTS production line has a surge capacity in excess of the planned production requirements. Several defense contractors possess the industrial capabilities to produce the DTS.

The requisite Industrial Capabilities (skills, processes, facilities/equipment and technologies) necessary to research, develop, manufacture, test, and evaluate DTS exist in industry. However, there is presently a single qualified source providing these capabilities and an alternate source could not be qualified for this system without affecting the program delivery cost and schedule. Therefore the industrial capabilities to manufacture the DTS are considered a moderate risk.

The sub-tier vendor base is stable and supplying modified COTS material. All levels of DTS production can be supported, although some concerns were identified, including potential test equipment bottlenecks and single qualified sub-tier suppliers.

F/A-18E/F Infra-Red Search and Track (IRST) System Industrial Capability Assessment (October 2010)

NAVAIR Program Executive Officer, PMA 265, requested DCMA-IAC to perform an ICA on the F/A-18E/F Infra-Red Search and Track (IRST) system to support its Defense Acquisition Board Milestone B decision. The objective of the ICA was to assess, identify risk, and offer risk-mitigating actions, if required, in understanding the industrial base and its capability to support the IRST system.

The F/A-18E/F IRST is a long wave infrared detection system, which allows for targeting of airborne vehicles in a *radar* denied environment. The system will provide an improved capability upgrade of the F-14D (AN/AAS-42) IRST system. Versions of IRST systems have been in production for over 18 years. The IRST is mounted in the forward section of the fuel tank and consists of the following subsystems: a sensor head (IR detector, optics and three-axis gimbal); a Commercial-Off-The-Shelf (COTS) processor with a high density digital recorder (used only during flight testing); and, an environmental control subsystem (ECS). The assessment was limited to the F/A18E/F IRST system provided as Contractor Furnished Equipment (CFE), the ECS and the Fuel Tank Assembly (FTA), which houses the IRST system.

Current capacity utilization levels indicate that each of the six contractors that support the IRST Industrial Base can support additional workloads, and it is assumed that this capacity will be available to support future F/A-18E/F IRST workloads. Requisite skills at the contractor sites are common throughout industry or considered replaceable within an acceptable amount of time (less than 12 months). The sub-tier industrial infrastructure consists of numerous subcontractors, employing the necessary industrial capabilities to support all levels/tiers of F/A-18E/F IRST production. However, there are some concerns, including foreign ownership, system processor card development, and raw material sole source supplier.

The prime contractor is the single qualified source with no alternative qualified sources within acceptable time and cost parameters. A potential risk also lies in the one-year production gap in 2011 where no new IRST builds will be performed, only work on field returns.

The F/A-18E/F IRST industrial base is considered a moderate industrial risk, since, for most of the components/systems analyzed, there is only one reliable source currently providing the requisite industrial capabilities (skills, processes, facilities/equipment and technologies) necessary to research, develop, manufacture, test, and evaluate F/A-18E/F IRST. The prime contractor is also considered a moderate financial risk.

DCMA-IAC's analysis indicates that several additional concerns warrant attention. One of the support sub-suppliers is a foreign owned company. They operate under a Special Security Agreement (SSA) with the U.S. government that allows them to operate as a U.S. firm. This company is a subsidiary of a U.S.-based company, but is owned by a company from the United Kingdom.

For the Block I release, the IRST will utilize a commercially available system processing card. To verify the manufacturer's capabilities and capacity of the processing card, it is recommended that an industrial capability assessment be performed. A potential industrial risk also lay in the one-year production gap in 2011 where no new IRST builds will be performed, only work on field returns. The personnel performing production on the IRST will be sent to other work areas and recalled when production is ready to start back-up. It is recommended that this issue be monitored for any potential impact to future IRST production.

It is recommended that the supply of epi-ready CdZnTe detector substrate material from the sole source supplier be closely monitored to mitigate any future impact of availability for the F/A-18 IRST system. The Missile Defense Agency (MDA) is currently working with a Canadian company to develop the capability to produce the same quality of CdZnTe detector substrate that could also be utilized for the F/A-18 IRST.

Overall, recommend that all single source components identified as a moderate industrial risk due to potential qualification concerns (acceptable time and cost parameters) be monitored for any potential impacts. Alternatively, qualifying a second source in these areas should be considered a priority to eliminate any potential issues in the out years. It is also recommended that all companies rated a moderate financial risk be monitored on a continuing basis for their financial condition.

3.4 Air Force

AF Industrial Base Assessment of Operational Flight Program and High-Integrity Avionics Software Tools (March 2010)

This assessment, requested by SAF/AQR & Aeronautical Systems Center, characterized supply chains and best innovative practices in the industry segment that supports the development and application of software tools used to develop operational flight programs (OFPs) and high-integrity avionics software. Software tools are computer programs used to produce other programs, including software applications, operating systems, and libraries. The F-22 was the first major military aircraft to include an integrated OFP, where the aircraft's systems are handled by a centralized OFP that

takes much of the traditional load off the pilot. The F-35 has also adopted an integrated OFP.

The software industry is organized as competing business ecosystems. Many companies that market software tools leverage products developed by large avionics manufacturers in response to evolving DoD standards and programming languages. Most companies marketing software development tools for aviation applications also supply a real-time operating system and work closely with microprocessor designers to better understand the functionality of the hardware. The software tool companies integrate subsystem operations by teaming with suppliers of specialty and commercial software products. This collaborative environment is used by avionics original equipment manufacturers to develop OFP applications for the aircraft manufacturers and by U.S. Air Force software maintenance organizations.

To reduce barriers to business and technical innovation, there is a need for more common and consistent approaches to applying standards, sharing information, configuring data, and deploying tools among the Services and individual avionics projects. These practices would offer incentives to more tool developers to compete for U.S. Air Force acquisitions and could accelerate the adoption of rapidly evolving commercial technologies. For example, an industry-wide approach, such as an XML-based approach, needs to be developed for representing the configuration data for an entire plane and its subsystems, including the software and the hardware hosting that software. In addition, DoD acquisitions can benefit from programs such as the Federal Aviation Administration's Designated Engineering Representative infrastructure for overseeing standards application, as well as the National Security Agency's Tokeneer Project for verifying toolsets for the development of high-integrity software. Finally, maintaining and updating legacy applications to incorporate new requirements present unique challenges to the Air Force in terms of when and how to adopt and verify new software languages and techniques.

The results of the assessment will be reviewed for incorporation into updates of the Air Force Weapon Systems Software Management Guidebook. Recommendations to establish an avionics software information exchange for high-integrity software and a high-integrity avionics software test bed will be reviewed as potential investment candidates.

Germanium Wafers Industrial Base Assessment (May 2010)

Germanium wafers are critical to the development and manufacture of solar cells for National Security Space (NSS) satellites. The demand for solar power, to include concentrator photovoltaic systems using Germanium wafers, is expected to grow significantly over the next four years. In response, Germanium wafer manufacturers have constructed new facilities and/or expanded existing ones. Concerns over stability of supply exist because of factors such as foreign sourcing and competition, current

technology initiatives, and government policies that can rapidly and negatively impact this market.

Currently, there is one qualified Germanium wafer source supplying solar cell manufacturers that support NSS space systems. That source is foreign-owned; the increasing demand is straining production capacity, which in turn impacts program schedules. Also, the material and volume specifications of the Germanium wafer manufacturers require their suppliers to produce high purity (i.e., greater than 50Ω-cm) Germanium metal in sufficient volume to manufacture thousands of Germanium wafers every month. Germanium is extracted from coal and zinc production at refining operations primarily in Europe and Asia. Currently, the single domestic source of Germanium precursor material and high purity Germanium metal has capacity limits. Additional investment is required to reduce the risks of foreign dependency and schedule delays to future Air Force systems.

The industry is moving to address some of these supply chain concerns. Domestic production capability is being established. The qualified foreign source recently completed construction of a wafer manufacturing facility in the U.S. that doubled their current worldwide annual production capacity to over one million Germanium wafers. A domestic manufacturer of Germanium wafers for commercial satellites is qualifying use of its products for NSS satellites. Access to two qualified domestic sources for Germanium wafers will lower overall risk to Air Force space acquisition programs. This will be critical should market demand increase as projected.

This assessment was performed at the request of the Under Secretary of the Air Force (SAF/US) and Air Force Research Laboratory (AFRL). The Air Force will continue to monitor this critical industry as individual decisions are made regarding procurements, as well as overall market conditions impacting commercial production operations.

Silicon Carbide (SiC) Fiber Production Capacity/Demand Report Update (May 2010)

This update was done at the request of the Joint Strike Fighter System Program Office and the Air Force Research Laboratory. The use of SiC fiber in military and civilian applications is growing and these fibers are used in Ceramic Matrix Composites (CMCs) to produce both engine and aircraft components offering distinct advantages over current metallic materials to include lighter weight, the ability to withstand high temperatures, and a low dielectric that can aid in reducing the radar signature of modern military aircraft, thereby enhancing the weapon system's survivability.

The F-35's Common Exhaust Nozzle uses SiC fiber CMC components to make up the exhaust nozzle's primary and secondary flaps and seals. The qualified source for this SiC material is a Japanese manufacturer. While other companies produce SiC

fiber materials similar to the material used on the F-35, there are no plans to qualify a second source. Due to rising demand, the price of SiC fibers increased 20 percent in 2009; however, the F-35's SiC fiber requirement is significantly lower than the FY07 forecasts as these higher costs have limited the utilization of SiC CMC exhaust nozzle components to only the Short Takeoff and Vertical Landing variant.

Several constraints regarding the current source of SiC have been identified by component manufacturers using the Japanese supplier. These include: slow delivery due to limited production capacity, export controls levied by the Japanese government that could curtail deliveries, and inconsistent product quality. These constraints have resulted in delays in fabricating components made from the SiC material. Earlier studies noted that a relatively modest investment could increase production capacity of qualified fibers from nine to twelve metric tons. This is facilitated by larger than forecasted supplies of the precursor, polysilane. Overall SiC demand is still lower than earlier forecasts predicted. While future demand forecasts still indicate a growing market, any plans to increase production capacity will have to proceed carefully so as not to significantly depress prices and potentially force suppliers out of the market. Applications being explored include an Army engine upgrade program and initiatives from turbine engine manufacturers for a variety of parts.

This assessment is supporting investment planning within the Air Force and broader Department of Defense research and development communities

Visible Sensors for Star Trackers Industrial Base Assessment (May 2010)

Star trackers use visible-frequency sensors as part of the satellite sub-system used for on-orbit attitude determination. Traditionally, star tracker manufacturers used Charge-Coupled Devices (CCDs) as the sensor of choice for star trackers aboard National Security Space (NSS) satellites. Manufacturers are now adopting a more advanced, less costly Complementary Metal Oxide Semiconductor (CMOS) technology. This assessment, requested by SAF/US, Space and Missile Systems Center, and AFRL, evaluated the supply chains associated with both CCD and CMOS sensor suppliers.

There are two primary domestic star tracker suppliers, along with a half dozen smaller vendors, that support the NSS medium accuracy star tracker marketplace. Overall, the star tracker marketplace is competitive with domestic suppliers operating at less than capacity. Demand for star trackers is expected to experience slight growth across the military, civil, and commercial sectors through 2015. Medium accuracy trackers make up approximately 90 percent, by unit, of the overall market. To date, CMOS sensor technology is in use in a majority of low-cost, high volume satellite applications. NSS satellite designs are beginning to transition from CCD to CMOS technology as qualification processes progress.

Since the star tracker market is driven by commercial applications, NSS systems will adopt CMOS sensor technology as most manufacturers will eventually phase out CCD devices. The primary risk faced by the Department of Defense is its ability to identify resources for non-recurring design and testing costs in order to qualify CMOS technology. If completed within a two to four years, NSS programs will avoid impacts due to obsolescence and/or parts availability. The study identified eight CCD and CMOS sensor suppliers to star tracker manufacturers – only two had domestic foundry capabilities. Supply chain vulnerability will remain an issue regardless of the technology being used. Additional investments in domestic foundry capability and CMOS technology should be investigated. The European Space Agency has supported the transition from CCD to CMOS by significantly funding the development of a standard visible sensor specification. To allow domestic manufacturers to compete, export control requirements for this technology will need to be reviewed to avoid restricting capabilities that are available in the global marketplace.

The Air Force will continue to monitor this critical industry as individual decisions are made regarding procurements, and overall market conditions impacting commercial production operations.

Industrial Base Assessment of Alternative Fuels for Military Use (June 2010)

This study requested by SAF/AQR and SAF/IE, assessed the industrial base capability to support Department of Defense alternative aviation fuel initiatives. This study identifies the potential market impact and/or risks associated with government investment solutions to mitigate technology, environmental, and business constraints; it also identifies significant advances in the development, refinement, and actual application of several alternative fuel generation methods.

The Department is a major consumer of energy, representing 97 percent of the total federal government's energy use. Within the Department of Defense, the Air Force is the major consumer of jet fuel, accounting for 64 percent of total use. Both the Department of Defense and the Air Force have established goals to reduce energy use and pursue alternative energy sources to reduce operating costs, carbon dioxide emissions, and dependence on foreign sources for energy supply. In 2005, the Air Force initiated alternative fuel certification for most aircraft in its inventory, focusing on fuels produced using coal-to-liquid and gas-to-liquid conversion processes. In 2009, the Air Force added fuels derived from biomass to the certification program. The certification program focused solely on the fuels' performance characteristics and compatibility with existing delivery systems. Other Department of Defense components also have active alternative energy initiatives.

Production processes for alternative fuels range from proven, mature, and commercially executed to just beyond the experimental stage. Significant technical challenges remain in the areas of carbon capture, catalyst materials, and equipment scale-up. There is no existing domestic industrial base or a favorable business climate

to support rapid migration of military aviation systems to the use of alternative fuels. Current business, environmental, economic, and social concerns represent significant barriers to entry for commercial firms planning large-scale alternative fuel production projects. Recent overseas gas-to-liquid construction delays, cost overruns, and technical problems reinforce industry concerns and make securing private investment funding difficult.

While the study originated within the Air Force, sponsorship was established through the North American Technology and Industrial Base Organization, which is chaired by Department of Defense and Canada's Department of National Defence. The report has been distributed throughout both departments, with emphasis on building existing partnerships or pursuing new activities in the areas of Planning, Technology Investment and Sharing, Collaboration, and Fuels Certification.

HC/MC-130J Aircraft Industrial Capability Assessment (July 2010)

In 2010, the Air Force Aeronautical Systems Center, Fixed Wing Branch, Wright Patterson Air Force Base, Ohio, requested the DCMA IAC to perform an ICA on increased production of the HC/MC-130J aircraft. This ICA was requested to support the Program Strategy Review in fulfillment of Milestone C requirements. The objective of the study was to assess the proposed increased production plan up to 36 C-130J aircraft per year by 2012. The new production plan includes various C-130J models on the same assembly line at the same time. In December 2010 the prime contractor will have progressively increased the move rate of the C-130J assembly line position to every six, instead of ten, days. . The new move rate will increase production of C-130Js to 27 in 2010, to 35 in 2011 and to 36 in 2012. The prime contractor plans to maintain 36 deliveries per year as long as confirmed orders are available. In addition to DoD requirements, the 36 C-130J aircraft per year quantity represents all orders including a significant amount of Foreign Military Sales (FMS). The current C-130J production rate in 2010 is 27 which included 12 aircraft for the DoD and 15 for FMS. In the past the prime contractor has been able to deliver other C-130 models in excess of 36 per year.

Most of the C-130J sub-assemblies are produced with the same tooling that has been in continuous use building earlier C-130 models since 1954. The C-130J assembly is a very high touch labor process with limited use of automation. The balancing of labor resources is the controlling variable in use to meet the increased production requirements. The prime contractor has moved fuselage workload to other company owned locations to better balance the new increased workload. This new workload transfer plan reduced the number of new employee requirements and to date has not caused any employment reductions to date. These union sites have a contract due for review/renewal in May 2011.

The HC/MC-130J is based on the Marine Corp KC-130J aerial refueling model. The specialized equipment for the HC/MC-130J includes aerial refueling receiving and delivery capability, an electro optical sensor pod surveillance system and upgraded

communication systems. The assembly line production flexibility now allows building multiple configurations of the C-130J simultaneously.

Based on C-130J program schedule requirements, the DCMA IAC found no significant risks or obstacles that would jeopardize the increased production rate of 36 aircraft per year by 2012. The supply chain is well prepared to support increased production rates and all required equipment is available and in good condition. All fuselage development sites are currently making parts that are meeting contract specifications ahead of the required build rate schedule. The C-130J purchases are taking place under both annual DoD budgets and congressional supplemental wartime funding to replace older aircraft in need of modernization.

The current prime C-130J contractor is the single qualified source providing these capabilities and owns the technical data package for the C-130J. Prior models of the C-130 had the technical data package owned by the Air Force. As the prime contractor is the single qualified source, an alternate source could not be qualified for these systems without affecting the program delivery cost and schedule. This results in a moderate risk to the C-130J program. This is considered an acceptable risk.

Nanotechnology Industrial Base Assessment and Strategic Plan for Nanomanufacturing (September 2010)

Developers of next generation weapon systems are looking at breakthroughs in the use of nanomaterials to meet future performance requirements. Nanotechnology is a field of science and technology aimed at controlling the structure of matter on a scale between 1-100 nanometers. Nanomanufacturing investments are aimed at enabling scaled-up, reliable, and cost-effective manufacturing of nanoscale materials, structures, devices, and systems. This assessment, requested by AFRL, developed an Air Force Strategic Plan for nanomanufacturing that identifies and prioritizes near-, mid-, and far-term program opportunities.

The study characterized this emerging industry into three initial levels in the aerospace nanomanufacturing value chain. At the lowest tier in the value chain is nanoparticle production where research is ongoing to discover nanoscale and nanostructured materials while understanding the material properties. At the second tier is nanoparticle integration where these nanomaterials are incorporated into more usable intermediate product forms such as fibers, yarns, and sheets or are uniformly dispersed in carrier agents such as liquids or polymers. The third tier is fabrication or device manufacture where the principles of nanoscale science and engineering are used to create novel, or modify existing, devices and systems to improve performance or provide new functionality.

Nanotechnology businesses, like many other startups, have both extreme opportunities and complex challenges. These include the cost of equipment and the availability of technical expertise. The Department of Defense will need to work with

this industry and provide support in maturing the technology, identifying candidate applications, transitioning nanomaterials/devices into system designs, and devising qualification and testing plans to validate performance characteristics. Three potential investment areas were identified based on multiple criteria used to prioritize known capabilities in the nanomaterials industry. The first investment area is the opportunity to reduce acquisition costs via enhancing Manufacturing Technology efforts in nano-enabled Direct Digital Manufacturing. The second area is to provide advanced manufacturing technologies for nano-enhanced Li-ion batteries in many Department of Defense weapon systems. The third investment area is the use of nanomaterials in electromagnetic systems for electromagnetic interference shielding and thermal management.

This assessment is supporting investment planning within the Air Force and broader Department of Defense research and development communities.

Air Force Annual Industrial Base Assessment (November 2010)

This report, requested by Assistant Secretary of the Air Force for Acquisition (SAF/AQ), provides an assessment of trends and issues affecting the sections of the national industrial base used by the Air Force. It summarizes the findings of numerous Air Force, Department of Defense, and industry studies and highlights industrial base issues that pose a risk to the Air Force's ability to acquire the systems and materials needed to carry out its mission.

The assessment evaluated five industrial base sectors consisting of relatively complex supply chains that support Air Force materiel requirements. Each sector analysis highlights the trends, issues, and concerns relative to that sector and, in some cases, the cross-cutting trends, issues, and concerns that affect multiple sectors.

Aircraft Sector - Most system and subsystem manufacturers in this sector are financially healthy and have robust teaming and supplier relationships. Commercial sales of both new aircraft and engines are expected to dramatically increase from 2010 to 2019 as the market comes out of recession and airlines re-capitalize. It is more difficult to project the volume of military sales, since many governments have announced plans to significantly reduce defense spending. At best, military sales will be flat with funds shifting from programs ending production (C-17, F-15, F-16, and F-22) to new platforms such as the F-35 and KC-X. Remotely piloted aircraft (RPA) represent a growing opportunity in terms of innovative design and product concepts that complement the traditional manned systems. There is the potential for sales from both traditional aerospace firms as well as new entrants, including start-up companies. This portion of the aerospace industrial base is still maturing with significant competition across the various types of RPA. The Air Force faces a number of challenges in working with the aircraft sector in the upcoming decade. The declining number of systems in production will free up capacity. This will eventually require decisions on personnel and facilities; as these decisions have economic, political, and security

implications. Costs and lead times for strategic metals will continue to be influenced by global commercial demand which, if it outpaces supply, could lead to concerns regarding availability. Use of airframe designs and components provided by foreign sources will continue to raise a range of technological leadership and supply chain vulnerability issues.

Sustainment Sector - Most suppliers are financially healthy. Commercial carriers outsource nearly all their maintenance workload. Global Maintenance, Repair, and Overhaul (MRO) market sales, including commercial and military expenditures, are well over $100B annually. Department of Defense MRO is performed in both commercial and government facilities, as well as on the flight line by military units. This sector's focus is on keeping aircraft flight worthy and mission capable. These services cover both planned and unscheduled maintenance and upkeep, as well as structural, power plant, and avionics work. Increased per unit replacement costs, lengthy development programs, and fiscal constraints are driving extensions in the service life of many systems. These trends have encouraged the Department of Defense and the Air Force to find ways to sustain fielded systems beyond their planned service lives. One of the biggest challenges is the continual need to maintain current sources of replacement parts or to develop new sources as the original manufacturers exit the market for economic reasons or simply go out of business.

Command, Control, Intelligence, Surveillance, and Reconnaissance (C2ISR) Sector - As commercial industrial capabilities and sales have grown, Air Force C2ISR capabilities have become increasingly dependent on the global electronics and telecommunications markets. While the Air Force may benefit from technological advances and economies of scale generated by the much larger commercial market, these factors can also reduce the responsiveness and willingness of electronics manufacturers to supply unique, low volume components for Air Force C2ISR requirements. This dependence on commercial production poses some risk to military systems as microcircuit manufacturers move operations to other countries. To ensure security of supply, the Department of Defense will have to rely on small, low volume domestic microelectronic design and foundry sources. This may result in higher per unit development and production costs, rapid technological obsolescence, and risk of financial stability for the suppliers.

Space Sector - While the large defense contractors are healthy, some concern exists over the long-term viability of key lower tier suppliers. The space sector includes satellites, launch vehicles, and Intercontinental Ballistic Missiles; it serves both commercial and military customers. As with the other segments of the defense industry, the space industrial base continues to face challenges adapting to current market conditions. Three prime contractors are responsible for design, integration, and test of most government space programs. Domestic demand is, in some cases, insufficient to keep all suppliers operating at an efficient capacity. Lower key suppliers have little interest in manufacturing 30 year old technology. In many instances, environmental issues will cause a supplier to exit the market. In addition, export control regimes may constrain the ability of these firms to utilize that capacity through international sales. As

a result, the space sector has a significant number of sole source suppliers some of which are foreign owned or based.

Weapons (Air Launched Munitions) Sector - The drive to develop more joint munitions will reduce the number of active production lines in all weapon categories (air-to-air and air-to-surface) resulting in a potentially negative impact on suppliers. Transitions to new generations of increasingly sophisticated munitions and the trend of increased globalization and foreign sourcing also present uncertainties for the supplier base. The relationship between the three large primes and their suppliers has been likened to an "inverted pyramid" where one or two small manufacturers supply common components across multiple end items. These suppliers provide such components as thermal batteries, rocket motors, jet engines, inertial measurement units, global positioning systems, missile seekers, fuzes, and warheads. This narrow supply base combined with limited capacity analysis and adoption of productivity measures may reduce the ability to surge production and delay the delivery of needed munitions to the warfighter.

An understanding of the underlying factors involved in industrial base risks that affect current and planned procurement activities is necessary to enable solutions that meet the requirements of all impacted stakeholders. The issues identified in the report fell primarily into two categories. The first category consists of those issues known to represent a risk to existing materiel requirements. In many cases, steps to mitigate the risks have already been taken and a periodic review of progress is required. The second category comprises those issues that don't pose a risk based on current requirements, but need to be understood and monitored for their potential future impact on the Department.

This assessment supports multiple activities across the Air Force, including investment planning within AFRL, acquisition strategy planning at Air Force Materiel Command Product Centers, and policy development.

Industrial Base Assessment of Domestic Integrated Circuit Industry and Development of an Integrated Circuit Risk Mitigation Process (November 2010)

Numerous studies have documented the off-shore migration of a significant segment of the commercial integrated circuit (IC) industry. Loss of critical industrial technology, control over IC design, and the fabrication process create a situation where the risks from counterfeit parts and malicious circuits can directly impact Department of Defense system assurance requirements. This assessment, requested by SAF/AQ and the Program Executive Offices, focuses on specific concerns over trends and changes in the IC market, highlights policy and related actions taken by both industry and Department of Defense in response to those concerns, and provides an assessment of the capability of the domestic IC industrial base to meet specific Department of Defense requirements.

The Department requires all customized microcircuits (called Application Specific Integrated Circuits) to go through a trusted facility. Under current Department of Defense policy, any IC could be identified as a key element posing risk to specific Critical Program Information; trusted foundries/accredited suppliers are identified as one way to mitigate the risk. The National Security Agency manages the Trusted Foundry program, designed to ensure access to at least one domestic state-of-the-art microcircuit fabrication facility. The Defense Micro Electronics Activity (DMEA) established Cooperative Research and Development Agreements with individual IC, component, and service suppliers for legacy technologies. The DMEA also established the Trusted Supplier Program so that suppliers using tailored criteria can have either all or some of their process accredited so that system assurance risk to Department of Defense program mangers is mitigated. There are 64 accredited domestic suppliers that can provide IC design and/or fabrication capabilities to Department of Defense.

While there are a significant number of accredited IC design and foundry suppliers, discrete combinations of feature size, substrate material, and device type can rapidly narrow the number of available qualified domestic sources to a single supplier. These sole source suppliers need to be periodically assessed to ensure their continuing viability. The assessment provides an integrated process for determining the level of risk and a variety of solutions (including tools, techniques, strategies, and resources) for Department of Defense program managers to pick from and use to effectively deal with IC-related system assurance requirements.

The results of the assessment will be reviewed for incorporation into updates of Risk Management and Systems Assurance Guidebooks and disseminated through both Program Management

3.5 Defense Contract Management Agency (DCMA)

Industry Economic Assessment Aerospace (June 2010)

DCMA IAC conducted an economic analysis of the aerospace sector. The economic analysis consists of an assessment of macro-economic, federal budget trends, DoD budget trends, technology trends, production trends, and financial and other industry trends. The objective of the Aerospace sector analysis is to provide an Economic and Federal Budget Outlook and a Supply, Demand and Industrial Analysis. The report outlines the outlook for three major aircraft sectors: Fixed Wing, Helicopters and Unmanned Aircraft Systems.

The aircraft sector, unlike the rest of the defense industry, was not adversely impacted by the global economic crisis in 2007-2008. As of the second quarter 2010, the capacity utilization rate for the aerospace and miscellaneous transportation sector

was 70 percent, compared to a 59 percent capacity utilization rate for the motor vehicles and parts sector.

The long-term commercial aircraft order book continues to have a healthy outlook. The demand outlook for new airplanes for 2010 to 2029 is projected to be 31,000 units valued at $3.6 trillion. In regards to DoD military aircraft procurement budget trend, currently it is projected to peak in 2011, followed by a two percent decline in 2012, and stabilizing thereafter through 2020.

According to the 2010 *TechAmerica* Vision Conference, the overall defense budget is projected to decline about 26 percent over the next decade due to concerns over the federal deficits levels and the redeployment from overseas contingency operations. One trend of concern to the Department is the potential atrophy of the design and development team capabilities for next generation military aircraft, as current programs reach their procurement completion phase.

Industry Economic Assessment Space and Missile (July 2010)

DCMA IAC conducted an economic analysis of the space and missile sectors. The economic analysis consists of an assessment of macro-economic trends, federal budget trends, DoD budget trends, technology trends, production trends, and financial and other industry trends. The objective of the space and missile sectors analysis is to provide an Economic and Federal Budget Outlook and a Supply, Demand and Industrial Analysis.

The space and missile sector budget is projected to decline because of record government deficits. The space and missile industrial base (like the overall industrial base) is impacted by skill shortages as older workers retire with fewer new workers available to replace them, creating a dire need for both government and industry to address this issue. Most companies in the space & missile industrial base are in good financial conditions. The solid rocket motor subsector is in a grim condition because of declining demand and a supplier base in poor financial condition. Excessive ITARs (International Traffic in Arms Regulations) are adversely impacting the ability of U.S. space and missile product producers to compete in the international markets. There is a significant problem with obsolescence and loss of interest by subs due to the nature of the age of the system. There are numerous technologies that are no longer supported and need constant requalification of new alternate technologies.

With declining demand and budget resources from the Department of Defense, the space industrial base must contain rising programmatic costs or face even more budget reductions and program cancellations. Department of Defense investment focus has been and will continue to focus on communications and surveillance. A faltering economy is impacting demand of commercial space products. However, as the economy improves, the demand for commercial satellites and launch services should

improve as well after 2012. The high cost of launch services hurts demand for both DoD and commercial satellites and payloads.

The National Aeronautics & Space Administration (NASA) provides a significant market for space and related products for the space industrial base. While the budget is somewhat stable (with some minor increases), NASA is undergoing significant change as the agency retires the space shuttle, cancels the constellation programs (Manned Moon missions by 2019), and begins contracting out cargo and later manned space flights to the International Space Station (ISS). There is likely to be a period of at least three years with no U.S. access to space as the shuttle retires and a new replacement vehicle becomes available. The solid rocket motor base is further impacted because most of the new space vehicle concepts do not use solid rocket motors as does the shuttle and the proposed constellation family of vehicles did.

The missile sector is also impacted by declining budgets and rising development costs. The key budget driver for the Missile sector is the winding down of the wars in Iraq and Afghanistan. Inventory replacement will keep the decline modest and may lead to some increases in missile funding after 2012. Rising development and other costs are leaving fewer programs that cover multiple missions, such as the JAGM (Joint Air to Ground Missile). However, limited budget resources will preclude full production of JAGM and other programs until after 2018. With the current budget and programmatic issues, further facility consolidation is likely over the next decade.

The missile defense budget will be facing tougher political and budgetary environment over the next decade. Rising programmatic costs and falling budgets will limited the number of systems that will be procured. Technical challenges (especially for lasers and sensors) will continue over the next decade, thus limiting the types of systems that will be developed and deployed. Missile defense has been more focused on naval based systems and theater and tactical threats. A new START (Strategic Arms Reduction Treaty) will limit some options for further development and basing of new systems.

Industry Economic Assessment Shipbuilding (August 2010)

DCMA-IAC conducted an economic analysis of the shipbuilding sector. The economic analysis consists of an assessment of macro-economic trends, federal budget trends, DoD budget trends, technology trends, production trends, and financial and other industry trends. The objective of the shipbuilding sector analysis is to provide an Economic and Federal Budget Outlook and a Supply, Demand and Industrial Analysis.

The shipbuilding budget and supporting industries are being hampered by record budget deficits and faltering economy. After rising in recent years, DoD Shipbuilding budgets are likely to fall because of high deficits. Global demand for ships is down because of the uncertainty about the global economy. Because of these factors, high unemployment in many shipbuilding related occupations is likely to continue. There is

also great concern about low capacity utilization in the shipbuilding and supporting industries.

For years, shipbuilding has long been a bill payer for the U.S., which led to some recent modest increases to replace aging ships to keep the fleet in the 280-313 ship range. Ship inventories in 2007 reached levels not seen since prior to WWI. U.S. shipbuilding programs have been plagued with rising costs and program cancellations over the past decade. Because of budget issues, DDG-51 has been restarted while CGX and DDG-1000 (capped at three ships) have been cancelled. The budget outlook has sparked a new debate on the size and make-up of the U.S. Navy.

Global and U.S. warship production trends are stable to slightly increasing over the next decade (primarily because of recent budget increases). Global warship markets are mostly closed to U.S. yards; the industry is not competitive in international commercial shipbuilding markets because of the high labor costs and regulatory requirements.

Because of declining budgets, consolidation is renewed at the prime level and continues at the sub-tier level. In July 2010, Northrop-Grumman announced that Avondale Shipyards would close at the end of 2012 because of high costs. Northrop-Grumman announced it is exploring options to sell its shipbuilding segment because of few "synergies" with the rest of the company. The shipbuilding sub-tier industries are populated with defense contractors and small firms, with consolidation is continuing among the smaller shipbuilders and various component producers. With this consolidation and austere economic climate, there are concerns of shortages of specific skills as total employment declines.

3.6 Defense Logistics Agency (DLA)

AM2 Landing Mat (October 2010)

DLA completed a Lean Six Sigma manufacturing and Value Stream Analysis (VSA) study of the sole source provider's production facilities in 2009. The study resulted in various investment strategies based upon required production outputs, material requirements, and availability of funds.

DLA exercised a strategy from the VSA study to improve wartime surge production output by pre-positioning components for the AM2 Pallet and Mat Assembly. In 2010, DLA maintained a pre-positioned investment of the following Government-owned components at the vendor's plant to surge AM2 Landing Mat:

1. 14,400 Unfinished Mat Extrusions (equivalent to 800 pallets)
2. 3,000 Finished End Frames (two per pallet, equivalent to 1,500 pallets)

3. 416,000 Finished Inserts (520 per pallet, equivalent to 800 pallets)
4. 32,000 Finished Connectors (40 per pallet, equivalent to 800 pallets)

Body Armor (October 2010)

DLA hosted a hard body armor working group in 2010 to help coordinate the body armor industrial base planning across the Department. The current hard body armor industrial base plan concurred upon by the stakeholders includes the following elements:

- DLA will complete a sustainment acquisition for Enhanced Small Arms Protection Insert (ESAPI) body armor and will award a minimum of two contracts in FY11. DLA will include the X-Threat SAPI (XSAPI) in the sustainment acquisition if the Army transitions the XSAPI technical data package to DLA with sufficient lead time.
- Assuming the XSAPI technical data package is transitioned to DLA, at least one of the awarded contracts will have capability to produce the XSAPI.
- After the sustainment contracts are awarded, an industrial base analysis will be performed to re-baseline the industrial capability and determine if any additional measures are required to meet surge requirements. .
- A separate acquisition for side inserts will be developed upon requirements determination.

Joint Service Lightweight Integrated Suit Technology (October 2010)

Customer requirements have steadily declined for the last several years. Requirements for FY11 have declined below the estimated minimum sustaining rate, which threatens the viability of this Joint Service Lightweight Integrated Suit Technology (JSLIST) industry. The Office of the Secretary of Defense (OSD) requested a validation of the filter fabric production minimum sustainment rate in the FY10 Resource Management Decision. DLA completed the JSLIST Filter Fabric Industrial Capability Minimum Sustainment Rate Assessment in August 2010. The study recommended an Industrial Base Maintenance Contract (IBMC) with Tex Shield Inc. to maintain critical production capabilities in their Eastport, ME, facility. The IBMC is necessary to mitigate future industrial base shortfalls if the vendor is forced to reduce its capacity or terminate production completely. The IBMC will maintain a warm industrial base during periods of lower demand and keep vital infrastructure in place in the event of a surge in requirements.

Manufacturing Base Analysis (October 2010)

DLA Aviation ensured that the manufacturing base was considered in sourcing strategies by reviewing 843 acquisition plans, performing over 98,000 Defense Priority

Rating reviews, and completing five Industrial Base Impact assessments for long term contracts exceeding a five year performance threshold. The assessments included an analysis of the number of potential manufacturers that produce the same or similar items based on manufacturing classifications. None of the industrial base sectors involved in the five assessments was determined to be at increased risk due to the proposed acquisition strategies.

Nomex® Supply Chain (October 2010)

Nomex® is the registered brand name of a flame resistant aramid fiber and is a sole source product from DuPont Advanced Fiber Systems. Material made from this fiber is heat and flame resistant. Nomex® material is required for several military clothing items including coveralls, gloves, and jackets. These items were traditionally worn by the aviation and combat vehicle communities. However, due to increasing threats from improvised explosive devices and resulting burn casualties, the need for flame resistance spread to non-traditional users including wheeled vehicle operators and ground troops.

Increasing requirements for Nomex® items during wartime led to the discovery that the supply chain had some inherent constraints limiting its ability to meet surges. The typical production lead time for end items with Nomex® material is six months to include the production of fiber, spinning the fiber into yarn, weaving the yarn into fabric, finishing the fabric, and producing the end item.

Based on the results of an industrial base assessment of the Nomex® Supply Chain in 2008, DLA made a Warstopper investment in 2009 for Nomex® Sage Green and Desert Tan fiber through a contract with DuPont. Under this contract, DuPont established a strategic buffer stock of fiber, which will not only allow the industrial base to surge in response to contingency requirements, but also reduce overall production lead-time for end items using this fiber.

Plans have been made to incorporate additional fiber into the current buffer stock contract. The fiber would include flame resistant staple (yarn making) natural fibers. The additional fibers are used to manufacture material for Army Aircrew Combat Uniforms, Improved Combat Vehicle Crewman Coveralls, Flame Resistant Army Combat Uniforms, Flyers' Drawers, Shirts, and Balaclavas.

Petroleum, Oil, and Lubricants (October 2010)

DLA Energy continues to support the DoD and commercial satellite industry with uninterrupted delivery of the two liquid propellants critical to the U.S. space program: hydrazine (N_2H_4) and dinitrogen tetroxide (N_2O_4). Both products have a limited domestic industrial base from a production perspective but are supported under a long-term contract (10-year base plus two five-year options) with reliable suppliers. There

were no interruptions of supply during FY10 for either product. In addition to the commodity supply, DLA Energy manages the transportation component of the supply chain for both products. DLA Energy delivered 100 percent of its hydrazine and N_2O_4 shipments to its customers without incident.

In FY10, DLA Energy exercised options on three alternative fuel contracts in support of the Air Force's and Navy's testing/certification programs and alternative fuel goals. Two contract options were exercised for Hydro-treated Renewable Jet (HRJ) -8 using camelina and tallow as feedstock. The contracts had an option quantity of 100,000 gallons each. Delivery will be at Arnold Engineering Development Center (Arnold AFB, TN), and at a contractor location yet to be determined. The third contract option was for 150,000 gallons of HRJ-5 using camelina feedstock, with delivery to Naval Air Station (NAS), Patuxent River, MD. DLA Energy also awarded a contract for 18,450 gallons of camelina derived HRJ-8 in support of the Army's test and certification program. Additionally, the DLA Contracting Services Office awarded an alternative fuel from organic sources research and development contract on behalf of DLA Energy that includes the delivery of 75,000 gallons of algae-derived F-76, with delivery to NAS Patuxent River.

DLA Energy continues to support the Air Force by supplying Turbine Fuel, Aviation, Thermally Stable (JPTS) for use in its highflying U-2 aircraft. DLA Energy currently has only two suppliers for JPTS--one in the continental U.S. and one outside the continental U.S. AGE Refining Inc. (San Antonio, TX) supplies approximately 4,074,000 gallons of JPTS per year, and SK Energy Co. Limited (Ulsan, Korea) supplies 750,000 gallons annually. The JPTS contracts are for a two-year base performance period, with three one-year option periods. AGE delivers fuel on a free on board (f.o.b.) destination basis via railcar to Beale AFB, CA, and Seabrook, TX. The AGE contract also includes an f.o.b. origin truck line item for delivery to various locations. SK delivers by truck to Osan Air Base, Korea. DLA Energy encounters difficulties in securing suppliers of JPTS due to the extensive qualification process required to be a certified supplier.

Strategic Metals Buffer Pilot (October 2010)

The initial concept and approach for the Strategic Metals Buffer Pilot was developed in FY07. The pilot will serve as an enabler for industry to obtain specialty steel for DLA-procured items and will significantly reduce material lead-time delays. Under the pilot, the steel mill will retain ownership of the additional work-in-process material to retain a quality chain of custody and valid warranties. In FY08, the project was formalized, coordinated with the Armed Services, the Joint Aeronautical Logistics Commanders Group, industry, and DLA leadership. A concept of operations and acquisition plan was approved and initial contract award was completed in September 2008 to provide a buffer of billet and ingot material. The vendor completed the initial terms of the contract and in July 2009, the Strategic Material Buffer was established and ready for use. In 2010, the contract option year was exercised to maintain capability.

The material buffer consists of Steel Grades M50 and 300M. Its business rules and procedures for releasing the material have been distributed and the rules and procedures are being tested. The metals buffer pilot concept and approach is expected to be a repeatable model for other raw materials and will improve critical raw material mapping to National Stock Numbers (NSNs).

Tents and Shelter Systems (October 2010)

DLA funded Minimum Sustaining Rate (MSR) contracts during FY07 through FY09 as an industrial preparedness measure to maintain a viable industrial base for the current MIL-SPEC tents and shelter manufacturers. The MSR warstopper investment was an effective measure to maintain the tent and shelter industry and provide surge and sustainment (S&S) coverage through protected warstopper inventory. However, even with the investment, declining requirements, supplier reliance on DoD business, and the penetration of commercial tents in the market still pose some risk to military tent manufacturers.

Tray Pack Ration Readiness (October 2010)

Tray pack rations are a member of the family of DoD field combat rations. They are used to sustain groups of military personnel in highly mobile field situations. The component items are thermally processed, shelf-stable foods packaged in hermetically sealed, steam table-sized poly tray containers. DoD contingency requirements for tray pack rations have greatly exceeded peacetime requirements.

Lean Six Sigma was also used to conduct an analysis with one of the Meals Ready-to-Eat (MRE)/Unitized Group Ration (UGR) vendors to identify areas where readiness and surge could be improved. The findings of the value stream mapping were reviewed by the vendor and DLA. As a result, the vendor is implementing improvement actions or has action plans, when surge activity warrants, to remove pacing internal constraints. DLA has taken action to procure retort machines, tray sealer units, and upgrade/increase retort manufacturing capabilities.

Unitized Group Ration (UGR) - E (October 2010)

Late in FY07, a compact, self-contained module that provides a complete hot meal for groups of 18 personnel was introduced. The UGR-E uses a simple pull-tab to heat food in just 30-45 minutes and is served in trays to provide a hot meal to our warfighters. Heater modifications continue to be researched for future release.

The evolution of this ration has spawned a continuing dialog as early high demands challenged the new supply chain. Subsistence Industrial Specialists continue to research component alternatives and additional suppliers due to design modifications

and newer production techniques. They are also visiting and evaluating 22 vendors that currently provide components for this ration, to ensure continued support in the face of economic conditions that have negatively impacted many small businesses as well as to ensure compliance with the Berry Amendment and Buy American Act when applicable.

The UGR-E shares poly tray production lines for its entrees with the UGR Heat & Serve and was part of the Lean Six Sigma analysis conducted during FY09. The findings and actions taken by the vendor and DLA will benefit all unitized group rations.

3.7 Missile Defense Agency (MDA)

The Missile Defense Agency (MDA) and the Defense Contract Management Agency (DCMA) conducted two industrial base assessments in 2010:

- Radiation Hardened (RadHard) Electronics
- Space and Satellite Programs

The studies of the RadHard Electronics and Satellite Systems industrial bases were part of MDA's on-going efforts to update the baseline assessments of missile defense industrial and technology capabilities. The RadHard Electronics and Satellite Systems industrial base assessments involved surveying and assessing the industrial capability and viability of the RadHard Electronics and Satellite Systems base. The study sought to identify sole/single sources, foreign sources/dependencies, business, and financial risks at developers and component manufacturers.

The MDA will use the findings and recommendations of these studies to implement risk reduction efforts by capitalizing on technology advances and/or development or identification of domestic capability as appropriate.

Radiation Hardened Electronics Industrial Capability Assessment (May 2010)

The Missile Defense Agency (MDA) requested the Defense Contract Management Agency Industrial Analysis Center (DCMA IAC) support an Industrial Capabilities Assessment (ICA) of Radiation Hardened electronic prime and their sub-tier suppliers. The purpose of the assessment is to analyze the industrial capability and financial viability of the Radiation Hardened Electronics supplier base. All Space and Missile electronic systems require some level of radiation tolerance or hardening. There are four types of Microelectronic Device Categories: Digital Processors; Digital Memory & Logic; Mixed-Signal Microelectronics; and Analog Integrated Circuits. Space presents an extremely harsh operational environment for satellites. The Van Allen belts, solar

flares, and other phenomena create radiation environments that limit the on-orbit life and performance capability of key space assets. Technology is advancing from a 6" to an 8" wafer to improve yield and productivity and reduce cost, 90NM capability with greater interest in exotic materials such as Silicon on Sapphire for its inherently RadHard composition.

There are at least 13 suppliers within the Industrial Base that are providing qualified Defense Supply Center Columbus (DSCC) Qualified Materials List (QML) RadHard devices. Some components have only one or two suppliers. There are two qualified RadHard suppliers for >1MRad Complementary Metal Oxide Semiconductor and Silicon on Insulator requirements. And there is an increasing use of commercial "Pure Play" foundries (foundries with no design capability) to support RadHard development and wafer assembly. International Traffic in Arms Regulations (ITAR) is a resource driver and limits commercial and foreign sales opportunities. Suppliers are often reluctant to fully test their components due to the part becoming ITAR restricted and not available for sales overseas. Numerous Government and private industry associations are driving RadHard requirements.

The following are the assessment recommendations: 1) Reduce dependence on Joint Army Navy Space (JANS) diodes sources with long lead times (72-84 weeks) that introduce excess costs and schedule delays; 2) Reduce dependence on foreign sole source for burn-in and test operations as this introduces high risks - one domestic source is expected to become DSCC QML certified this year; 3) Continue to monitor the health of diode glass since it is foreign sourced; 4) Continue to fund DARPA, AFRL, NASA and MDA Small Business Innovation Research and Small Business Technology Transfer program RadHard electronics Broad Agency Announcements to include opportunities for new technology insertion; 5) Revitalize Radiation-hardened Electronics Board. Provide single Government point of contact to industry on RadHard electronics technology roadmap opportunities and industrial base monitoring; 6) Continue to monitor: (a) DSCC/Aerospace Corporation RadHard JANS test requirements within the QML specification process, (b) requests for mergers and acquisitions approval in accordance with DODI 5000.62 (DASD(MIBP)), (c) where ITAR regulations and testing requirements impact competition and, (d) off shore packaging of RadHard electronic components for counterfeiting.

Satellite Systems Industrial Capability Assessment (October 2010)

MDA requested the Defense Contract Management Agency Industrial Analysis Center (DCMA IAC) support an ICA of Satellite Systems and associated prime and sub-tier suppliers. The purpose of the assessment is to analyze the industrial capabilities and technology development to support Satellite Systems and the financial viability of the supplier base. The focus of the analysis was on unclassified Intelligence, Surveillance and Reconnaissance systems. Sixty-seven prime contractors, subcontractors, and component manufacturers were identified and assessed for risks

(long-lead, sole source, foreign source, financial instability). Fourteen contractors received a site visit to further assess their risk.

The assessment concluded that the U.S. space industrial base, to include the Department of Defense, NASA and commercial (Classified and Communication Satellites) has experienced growth in the last few years. Competition from foreign suppliers, mostly European, is increasing. Sole source/foreign source and long lead concerns include: Type 211 Mercury Cadmium Telluride (HgCdTe) Infrared (IR) detector Cadmium Zinc Telluride (CZT) substrate *(sole/foreign source)*; Electronic system pulse power magnetic inductor cores *(foreign sole sourced)*; Transmitter/Receiver suppliers *(foreign sourced)*. Within the MDA/DoD Satellite industrial base, one high financial risk and numerous moderate industrial risks were identified: Single source for 12" 90NM – 28NM wafers used for DSCC QML Field-Programmable Gate Array; Transponders (24-32 months) and Inertial Measurement Units (24-30 months); Specialty Diodes and Transistors (11-14 months); and Super Precision Bearings (over 10 months). ITAR restricts U.S. companies from competing globally and makes them reliant on a dwindling number of U.S. government contracts. The RadHard "Trusted Foundry" process is conflicting when addressing off shore RadHard foundries.

Final recommendations include: qualifying a second source for Solar Cell Cover Glass; providing investment options to develop production of Magnetic Pulse Power Actuator Cores; modifying ITAR Regulations so they only apply to the most advanced technologies; continuing coordination with the North American Technology and Industrial Base Organization/Title III/Canadian Industry for funding of a Canadian company to complete development of alternate qualified source for Type 211 CZT Substrate for HgCdTe IR Detectors; continuing funding of Science, Technology, Engineering and Math programs to help alleviate an aging workforce and to mitigate the difficulty in hiring engineering graduates with U.S. citizenship; continuing technology investment with the Operationally Responsive Space Office in Albuquerque, NM; maintaining that Government contracts should be multi-year with visibility into future constellations to optimize capacity utilization and overall resource planning; and reviewing the DASD(MIBP) Inter Agency Task Force up-coming release of the Solid Rocket Motor Industrial Base Sustainment Plan to determine any potential impact to the satellite launch industrial base.

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4. Related Activities

The Department of Defense's preferred approach to establishing and sustaining the defense technology and industrial base is to leverage its research, development, and acquisition processes and decisions to create a competitive environment that encourages industry to invest in technology development and make sound technology insertion and production capacity/facilitization decisions. When market forces are insufficient, however, the Department uses powerful Defense Production Act tools to focus industry attention on critical technology development, accelerate technology insertion into manufacturing processes, create, or expand critical production facilities, and direct production capacity towards meeting the most urgent warfighter needs.

4.1 Title III of the Defense Production Act

The availability of domestic production capabilities for critical defense technologies is an essential element of national security. Title III of the Defense Production Act (50 U.S.C. App. 2061 *et seq.*) is a program specifically designed to create, maintain, modernize, protect, expand, or restore industrial capabilities required for national defense. A key objective of the Title III Program is to accelerate the transition of technologies from research and development to affordable production and insertion into defense systems. To create the needed industrial capacity, Title III authorities provide for the use of financial incentives in the form of purchases, purchase commitments, the purchase or lease of advanced manufacturing equipment for installation in government or privately owned facilities, the development of substitutes, and loans or loan guarantees. Title III activities strengthen the economic and technological competitiveness of the U.S. defense industrial base and can reduce U.S. dependency on foreign sources of supply for critical materials and technologies.

Title III is an authority, not a source of funds. Funding for individual Title III initiatives is provided by the Joint or Service Program Offices of Record, Defense Agencies or other Federal Agencies as funding offsets for specific Title III efforts. The Title III Program does not conduct annual project calls. Projects are developed in response to specific Government requirements and associated funding as provided for these efforts.

In calendar year 2010, the Title III Program had 29 projects underway. Two projects were completed in 2010. Following are the two stories of these exceptional successes of the DPA Title III Program.

Silicon Carbide Monolithic Microwave Integrated Circuit Devices In FY10, the Title III Program completed a five-year partnership with Cree, Inc., Durham, NC, a merchant manufacturer of silicon carbide materials and wide bandgap devices, to pursue high-risk investments targeted at improving production capacity, device capability, and affordability for U.S. defense systems. The results of the program were significant. They included development of SiC MMIC switches for the Army's Joint Tactical Radio System (JTRS) program, and development of high performance S-band drivers and high power MMICs available at reduced cost to other defense systems. The project dramatically reduced the cost of SiC MMIC devices from $8 per watt in 2005 to $1.85 per watt in 2010, a 77 percent cost reduction. This project also contributed to success on the battlefield. Improvised Explosive Devices (IEDs) are the single largest threat to U.S. forces deployed in Iraq and Afghanistan. In September 2006, Cree was awarded a SiC Metal Semiconductor Field Effect Transistor (MESFET) production contract to support the Army's Counter Radio-Controlled IED Electronic Warfare (CREW) program. The Title III SiC MMIC Devices program enabled the establishment of Cree's manufacturing infrastructure, making CREW an unquestioned success. Over 25,000 10-Watt SiC MESFET transistors have been delivered to support the program with no field returns. Countless American lives have been saved and casualties among U.S. soldiers have been on a strong decline since the CREW system's deployment. For the commercial and government consumers, there was a significant impact on improved energy efficient lighting. The SiC wafers employed in MMIC fabrication are also used in the production of daylight quality Light Emitting Diodes (LEDs). Economies-of-scale can be generated if a large commercial demand for LEDs is created; this drives down cost for SiC MMICs because the significantly higher SiC wafer volume required for LEDs will lower costs for the wafers needed for the MMIC devices. Cree has developed an LED light fixture design for commercial applications that is much more energy efficient and eco-friendly than its fluorescent predecessor and is eco-friendly. The Pentagon Renovation office evaluated it as a replacement for conventional fluorescent lighting, and the results were excellent. More widespread use of these LED devices helps SiC MMICs remain more affordable for Defense. This project was funded in part with offsets transferred to the Title III budget from the Missile Defense Agency and Navy. Other funds were transferred from the Army and Navy. Total government funding was $22.8M, combined with $7.5M in cost sharing by the contractor. This was a competitive solicitation.

Traveling Wave Tube Amplifiers for Space The Defense Production Act Title III Program partnered with L-3 Communications Electron Technologies, Inc. (L-3 ETI), to leverage proven manufacturing processes to establish a domestic source for space qualified K-band Traveling Wave Tube Amplifiers (TWTAs). This Title III initiative was undertaken in response to potential domestic industrial base shortfalls identified in the 2006 Annual Industrial Capabilities Report to Congress. With technical leadership and funding support provided by the Air Force, a Title III program was initiated in 2007 to strengthen L-3 ETI's proven manufacturing expertise and to ensure an economically viable source for mission critical TWTAs. The objective of this program was to create a high quality TWTA with improved manufacturing yield at reduced cost for DoD applications. The establishment of a domestic manufacturing source for K-band TWTAs

has improved the ability of the DoD to obtain high quality components, on time, and at a fair market price. This program greatly reduced the schedule, performance, and cost risks to U.S. government and commercial satellite programs that were previously limited to only one worldwide source. The Title III team worked closely with L-3 ETI to make substantial design, process, and quality upgrades to achieve world-class manufacturing capabilities. Focus areas of the project included: continuous process and product improvements, marketing flexibility, price and pricing strategies, quality and quality enhancements, delivery, and satisfaction of customers' current and future needs. These manufacturing achievements translate to marked improvements for the DoD in general and the modern warfighter, specifically. While the DoD will benefit from the better manufacturing yields and reduced costs, the individual warfighter, whose work and well-being demand daily reliance on an increasingly comprehensive Global Information Grid, can expect a dramatic upgrade in critical data transmission and, with it, a distinct tactical advantage. L-3 ETI recently received multiple orders for commercial K-Band TWTA products. While these orders do not directly support specific warfighter applications, they do ensure the business viability of L-3ETI thus maintaining access for the DoD to emerging technologies. Also, because of a shortage of DoD-owned satellite communications capacity, the U.S. government has increasingly turned to commercial operators to close the bandwidth gap. Deliveries to world-wide commercial customers are scheduled to begin in early 2011. Prior to this Title III Program the capability and capacity of any domestic American firm to win these orders was nonexistent. This project was funded in part with offsets transferred to the Title III budget from the Navy. Total government funding was $5.3M, combined with $5.3M in cost sharing by the contractor. This was a sole source solicitation, as a single domestic source was identified for the specific technology of interest.

Following are brief descriptions of each of the remaining active Title III projects.

ALON® and Spinel Optical Ceramics

Military weapon platforms such as the Stryker and High-Mobility Multipurpose Wheeled Vehicle (HMMWV) require lighter weight, higher performance, and lower cost optical materials. Aluminum oxynitride (ALON) and spinel (magnesium aluminate spinel) are extremely durable optical ceramics with excellent ballistic and transmission capabilities. ALON® and spinel components demonstrate characteristics similar to sapphire; however, they are producible in larger sizes, higher quantities, more complex geometries, and at lower costs. This is primarily due to the manufacturing processes, which utilize well-understood, conventional ceramic powder processing techniques. Title III is supporting an initiative to establish an integrated, flexible manufacturing process capable of producing these two materials in the shapes and sizes required for aircraft transparencies, missile domes, reconnaissance windows, and transparent armor applications. Emphasis will be placed on increasing size, quality, yield, and affordability of both ALON® and spinel materials, and on facilitating component evaluation, qualification, and insertion. This project was funded through a Congressional increase to the Title III budget. Additional funding from the Army and Air Force was added to the

effort. Total government funding was $11.5M, combined with $2.4M in cost sharing by the contractor. This was a sole-source solicitation.

Armor and Structures Transformation

The excellent strength-to-weight and corrosion-resistance properties of titanium make it useful for many structural applications. It also has excellent ballistics properties that, along with the low weight, make it ideal for armor. Due to large increases in commercial aerospace demand for titanium, lead times for titanium have grown to over one year, while costs have more than tripled. By working outside the aerospace titanium supply chain, this Title III program will help reduce cost and shorten delivery lead-times for structural titanium and titanium armor. The initial effort will focus on implementing the capability to direct-roll titanium in widths and thicknesses that can be used for armor tiles on military ground vehicles. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $12.8M, augmented by $2.1M of contractor cost sharing. This was a competitive solicitation.

Armstrong Titanium Production

The Title III Program has begun a project to establish domestic capability to produce lower cost titanium powder using non-melt technology in the form of the patented Armstrong Process® technology. The Armstrong Process® can produce commercially pure titanium powder directly from titanium tetrachloride by injecting it into a stream of liquid sodium. Alloyed titanium powders can be created in the same process by injecting chlorides of the alloying elements. The Armstrong Process® is a disruptive technology in the titanium manufacturing market because of its potential to significantly reduce titanium parts manufacturing cost and lead times for both commercial and military manufacturers. With the Armstrong Process® powder, direct consolidation techniques can form near net shapes, sheets, plates, blocks, or pipe. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $4.5M, augmented by $4.5M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Atomic Layer Deposition (ALD) Hermetic Coatings Project

ALD is a deposition technique that lays down protective films one atomic layer after the other directly onto essential circuits, thus eliminating the need for costly and inefficient protective encapsulates. The purpose of this program is to establish and expand a domestic industrial base capability to apply near-hermetic quality environmental coatings to both military and commercial microelectronics. Compared to traditional hermetic enclosures, microelectronic protection through ALD coatings will result in increased corrosion protection and operational life of the circuits as well as reduced size, weight and protection cost. A viable ALD hermetic coatings process has been demonstrated. By the conclusion of the project the ALD process will transition to production, and the DoD will have a qualified, domestic source for the ALD hermetic coating. This project was funded in part with offsets transferred to the Title III budget from the Missile Defense Agency and Navy. Other funds were transferred from the

Army and Navy. Total government funding was $5.4M, combined with $0.5M in cost sharing by the contractor. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest

Beryllium Production

This project will assure the United States and its allies of an uninterrupted supply of primary (high purity) beryllium metal. Current inventories of National Defense Stockpile beryllium ingots are projected to be exhausted in the near future, and imports of beryllium cannot meet the purity levels required for many defense applications. Essential strategic uses, where there is no suitable substitute for high purity beryllium, include: airborne Forward-Looking-Infrared (FLIR) systems for fighter aircraft and attack helicopters; guidance systems on existing strategic missiles; surveillance satellites; ballistic missile defense systems; and reflectors for high flux, nuclear test reactors. The Title III Program, awarded to Brush Wellman, Inc. (BWI) in June 2008, initiated construction of the beryllium "Pebbles Plant" in Elmore, Ohio. Plant construction began in July 2008 and was completed October 2010. BWI will begin production of beryllium pebbles in early 2011. Initial funding was provided through DoD increases to the DPA Title III budget. Additionally, Congressional increases were added to accelerate the restoration of this critical domestic production capacity. Total Title III funding for this project is $69.7M, augmented by $9.9M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Coal-Based Carbon Foam

Coal-based carbon foam is an inexpensive, lightweight, fire-resistant, impact-absorbing material that can be fabricated in a variety of shapes, sizes and densities. It replaces conventional materials that are higher cost, lower structural capability, hazardous for fire, and heavier. Its electrical conductivity can be varied over nine orders of magnitude, and it has a low coefficient of thermal expansion. Carbon foam's applications include replacing components in naval ship exhaust and ventilation systems and rapid development of manufacturing tooling. It exhibits similar properties as other materials at a lower cost, and outperforms other products at noise reduction, fire resistance, impact resistance, energy absorption, and thermal properties. The goal of this Title III effort is to expand the domestic production capability for coal-based carbon foam to meet the Department's needs for blast mitigation, hot structure applications, and low-cost tooling. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $10.5M, augmented by $0.9M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Extremely Large Domestic Expendable and Reusable Structures

Current domestic large-scale composites production capacity is constrained by processing limitations in the manufacture of structures with diameters in excess of five meters. Structures and components currently made of metal add weight to space launch and delivery vehicles, adversely affecting payload capacity. Composites

technologies have successfully demonstrated the ability to provide lighter weight, higher strength structures for current and next generation space launch and delivery vehicles. This Title III initiative will scale-up domestic composites manufacturing and processing capacity via the incorporation of state of the art composite structures production equipment. Several DoD, NASA, and U.S. commercial space industry programs will benefit from more efficient and expanded production capabilities. Such programs include those applications requiring crew lifters, heavy cargo lifters and other heavy space launch vehicles. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $14.3M, augmented by $9.1M of contractor cost sharing. This project is being executed as an amendment to the agreement for "Integrated Advanced Composite Fiber Placement" project below.

Flexible Aerogel Materials

This Title III venture established affordable production by a domestic supplier of flexible aerogel materials. Aerogels are nanoporous solids with up to 99 percent open porosity often called "frozen smoke." The nanoscale lattice and pores provide high performance with minimal weight and space. Military applications are expected for high temperature thermal insulation, acoustic protection, infrared suppression, and energy absorption. Many commercial applications for these same qualities are expected at lower temperatures. Work on this project has included testing and qualification of the materials for potential applications, cost reduction, and the establishment of a full scale, high volume production capacity for high temperature aerogels. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $17.1M augmented by $38M of contractor cost sharing. This was a competitive solicitation.

Gallium Nitride (GaN) X-Band Monolithic Microwave Integrated Circuits (MMICs)

The objective of this project is to assess, refine, and validate a domestic production-ready process for X-Band (8 GHz to 12 GHz) GaN MMICs, thereby creating a domestic source of supply for GaN MMICs. GaN technology significantly enhances the warfighters' capabilities by increasing radar ranges, sensitivity, and search capabilities. GaN transistors operate at higher temperature levels, and produce higher output power than those of current technology transistors of comparable size. The most advantageous property of GaN is its high power density. It is ten times higher than that of silicon or gallium arsenide. Another important benefit is the high input and output impedance that GaN offers. This high impedance directly translates to wider bandwidth power amplifier designs that maintain higher efficiencies. Defense applications include communication systems, radar applications, electronic warfare, imaging, and sensor systems. This project was funded in part with offsets transferred to the Title III budget from the Missile Defense Agency, plus other funds were transferred from the Missile Defense Agency. Total government funding was $9.0M, augmented by $2.3M in cost sharing by the contractor. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest

Gallium Nitride (GaN) Radar and Electronic Warfare (EW) Monolithic Microwave Integrated Circuit (MMIC) Producibility

The objective of this Title III project is to assess, refine, and validate domestic production ready processes for S-Band and Wideband GaN MMICs, and ensure two domestic sources of supply for GaN MMICs. The overarching goal is to achieve manufacturing readiness level of eight (ready for low-rate initial production) through the application of Six Sigma techniques to reduce process variation and demonstrate repeatable MMIC performance, life and reliability. This project was funded in part with offsets transferred to the Title III budget from the Missile Defense Agency and Navy. To date, total government funding is $35.0M, combined with $3.6M in cost sharing/contribution by the contractor. This project was awarded to two contractors through a competitive solicitation.

High Homogeneity Optical Glass

This Title III project is structured to increase the manufacturing capacity, optimize production yields and ensure greater availability of affordable High Homogeneity Optical Glass (HHOG) products. HHOG blanks are the basic building blocks in the fabrication of high precision optical lens systems, which are key technology drivers for several commercial, defense and national security related applications. H4 grade and higher HHOG blanks are characterized as possessing a maximum refractive index variation across the entire optic of ±1.0 x 10-6. If the refractive index is non-uniform, or non-homogeneous, then light rays passing through the material at different locations will be bent in random directions and in an amount approximately proportional to the non-homogeneity. This can have several effects depending on the application. Of particular concern to the DoD are lens products required in optical designs for aerial, satellite and other space surveillance equipment. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $2.9M, augmented by $3.1M of contractor cost sharing. This was a competitive solicitation.

Integrated Advanced Composite Fiber Placement

Current process/production rates for large aerospace composite products are slow and time consuming in comparison to expected demand. Significant aerospace industry growth and inadequate manufacturing capabilities could jeopardize the assembly demands required by the Department. This Title III project will expand the domestic supply base for automated composite technologies, maximize processing/cost benefit ratios, and provide cost effective fiber placement composite processing technologies for military and commercial aircraft structures. The project aims to increase commercially viable production efficiency and make the process enhancements generally available to the commercial composite production market. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $27.1M, augmented by $11.4M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Light-Weight Ammunition and Armor

The objective of this effort is to establish a domestic source for the production of light-weight ammunition cartridge casings using a high strength polymer material.

Ammunition casings produced with this material may provide significant advantages over traditional brass casings, such as decreased combat carrying weight, increased muzzle velocities, improved weapons accuracy, better corrosion-resistance, lower cost and increased savings from production synergies. Other benefits include lower deployment and transportation costs. This project was funded through Congressional increase to the Title III budget. Funding of $2.0M was also added from the Marines. Total government funding is $12.9M, augmented by $10K of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest

Lithium Ion Battery Production

This Title III program is supporting the development of a domestic source for prismatic lithium-ion cells and batteries for spacecraft use. Lithium Ion (Li-Ion) rechargeable battery technology provides higher power for longer durations with lower weight and favorable space constraints when compared to Nickel Cadmium (NiCd) or Nickel Hydrogen (NiH) rechargeable batteries. The Li-Ion battery offers the highest energy andpower package of the developed batteries today. Additional advantages include better recharging capability with no memory effect and increased temperature operating ranges. This technology offers designers a weight saving option compared to other battery types for overall weapon systems performance. This project was funded initially by funding provided from the DoD Title III budget, plus other funding transferred from the Air Force and another government agency. A one million dollar Congressional increase for Title III was provided during project execution. Total government funding is $42.5M, augmented by $11.7M of contractor cost sharing. This was a competitive solicitation.

Low Cost Military Global Positioning System (GPS)

Military GPS receivers are a vital piece of equipment for soldiers on the battlefield. GPS receivers allow the warfighter to perform both strategic and tactical maneuvers with a high degree of confidence of success. Without GPS receivers, soldiers are at a loss for both their specific positioning on the battlefield and that of their fellow soldiers. The primary objectives of this Title III project are to create domestic production capabilities for essential subcomponents for the Defense Advanced GPS Receiver (DAGR), and to pursue methods for reducing their weight, size, power-consumption and cost, while improving performance capabilities. This project was funded through Congressional increase to the Title III budget. Total government funding is $7.9M, augmented by $12.4M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Military Lens System Fabrication & Assembly

This Title III program is establishing a domestic resource for mono-spectral and advanced multi-spectral optical systems and lens components. This effort will develop a manufacturing capability for design, fabrication, finishing, coating, assembly, and testing of mono- and multi-spectral night vision optical systems that can be integrated

into military and commercial surveillance systems. Multi-spectral systems are shared aperture systems that allow widely separated wavelength bands to be transmitted through a common aperture and share common elements in the optical train. They offer considerable advantages for the warfighter, including weight and volume reduction, by allowing them to carry fewer pieces of equipment; improving performance, by allowing both bands to utilize the full aperture of the systems; and optimized system design for a larger set of operating conditions/environments. This project was funded through Congressional increase to the Title III budget. Funding of $0.9M was also added from the Industrial Base Innovation Fund. Total government funding is $8.8M, plus augmented by $2.5M of contractor cost sharing. This was a competitive solicitation.

Mini-Refrigerant Compressors for Man-Portable Cooling

Title III is currently supporting an enterprise that will establish a domestic low-volume production facility for mini-refrigerant vapor compressors. The program's industry partner recently purchased a production facility, and Title III is assisting with plant facilitation, to include the purchase of manufacturing, assembly and test equipment. Applications for personal cooling systems encompass aircrew cooling; soldier cooling, both dismounted and within ground vehicles; and personal protective equipment cooling, such as Explosive Ordinance Disposal and Chem/Bio-Hazard suits. The compactness of these mini-compressors enables them to be installed within electronics cabinets to provide active cooling of components. This increases the performance, reliability, and life of mission-critical electronics systems in high temperature environments. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $12.1M, augmented by $0.6M of contractor cost sharing. This was a competitive solicitation.

Polycrystalline Laser Gain Materials (PLGM)

This Title III program is establishing a domestic resource for Polycrystalline Laser Gain Materials (PLGM). PLGM are high-strength, optically transparent materials with good thermal properties that are doped with rare-earth metal additives to produce laser gain materials for use as lasing media. These materials can be shaped and polished to yield high-power laser line emission at a variety of infrared wavelengths depending on the dopants. This effort will develop a manufacturing capability for design, fabrication, finishing, coating and testing of PLGM that can be used in military high energy laser weapon systems and that have additional applications for range finding, laser radar, and infrared countermeasures. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $4.7M, augmented by $1.4M of contractor cost sharing. This was a competitive solicitation

Polyhedral Oligomeric Silsesquioxanes (POSS™) Nanotechnology

This Title III project is scaling up production of Polyhedral Oligomeric Silsesquioxanes (POSS®), a nano-sized material that, when used as a chemical additive, can greatly enhance the performance of polymers for a variety of DoD and commercial applications. POSS® has been demonstrated as useful in applications such as radiation shielding for space-based microelectronics, coatings that prevent growth of

tin whiskers on lead-free solder, photoresist material for semiconductor manufacturing, automotive fuel filters, food packaging, optical lenses, and aircraft tires. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $16.9M, augmented by $0.2M of contractor cost sharing. This was a competitive solicitation.

Radiation Hardened Cryogenic Readout Integrated Circuits (ROICs)

Title III resources are being utilized to establish a viable, domestic foundry for commercial production of less than or equal to 0.35 micron, deep sub-micron Complementary Metal Oxide Semiconductor (CMOS) ROICs. ROIC microelectronics are a critical technology employed in the manufacture of focal plane arrays (FPAs) that are utilized in high altitude and space-based imaging and missile systems. The next generation imaging requirements are dependent on the availability of advanced ROICs that provide high density with analog components, smaller pixels (increased resolution), and increased functionality through on-chip processing. Additionally, ROICs need to be physically larger (enabled through stitching technology) for increasing focal plane array size requirements, reduction of particle counts that improve production yields, and improved fabrication cycle times. All of these improvements will collectively increase the mission capability of the systems. This project was funded through Congressional increase to the Title III budget. The Air Force added other funding to the effort. Total government funding is $13.0M, augmented by $19.7M of contractor cost sharing. This was a competitive solicitation.

Radiation Hardened Microprocessors

This Title III project is scaling up production capacities for high performance radiation hardened microprocessors with a progression from radiation tolerant to radiation hard. The much higher clock rates will lead to significant cost and weight savings for space systems. Higher performance means greater on-orbit processing capabilities and reduced ground support requirements. As with the other Title III radiation hardening projects, these microprocessors will enable spacecraft to operate in the challenging radiation environments of nuclear threats and long-term natural radiation. This project was funded through Congressional increase to the Title III budget. Other funds were added by other government agencies. Total government funding is $14.2M, augmented by $4.2M of contractor cost sharing. This was a competitive solicitation.

Reactive Plastic CO_2 Absorbent

Reactive Plastic Carbon Dioxide (CO_2) absorbent material is a technology that secures the CO_2 absorbing material to a plastic sheet in a polymer matrix bond. This material is an important resource for national defense. It is utilized primarily in military scuba, submarines, space, and an array of homeland security applications to “clean” CO_2 from air needed for breathing. This technology is driven by the Navy, which seeks to utilize the advantages of reactive plastic CO_2 absorbent in rebreather gear. These advantages include stealth diving capabilities (i.e., no bubbles from the rebreather) with

extended diving durations and reduced breathing effort by the divers. Other applications include medical, fire rescue, and mining operations where an inherently high risk of CO_2 exists. Title III is supporting efforts to increase the domestic production capacity of CO_2 absorbent material. This project was funded through Congressional increase to the Title III budget. Additional funds were added by the Manufacturing Technology Program. Total government funding is $12.1M, augmented by $2.1M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest

Silicon Carbide Powder Production and Ceramic Armor Manufacturing

High purity silicon carbide (SiC) powder, specifically submicron alpha SiC powder, is a critical item for national defense. This refined form of SiC powder is the key ingredient required to produce high quality, light weight, and cost effective SiC ceramic armor for the warfighter. Primary applications include armor for land, air, and naval platforms and lightweight body armor. This Title III project is increasing the domestic production capacity for both submicron alpha SiC powder and SiC ceramic armor. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $4.9M, augmented by $4.2M of contractor cost sharing. This was a competitive solicitation

Thermal Battery Production

The objective of this Title III initiative is to strengthen and expand a domestic source for advanced thermal batteries. Military unique, high performance batteries are the only viable power source for many defense systems. The Missile Defense Agency and Service program offices have identified several high performance battery technologies for which there is insufficient availability or producibility to meet known and planned program requirements. The Title III program is developing incentives for a domestic company to scale up production and expand internal capacity. The applicability of these batteries to a wide variety of DoD weapons systems offers Army, Navy, and Air Force program offices the ability to greatly enhance system performance. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $14.4M. This was a competitive solicitation.

Titanium Metal Matrix Composites (TiMMCs)

TiMMCs offer material properties that enable aircraft designers to engineer components that are stronger, lighter, and more durable than existing steel and pure titanium components. These improvements can expand U.S. air superiority margins over opposition forces by increasing lethality for U.S. munitions, increasing survivability for the warfighter, and ultimately increasing mission success rates. Title III funding will enable expansion of the domestic production capacity of TiMMCs to support the warfighter and assist the development of a database of TiMMC material characteristics and the processes required to produce TiMMCs. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $22.9M,

augmented by $1.1M of contractor cost sharing. This was a sole source solicitation as a single domestic source was identified for the specific technology of interest.

Vacuum Induction Melting, Vacuum Arc Remelting (VIM-VAR) Furnace Capacity

Low alloy VIM-VAR steel is a highly refined steel that is processed through multiple melts under vacuum to reduce excess gases and other impurities. VIM-VAR alloy steel is essential for many military applications including engine bearings, helicopter rotor shafts, transmission gears and engine mounts. This Title III initiative to increase VIM-VAR capacity will reduce the order lead times and ensure the domestic supply of clean alloy steels for critical military components. This project was funded through Congressional increase to the Title III budget. Total Title III funding is $25.6M, augmented by $33.5M of contractor cost sharing. This was a competitive solicitation.

4.2 Defense Priorities and Allocations System (DPAS) and Special Priorities Assistance

Title I of the Defense Production Act provides the President the authority to require preferential performance on contracts and orders, as necessary, to meet national defense and emergency preparedness program requirements. Executive Order 12919 delegates these authorities to various federal departments and agencies.

The Secretary of Commerce has authority to manage industrial resources. To implement its authority, the Department of Commerce (DOC) administers the DPAS. The DOC has further delegated authority to the Department of Defense under the DPAS to: (1) apply priority ratings to contracts and orders supporting national defense programs; and (2) request the DOC provide SPA to resolve conflicts for industrial resources among both rated and unrated (i.e., non-defense) contracts and orders; and (3) authorize priority ratings for other U.S. federal agency and friendly nation defense-related orders in the United States when such authorization furthers U.S. national interests.

ODASD (MIBP) convenes and chairs a Priority Allocation of Industrial Resources (PAIR) task force to quickly resolve industry constraints that interfere with military operations and warfighter readiness. The task force ensures industrial resources are allocated to DoD programs in accordance with operational priorities when emergent requirements create competing demands among acquisition programs. The MIBP directorate works closely with the DOC to ensure effective prioritization of materials, and to expedite delivery of urgently needed defense materials and services.

PAIR activity from October 2009 through December 2010 resulted in SPA being provided to DOD buying components and foreign governments, and the formal issuance

of 9 DOC industry directives. All actions were in support of ongoing Operations in Afghanistan as depicted in the following table (p. 80). Four of these were to accommodate the needs of U.S. forces, and the remaining five addressed the needs of foreign nation coalition partners.

For example, MIBP engaged with industry to address numerous delivery issues on behalf of Special Operations Command (SOCOM) to expedite fielding of night vision systems in Afghanistan. An Industrial Capability Assessment was completed to determine industry's ability to deliver these systems quickly and an arrangement was brokered between the Command and competing Service requirements to preserve access for all while meeting the urgent needs of SOCOM. The assessment provided insight into industry constraints and enabled the prioritization of delivery requirements by using DPAS priority rating authority to reconcile competing Service needs.

DPAS SPECIAL PRIORITIES ASSISTANCE CASES – OCT 2009- DEC 2010

Date(s)	Item	Assistance for	Summary
10/09	Helicopter Ammunition and Parts	Coalition Partner	Provided rating authority to ensure supply of helicopter equipment for deploying forces
10/09, 11/09, 12/09, 02/10	Night Vision and Image Intensification Equipment	U.S. Navy, and Coalition Forces	Organized allocation and provided rating authority to ensure supply of night vision equipment for deploying U.S. and coalition partners
11/09, 12/09, 11/10,	Ordnance	USAF	Reallocated delivery to accelerate production and fielding of new weapon
12/10	Counter Improvised Explosive Device Read Only Memory Devices	Coalition Partner	Provided rating authority and accelerated receipt of devices

Source: ODASD (MIBP)

4.3 DoD Manufacturing Technology Program

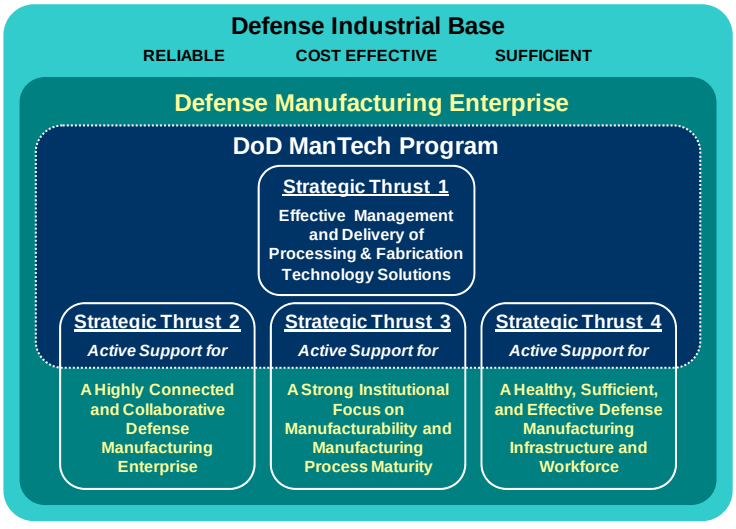
For over 50 years, the DoD Manufacturing Technology (DoD ManTech) Program has demonstrated its value through process technologies that make new products possible, as well as through manufacturing process improvements that get at the heart of defense system affordability challenges. The program provides the crucial links from technology invention to production of defense-critical needs that are in areas beyond the normal investment risk of industry. Ensuring that technology is affordable and producible remains key to making our forces more agile, deployable, sustainable, lethal, and dominant. While ManTech investments generally translate into initial system

affordability improvements or cycle time reduction, investments are also made in new capabilities that provide dividends in system performance or life cycle cost that can far outweigh the initial system delivery costs.

Individual ManTech Programs at Army, Navy, Air Force, and Defense Logistics Agency (DLA) focus primarily on production issues specific to each component. The Army ManTech Program (FY11: $60M) is addressing the highest priority manufacturing requirements across five domain areas; air, ground, C2, soldier, and advanced manufacturing initiatives. The Navy ManTech Program (FY11: $ 46.2 M) is focused on shipbuilding affordability and has made significant contributions in driving down the cost of the Virginia Class submarine among other major platforms. The Air Force ManTech Program (FY11: $39.7M) has a near term focus on reliable and affordable advanced propulsion, stealth, and sensors for Air Force tactical fighter and strategic strike systems. DLA's ManTech program (FY11: $19.5M) addresses DOD operations and support costs, including those associated with castings, forgings, batteries, combat rations, and obsolete microcircuits.

Additionally, the Defense-Wide Manufacturing Science and Technology (DMS&T) Program (FY11: $18.9M) overseen and managed by OSD, rounds out the DoD ManTech investment portfolio. It complements the component ManTech programs by focusing on emerging technologies supporting multi-service DoD priorities and cross-cutting, game changing initiatives that are beyond the scope of any one Service or Agency. Recommended by Congress in 2006, the DMS&T funding line was established in FY08 and is already fostering significant productivity and efficiency gains in the defense manufacturing base.

The DoD ManTech program directly supports the USD (AT&L) Efficiency Initiative (Better Buying Power), principally in the first key area; namely, "Target Affordability and Control Cost Growth." The theme of the DoD ManTech Program Strategic Plan (submitted to Congress in 2009) is *Delivering Defense Affordability*, and its four strategic thrusts, depicted in the graphic below focus ManTech community investments on this theme.



The office of the Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (ASD MIBP) exercises OSD-level oversight of the component ManTech Programs and manages the DMS&T portion of ManTech. The individual programs collaborate and coordinate their efforts through the Joint Defense Manufacturing Technology Panel (JDMTP), whose principals are the directors of the component ManTech Programs. The JDMTP has an exemplary history of effective coordination at a technical level to ensure that programs are aligned with higher level objectives, that unnecessary duplication is avoided, and that investments have the greatest joint-service leverage.

DoD ManTech ARRA Funding Results in Deployable Fuel Cells for the Army

The Department of Defense has an immediate need for reliable, lightweight, and ruggedized fuel cells, capable of providing power during extended missions in austere environments. These fuel cells also need to be more affordable through manufacturing maturation efforts. If successful on both counts, a strong domestic production base for both commercial and military fuel cells will be realized.

To that end, the DoD MS&T program received $18.4M in American Recovery and Reinvestment Act (ARRA) stimulus funding to sufficiently ruggedize and mature both a 300W and 50W fuel cell power system. Low Rate Initial Production (LRIP) quantities are being produced by both of these efforts. Additionally, two design iterations with DoD user feedback have been incorporated to increase the probability of user acceptance. The 300W man-portable program has a platoon-level recharging requirement for current operation, as well as the Army's future Net Warrior Program. The 50W wearable system is necessary for deployed Air Combat Controllers in remote locations. During these missions, Air Force personnel need continuous access to high-power portable electronics, such as satellite communication radios, laser designators, and laptops. The 50W units to date have made substantial progress against Air Force requirements and are being incorporated into an Advanced Technology Demonstration.

The 300W fuel cell units were field tested in November 2010 in Fort Riley, Kansas and received high marks. The Army battalion testing the units subsequently received deployment orders to Afghanistan and requested that the fuel cells accompany them. MIBP transitioned oversight to the U.S. Army Rapid Equipping Force the operational evaluation and continued development in support of PEO Soldier. A successful deployment experience will jump-start the demand for this capability. This in turn will increase the likelihood that the United States will retain its lead in this important technology, further strengthening the industrial base for fuel cells.

Office of the Secretary of Defense

Creates Manufacturing Process Data File (MPDF): a Prototype Integration Facility for M2 Machine Gun

The M2 Machine Gun is a 1930s-designed weapon system that continues to serve the armed forces. The procurement of spare parts over the years has included two dimensional paper drawing designs, along with manual machining centers. These processes caused conflicts and a burden on the legacy methods of replacement part procurement.

The Manufacturing Science and Technology program utilized the ManTech's capabilities to successfully develop a comprehensive facility that integrates Computer-Aided-Design (CAD) systems, Computer-Numerically-Controlled (CNC) machining centers, and Coordinate Measuring Machine (CMM) programs-processes required to meet the replacement part demands. By developing three dimensional CAD files to augment the 2D drawings, the Manufacturing Process Data File (MPDF) permits the process router to define the manufacturing and special processing requirements, which allows suppliers to input work-in-process status to an Internet portal that provides the procurement activity with real-time progress status.

The Manufacturing Process Data File, created by Picatinny Arsenal, has improved start-up through first-article-inspection production completion times by 46 percent and consolidated three industrial base sources. Gun Barrel Extension MPDF creation costs have a return on investment with the purchase of the second lot, and each 1000 piece Gun Barrel Extension purchase realizes more than $11K in savings. This advancement establishes configured vendor networks in order to make spares available in organic and commercial base for future needs.

Defense-Wide Manufacturing Science and Technology (DMS&T)

ManTech Decreases Inspection Time of 3-D Airfoils for Advanced Turbine Engines

The Challenge:
Engines have hundreds of airfoils that are made from organic matrix composites, ceramic matrix composites, or cast alloys. The current processes for inspecting complex airfoil designs for turbine engines are too slow, taking an average of one hour per airfoil, and cannot meet full rate/surge production or efficient maintenance operations of advanced turbine engines.

ManTech Response:

- An Integrated Project Team (IPT) was formed of engineers from the Air Force Research Laboratory (AFRL), Army Aviation and Missile Research,

Development, and Engineering Center (AMRDEC), airfoil casting suppliers, sensor suppliers, and three turbine engine Original Equipment Manufacturers
- A "Three Dimensional Airfoil Inspection" (3DAI) system was prototyped in 17 months that provides an alternate dimensional inspection methodology for complex turbine engine airfoils
- The team demonstrated a method for high speed data collection and analysis of airfoil geometry, which leads to a significant reduction in cycle time

Impact:
- Reduced airfoil dimensional inspection times from one hour to two to four minutes
- Reduced cost and man-hours of inspection
- Implemented on T700 platform as well as legacy engines

ManTech Improves Silicon Carbide Tow Coating Process

The Challenge:
Ceramic Matrix Composite (CMC) parts made with silicon carbide (SiC) are lighter than metal and provide improved acceleration, speed, and fuel efficiency in aircraft. However, the current machines used to manufacture CMCs require long start-up, cool-down, and maintenance cycles for each coating run, which adds to the overall aircraft cost and reduces capacity.

ManTech Response:
- Air Force ManTech, Army Aviation and Missile Research, Development and Engineering Center (AMRDEC), and the Defense-Wide Manufacturing Science and Technology Programs teamed with General Electric Aviation (GEA) to reduce the manufacturing steps for SiC tow coating and to provide greater throughput with substantially lower costs
- The CMC multi-step batch process was converted into a single step process
- Manufacturing costs and engine weight are reduced to improve acceleration, speed, and fuel efficiency
- Composite materials were validated during CMC panel fabrication and mechanical property testing

Impact:
- Increased coating run length by 100 percent from 137 meters to 275 meters of fiber
- Reduced labor cost for coating process by 70 percent

Army

ManTech Reduces Cost of Embedded Sensors for Aviation Composite Structures

The Challenge:

Aircraft such as the AH-64 Apache have been in service for more than 20 years, yet the airframes have limited sensing and diagnostic technology to reliably assess the structural health of the airframe. Pilots need to detect and assess structural damage in real time when aircraft are hit by ground fire. Additionally, as new composite materials are integrated into aircraft structural components, airframe health monitoring is more critical than ever. Current manufacturing and installation processes for lightweight sensors are costly and lack military-grade reliability.

ManTech Response:

- An Army Manufacturing Technology project identified and integrated a sensor network to collect information on the effects of vibration, temperature, strain, and ballistic damage on the airframe
- Developed processes and selected optimum materials for sensor installation inside the composite skin of the aircraft
- Army ManTech investment of $4.9M with Apache program funding of $3.6M

Impact:

- Improved the manufacturing process of the sensor using direct print for sensor grid production
- Reduced unit cost of sensor sheet by >65 percent (from ~$2000 per sheet to <$700 per sheet)
- Increased performance and reliability of sensor system by reducing manufacturing variability
- Reduced direct operating costs for Apache airframes through sensor capability for structural health monitoring that enables increased time between overhaul

Provided the warfighter with affordable, real-time aircraft ballistic damage indication capability

Navy

ManTech Reduces Labor Costs While Improving Safety for Weld Reinforcement Removal

The Challenge:

Butt welding exterior ship panels produces a weld protrusion that exceeds the DDG 1000 exterior surface fairness requirements. As a result, approximately 23,000 feet of weld reinforcement must be hand ground flush at three feet/hour causing increased shipbuilding costs, frequent injuries, and costly medical expenses.

ManTech Response:

- With an investment of $1.3M, a Navy ManTech team developed a mechanized tool that removes 80 percent of the weld reinforcement at rates exceeding 20 feet/hour
- The tool operates continuously in a rugged shipyard environment in all orientations (flat, vertical, horizontal and overhead)
- Bath Iron Works implemented the technology on DDG 51 in June 2009 and on DDG 1000 in August 2009

Impact:

- Increased removal speed over 500 percent from three feet/hour to 20 feet/hour
- Reduced direct labor by as much as 75 percent
- Reduced cost of $924K per hull from reduced labor and decreased injury claims on DDG 1000 alone
- Lightweight, portable Track Weld Shaver is now commercially available
- Applicable to other ships including Landing Helicopter Assault, Amphibious Transport Dock and the National Security Cutter as well as for commercial vessel and windmill construction

Air Force

ManTech Develops Revolutionary F-35 Inlet Duct Robotic Drilling (IDRD*)*

The Challenge:

F-35 aircraft inlet ducts must be manually drilled from the inside in order to attach frames around the duct. This process is ergonomically difficult and requires excessive tooling, labor costs, and long cycle time (approximately 50 hours of drilling per duct).

ManTech Response:

- Demonstrated automated hole drilling with a Phase-II Critical Small Business Innovation Research (SBIR) program team of primes, small businesses, system integrators, and the F-35 Joint Strike Fighter Joint Program Office (JPO)
- Improved maturity of production-ready automated hole drilling process to manufacturing readiness level (MRL) 8, pilot line demonstration

- Transitioned three production inlet duct robotic drilling cells to production line in Palmdale, CA
- Air Force ManTech, SBIR and F-35 JPO invested $6.2M

Impact:
- Reduced tooling, floor space, and manpower cost
- Reduced drilling cycle time by 75 percent (from 50 to 12 hours per duct)
- Robotically drilled F-35 inlet ducts now meet full rate production targets of one aircraft per day
- Eliminated ergonomic work-related injuries

Defense Logistics Agency (DLA)
ManTech Improves Test Capability for Integrated Circuit Emulation

The Challenge:
The industrial base no longer supplies many high performance, high reliability microcircuit types required by the Department. Military system readiness and costs are adversely impacted by microcircuit obsolescence. The DLA Microcircuit Emulation Program (MEP) provides the ability to reverse engineer, design, manufacture, and test (i.e., emulate) microcircuits for military platforms and assures a continuing source of advanced digital microcircuits.

ManTech Response:
- Improved the current emulation manufacturing test capability by reducing test cycle-time and extending the capability to address more complex microcircuits
- DLA ManTech partnered with the Industrial Base Innovation Fund (IBIF) to invest $0.79M
- The DLA MEP provides Form, Fit, Function and Interface (F3I) integrated circuit replacements for military vehicles such as F-15, C-17, B-52, A-10, Joint STARS, Phalanx, Harrier, Apache, and the Bradley Fighting Vehicle
- Provided advanced non-procurable microcircuits for production, support and National Stock Requirements for F-18, MLRS, and Apache

Impact:
- Reduced lead times by 20 weeks
- Increased benchmark device yield from 50 percent to 80 percent
- Increased test capacity for complex ICs
- Supported greater than 350 registered weapon systems
- Over 100,000 military-quality-emulated devices have been shipped

5. Programs and Actions to Sustain Capabilities

In 2010, the Department acquired and/or maintained facilities, equipment, or components, or took other actions needed to meet projected and actual military contingency requirements.

- DLA currently has contracts in place that guarantee immediate availability of up to $328M in medical materiel for S&S. This coverage increases to a total of $970M, over a six-month period, if all "refresh" options are exercised. The basis for medical contingency contracts is the Medical Contingency File (MCF) database, which consolidates and aggregates the Services' time-phased wartime requirements. Once the requirements are known, contract coverage for contingency materiel is sought to meet the response times and levels defined by the Armed Services. The commercial coverage of $970M represents the amount of the total requirement identified in the most recent MCF update that is owned or under contract by DLA for the specific purpose of initial outfitting or re-supply upon deployment.

- DLA invested $9.8M during FY10 for an Industrial Base Maintenance Contract (IBMC) to Meridian Medical Technologies (MMT) to retain a capability to satisfy the Services' wartime S&S requirements for Nerve Agent Antidote Autoinjectors (NAAA). NAAAs are military-unique items designed for rapid self-administration through clothing upon exposure to a nerve agent. MMT, the sole U.S. Food and Drug Administration approved manufacturer of NAAA, produces five types of NAAAs that fall under the Nuclear Biological Chemical Defense Program. The IBMC pays MMT to maintain a warm base and to rotate prepositioned components in order to increase production capacity to satisfy the Armed Services' wartime NAAA requirements. Also, during FY10, DLA purchased additional components for surge valued at $6M. The components are stored with the manufacturer to meet the Armed Services' contingency requirements.

- DLA obtained "no charge" surge coverage on 452 contracts. This coverage represents a cost avoidance of $62,530,438 that neither DLA nor the Armed Services will have to expend for supplies to ensure that critical war/contingency items will be available.

- The Industrial Base Innovation Fund (IBIF) is a Congressionally-directed program established in 2008 and continuing through 2010, which is administered by DLA Logistics Research & Development Program. The direction for IBIF 2010 was "to continue to make investments in manufacturing research that address defense industrial base shortfalls especially related to surge production requirements and diminishing sources of defense material." In 2010 the IBIF Program made 21 contract awards totaling $20M. Small businesses accounted for 11 of those

awards. IBIF made 16 awards to companies that are not weapon system integrators.

In 2008, DLA completed a study to identify in detail the bottlenecks in the production process of Unitized Group Rations (UGRs). The study focused on identifying investments required to increase surge production capacity. Capacity of three current and potential UGR vendors to meet surge requirements was studied, resulting in three investment options. The recommended option was for the government to invest $1.8M to procure retort machines (these units cook the food in the pouch), two Tray Sealer units (these units seal the pouches), and associated support items, including spare parts kits, manuals, and retort racks. Awards were made to two firms in September 2009. All equipment passed First Article Testing by July 2010, and DLA Troop Support Subsistence has taken delivery of these items. Pending the next UGR long term contract award in FY11, an assessment will be conducted at vendor facilities to decide what pieces of the GFE will be positioned to support surge requirements. Utilization of this GFE for surge production will result in an additional 288,000 rations per month, which significantly closes the gap between production capacity and requirements. It should be noted that this GFE can also be used to augment production for the MREs. In addition, DLA Troop Support Subsistence assumed ownership of two critical pieces of equipment, at no cost, from the Combat Rations Network for Technology program. One piece of equipment, a Raque-brand Fill and Seal machine, will be positioned at a UGR vendor facility. The vendor will refurbish and upgrade this equipment at no cost to the government. The use of this machine will result in an additional 15 percent increase in UGR production; it can also be used for testing and training purposes during peacetime. In October 2009, DLA Troop Support Subsistence also purchased additional retort racks to be used during a surge event. One of the bottlenecks in the production of UGRs as well as MREs, is the shortage of racks. The racks are a new design and made of a new material to allow for greater heat penetration and transfer. DLA Troop Support Subsistence has taken delivery of these items and they are now in storage at no cost to the government.