

**Annual Industrial Capabilities Report
to
Congress**



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Office of Under Secretary of Defense
Acquisition, Technology & Logistics
Industrial Policy

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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. Introduction

The Department desires that the industrial base on which it draws be reliable, cost-effective, and sufficient to meet strategic objectives. Stable, robust, Department of Defense (DoD) funding is the primary factor in sustaining those industrial capabilities supporting defense because such funding focuses market demand across a broad spectrum of industry segments to meet emerging and projected DoD requirements. Several other criteria also can be used to evaluate the extent to which the industrial base has the desired attributes of reliability, cost-effectiveness, and sufficiency.

For example, a “reliable” industrial base is one in which suppliers ship contracted products and services on time. Additionally, reliable firms are viable for the long-term when they are likely to be healthy for the long-term. That is, the Department would like the firms on which it draws to have a stable or expanding business base, earn fair operating margins for owners, and invest in internal research and development and capital equipment such that long-term viability, innovation, and competitiveness is likely.

A “cost-effective” industrial base is one in which suppliers deliver contracted products and services at or below cost targets. Cost-effective suppliers require not only stable, well-structured weapon system programs, but also optimized acquisition strategies. A cost-effective industrial base maintains an adequate number of competitive suppliers in key and emerging technology areas. In addition to the number of suppliers in a given product area, another indicator of competitiveness (and cost-effectiveness) is the extent to which suppliers participate in non-defense (dual-use) U.S. markets and export products overseas. In fact, a positive trade balance within a market segment is a solid indicator that firms within that segment are world-class and provide cost-competitive products.

Finally, a “sufficient” industrial base is one in which suppliers deliver contracted products and services that meet Department performance requirements. Suppliers with sufficient industrial capabilities are flexible and react positively and quickly to changing requirements and priorities within the Department, particularly during times of conflict—indicative of the adaptability of both production lines and technology. They can effectively manage their way through requirements peaks and valleys while maintaining the ability to hire, train, and retain the specialized skills required to meet these dynamic requirements. They also have technology or technology development programs planned and/or in place to meet current and projected DoD needs.

U.S. suppliers appear well-positioned to supply the most critical technologies enabling 21st century warfare. Nevertheless, although the industrial base supporting defense generally is sufficient to meet current and projected DoD needs, there are and will always be problem areas that the Department must address. This report addresses many of these problem areas.

1.1. Three Broad Areas of Interest

DoD research, development, and acquisition, and associated policies and program decisions, play the major role in guiding and influencing industry transformation by focusing market demand across a broad spectrum of industry segments to meet emerging and projected DoD requirements. First, the Department's weapons system acquisition policies and decisions shape the technological and programmatic focus of industry. Second, decisions made on mergers and acquisitions involving defense firms continue to shape the financial and competitive structure of the industry. Third, DoD evaluations and assessments of sectors or specific industry issues help identify future budgetary and programmatic requirements. Finally, the Department incorporates industrial base policies into its acquisition regulations and strategies on an ongoing basis to promote competition and innovation, and in specific cases to preserve critical defense industrial capabilities and technologies.

These Department processes and decisions normally are sufficient to establish and sustain the industrial capabilities needed to secure the nation's defense. However, despite its overall sufficiency, niche problem areas continue to surface within the base.

Surge/Mobilization

Although capabilities within the industrial base supporting defense generally are sufficient to meet current and projected DoD requirements, the Department has been faced recently with industry segment capacity concerns centered on difficulties associated with rapidly increasing production of "critical" (based on unique evolving operational scenarios) items. This is most recently true for items associated with body armor and up-arming vehicles. The Department has a variety of tools to address such issues, such as by prioritizing industry deliveries to meet the most critical warfighting needs first.

The provision of body armor to troops deploying to Iraq demonstrates both the very real difficulties in properly assessing evolving operational requirements, as well as industry's ability to respond to those requirements once established. DoD body armor requirements increased greatly prior to combat operations in Afghanistan and Iraq, straining domestic industry's ability to meet DoD warfighting requirements. In particular, a short supply was the specialized ballistic backing material incorporated into the body armor. Between April 2002 and May 2003, the Department's monthly requirements for the backing material quadrupled and the sole domestic source—Honeywell—was unable to keep up with the demand. Although not completed in time to support initial operations in Iraq, Dutch State Mines (headquartered in the Netherlands) built a new production facility for a comparable backing material in Greenville, North Carolina, significantly increasing domestic production capacity. Increased capacity for the backing material is absolutely essential because DoD requirements continue to evolve as body armor design advancements make enhanced protection possible.

These issues, difficulties, and success stories highlight the need for the Department to continue to improve its requirements generation process—particularly for contingency operations—in order to provide better and more timely guidance to its industry partners. The Department must carefully balance the costs associated with maintaining excess production capacity for operationally-critical items in order to respond to a sudden accelerated production requirement, the unavoidable lead time necessary to fund and establish increased production capacities for those items, and the risk associated with having only a marginal peacetime production capacity on which to draw should sudden accelerated production become necessary.

Commercial Markets

There are cases in which the Department relies extensively on industry segments for which it is a relatively minor player. For instance, commercial information technology (IT) and products represent the state-of-the-art in 21st century communications. They are produced globally and non-U.S. suppliers may offer the best products in certain market segments. The global commercial IT market dwarfs the defense IT market and the Department's leverage over that market is limited. Whereas U.S. defense spending accounts for roughly half the world's defense spending, U.S. defense IT spending accounts for only about one percent of the world IT market. The tools used to leverage the defense market are highly unlikely to have the same effect in the commercial IT market. Although there are risks associated with employing commercial technologies (for example, uncertain strategic technology direction, uncontrolled technology access and dissemination, obsolescence) commercial IT products offer a number of benefits. The technology is the most current and advanced available, development costs are amortized over the broader commercial business base, and there are numerous competitive suppliers. Accordingly, commercial IT products frequently offer better performance and are less expensive than technology procured solely for DoD applications. To the extent that the Department can utilize commercial IT, it does.

Other industry segments with strong commercial market focus offer similar benefits and entail similar risks. The Department must be able to continue to leverage state-of-the-art commercial technologies and products from the global marketplace. However, in these global markets, the Department has limited ability to influence the strategic direction of the market, faces security of supply risks, and is confronted with the potential for tampering. For instance, as DoD contractors move software development work offshore for economic reasons, the potential security ramifications inherent in malicious code (e.g., Trojan horses, back doors, and time bombs) increases. In addition, the potential exists for a more strategic problem: prospective loss of intellectual capability, particularly in microelectronics, as research, development, and design work threatens to follow production work to cost-saving offshore facilities. The Department is assessing these issues and their potential impact on sensitive defense applications in more detail in the coming year.

Contractor Performance

Cost, schedule, and technical performance are ultimately the bottom line metrics in assessing the defense industrial base. A healthy industrial base is not the Department's ultimate objective. A healthy industrial base is a vehicle to the Department's ultimate objective: the most affordable, supportable, and effective defense capability in the world. The Department has a major role to play in enabling superior contract performance. It must realistically balance program performance, funding, and schedule requirements. Failure to do so dooms programs and the industrial base supporting those programs to failure.

1.2. The Defense Industrial Environment

Consolidation

The Department understands that the industry supporting defense is reshaping itself to respond to significant changes in military missions. Major defense firms are responding by reducing excess capacity, streamlining processes, and revamping supplier relationships. These changes may have negative impacts on certain suppliers within the United States. Recognizing the potential long-term negative consequences of firms exiting the defense business, the Department has policies, processes, and structured procedures in place to make appropriate judgments about identified industrial issues and to integrate those judgments into its regular budget, acquisition, and logistics processes. DoD Directive 5000.60, "Defense Industrial Capabilities Assessments," and the accompanying DoD Handbook 5000.60-H, "Assessing Defense Industrial Capabilities," establish the policies, procedures, and circumstances under which the Department will take action to preserve endangered industrial capabilities. Before taking action, the Department must verify the warfighting utility of the industrial capability, that the industrial capability is unique and at risk, that there are no acceptable alternatives, and that the proposed action is the most cost- and mission-effective.

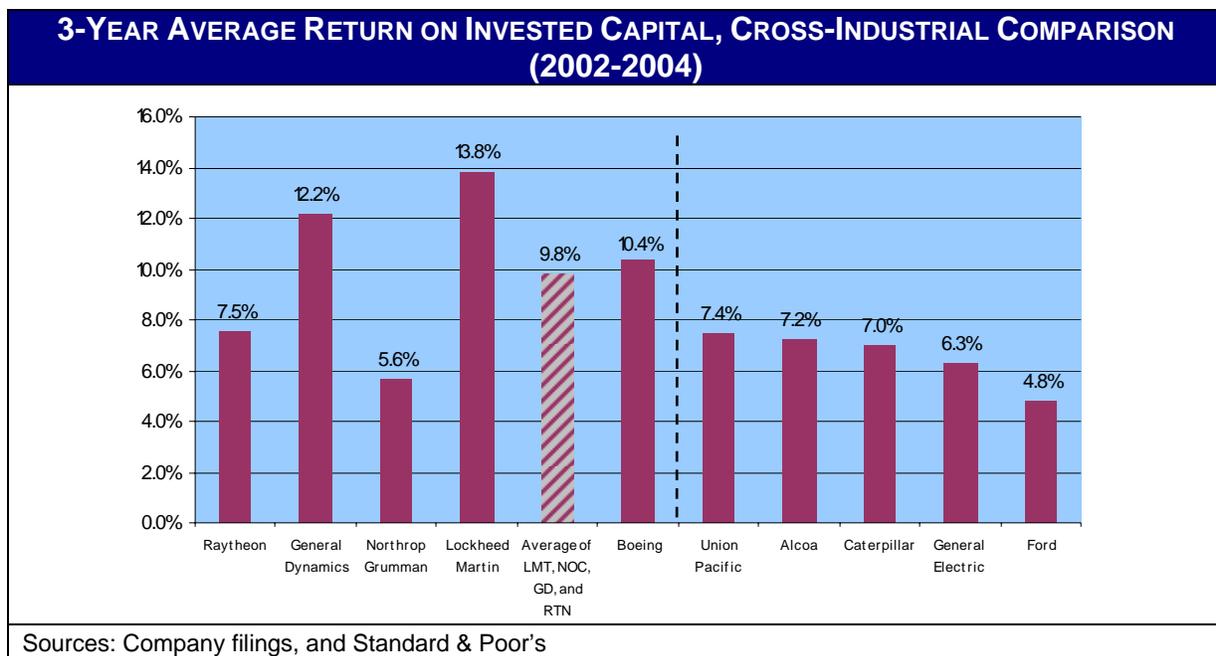
These criteria deliberately set a high standard for intervention into the industrial base in order to ensure that limited DoD resources are not expended unnecessarily. Although the bar is high, the Department has recently intervened to address critical issues. In 2004, the Department contracted with IBM for a Trusted Foundry Access Program that assures DoD access to leading edge integrated circuit products that can be trusted for use in sensitive defense systems. It also is the first step in a broader strategy to maintain long-term access to leading edge integrated circuit products and to ensure that defense-specific integrated circuits built for sensitive DoD systems can be trusted. The Department also recently took action to maintain a stable domestic industrial capability for high purity beryllium. Beryllium is a strategic material employed in a variety of critical defense systems including aircraft, missiles, satellites, and nuclear warheads. The Department allocated \$7.8 million in Fiscal Year 2006 to begin a Title III project to establish a new domestic production facility for high purity beryllium metal;

and has allocated additional funding annually through Fiscal Year 2010 to complete that facility.

Economic Outlook

The overall economic outlook for the U.S. aerospace/defense industry is positive. Aerospace sales in 2005 totaled \$170 billion, an increase of 8.9 percent over 2004's \$156 billion according to the Aerospace Industries Association (AIA). Net profitability also improved over 2004's 4.2 percent to 5.2 percent. AIA estimates that aerospace sales in 2006 will hit \$184 billion, an 8.2 percent increase over projected 2005 sales of \$170 billion. It also expects profitability to increase, projecting 2006 net profit margin of 6.6 percent, a 26 percent increase over 2005.

In addition, aerospace/defense operating profit growth has outpaced the S&P 500 in five of the last nine years; and the earnings outlook for 2005 and beyond is for strong, double-digit growth. In fact, when measured by return on invested capital—arguably the purer measure—the chart below demonstrates investment in a major aerospace company beats investments in comparable non-defense industrials.

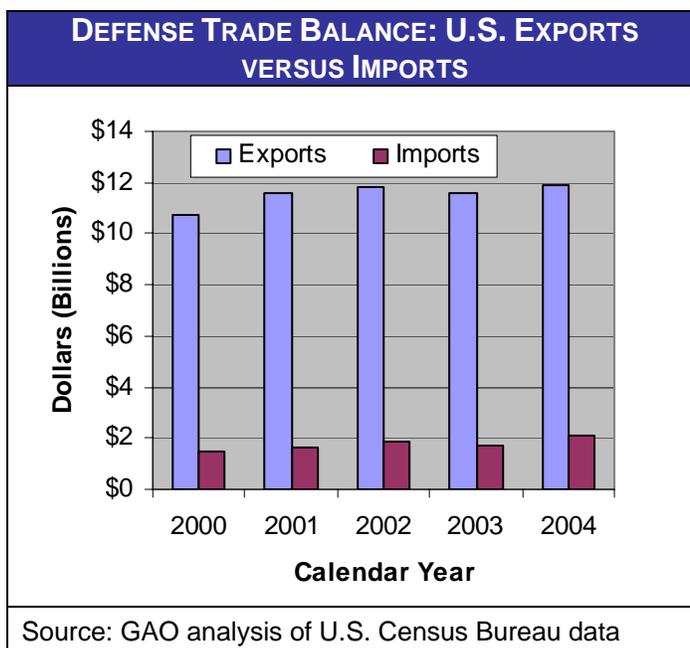


This is because aerospace/defense firms benefit from lower capital requirements driven by: (1) the Government being a good bill payer (which reduces working capital); (2) progress payments (which reduce inventory levels); and (3) shared use of facilities (which reduces capital investments). Finally, defense assets are plenty attractive to the merger and acquisition communities as measured by the large number of antitrust and foreign investment reviews in 2005—see Chapter 2 for details.

Industry Globalization

Defense exports play an important economic role in strengthening the U.S. defense industrial base. The U.S. aerospace and defense industry had a foreign trade surplus of \$31 billion in 2004. A total of \$4 billion of that surplus was in defense items. About 20 percent of U.S. weapons systems output are exported, representing billions of dollars toward that surplus and tens of thousands of U.S. jobs directly supported by foreign defense trade. Sales to foreign customers have frequently been critical to keeping entire production lines open, such as the F-16 and F-15 fighter jets and the Apache helicopter. In turn, keeping those lines open protects blue-collar workers and lower-tier suppliers that are critical to a healthy defense industrial base. Foreign defense trade is also vital to security, since the allies that buy these products are often at our side during armed conflicts around the world. AIA recently developed a web portal, the sole purpose of which is to provide valuable information that will help explain this complex issue and demonstrate the need for policies that foster defense trade with our international friends and partners.¹

The U.S. sells significantly more defense articles and services to foreign entities than it buys. Based on recent Government Accountability Office (GAO) analysis, between 2000 and 2004, U.S. defense exports averaged \$11.5 billion a year, versus imports of \$1.8 billion a year. The charts opposite show that U.S. exports of defense articles ranged from \$10.7 to \$11.9 billion while imports ranged from \$1.5 to \$2.1 billion. Another measure of the trade balance shows that imports averaged only 15 percent of exports during the period.²



Calendar Year	Defense Exports (Billions)	Defense Imports (Billions)	Imports as % of Exports
2000	\$10.7	\$1.5	14%
2001	\$11.6	\$1.6	14%
2002	\$11.8	\$1.9	16%
2003	\$11.6	\$1.7	15%
2004	\$11.9	\$2.1	18%

Recognizing the barriers to becoming DoD contractors and subcontractors, non-U.S. suppliers are becoming U.S. suppliers through investment and by establishing U.S. manufacturing facilities. This foreign investment in the United States reflects a relatively new phenomenon in the U.S. aerospace/defense industry. To improve access to the

¹ Aerospace Industries Association's Defense Trade Resources website.

² GAO-06-319R Defense Trade Data, Briefing to Senate Committee on Armed Services, January 2006.

U.S. defense (and to some extent, non-defense) market, non-U.S. firms increasingly are investing in the United States. Overall foreign direct investment³ in the United States decreased by more than 50 percent from the period 1997-2000 to the period 2001-2004. However, foreign direct investment in the U.S. aerospace sector dramatically increased, nearly doubling over the same period.

FOREIGN DIRECT INVESTMENT IN THE UNITED STATES (MILLIONS OF CURRENT DOLLARS)			
Foreign Direct Investment in the United States -- Annual Flow			
	1993-1996	1997-2000	2001-2004
Overall			
Volume	\$238,985	\$875,215	\$383,485
% Change		266%	-56%
Aerospace			
Volume	-\$55	\$2,306	\$4,568
% Change		4293%	98%
Source: U.S. Department of Commerce, Bureau of Economic Analysis, Aerospace data drawn from NAICS 3364 (Aerospace Product & Part Manufacturing, which includes aircraft, engine, missile, and space systems and parts and auxiliary equipment manufacturing).			

Conclusion

When the Department has to deal with shortcomings in the industrial base, it has a wide variety of tools with which to promote innovation and competition.

- Directly fund innovation in its science and technology accounts, and encourage industry to do the same via their independent research and development accounts.
- Induce innovation by employing acquisition strategies that encourage competition at all levels of contract performance.
- Use contract provisions to preclude the ability of contractors to favor in-house capabilities or long-term teammate products over more innovative solutions available elsewhere.
- Block exclusive contractor teaming arrangements that effectively reduce the number of suppliers in a given market, especially if the teammates are dominant in a particular market sector.

The Department also can, and does, formally establish restrictions within the Defense Federal Acquisition Regulation Supplement (DFARS) on the use of foreign

³ Foreign direct investment includes equity capital, inter-company debt, and reinvested earnings.

products for certain defense applications, when necessary to ensure the survival of domestic suppliers required to sustain military readiness. These DFARS foreign product restrictions are imposed by administrative action (that is by a DoD policy decision, not by statute). Currently, the Department has administratively-imposed DFARS foreign product restrictions for Polyacrylonitrile carbon fiber (used primarily in aerospace systems), periscope tube forgings, ring forgings for bull gears, and ship propulsion shaft forgings.

In conclusion, the Department of Defense has the authorities, responsibilities, and resources to address shortcomings in the industrial base supporting defense. Reliable and cost-effective industrial capabilities sufficient to meet strategic objectives are and will continue to be priorities of the Department.

2. Defense Mergers and Acquisitions

2.1 Introduction

Robust, credible competition is vital to providing the Department with high quality, affordable, and innovative products. The Department has no blanket policy of discouraging further consolidation or divestiture, or encouraging a specific industry structure. The Department believes that the competitive pressure of the marketplace is the best vehicle to shape an industrial environment that supports the defense strategy. Therefore, the Department of Defense takes action to intervene in the marketplace only when necessary to maintain appropriate competition and develop and/or preserve industrial and technological capabilities essential to defense that the marketplace, left unattended, would not. The Department evaluates each proposed transaction on its particular merits in the context of the individual market and the changing dynamics of that market.

The Department must establish, maintain, and strengthen industrial relationships that ensure that the future defense industrial base is both healthy and vital. In doing so, the Department maintains focus on the need to encourage competitive forces for innovation while acknowledging the need of companies to scale up or combine with other firms to create new industrial capabilities essential for future warfare. Such flexibility is essential if the Department is to capitalize on the revolutionary technologies of tomorrow.

DoD reviews several kinds of business combinations involving defense suppliers: (1) proposed mergers or acquisitions filed under the Hart-Scott-Rodino Antitrust Improvement Act of 1976 (currently, transactions valued at more than \$50 million); (2) other collaborations among competitors that have been made public (joint ventures, mergers, and acquisitions) of special interest to the Department that do not meet the Hart-Scott-Rodino Act filing threshold; and (3) proposed acquisitions of U.S. defense contractors by non-U.S. firms for which filings have been made pursuant to the Exon-Florio Amendment to the Omnibus Trade and Competitiveness Act of 1988.

The Department has become increasingly sensitive to the innovative capabilities of small firms and is concerned that transactions not perturb the company's current innovative value to the Department. The Department also is concerned that such transactions not trigger future consolidations detrimental to the Department. The Department, therefore, will seek to use internal remedies to protect/promote innovation and may seek regulatory support to protect innovation.

2.2 Merger and Acquisition Reviews

The Federal Trade Commission and the Department of Justice (the “Antitrust Agencies”) have the statutory responsibility for determining the likely effects of a defense industry merger on the performance and dynamics of a particular market; and whether a proposed merger should be challenged on the grounds that it may violate antitrust laws. As the primary customer impacted by defense business combinations, DoD’s views are particularly significant because of its special insight into a proposed merger’s impact on innovation, competition, national security, and the defense industrial base. Accordingly, the Department actively works with the Antitrust Agencies.

DoD reviews are structured to identify impacts on national security and on defense industrial capabilities; evaluate the potential for loss of competition for current and future DoD programs, for contracts and subcontracts, and for future technologies of interest to the Department; and address any other factors resulting from the proposed combination that may adversely affect the satisfactory completion of current or future DoD programs or operations.

In 2005, the Department reviewed 23 transactions, as shown in the following table, pursuant to the Hart-Scott-Rodino provisions of the Antitrust Improvement Act. Of those cleared by the Antitrust Agencies, one required a consent order to protect continued competition. Several cases involved mitigation of organizational conflicts of interest, and were subsequently cleared.

DEFENSE MERGER AND ACQUISITION REVIEWS – 2005			
Acquirer	Acquired Company	Value (\$M)*	Disposition
BAE	United Defense	\$4,192	Consent Decree
ChevronTexaco	Unocal	\$1,600	No Objection
Cobham	Koch	\$63	No Objection
Cobham plc	REMEC Defense & Space	\$260	No Objection
Cubic	TCOM		No Objection
DRS Technologies	Engineered Support Systems, Inc.	\$1,970	No Objection
General Dynamics	Anteon	\$2,234	In Process
General Dynamics	FC Business		In Process
Goodrich	Sensors Unlimited		No Objection
Honeywell and Rockwell Collins	Integrated Guidance Systems Joint Venture		In Process
Intelsat	PanAmSat	\$6,200	In Process
L-3 Communications	Titan	\$2,650	OCIs addressed
L-3 Communications	GD Propulsion	\$185	No Objection

DEFENSE MERGER AND ACQUISITION REVIEWS – 2005 (CONTINUED)			
Acquirer	Acquired Company	Value (\$M)*	Disposition
L-3 Communications	Boeing EDD	\$90	No Objection
Lockheed Martin	Coherent Technologies		No Objection
Lockheed Martin	The Sytex Group, Inc. (TSGI)	\$462	No Objection
Lockheed Martin and Boeing	United Launch Alliance		In Process
Northrop Grumman Corp.	Integic Corp		No Objection
ORBIMAGE	Space Imaging	\$59	In Process
Precision Castparts	Special Metals Corp.	\$540	In Process
SES Global	New Skies	\$1,160	In Process
Valero	Premcor	\$6,900	No Objection
Valero	Kaneb	\$2,800	No Objection

2.3 Foreign Investment in the United States

The Exon-Florio Amendment to the Omnibus Trade and Competitiveness Act of 1988 established Section 721 in the Defense Production Act. This section authorizes the President to suspend or block foreign acquisitions, mergers, or takeovers of U.S.-located firms when they pose credible threats to national security that cannot be resolved through other provisions of law.⁴ The President has delegated management of the Exon-Florio Amendment to the interagency Committee on Foreign Investment in the United States (CFIUS), chaired by the Department of the Treasury.

Under Exon-Florio, the President has 30 days from the time he is notified of a foreign acquisition to initiate an investigation of the transaction. During the first 30 days after formal notification, CFIUS members conduct a preliminary review to determine whether the transaction poses credible threats to national security and, if so, whether there are means to adequately mitigate those threats under various statutes or departmental regulations. By the 30th day, the CFIUS must either approve the transaction, with or without risk mitigation measures, or initiate an additional 45-day investigation. There are no other options under the law. If the CFIUS completes an investigation, the President has 15 additional days to decide what action to take. Amendments to Exon-Florio enacted in 1992 require that (1) the DoD make determinations on whether the U.S. firm being acquired is engaged in the development of defense critical technology or is otherwise important to the defense industrial and technology base, and (2) the President inform Congress of his decision in each case involving a Presidential investigation.

⁴ Excepting the International Emergency Economic Powers Act.

The Department of Defense is a member of the Interagency Committee. As a CFIUS member, the Department evaluates the national security aspects of proposed foreign acquisitions of U.S. defense contractors and other U.S. firms indirectly impacting national defense. In assessing foreign acquisitions, the Department's principal objectives are to: (1) protect the reliability of supply of goods and services to the Department; (2) minimize the risks of unauthorized transfer of classified information and military and dual-use technologies; and (3) assure there is congruence of strategic interests between the acquiring firm and the DoD. Simultaneously, the Department strives to facilitate the development of an integrated defense industrial base among U.S. allies and trading partners in order to increase interoperability in coalition warfare and reduce DoD acquisition costs.

To assist in achieving these objectives, the Department determines in each case whether the firm being acquired possesses critical defense technology or is otherwise important to the defense industrial and technology base based on the outputs of the Defense Industrial Base Capability Study (DIBCS) series and other technology assessments that underlie DoD recommendations regarding export licensing regulations. The intelligence community also prepares for the Department a risk assessment of the acquiring firm and country which evaluates: (1) their compliance with U.S. and international export control laws and other international regimes which regulate proliferation of weapons of mass destruction; (2) their potential reliability as suppliers to the defense industrial base; and (3) their support in fighting international terrorism.

Given the statutory constraints of the Exon-Florio Amendment to the Defense Production Act, the Department cannot publicly discuss specific reviews. Information submitted to the CFIUS is protected by law from disclosure to ensure that voluntarily-submitted, sensitive business information is not compromised.

During 2005, a review of the 65 CFIUS cases filed indicates that 12 percent of the transactions involved U.S. firms deemed to possess critical technologies and 17 percent involved U.S. firms that were determined to be otherwise important to the defense industrial base. In 23 cases, the Department, acting under its own industrial security regulations that apply to firms with classified contracts, remedied concerns about foreign ownership, control, and influence by imposing risk mitigation measures on the acquiring firms. In five other transactions, CFIUS member agencies negotiated risk mitigation agreements unrelated to the industrial security regulations. In one case, a 45-day investigation was initiated to supplement the initial 30-day review. The total dollar value of all 2005 CFIUS transactions was \$29.7 billion.

3. Industrial and Technological Capabilities Assessments

Methods and Analyses

The U.S. defense industrial base and the global defense market provide the manufacturing capacity and technological capabilities which 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.

3.1 DoD-Wide

Foreign Sources of Supply: Assessment of the United States Defense Industrial Base (March 2005 Update)

Section 812 of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136) directed the Secretary of Defense to establish a program to assess the degree to which the United States is dependent on foreign sources of supply; and the capabilities of the United States defense industrial base to produce military systems necessary to support the national security objectives set forth in section 2501 of title 10, United States Code. In meeting the requirements of Section 812, the Department is to use existing data for the assessment program. The Department is to submit to the Congress by February 1st of each year, a report on the assessment program covering the preceding year.

The DoD assessment program described in the first annual report (November 2004), was based on three separate assessments that collectively provided visibility into the extent and impact of foreign suppliers: (1) an assessment of DoD prime contracts valued at over \$25,000 for defense items and components, (2) a recent assessment of

foreign content in certain defense systems, and (3) comprehensive assessments of the industrial base supporting defense (i.e., the *Defense Industrial Base Capabilities Studies* series of assessments). This report concluded that the Department employs foreign contractors and subcontractors judiciously, and in a manner consistent with national security requirements.

In March 2005, ODUSD(IP) issued an addendum to the first annual report that incorporated Fiscal Year 2004 contract information. Based on the assessment of DoD prime contracts valued at over \$25,000, the report concluded that the Department procures very few defense articles and components from foreign suppliers. In Fiscal Year 2004, the Department awarded contracts to foreign suppliers for defense articles and components totaling just under \$1.5 billion, about 2 percent of all DoD contracts for defense items and components—U.K. and Canadian firms were the prime beneficiaries, receiving \$340.2 million and \$600.9 million respectively for about 63 percent of the total.

Aerospace Forging Industry Industrial Capability Assessment (June 2005)

Concern over rapidly escalating raw material costs prompted the office of the Deputy Under Secretary of Defense for Industrial Policy (ODUSD(IP)) to request the Defense Contract Management Agency's (DCMA) Industrial Analysis Center (IAC) to identify domestic suppliers providing large forgings used in aircraft structures and gas turbine engines.

Suppliers in this market segment generally utilize a "closed-die" forming process and capacity is dependent on the size of hydraulic forging presses. Large aerospace forgings are typically assessed as single source items because the dies that are an integral part of the manufacturing process are designed and owned by the individual forging supplier. The assessment identified five domestic sources that are providing large forgings used in the aerospace sector; however, time constraints limited the scope of this "quick-look" assessment and DCMA recommended future additional study of the large closed-die forging industry in order to (1) more fully understand the impact of rapidly escalating material costs on the industry and (2) determine if suppliers have sufficient capacity to accommodate an expected upturn in the commercial aircraft market and planned ramp-up of the F-35 (Joint Strike Fighter) production. The outcome of this assessment supported the Department's decision to take no extraordinary action to fund additional large forging workload.

Biannual Assessment in Support of the Chemical and Biological Defense Program (June 2005)

The Joint Program Executive Officer for Chemical and Biological Defense (JPEO-CBD) requested DCMA to conduct a biannual assessment to support the Chemical and Biological Defense Program. The study identified a sample population of prime contractors and critical subcontractors and evaluated capacity, capabilities, and

potential risks for individual protection, decontamination, collective protection, contamination avoidance, and medical/pharmaceutical sectors. DCMA also evaluated bio-safety and consultant contractors that provide services to the government in the chemical, biological, radiological, nuclear and environmental (CBRNE) areas including defense operations; modeling and simulation; information technology; wireless communication; industrial technology solutions; nuclear engineering; and chemical, biological, and explosive science.

The study concluded that most contractors were rated as having low to moderate industrial and financial viability risk. Most contractors can surge production with relatively little effort. Investments necessary to increase production by 100 percent are negligible for most of the large companies, but cost prohibitive for the smaller companies. Most contractors plan to internally finance 100 percent of capital expenditures and few will receive or seek supplemental assistance from the Department. Bottlenecks to production were taken seriously and contractors had “get-well” plans in place. Research indicated primes and critical subcontractors (domestic and foreign) took initiative to invest capital in research and development (R&D) for manufacturing.

Defense Industrial Base Capabilities Study: Focused Logistics (June 2005)

In February 2003, ODUSD(IP) published *Transforming the Defense Industrial Base: A Roadmap*.⁵ That report identified the need for systematic evaluation of the ability of the defense industrial base to develop and provide functional, operational effects-based warfighting capabilities. The Defense Industrial Base Capabilities Study (DIBCS) series began a systematic assessment of critical technologies and industrial capabilities needed in the 21st century defense industrial base to meet warfighter requirements as framed by the Joint Staff’s Functional Concepts and Joint Operational Architecture. The DIBCS series ties directly to warfighter needs by linking industrial base capabilities to warfighter capabilities derived from the Joint Staff’s Functional Concepts.

The overall objectives of the DIBCS series are to: (1) identify technologies critical to Joint Staff functional warfighter capabilities, and to establish a reference database of these key critical industrial base capabilities mapped to warfighting functional capabilities; (2) conduct industrial base capability assessments on priority critical technologies to identify deficiencies; and (3) develop a systematic method to craft industrial base strategies to remedy identified industrial base deficiencies and encourage proactive, innovative management of the industrial base.

DIBCS: Battlespace Awareness (BA),⁶ published in January 2004, was the first in a series of five reports that addressed the functional concepts framed by the Joint Staff’s Functional Concepts and Joint Operational Architecture. A summary of *DIBCS*

⁵ Report available on the Internet (<http://www.acq.osd.mil/ip>).

⁶ Report available on the Internet (<http://www.acq.osd.mil/ip>).

BA can be found in the *Annual Industrial Capabilities Report to Congress, February 2004*. *DIBCS: Command and Control*, *DIBCS: Force Application*, and *DIBCS: Protection*,⁷ were the second, third, and fourth studies in the series, respectively. All were published in 2004 and summaries can be found in the *Annual Industrial Capabilities Report to Congress, February 2005*.

DIBCS: Focused Logistics, published in June 2005 is the fifth and final report in the initial DIBCS series. It employs the same logical, systematic methodology to link the industrial base to warfighting capabilities. The primary objective of this study was to identify Focused Logistics (FL) warfighting capabilities and technologies, assess the associated industrial base, and address deficiencies. The study identified 525 warfighting capabilities directly enabling U.S. warfighting leadership in this area. Of this total, 364 technologies emerged as ones in which the United States should be ahead of any potential adversary. An assessment for industrial base sufficiency of the 58 most pressing applications of the 364 technologies found that, with few exceptions, available industrial base capabilities are sufficiently innovative and robust. The report revealed industrial base issues in five areas including direct energy conversion, advanced solid rocket motors; fast reusable tooling; automated strike up/strike down machinery—automated stowage and retrieval system; and autonomous rendezvous and docking. Recommendations for remedies in these areas are under review and consideration.

Now that the initial five reports in this series are complete, ODUSD(IP) is consolidating and reviewing the recommendations and working with other DoD components to develop a Department-wide implementation strategy.

Pan Carbon Fiber Industrial Capability Assessment (October 2005)

ODUSD(IP), with the support of DCMA's IAC, conducted an assessment of the Polyacrylonitrile (PAN) carbon fiber industrial base to satisfy the requirements of Section 832 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Public Law 108-375. The assessment addressed the domestic and international industrial structure that produces PAN carbon fibers, current and anticipated market trends for the product, and how the trends compare to the assessment as reported to Congress by the Secretary of Defense in January 2001, which recommended restrictions be lifted in 2005.

The IAC assessment found that the Defense Federal Acquisition Regulation Supplement restriction on PAN carbon fibers has served its purpose to protect U.S. suppliers during economic downturn. Domestic suppliers are viable and world-wide PAN carbon fiber demand is increasing. The outcome of IAC's assessment supported the Department's recommendation to Congress to end the administratively-imposed PAN carbon fiber restriction.

⁷ Reports available on the Internet (<http://www.acq.osd.mil/ip>).

Space Launch Vehicles System (October 2005)

Based on concern regarding the downturn in the commercial satellite market and reduced DoD satellite procurement, DCMA's IAC conducted an assessment of the impact of consolidation and curtailed requirements on the industrial base and industrial capabilities within the space launch vehicle sector. The assessment found that launch vehicles (LV) account for a small portion of the prime and key subcontractor parent company business base. The May 3, 2005, Boeing and Lockheed Martin proposed joint venture (United Launch Alliance) would reduce the medium and intermediate LV primes from two to one. Only Boeing and Lockheed Martin produce medium and intermediate class expendable launch vehicles (ELVs) (Delta IV and Atlas V). The government provides funding to maintain capabilities at both companies. U.S. space transportation policy (NSPD-40) requires maintaining access to space for national security payloads via two LV families. The Department is to fund the annual fixed costs for both launch service providers unless or until the Secretary of Defense certifies that a capability that reliably provides assured access to space can be maintained without two families of launch vehicles.

The IAC assessment concluded that without an increase in commercial and DoD satellite launch workload, choices are limited to: 1) maintain the status quo with continued government funding to maintain two launch families access to space, or 2) approve the joint venture. This assessment is being considered as the Department reviews the proposed joint venture.

Strategic Assessment for the Precision Guided Munitions Industrial Base (October 2005)

Precision guided munitions (PGMs) have become the weapons of choice in recent conflicts. While DoD policy, in general, is to fight with the weapon inventories on hand, recent history indicates that accelerated production of certain PGMs may be required to successfully prosecute future conflicts.

Recent experience has shown a clear preference for PGMs in conducting 21st century warfare, yet the study concluded that funding predictability for PGM requirements remains a challenge for optimal industrial planning. The study also found that bottlenecks in the supplier base still exist; there is limited excess production capacity available to support further production acceleration of key components such as thermal batteries, inertial measurement units, and global positioning system receivers. In addition, Department budgetary practices do not reflect the preferred status of current PGMs or future preferred munitions. Specific recommendations for improving the agility of the PGM industrial base are under review and consideration.

3.2 Army

Industrial Capabilities Assessment for the AN/MLQ-41 Detecting System Countermeasures (March 2005)

The Army conducted this industrial research to identify all possible contributors to improving signals intelligence (SIGINT) and countermeasure systems. The function of SIGINT is to receive, monitor, analyze, and, to the maximum extent possible, compromise all forms of electromagnetic information transfer. The principal components of SIGINT systems are antenna, receivers, and processors. Research indicated that there are 30 or more companies in the United States involved in SIGINT technology, including development and manufacturing of critical components and complete SIGINT systems. This sector has a sufficient capacity and excellent capability to meet current demands.

The purpose of this assessment was to identify any risks associated with support of the AN/MLQ-41 Detecting Systems Countermeasures for both hardware and software, enabling the Army to mitigate any potential risks that are identified. The sensor and communications sector that is primarily developing the AN/MLQ-41 is comprised of large corporations with no foreseeable potential viability risks. Therefore, the assessment focused on the small and off-shore companies, providing critical hardware and software that could pose more risk. The analysis did not identify any single point failures and domestic manufacturing capabilities exist that could substitute production if required. However, sole source items were identified in connection with the proposed configuration. Due to the density and volume, the manufacturing capability is, overall, a "low risk." The Army will reassess the capability of the small businesses and re-evaluate the sole source suppliers prior to a full rate production decision. The reassessment will include consideration of production quantity, sustainment, and delivery schedule.

Industrial Capabilities Assessment for the Standardized Integrated Command Post System (June 2005)

This assessment was performed to provide the Standardized Integrated Command Post System (SICPS) product manager with a summary of the current status of the industrial base and its ability to support the SICPS program. The objective of the SICPS is to provide standardized command post infrastructure, allowing commanders and staffs to digitally plan, prepare, and execute operations, thereby contributing to the development of the common operational picture and sharing of situational understanding.

This assessment provided information on critical vendors that would assist the product manager in identifying strengths and weaknesses in the industrial base. A capability gap exists for standardized command post platforms that integrate command, control, communications, computers, intelligence, surveillance, and reconnaissance

(C4ISR) systems into a complete system to facilitate command post deployment and employment.

At this phase of the SICPS program's life cycle, the industrial base required to support the SICPS program is considered a low risk to the successful development, production, and fielding of the system. SICPS is primarily a non-developmental effort integrating government-furnished equipment (GFE), commercial off-the-shelf (COTS) products, and items based on existing successful and fielded technology. Reliance on GFE and COTS products used extensively on other U.S. and joint systems that require minimal adaptation to the SICPS system has the affect of minimizing the risk of program production quantities or schedule changes adversely affecting the domestic industrial base. The industrial base possesses a full range of industrial capabilities required for research, design, development, test and evaluation, and maintenance that are sufficiently mature and established to meet SICPS program requirements.

Tactical Communications Sector Industrial Base Assessment (June 2005)

This report examined the capability of the industrial base to develop, manufacture, and support the tactical communications systems used by the warfighter. With the exception of flat panel displays, the health of the commercial communications sector is excellent. The initiatives to develop new technologies supporting communications have made the communications sector a healthy market. Many new weapon systems are utilizing COTS technologies to satisfy the requirements of their programs, thus decreasing the development time and initial cost to field a new system.

Recommendations included exploring opportunities for collaborative, cross-Service display technologies and initiating a proactive diminishing manufacturing sources and material shortages (DMSMS) and sustainment engineering program.

Future Combat Systems Industrial Capability Assessments (September 2005)

The Future Combat Systems (FCS) Industrial Working Group (a broad consortium of senior operations personnel from the Army, industry, and defense organizations like DCMA) performed assessments of critical technologies and industrial capabilities needed for FCS. The overall objective of the assessments was to establish a baseline for emerging issues, critical technologies, and industrial capabilities that will affect the FCS program as it moves through system development and demonstration (SDD) and transitions to production. Pursuant to a contract already in place, iterative industrial base assessments will be conducted during SDD and leading up to the Milestone C review.

The report consists of 29 individual industrial capability assessments for FCS platforms and components mapped to operational requirements synopsized in three top level annexes. In addition, comprehensive analyses were conducted on many FCS

related technologies, materials, facilities, and components. Past experience reveals that most industrial base risks arise within the lower tiers of the supply chain. Since FCS is currently in development, many subtier suppliers are not yet identified or on contract. Consequently, this assessment was limited to the top tier suppliers (i.e., platform integrators), with the intent of identifying as many subtier suppliers as possible. Finally, the assessment addressed surge capabilities, alternate suppliers, and foreign sources.

While quite a few industrial base risks were identified, none presented unacceptable risk at this point in the program. However, an industrial base watch list was developed and will be monitored with special reports included in the FCS industrial capability assessment updates required prior to Milestone C.

Sensors Sector Industrial Base Assessment (September 2005)

Due to the increased focus on homeland security, Operation Iraqi Freedom (OIF), and Operation Enduring Freedom (OEF), the demand and interest in sensor-based technology has greatly increased. This assessment examined the capability of the sensor industrial base (private and organic) to develop, manufacture, and support legacy and future weapon systems used by the warfighter. Sensor systems rely primarily on contractors to provide advanced, critical technologies that are not available from the commercial sector. In general, the contractor base for the sensors sector is financially healthy. Army sensor systems include radars, countermeasures, countermines, identification friend or foe systems, unattended ground sensors, and meteorological and global positioning systems. Findings of the assessment were:

- Recent consolidation in the microwave power tubes (MPT) industry resulted in a shrinkage of the MPT industrial base. The potential of a critical knowledge drain exists if workforce reductions occur. MPTs are critical components in radar and countermeasures systems.
- Obsolescence and long delivery times are common issues for the maintenance and rebuilding of legacy sensor equipment at Army depot and contractor facilities. Critical items identified include frequency control components, microwave tubes, receivers, radio frequency and microwave filters/circuits, antennae, diplexers, and circuit card assemblies.
- Presently, there is limited foreign dependency for technology used in sensors systems. Meteorological and countermine systems currently rely on some foreign sources.
- The Department and its suppliers face a potential major supply problem for military integrated circuits due to a reduction of leading edge fabricators in the United States. In addition, Taiwan and China, as well as other countries, are greatly increasing their fabrication capabilities.

The report recommended that the Department: 1) Monitor the capabilities of the industrial base to ensure that it can satisfy sensor program needs. The Department

must continue to take action, through manufacturing technology investments, Defense Production Act Title III programs, and other R&D programs to develop and preserve militarily-critical technologies; 2) Initiate a proactive DMSMS and sustainment engineering program. Obsolescence is becoming a major factor in the continued support of major weapons systems. As the service life of a DoD weapon system is extended, the obsolescence issues increase. These problems can affect readiness and operating cost if left unresolved by increasing repair times and the cost of resolving the materiel shortage. The Department is working to fund and implement these programs.

3.3 Navy

Depot Source of Repair Capability for the Expeditionary Fighting Vehicle (March 2005)

DCMA's IAC was tasked by the Marine Corps to perform an assessment identifying core capability and cost-effective sources of repair for the Expeditionary Fighting Vehicle (EFV) while mitigating program risk and supporting wartime missions associated with private sector contracting for depot maintenance. The assessment focused on the capabilities and capacities of organic and private facilities to support maintenance, repair, and overhaul of depot level components/systems of the EFV, specifically the circuit card for the remote acquisition control module and the hull power distribution unit.

Most of the components that comprise the circuit boards are commercially available and can be purchased from a variety of vendors. The processes to manufacture and repair circuit boards are common and readily available in the industrial base from a variety of electronic system manufacturers. Additionally, the skill levels required to perform these repairs are commonly possessed by electronic technicians. These electronic technician skills are available in both private industry and the DoD depots surveyed. A major issue found regarding circuit card repair is obsolescence of the components and technology upgrades in the electronic industry. The repair of a board/circuit card could easily exceed the cost limit for repair, thereby making it more advantageous to replace it with a new board. Other factors supporting new—rather than repair—is the expected longevity of the board/circuit card after final design and integrating new technology. The IAC concluded that repair of circuit cards is a low industrial capability risk and that original equipment manufacturers would be better suited to maintain the repair of the circuit cards. This would also help to eliminate and control any obsolescence.

U.S. Microwave Tube Industry (December 2005)

Sales of the microwave tube industry, a DoD-dominated industry, continue to increase at two to three percent over the past three years and are expected to continue

in 2006. Microwave tube utilization is increasing in the higher frequency operational regions as new requirements emerge, while some lower end product applications are transitioning to other technologies.

Consolidation and restructuring continues as the industry formulates itself as a subtier component provider to DoD organizations and military original equipment manufacturers. With the acquisition of Boeing's Electron Dynamic Devices group in Torrance, California (sole supplier of space satellite qualified tubes in the United States), by L-3 Communications, the industry now includes two dominant suppliers (Communications Power Industries, Inc., and L-3 Communications–Electron Devices Division) and one major supplier (Teledyne Electronic Technologies).

Industry consolidation continued with the 2005 acquisition of Titan Corporation by L-3 Communications. California Tube Labs in Watsonville, California, a small business organization, wholly owned by Titan, was included in the acquisition.

No changes have been noted in the Department's science and technology (S&T) and R&D investment strategy for microwave tubes. Basic research continues under the leadership of Air Force Office of Scientific Research with independent government laboratory applied research performed by the Naval Research Laboratory. The 2004 Congressionally-directed report from the Department addressing the balance of R&D investments in microwave tubes and solid-state radio frequency microwave devices, remains in progress.

In summary, the U.S. microwave tube industry continues to meet the current DoD needs, but investment strategies and industry structure require close monitoring for impacts on DoD operational capability.

3.4 Air Force

Laser Communications Industrial Base Assessment (March 2005)

Laser communications, which include technologies for free space optics (FSO), provide a highly-mobile line-of-sight solution to secure data transfer needs over a large space when fiber-based solutions are not feasible or desired. The military has identified two operational environments for laser communications: ground-based and mobile (air-based or ground-based). This assessment evaluated recent technology advances and applications within the commercial market for laser communications, documented research initiatives within the Department to leverage laser communications to address operational needs, and identified key manufacturing capabilities within the military and non-military segments of the laser communications market.

Recently, the laser communications market underwent considerable consolidation resulting from both a market downturn and overly optimistic expectations

(As recently as 2001, industry envisioned revenues would reach sales of \$400 to \$500 million by 2003; yet, the total sales were closer to \$40 million). FSO components are derived from commercial fiber-optic and telescope technology. For the most part, FSO product lines represent a small segment of the business base of large telecommunication hardware manufacturers. Military contractors utilize off-the-shelf items to custom design, fabricate, and integrate laser communication systems, often classified or proprietary, that push the state-of-the-art for demonstration purposes. This work often advances different technical capabilities, but rarely results in new manufacturing capability.

The laser communications industry is driven predominately by commercial demand for ground systems and does not currently provide off-the-shelf solutions to problems requiring active tracking for mobile platforms and a standardized method of localization and handshaking (finding a person with whom to talk). While the industry has demonstrated the feasibility of mobile laser communication technologies, each solution was custom designed, fabricated, and manufactured in small numbers. Potential industrial base constraints include fabrication of photo detectors from advanced materials, production of micro-electronic mechanical systems (MEMS) corner cube reflectors, and development of fast steering mirrors.

This assessment supports multiple activities within the Air Force C4ISR community, including investment planning within the Air Force Research Laboratory (AFRL), acquisition strategy planning at Electronic Systems Center, and policy development.

Aerospace Gyroscope Industrial Base Assessment (May 2005)

Aerospace inertial navigation and guidance systems rely on gyroscopes to sense direction and movement. A typical aircraft can have as many as a dozen gyroscopes incorporated into a number of its subsystems. This assessment characterized current and emerging gyro technologies, profiled the manufacturers according to technologies they are pursuing, and evaluated each company's financial viability in order to assess the overall health of the gyro industry.

There are three major gyroscope technologies: spinning mass (mechanical); optical (ring laser and fiber optic); and vibrating (hemispherical resonator and MEMS). Vibrating technology is rapidly replacing spinning mass and optical gyros due to higher accuracy, lower power consumption, and longer service life (more than 100,000 hours). The assessment identified twenty-one companies and categorized them according to technology use and type of gyroscope(s) produced. More than half the manufacturers identified in the report make a vibrating gyroscope predominately using MEMS technology.

Given the number of manufacturers and increased demand driven by new applications, the market for new gyroscope technologies should continue to grow over

the next decade. Individually, the majority of the gyroscope manufacturers evaluated are financially healthy. Only one company was rated as a high financial risk and four other companies were rated as moderate risks. For most applications, new gyro technologies such as fiber optics and MEMS can be adopted.

The assessment will support the Air Force Materiel Command's Instruments Commodity Council in developing sourcing strategies that assure the availability of parts to improve weapons system performance and drive down supply chain costs and cycle times. The assessment provides useful insight in evaluating the potential of replacing gyro components in aging systems with new, more reliable technologies.

Command and Control, Intelligence, Surveillance, and Reconnaissance Sector Industrial Base Assessment (May 2005)

The command and control, intelligence, surveillance, and reconnaissance (C2ISR) industrial sector assessment determined the current state of the manufacturing base to support near-term and mid-term needs, characterized the C2ISR sector regarding current and planned Air Force requirements, and identified where risk mitigation strategies might be appropriate. The assessment describes the nature and taxonomy of C2ISR, identifies critical C2ISR components and key manufacturers, provides a sector market analysis that includes financial assessments of the key manufacturers, and outlines DoD requirements for the C2ISR sector in terms of budgets and programs.

The C2ISR capabilities of Air Force weapon systems are growing rapidly to counter a broad spectrum of evolving threats to national security. Including computers and communications, the military C2ISR market will be worth more than \$83.9 billion over the next ten years. The electronics and instruments industries in the United States are utilizing less than 75 percent of current production capacity. The companies profiled in the report were economically viable with most financial measures trending upward. The defense industrial base for electronics depends heavily on the commercial electronics sector for product development and manufacturing capability. Despite continuing overall demand in the industry, U.S. employment growth through 2012 is expected to decline due to the introduction of new technology and automated manufacturing processes, a slowdown in growth of output from previously high levels, strong import competition, and automation of production of increasingly sophisticated equipment.

The study evaluated seven components critical to military systems at risk due to technical, market, or manufacturing concerns. These components are focal plane arrays, precise timing and frequency devices, traveling wave tubes, liquid crystal polymers, optical telescopes, displays, and receive/transmit diplexers. The Department is reviewing recommendations for assessments to document operational capabilities that are affected by current manufacturing limitations associated with these components and the impact of emerging technologies as potential alternatives. For several

components, there may be a potential need for an investment in national production capacity and joint-Service technology development to meet future requirements.

This assessment supports multiple activities within the Air Force C2ISR community including investment planning within AFRL, acquisition strategy planning at Electronic Systems Center, and policy development.

Air Force Material Command Commodity Council Forging Industrial Base Assessment (June 2005)

This assessment evaluated key elements of DoD landing gear supply chains with emphasis on forged components. Due to the demanding service requirements of these components, custom or impression die forgings (aluminum, steel, and titanium) are typically used in these applications. Forged alloys provide the combination of strength, toughness, and durability required to withstand the cyclic rigors of aircraft takeoffs and landings. The assessment identified key manufacturers and material suppliers, provided a market analysis that included financial assessments of the key manufacturers, and highlighted ongoing DoD investments in forging technologies. The assessment developed relationship maps which identified critical customers, processors, and suppliers within the landing gear supply chain.

Aerospace forgings account for a small percentage of the sales and production capacity of the total forging market. Declining sales over the past five years have impacted the financial health of the primary suppliers of aerospace forgings, resulting in lagging profits and limited capital investment/modernization. Large presses are necessary to produce both military and commercial aircraft structural components. The United States has several large forging presses, but the biggest presses are overseas.

The assessment describes multiple initiatives, sponsored in part by the Department, that are underway within the domestic aerospace forging industry to improve both production capabilities and responsiveness to customer requirements. These initiatives address a number of systemic problems that exist between the user/customer, the aircraft or landing gear manufacturer, and the forging supplier. These problems include the need to improve processes (including contractual language) that adequately capture and maintain product and tooling information, improve access to common parts history data across the Services, and develop accurate material management tools. Examples of these initiatives include the ongoing development of a National Forging Tooling Database that could readily support DoD landing gear supply chains and the Navy's successful "leaning out" of F/A-18 landing gear repair processes at its depot facilities.

The assessment supports the Air Force Materiel Command's Landing Gear Commodity Council in developing sourcing strategies that assure the availability of parts to improve weapon systems' performance and drive down supply chain costs and cycle times.

Aeronautical Structures Sector Industrial Base Assessment (September 2005)

The aeronautical structures sector assessment determined the current state of the manufacturing base to support near-term and mid-term needs, characterized the sector as it relates to current and planned Air Force requirements, and identified where risk mitigation strategies might be appropriate. The assessment describes the nature and taxonomy of aeronautical structures for fixed-wing aircraft, identifies critical components and key manufacturers (including those for low-observable materials), provides a sector market analysis that includes financial assessments of the key manufacturers, and outlines DoD requirements for the sector in terms of budgets and programs.

Structures design and manufacturing capabilities for Air Force aeronautical weapon systems, manned and unmanned, will be enhanced as new platforms incorporate next generation metals and composites technologies. Synergy between military and commercial applications will improve the overall viability of this sector. Systems such as the F-35 Joint Strike Fighter, Boeing 787, V-22 Osprey, Global Hawk, and Joint Unmanned Combat Air System are expanding the use of innovative composite materials to improve both performance and affordability. There are no apparent bottlenecks in the supply of structural components and assemblies. Financially, the casting/forging market was the only segment of the airframe structural industrial base identified as at risk. As noted in the forgings industrial base assessment, earnings within the casting/forging market have remained depressed due to reductions in military and commercial aircraft purchases, high capitalization costs, and the use of alternate technologies (high speed machining, laser additive manufacturing, and organic composites). Employment across the entire sector will remain stable or decline slightly over the next ten years due to increasing productivity and higher unit costs that result in decreased production quantities.

There are numerous technologies and processes that can impact both the cost and performance of structures for current and future systems. Investments in areas such as high speed machining of hard metals, assembly of hybrid (metallic/composite) structures, laser additive manufacture, and advanced tooling concepts for composites could ensure the long-term viability of domestic suppliers while further enhancing performance and affordability. The military can also better leverage emerging commercial technologies. For example, several small business jets are being produced entirely from composites while one design employs friction-welded aluminum, eliminating nearly sixty percent of the fasteners normally required. The Department is considering recommendations for supplier initiatives that streamline business practices, as well as qualification of new technologies and products (e.g., commercial composite fibers) for military applications.

This assessment supports multiple activities within the Air Force aeronautical systems community including investment planning within AFRL, acquisition strategy planning at Aeronautical Systems Center, and policy development.

Gas Turbine Engine - Fuel Control Systems Industrial Base Assessment (September 2005)

The U.S. Air Force currently fields over 5,500 turbine engine powered aircraft. Each engine utilizes fuel control components that, over the years, have developed from simple fuel metering devices to complex systems that use inputs from numerous sensors to determine the correct fuel flow. The current types of fuel controls are hydro-mechanical, unified (analog electronic), digital electronic, and full authority digital engine controls (FADEC). This assessment provided an analysis of the leading suppliers of aircraft fuel control systems and major aircraft fuel control system components, such as main engine fuel pumps, nozzles, valves, fuel flow regulators, and electrical harnesses. The assessment included company profiles, financial risk analyses, market information, and a discussion of emerging technologies and the possible impact they might have on engine reliability.

The assessment profiled 12 fuel control system and/or component manufacturers that were selected based on the number of parts they supply to the Air Force. Using an estimate of fuel control system costs averaging 15 percent of the price of the engine, the assessment extrapolated market data based on aircraft engine forecasts. During the past five years, over 20,000 commercial and military fuel controls were produced generating \$10.6 billion in sales. Estimates predicted that during the next ten years, over 35,000 fuel controls will be sold generating sales of \$19.2 billion.

Prime turbine engine manufacturers outsource the design and production of either the complete FADEC or the FADEC operating system for a number of reasons, including maintaining key skill sets, amortizing development costs, and safety/liability considerations. These same considerations are driving some industry restructuring including partnership agreements. Overall, the sector is financially healthy with all but two of the 12 companies evaluated rated as low risk.

The assessment supports the Air Force Materiel Command's Engine Commodity Council in developing sourcing strategies that assure the availability of parts to improve weapon systems performance and drive down supply chain costs and cycle times.

Gas Turbine Engine - Bearings Industrial Base Assessment (October 2005)

Precision bearings are used on turbine engines, critical airframe subsystems, and aircraft transmission/drive systems. As a result, bearings represent a critical commodity for the Air Force. An understanding of the North American market for aerospace bearings and the industry that supports that market is essential to efficiently and effectively structure acquisition support to maintain operational readiness. This assessment focused on current forecasts for the U.S. market for commercial and military aerospace applications, viability of both domestic and foreign manufacturers, and technology trends in anti-friction bearings that will impact both leading manufacturers and their customers. The assessment also evaluated bearing maintenance and repair as they relate to Air Force engine applications to evaluate the potential impact to procurement strategies.

The current global market for bearings of all types is \$30 billion. Aerospace bearings account for approximately 20 percent of that market. The ability to produce super precision bearings has increased significantly in the past decade, but the gain in capacity is dedicated to non-aerospace/military applications, such as bearings for medical equipment and computer disk drives. Bearings manufacturers fall primarily into two categories: large multi-national corporations that produce bearings for a broad range of applications of which aerospace represents less than a quarter of overall sales; and small niche firms that specialize in developing and producing new bearing technologies (e.g., gas (air), magnetic, ceramic, and oil-free) specifically for the aerospace market. Of the top ten large manufacturers, only two are headquartered in the United States.

While foreign-owned bearing manufacturers continue to capture larger shares of the U.S. market, most have manufacturing facilities in the United States. Two issues impacting the industry's competitiveness are access to capital for product development and facility modernization, and training and retaining skilled labor. Machines in domestically-owned bearing facilities have an average age of 19 years compared to a 12-year average in foreign-owned facilities. On top of all this, rising steel prices are further eroding profit margins. More aerospace applications are adopting new bearing technologies thereby fostering a growing specialized domestic industry that, given time, may limit our dependency on foreign-owned bearing manufacturers.

The assessment supports the Air Force Materiel Command's Engine Commodity Council in developing sourcing strategies that assure the availability of parts to improve weapon systems performance and drive down supply chain costs and cycle times.

Directed Energy Systems Industrial Base Assessment (December 2005)

Directed energy, in both laser and high power microwave forms, is an emerging, high-payoff family of technologies that is expected to provide transformational capabilities for the Department and the Air Force. The directed energy systems

industrial base assessment evaluated capabilities within the domestic manufacturing base to support the transition of maturing technologies, characterized the sector as it relates to current and planned Air Force requirements, and identified where risk mitigation strategies might be appropriate. The assessment constructed taxonomies for both high energy lasers (HEL), defined to include 100-watt and higher energy lasers, and high power microwaves (HPM) to facilitate the identification of critical components and key manufacturers.

The taxonomies highlighted laser sources/materials, adaptive optics, power/power conditioning, microwave sources/materials, and antennas as subsystems providing enabling capabilities. Over 100 U.S. companies, universities, and government laboratories were identified that currently support HEL or HPM research, test, and manufacture of critical components. A combination of surveys, site visits, and data mining provided insight into the segment's financial viability, market dynamics, and supply chain constraints. The companies evaluated within this market consisted of both large defense contractors and small independent research firms. Overall, the HEL and HPM industry is financially healthy. Over 80 percent of the companies evaluated indicated positive sales or debt trends. Foreign competition is growing in this area and the assessment identified a reliance on a significant number of foreign lower tier suppliers. These are predominately the same suppliers associated with other military and commercial electronic systems (i.e., substrates, photomasks, optics, and advanced materials).

There are a number of manufacturing challenges involved with transitioning current development prototypes to more traditional production-oriented programs. These challenges include fabrication of high power materials, innovative designs for thermal management, component development for improved power management, component miniaturization, and system ruggedization. At the same time, both the Department and industry would benefit from initiatives to reduce costs and increase manufacturing efficiencies at both the component and subsystem levels.

This assessment supports multiple activities within the Air Force technology development community including investment planning, acquisition strategy planning, and policy development.

3.5 Defense Contract Management Agency (DCMA)

Industry Surge Capability Analysis (September 2005)

Joint Staff (J-4) requested DCMA's IAC to analyze industry's capability, capacity, and surge capability for 50 munitions programs, the Joint Service Lightweight Integrated Suit Technology (JSLIST) Chemical Protective Suit, the Interceptor Body Armor System, and Unmanned Aerial Vehicles (UAVs). The analysis assessed these industries for their deliberate planning and contingency operations. The request

emanated from DCMA's prior analysis of critical munitions during the Kosovo conflict in August 2001 and their subsequent annual updates to J-4, Joint Ordnance Commanders Group, ODUSD(IP), and the Services. The study includes prime and important subcontractor locations and production capabilities; manufacturing capacity; lead times; current and surge production rates; production limiting factors; predictive, vertical, and horizontal analysis; and munitions market and business base analysis.

The munitions industry is healthy and is directly dependent on DoD funding levels. Recent history indicates accelerated production of certain munitions may be required to successfully prosecute future conflicts. Bottlenecks in the supplier base remain limited and excess production capacities are available to support further production acceleration of key components. However, while there is reserve capacity available for certain critical components, the time required to accelerate production to maximum facilitated rates can exceed 12 months.

FY 2006, DoD UAV funding slightly declined from FY05. There are currently four primary domestic contractors building UAVs for the Department. The assessment found that competition exists at all levels within the UAV industry, but the industry is consolidating.

The JSLIST over-garment is a two-piece jacket and trouser. The pivotal JSLIST issue for production of the laminated fabric is the availability of activated carbon beads from a foreign source. There are no requirements for the JSLIST beyond 2008 and the joint program manager for Individual Protection is considering several new technologies for future systems.

The Interceptor Body Armor System's ceramic plate, Small Arms Protective Inserts (SAPI) program is complete and the next generation Enhanced or ESAPI was designed and entered production to meet new operational threats. DCMA provided continued support and analysis to the Priorities and Allocations of Industrial Resources (PAIR) Board evaluating backing material manufacturers to ensure that production capacity is used to meet DoD's most critical needs.

Combat Vehicle Army Transformation Industrial Base Study (ATIBS) 2005 Comparative Analysis (November 2005)

The purpose of this study was to review the issues, conclusions, and recommendations made in the combat vehicle sector of the 2003 Army Materiel Command's *Army Transformation Industrial Base Study (ATIBS)* study, and assess if risks still exist. At the prime contractor level, the 2003 study concluded that the viability of one of the two combat vehicle contractors was uncertain. At the subcontractor level, the study concluded that the procurement requirements for key components on legacy systems, including diesel engines and transmissions, will fall below contractor's purported minimum sustaining rate (MSR) and require action to mitigate risk. DCMA's IAC reviewed the issues and risk mitigating options that were presented in the 2003

ATIBS and found that supplemental funding associated with the Global War On Terror (GWOT) resolved many of the 2003 study issues—providing much needed workload to contractors that were found at risk, and resulting in higher sales, increased capacity utilization and, consequently, production exceeding MSR. However, risk still exists with low production rates for transmission and diesel engines. The Army is currently addressing these issues and projecting that they will be resolved near-term. Risk also exists for an industry wide ramp-down that could impact DoD's ability to support the legacy system when supplemental funding is withdrawn from the budget.

Large Power Transformers (November 2005)

DCMA's IAC assessed the dependency of U.S. power generating companies on foreign manufactured large power transformers (>500 megavolt amps (MVA)) and performed a cost/benefit analysis of re-establishing the manufacturing capability in the United States.

The study revealed that there is a dependency of U.S. power generating companies on foreign suppliers for large power transformers. The cost/benefit analysis concluded that it would not be economically feasible to establish a domestic source for these transformers. Some of the factors used in this determination were start-up costs and market demand in North America.

Material Cost Study (November 2005)

A broad survey of the defense industry (over 192 industrial sites) identified critical raw materials that are essential for production processes for defense programs. The study assessed periodic price changes, availability, and delivery delays that impact schedule. Metrics included price trends, employment, utilization, and sales. The companies surveyed most frequently identified steel, aluminum, and titanium as the most critical raw materials.

Of the participating companies in the study, 59 percent reported increasing material cost and 16 percent reported availability problems impacting schedules. Causes included rising energy cost, global demand, and government requirements.

3.6 Defense Logistics Agency (DLA)

Next Generation Manufacturing Technology Initiative Battery Study (July 2005)

The objective of the Defense Logistics Agency's (DLA) Next Generation Manufacturing Technology Initiative was to assure long-term availability of affordable batteries to meet DoD warfighter requirements for current/future demands. The

initiative also determined the economic state-of-the-art health, long-term viability, major producibility, availability, affordability, and R&D prospects for the future. Surveys (of both private industry and government sources) and on-site visits afforded participants the opportunity to express their concerns and to suggest potential solutions to the issues facing this increasingly important segment of the domestic manufacturing base.

The majority of the companies reviewed can meet the future demand for batteries and estimated manufacturing capacity is sufficient to meet future surge requirements. The companies are mature with manufacturing readiness levels of eight or nine.

Clothing and Textile Industrial Base Study (September 2005)

DLA tasked DCMA to perform an assessment on contractors supporting the clothing and textile industry. DCMA reviewed selected manufacturers of battle dress uniforms, dress uniforms, footwear, and extreme cold weather systems and shelters.

Industrial capabilities required to manufacture military footwear and clothing and the industrial capabilities required to design and manufacture military shelters are considered a "low risk." There are multiple manufacturers for each item and the Berry amendment assures that DoD textile contracts are awarded to these domestic sources. A large majority of the manufacturers are highly dependent on the Department for their work. Most stated that it is impossible to compete with Third World labor rates and that many U.S. firms are either moving plants offshore, downsizing, or closing. Commercial contracts at most of the companies surveyed account for less than ten percent of their work.

Tray Pack Ration Readiness (September 2005)

Tray pack rations are a type 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-size metal or polymeric containers. DoD contingency requirements for tray pack rations greatly exceed peacetime requirements. DLA compared current tray pack ration industrial capabilities to those required to meet contingency requirements. DLA's re-evaluation of previously-addressed issues concluded:

- The commercial food industry has moved to polymeric trays for shelf-stable food service items. The Military Services have also transitioned from metal tray cans to the polymeric tray for their peacetime requirements. The Services are also developing new technologies for reducing costs and moving toward commercial applications.

- In order to meet projected tray pack ration wartime requirements, prepositioned tray pack metal cans and tray pack equipment must be utilized as the peacetime production of polymeric tray packs would prove to be a limiting factor.
- During OEF/OIF, the Department experienced shortfalls in polymeric trays; it responded by using prepositioned metal trays and Government Furnished Equipment (GFE).
- DLA identified and is aggressively pursuing the use of large, pump-able pouches when feasible in lieu of fill and seal trays to further improve industry's capability to meet both the peacetime and wartime demands.
- DLA identified funding under its "critical few" program for FY06 investment of \$3 million in GFE to further expand the industrial base capabilities to produce polymeric trays.

Extreme Cold Weather Clothing System (October 2005)

Based on estimated requirements in support of OIF and OEF, DLA awarded multi-year contracts in December 2004 for the Extreme Cold Weather Clothing System (EXWCS) which will provide sustained support for outyear requirements. DLA had sufficient material on hand to support the anticipated requirement for the 2004/2005 winter season. In order to provide flexibility in meeting any fluctuation in demand, deliveries from these contracts will accommodate the 2005/2006 winter season. DLA continues to coordinate with Central Command and DLA Defense Contingency Support Team teams in Iraq and Afghanistan. While no immediate industrial base problem exists with ECWCS, this effort highlights that the industrial base can best support the Services with effective war reserve planning as well as improved collaboration on requirements. DLA is currently coordinating with the Army program manager to facilitate an ECWCS transition to third generation technology. The new style will utilize the Army's new universal camouflage pattern. The Army is currently doing field testing in Southwest Asia. DLA is expected to maintain these new requirements in FY08 (2007/2008 winter season).

Joint Services Lightweight Integrated Suit Technology Ensemble (October 2005)

DLA conducted a re-assessment of the production process for the Joint Services Lightweight Integrated Suit Technology (JSLIST). Increased JSLIST demands since OEF and OIF have stressed production capacity. The 2003 contingency demand for the liner fabric increased normal production by 50 percent and continued through the first part of 2005. Four contractors are currently manufacturing a combined total of 128,000 suits per month. This maximum production rate has fluctuated due to material limitations in the supply chain, specifically carbon beads and liner fabric. In January 2004, Bluecher developed their own beads in their manufacturing plant in Germany.

Ongoing field and chemical testing showed that the liner fabric made with the Bluecher beads met or exceeded the parameters of the current approved liner fabric and qualified the Bluecher beads for use in JSLIST suits. This allowed production of liner material to gradually increase and be supplied to manufacturers. Production quantities have increased from 86,000 suits per month in October 2004 to 128,000 per month starting in April 2005. Production will be maintained at 128,000 suits per month, the maximum production rate based on the limited availability of fabric.

Meals Ready to Eat (October 2005)

The defense industrial base continues to meet the significant requirement support for the Meals Ready to Eat (MRE) combat rations program for OEF. Additionally, the Federal Emergency Management Agency's (FEMA) requirements to support hurricane disasters within the United States have totaled 2,200 cases of MREs to date. The current commercial industrial base has been more than capable of supporting the surge in requirements.

The war reserve level for MREs was increased to five million cases; however, once the new level is reached, peacetime rotation and increased handling charges remain concerns. There are other state and local agencies that would like the support of DLA but are currently unauthorized to purchase rations under Section 803 (Anti-Terrorism and Homeland Security).

3.7 Missile Defense Agency (MDA)

Solid Rocket Motor Subtier Industrial Base Assessment (June 2005)

MDA assessed the industrial capability and viability of the critical solid rocket motor (SRM) subtier industrial base. The assessment analyzed sites performing development, manufacture, test of materials, and assembly of subcomponents and/or subsystems for SRMs engaged in Ballistic Missile Defense's spiral acquisition strategy. It also identified single sources, foreign sources/dependencies, and other risks such as business and financial viability.

The study team assessed thirteen contractors and concluded that the most critical suppliers were the sole U.S. supplier of ammonium perchlorate (AP) and a foreign-owned sole U.S. supplier of binder for propellant composition that is used on approximately 90 percent of DoD programs and all MDA programs. AP (propellant oxidizer) affects all DoD, NASA and MDA programs. American Pacific Corporation, the Department's sole AP supplier, has recently had to absorb additional charges for legacy environmental remediation, increases in electrical power and contend with the normal escalation of labor and materials costs. The combination of these increased fixed costs, when compounded by a decline in demand, is putting significant financial pressure on

American Pacific. The binder supplier could potentially close or exit the market as early as end of 2006. Additionally, the SRM industry requires a reliable source for aerospace grade rayon fiber or suitable replacement material. MDA briefed the report to several offices within the Under Secretary of Defense for Acquisition, Technology & Logistics.

As a follow-on to this study, MDA and the DMCA's IAC performed a business case evaluation of the hydroxyl-terminated polybutadiene (HTPB) R45 binder supplier that was identified as a near-term potential single point failure. ODUSD(IP) is facilitating discussions between the SRM primes and the binder supplier to ensure that plans are in place to avoid potential future supply disruptions.

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4. Related Activities

The Department'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 make sound technology development investments, as well as sound technology insertion and production facility/capacity 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 production capabilities for critical defense technologies is an essential ingredient of national security. Title III of the Defense Production Act (50 U.S.C. App. 2061 et seq.) is a program specifically designed to establish, expand, maintain, or modernize 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.

Title III provides 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, and the development of substitutes. 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.

In calendar year 2005, the Title III Program had fourteen projects underway, one of which was completed during the year.

Wireless Vibration Sensors

The objective of this project was to enable the timely production and fielding of affordable, smart sensors that will make condition-based maintenance (CBM) possible. CBM is a critical enabling tool to lower asset lifecycle costs by providing online measurement and quantification of equipment components and an assessment of the condition and maintenance needs of an asset (e.g., an aircraft engine). Incorporating this technology into defense systems will enable more effective maintenance strategies. CBM promises substantial reductions in maintenance costs as well as increased readiness levels across a variety of defense systems.

The project incentivized a domestic firm to achieve specific performance and production goals, including:

- Increase production capacity to 10,000 sensing points per year
- Reduce production costs through increased manufacturing yield, reduced cycle time, and re-design of components
- Research and documentation of a strategic business plan and marketing plan
- Certification of ISO 9001 quality
- Demonstration of value to customers through beta tests

The project achieved all threshold requirements and it exceeded the production capacity goal. Notably, the project achieved a 15-fold increase in capacity as a result of Title III investment.

On-Going Projects

Beryllium Production

This project will ensure a continuing supply of primary (high purity) beryllium metal to the United States and its allies for defense and critical civilian applications. The current supply may be depleted in the near future when inventories of National Defense Stockpile (NDS) beryllium ingots are projected to be exhausted. Imports of beryllium cannot meet the purity levels required for defense applications. Critical strategic applications, where there is no suitable substitute for beryllium include: airborne forward-looking infrared systems for fighters and attack helicopters; guidance systems on existing strategic missiles; surveillance satellites; missile defense systems; and numerous others. The project will ensure future supplies of high purity beryllium metal through a cost share program with private industry to build a new primary beryllium production facility.

Flexible Aerogel Materials Supplier Initiative

This project is establishing 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.” Aerogel is the most thermally efficient material known. The nano-scale lattice and pores provide high performance with minimal weight and space. Military applications for high temperature thermal insulation include acoustic protection, infrared suppression, and energy absorption. Many commercial applications for these same qualities are expected at lower temperatures. The project involves testing and qualification of the materials for potential applications and, eventually, a full scale, high volume production capacity.

Lithium Ion Battery Production

This project will establish a U.S.-owned domestic source of cathode materials using assured sources of precursor materials, strengthen the U.S.-owned domestic industrial base for prismatic lithium ion cells and batteries for spacecraft use, and establish U.S.-owned domestic sources for other base cell components and their precursors. 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/power package of the developed batteries today. This technology offers designers a weight saving option when compared to other battery types for overall weapon systems performance. Additional advantages include better recharging capability with no memory effect and increased temperature operating ranges.

Military Lens System Fabrication & Assembly

This project is establishing a domestic capability for mono-spectral and advanced multi-spectral optical systems and lens components. It 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 the warfighter to carry fewer pieces of equipment, improved 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.

Mini-Refrigerant Compressors for Man-Portable Cooling

This project will establish a domestic production facility for mini-refrigerant compressors. Through Title III, a new production facility will be built and facilitated with 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 such as explosive ordinance disposal (EOD) and chem/bio-hazard suits. Further, 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. The project will demonstrate capability for full, sustained production capacity plus improvement and optimization of production processes.

Radiation Hardened Electronics Capital Expansion

This project made substantial capital investments as part of an DoD initiative to establish a state-of-the-art production capability for advanced (0.15-micron) strategic radiation hardened devices using commercially available microelectronics equipment modified for radiation hardened production. This capability will provide substantially higher electronic operating speeds and will lower the power/size of electronics in space craft. The smaller size and higher performance made possible by this project will generate highly leveraged savings for spacecraft in terms of size, weight, reliability, and launch costs. Radiation hardened electronics enable spacecraft to operate in challenging radiation environments resulting from nuclear threats and exposure to long-term natural radiation. Several defense programs require strategic radiation hardened microelectronics. Without Title III support, these programs will have difficulty achieving system performance objectives and insertion schedules.

Radiation Hardened Cryogenic Readout Integrated Circuits

This project will 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) radiation hardened (RH) cryogenic readout integrated circuits (ROICs). RH cryogenic microelectronics is 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, which must function in harsh natural or man-made radiation environments that are compounded by the cryogenic requirements of high altitude and space. RH cryogenic microelectronics process technology is used to manufacture ROICs, which are integral components of FPAs. The next generation imaging requirements of high altitude and space-based weapon systems are dependent on the availability of advanced ROICs that provide high density with analog components, smaller pixels (increased resolution), increased functionality (on-chip processing), lower power dissipation, lower noise, larger FPAs (stitching technology), and better producibility (yield). All these improvements will collectively increase the mission capability of the systems.

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 hardened. The much higher clock rates will lead to significant performance improvements. Other benefits include cost and weight savings for space systems. Higher performance means greater on-orbit processing capabilities and lower ground support requirements. As with the other Title III radiation hardening projects, these microprocessors will enable spacecraft to operate in the hostile radiation environments of nuclear threats and long-term natural radiation.

Rigid Polymer Materials

Title III is creating a capability to produce thermoplastic polymers with strengths and stiffness significantly greater than other high performance thermoplastics. These materials offer tremendous benefits including transparency, toughness, resistance to fire and heat, and resistance to solvents. Even small amounts of these polymers dramatically improve the strength of structural foams. They are processible by a variety of methods, including compression molding, injection molding, and extrusion. Unlike most thermoplastics they are easily machined. They are currently being evaluated for selective laser sintering. Expected products include: mechanical components such as bearings and gears; transparent coatings and lightweight armor for personnel and vehicle protection; and thermal protective applications such as missile components and thermal barriers. High purity forms of the products are being used in electronics manufacturing and medical devices. This project is focusing on cost reduction, the improvement and optimization of production processes, and the testing and evaluation of the material.

Silicon Carbide Devices

This project is establishing a domestic supplier of low cost, high performance silicon carbide (SiC) metal semiconductor field effect transistor (MESFET) monolithic microwave integrated circuits (MMICs) that can satisfy military requirements for advanced radar systems. The project will also demonstrate improvements in the characteristics of 100mm SiC substrate and epitaxial materials and processes to enable high yield, high performance and reliable SiC MMICs that can be produced at an affordable cost. The project will develop and demonstrate substrates and epitaxial structures with defect densities commensurate with high yield production of high performance, reliable SiC MMICs.

Thermal Battery Production

The objectives of this Title III project are to establish, 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 along with 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. These critical materials and technologies represent gaps that must be filled for the advanced systems to meet performance and production schedule goals. This project is incentivizing a domestic company to scale-up and expand production capacity. The applicability of these critical batteries to a wide variety of DoD weapons systems offers Service program offices the ability to substantially improve system performance.

Thin Silicon-On-Insulator (SOI) Wafers

This project is establishing a domestic full-scale production capability for thin silicon-on-insulator (SOI) wafers. Thin film SOI electronic wafers are critical materials that enable the fabrication of radiation-hard, ultra large scale digital devices such as microprocessors, application-specific integrated circuits, and static random access memories. These radiation hard circuits fabricated with SOI materials are essential to defense systems, such as surveillance, communication and navigation satellites, ballistic missiles, surveillance systems, and inertial navigation systems. They provide a superior technology for sensitive ultra-low power space and, battery-powered applications due to reduced power requirements, increased device density, and faster device performance over circuits fabricated in bulk substrate technologies.

Yttrium Barium Copper Oxide High Temperature Superconductor

This Title III project will establish high volume, high quality, domestic production capacity for second-generation (2G) high temperature superconductor (HTS) coated conductors. The conductor, based on yttrium barium copper oxide (YBCO) material, will be a higher-performance, lower-cost replacement for first-generation HTS wire. YBCO 2G superconductor is an enabling technology for defense applications which require high electrical power in the megawatt range. These applications include advanced capability electric systems (ACES), directed energy weapons (DEW), motors, generators, transformers, primary power cabling, power converters, high field magnets (such as gyrotron magnets), etc. Ship propulsion motors employing YBCO 2G conductors can be one-fourth the size and one-third the weight of conventional systems (including cooling systems). Additional benefits include higher net efficiency, substantial power and fuel savings, and they are inherently quieter. Complete development of the technology will lead to transfer of the YBCO coated conductor into electric power applications such as transformers, transmission cables, motors, fault current limiters, and generators. The project will establish one or more domestic sources for YBCO coated conductors, making the benefits of 2G HTS available five to seven years earlier.

4.2 Defense Priorities and Allocations System/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 been delegated the authority to manage industrial resources. To implement its authority, the Department of Commerce (DoC) administers the Defense Priorities and Allocations System (DPAS). The DoC has further delegated

authority to the DoD under the DPAS to: (1) apply priority ratings to contracts and orders supporting national defense programs; and (2) request the DoC provide Special Priorities Assistance (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 defense interests.

ODUSD(IP) also convenes and chairs the Priority Allocation of Industrial Resources (PAIR) task force. The task force's mission is to ensure industrial resources are allocated to DoD programs in accordance with operational priorities when emergent requirements create competing demands among Services. The task force typically uses SPA to request DoC allocate materials or expedite deliveries of defense items in accordance with PAIR decisions. During 2005, the PAIR was heavily involved in prioritizing deliveries of the ballistic backing material used in body armor.

Not all SPA requests are a result of PAIR actions. During 2005, the office of the DUSD(IP) executed 14 SPA requests as depicted in the following table. All 14 were in support of Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF): eight were for U.S. forces, and six were for the U.K.

DEFENSE PRIORITIES AND ALLOCATIONS SYSTEM/ SPECIAL PRIORITIES ASSISTANCE CASES – 2005			
Date(s)	Item	Assistance for	Summary
01/05 through 12/05	Ballistic Material (Four SPA requests to cover deliveries in 2005)	Army/ Marines Corps	Directed prioritization of deliveries of ballistic material used in the production of the Small Arms Protective Inserts (SAPI) for Interceptor Body Armor (IBA).
01/05 & 07/05	CH-47 Chinook Spare Parts (Two SPA requests)	U.K.	Sponsored industrial priority ratings for the U.K. to procure spare parts for sustainment of the U.K. CH-47 fleet.
03/05	Sniper Rifles	U.K.	Sponsored industrial priority rating and expedited delivery for the U.K. to procure sniper rifles for operations in Iraq.
07/05	Apache Helicopter Strap Assemblies	U.K.	Sponsored industrial priority rating and expedited delivery for the U.K. to procure sustainment items for Apache helicopter operations in Iraq.
08/05	Night Vision Devices	U.K.	Sponsored industrial priority ratings for the U.K. to night vision devices for its counter-terror operations.
08/05 & 12/05	Counter-Improvised Explosive Device Systems (Four SPA requests)	Army/ Marines Corps	Provided notification to Department of Defense and industry that counter-IED programs would be provided the highest industrial priority support in the event of a delivery conflict.
11/05	Aircraft Cargo Pallets	U.K.	Supported expedited delivery of cargo pallets for the U.K.'s world-wide operations.
Source: ODUSD(IP)			

4.3 Technology Transition Initiative (TTI)

The Technology Transition Initiative (TTI) was established in March 2003 pursuant to Section 2359a of title 10, United States Code, to provide a process to identify the most promising mature laboratory technologies and bridge the funding gaps that often exist between the time such technologies are demonstrated and when funding can be programmed to procure them for intended weapon or support systems. Program management oversight for the TTI is provided by the Office of Technology Transition under the Deputy Under Secretary of Defense for Advanced Systems and Concepts (DUSD(AS&C)). Since the program's initiation, the Technology Transition Manager, through the DUSD(AS&C), has issued internal guidance implementing Section 2359a of title 10, and worked with members of the Technology Transition Council (TTC) to establish a Technology Transition Working Group (TTWG), consisting of a senior representative for each member of the TTC. The TTWG's purpose is to assist the Council in carrying out its function: to research, identify, and recommend mature technologies that meet the requirements of TTI.

The DUSD(AS&C) issues an annual call for TTI proposals to the Services, Defense Agencies, and Combatant Commands for mature technologies that are ready to transition, but face delays due to a lack of transition funding. They identify and prioritize promising technologies that support Joint and Service/Agency-specific capability needs and evaluate them against the TTI selection criteria. The TTI Manager then conducts a Department-wide review of the project proposals and provides a list of projects recommended for funding to the DUSD(AS&C). To be considered for TTI funding, a project must meet the following criteria, used in both stages of the evaluation process:

- TTI funding accelerates product transition;⁸
- Project is from S&T base;⁸
- Cost sharing is encouraged to leverage funding;⁸
- Project duration is less than four years;⁸
- Critical DoD requirement is satisfied (value to the warfighter);
- Project is Joint or multiple Services/Defense Agencies;
- Technology is mature (technology readiness level (TRL) 6 or 7)
- Project has established exit criteria; and
- Commitment to transition path (Program Objective Memoranda (POM) funding, etc.).

As these technologies are inserted into DoD acquisition and sustainment, industrial production capabilities are built or enhanced to meet these new requirements. In some cases displacement of existing capabilities is anticipated.

⁸ Congressionally mandated criteria.

4.4 DoD Manufacturing Technology Program

DoD's Manufacturing Technology (ManTech) program develops and matures key manufacturing processes to accelerate technology improvements in the acquisition and sustainment of DoD weapon systems and components. Ensuring that technology is affordable and producible remains imperative to making our forces more agile, deployable, sustainable, lethal, and dominant anywhere in the world. This program addresses process technology issues early in the design process, in development, in production, and into sustainment. ManTech investments enable industry to develop and provide defense-essential, affordable, low-risk manufacturing processes that effectively transition technology into new and existing equipment for the warfighter. Teamed with industry, ManTech provides the crucial links from technology invention to production of defense-critical needs that are beyond the normal investment risk of industry. ManTech improvements generally translate into affordability improvements or cycle time reduction. However, investments also focus on developing “new” capabilities that actually may result in a more expensive component, but will provide dividends in system performance or life cycle cost that far outweigh the initial cost. The program is structured around three major thrust areas:

- *Processing and Fabrication* activities develop affordable, robust processes and capabilities for metals, composites, electronics, and energetics/munitions critical to defense applications over their full life cycle. Projects create improvements to manufacturing processes on the shop floor and in repair and maintenance facilities (depots, logistics centers, and shipyards).
- *Advanced Manufacturing Enterprise* activities accelerate implementing world-class industrial practices and advanced design and information systems in the defense industrial enterprise that supports weapon system development, production, and sustainment.
- *Sustainment* projects coordinate common DoD requirements for maintenance, repair, and overhaul technologies and advancements to affordably extend current weapon systems beyond their intended operational life.

Although the requirement to submit a five-year plan for the ManTech program has been repealed with the deletion of 10 U.S.C. Section 2521(e), the Department continues to monitor the status of transition and implementation.⁹

Technology Transfer & Dual Use

ManTech program success is measured by the transitioning of advanced technology from research and development to implementation into new or existing systems. ManTech works with the commercial industrial base as early in the process as possible, by either adopting its best practices or transferring results of military processes to the commercial arena.



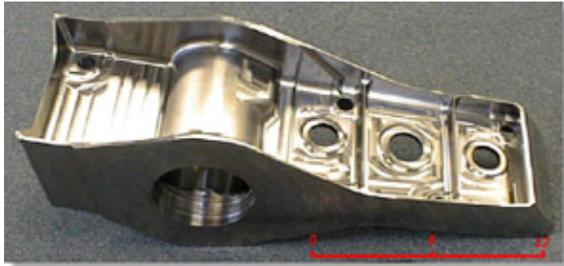
⁹ The most recent plan is available at <http://www.dodmantech.com/pubs/pubs.shtml>.

Examples include two projects, the Laser Additive Manufacturing project and the Laser Shock Peening initiative, that received the Defense Manufacturing Technology Achievement Award recognizing innovative manufacturing processes that improve the affordability, cycle time, readiness, or availability of defense weapon systems or components.

Laser Additive Manufacturing

The Laser Additive Manufacturing (LAM) project, a joint Army/Air Force/DLA project, contributed to an entirely new manufacturing process for titanium structure fabrication. This process was recently applied to aluminum F-15 Strike Eagle pylon ribs that were failing prematurely. Action in the Iraq war had depleted the inventory. Ship sets made from titanium replaced the failed components in only two months and have a life extension of five times that of aluminum, thereby significantly increasing the safety of the structure and increasing the mission availability of the aircraft.

LAM is based on a stereo lithography approach to manufacturing. Using software to convert a computer-aided design file to a sliced format, parts with properties in the class of forgings are built one layer at a time, making LAM a true manufacturing-on-demand process. Cycle time is reduced by up to 80 percent; the cost of many components is reduced by ten to 30 percent; and the process is environmentally friendly and provides tremendous surge capability.



This project also exemplifies the “jointness” aspect of the ManTech program, demonstrating the impact that can be realized through joint investment. The Army funded the development of the production system for LAM. The Air Force funded the refinement of the process and the development of aviation applications. The Navy provided funding for application to F/A-18 components. DLA funding is supporting full qualification of weapon system applications from all Services and the development of a next generation capability. And, finally, most of the work was cost shared by the companies involved.

Laser Shock Peening

The Air Force ManTech program, in conjunction with industry, developed laser shock peening, an emerging technology, as a potential solution to increase the durability of titanium fan blades and decrease the sensitivity to foreign object damage. Laser shock peening uses a high-energy laser pulse to impart an intense shock wave into the surface of metal parts. The shock wave creates deep compressive residual stresses, greatly improving fatigue properties and toughness.

For the Air Force, application of laser peening to the engine blades of the B-1B Lancer, F-16 Falcon, and F-22A Raptor has already avoided over \$59 million in costs through reduced turbine engine airfoil failures, blade replacement costs, and reduced repair costs due to secondary engine damage. In addition, aircraft crew safety and mission readiness have been vastly enhanced.



The laser shock peening process is being evaluated for a number of other DoD weapon system applications such as transmission gears in the CH-47 helicopter, turbine engine blades in tanks and other ground vehicles, and aircraft landing gear components.

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5. Programs and Actions to Sustain Capabilities

In 2005, the Department acquired and/or maintained facilities, equipment, or components, or took other actions needed to meet projected and actual military contingency requirements. Specifically, the Department:

- Invested approximately \$34 million in medical contingency contracts to gain guaranteed immediate availability of up to \$382 million worth of pharmaceutical and medical/surgical items identified by the Services as go-to-war shortfalls. This coverage increases to a total of \$800 million, over a six-month period, if all “refresh” options are exercised.
- For nerve agent antidote autoinjectors, continued support contracts to remedy projected surge and sustainment shortfalls during wartime. Just over \$11 million in contract investments guarantees the availability of sufficient materiel to satisfy the Services’ wartime requirements.
- Allocated \$10 million in supplemental warstopper funding appropriation between two battery manufacturers. These investments decreased ramp-up time by 50 percent and improved vendor surge ability by 121 percent in the first 90 days. The projected five-year return on investment for this industrial measure is 5.22 to one.
- Allocated \$1.85 million in supplemental warstopper funding appropriation to develop additional windshield film coating capacity for the UH-60 Blackhawk and AH-64 Apache helicopters. This effort provided expanded capacity to not only backfill existing UH-60 orders, but also put into place the necessary capability to meet anticipated demand in future contingencies.
- Invested \$300,000 with industry to provide enough pre-positioned specialty steel to meet the six-month wartime planning requirements for the Bradley Fighting Vehicle System’s hydraulic transmission parts and sustain that level of production for up to one year until the receipt of the next delivery of steel. This investment is one-tenth the cost of purchasing and storing 940 finished transmission assemblies, and provides the coverage needed to support additive demands anticipated in worst-case contingency scenarios.
- Invested about \$130,000 to develop a combat rations network for technology (CORANET) in response to prior year’s industrial capability assessments that indicated both a need for and an opportunity to implement newer, more advanced processes and methods into current food manufacturing plants.