

GAO

Report to the Chairman, Subcommittee
on Technology and National Security,
Joint Economic Committee,
U.S. Congress

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INDUSTRIAL BASE

Significance of DOD's Foreign Dependence



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National Security and
International Affairs Division

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January 10, 1991

The Honorable Jeff Bingaman
Chairman, Subcommittee on Technology
and National Security
Joint Economic Committee
United States Congress

Dear Mr. Chairman:

As you requested, we have reviewed several matters relating to the Department of Defense's (DOD) use of foreign sources for critical components of its weapon systems. More specifically, we analyzed (1) the significance of U.S. dependencies on foreign sources, (2) DOD's awareness of foreign dependencies and whether previously identified foreign dependencies still exist for the Abrams tank and F/A-18 Hornet aircraft, (3) the use of buy American restrictions during the procurement of items essential to the production of the Abrams tank and the F/A-18 aircraft, and (4) two major DOD efforts to assess the significance of foreign dependencies on the U.S. defense industrial base: the U.S. defense industrial base information system and revised DOD guidance for assessing foreign dependence throughout the acquisition process.

Results in Brief

The overall extent of foreign sourcing and foreign dependency and their significance for national security are unknown because, among other things, DOD has only limited information on foreign sources of supply at the lower tiers of the supplier base. Moreover, no criteria have been established for determining what the levels of foreign dependency tolerance should be for various items and what actions DOD could or should take to reduce the associated risks. We also found that:

- DOD officials have little awareness of the extent of foreign sourcing or dependency in their weapon systems, particularly beyond the prime contractors and their immediate subcontractors. DOD program officials are not required, and take no special action, to maintain visibility into foreign sourcing/dependency.
- Several items for the Abrams tank continue to be foreign dependent. Domestic sources were usually not awarded the work under DOD contracts or subcontracts because of availability, quality and cost considerations. For those items in which cost was the primary consideration, contractors stated that even if DOD were willing to pay the higher prices

of domestic suppliers, they would be unable to satisfy DOD's total requirements because of production capacity constraints.

- The ejection seat for the F/A-18 aircraft is currently foreign dependent, but plans now exist to develop a second source that will be domestically located.
- Program officials and the contractors for the Abrams tank and the F/A-18 aircraft items that we reviewed stated that the use of buy American restrictions has been limited by exceptions that mainly recognize other U.S. policy goals. Such goals include (1) the standardization and interoperability of weapon systems and equipment with North Atlantic Treaty Organization (NATO) allies and (2) the desire for minimizing the cost of weapon systems.
- DOD's planned revisions to its acquisition and industrial preparedness regulations would require program managers to assess the capability of the U.S. industrial base to meet production requirements for weapon systems, but concerns remain about the enforcement and coordination of these revisions.

Background

In an interdependent global economy, foreign sources of supply, manufacturing, and technology abound in both the commercial and defense sectors. There are economic, political, and military advantages to using foreign sources of supply for military equipment, components, material and technology. The concern over foreign sourcing relates to whether a dependency constitutes a risk, or vulnerability, to the United States. Such a risk would exist if the United States were to become so dependent on a foreign source that its ability to produce a critical weapon system and/or secure the most advanced technology for the development of a future weapon system were to become compromised.

DOD officials have stated that in this global market, domestic manufacturers seek out suppliers based on factors other than location, such as cost, quality, performance, and delivery time. When these factors are considered, a domestic manufacturer may determine that a foreign supplier provides the greatest benefit. Selecting foreign sources has also occurred as a result of cooperative programs with other NATO countries. These programs are designed to encourage participation of NATO manufacturers in the production of U.S. weapon systems to achieve rationalization, standardization, and interoperability. Finally, foreign sourcing could be the result of offset agreements whereby the effect of U.S. prime contractors' sales of equipment to another country are offset by subcontracted parts from that country. Although foreign sourcing does not necessarily mean dependency, many experts agree that the trend toward

increasing foreign sources should be closely monitored to reduce potential national security risks.

A framework for assessing the national security risks that may arise from overseas purchases was established in a National Defense University report.¹ According to the report, foreign sourcing, that is, the use of sources of supply, manufacture, or technology that are located outside the United States or Canada, may result in a foreign dependency, if there are no immediately available alternatives. Not all foreign dependencies will pose a threat to national security and require action. The existence of a threat depends on whether the lack of available alternatives jeopardizes national security by significantly reducing the capability of a critical weapon system.

In December 1984, the Joint Logistics Commanders (JLC) concluded that an investigation into the nature and scope of foreign dependency was needed to provide clear direction for subsequent mission tasking to the military services. In 1986, the JLC issued a report, A Study of the Effect of Foreign Dependency, with recommendations on how DOD could reduce the damage to the U.S. defense industrial base due to existing foreign dependencies and help identify and prevent future foreign dependencies.

Currently, there are legislative mandates and DOD directives that restrict, or allow DOD to restrict, procurement of selected foreign products. Among other things, these restrictions are intended to protect and preserve the U.S. defense industrial base, and are generally referred to as “buy American” restrictions.²

¹U.S. Industrial Base Dependence/Vulnerability, a 1987 report of The Mobilization Concept Development Center of the National Defense University.

²Buy American restrictions that affect DOD procurement include those mandated by Congress, DOD-wide class restrictions imposed by the Office of the Secretary of Defense to bolster the U.S. defense industrial/mobilization base, those imposed for mobilization requirements on certain defense equipment by the military departments and the Defense Logistics Agency, and those related to the Buy American Act and the DOD Balance of Payments Program that offer price preferences to domestic firms but do not preclude purchases from foreign sources. It should be noted that the Buy American Act applies to end items, and does not generally apply to components or subcontracted items.

The Significance of Foreign Dependence Is Unknown

The overall extent of foreign sourcing and foreign dependency and their significance for national security is unknown. The inadequacy of DOD's data bases and models is cited as a problem hindering effective industrial base planning.³ Determining if foreign sourcing results in dependency and whether this dependency poses a national security threat requires not only collecting and assessing data but also determining acceptable levels of foreign dependency tolerance.

In an increasingly interdependent global economy, foreign sources of supply are an economic reality. Overseas sources of supply provide economic and political advantages that may include lower costs, better technology, better integration with our allies, and access to an industrial base much larger than our domestic base. However, there are potential disadvantages associated with foreign source procurement that may include (1) dependencies on foreign sources that may be less reliable than domestic ones, (2) questionable or reduced domestic production capabilities because domestic manufacturers may not have sufficient demand to keep lines of production open, and (3) questionable access to advanced technology that may be important to superior weapon systems performance.

Several studies provide valuable information on the benefits and risks associated with foreign sources of supply, the need for collection and analysis of systematic and selective data to demonstrate that a dependency poses a risk to national security, and proposals on how to measure such risks. These studies are discussed in appendix I.

DOD's Awareness of Dependencies Is Limited and JLC-Identified Dependencies Still Exist

DOD program and procurement command officials for the weapon systems we reviewed stated that, in general, program and procurement officials are not required, and take no special action, to maintain visibility into foreign sourcing or foreign dependency.

We reviewed selected items from two weapon systems, the M1 Abrams tank and the F/A-18 Hornet fighter aircraft, identified as foreign dependent in the 1986 JLC study. These items continue to be foreign dependent as shown in table 1, and the reasons are discussed in appendix II.

³Industrial Base: Adequacy of Information on the U.S. Defense Industrial Base (GAO/NSIAD-90-48, Nov. 15, 1989) discusses our evaluation of certain aspects of the federal government's data collection and coordination efforts among agencies that play an important role, including the Department of Commerce and the Federal Emergency Management Agency.

Table 1: Status of JLC-Identified Foreign Dependencies in the M1a1 Abrams Tank and F/A-18 Hornet Aircraft

JLC-identified dependencies (1986)	Status (1990)
M-1 Abrams Tank	
Optic Quality Glass	Foreign Dependent ^a
Trimer	Foreign Dependent
Z-shaped Extrusion	Foreign Dependent
Ammunition Storage Rack	Foreign Dependent ^b
Various Semiconductors	Foreign Dependent
F/A-18 Hornet Fighter	
Ejection Seat	Foreign Dependent ^b

^aDetermined to be foreign dependent because the loss of some or all foreign sources would most likely result in domestic demand exceeding domestic production capacity.

^bPresently sole-sourced from overseas suppliers.

The 1986 JLC study recommended that DOD (1) develop a management information system to obtain visibility on foreign dependencies for weapon system components throughout the lower production tiers and (2) require service program managers and contracting officers to assess, throughout the acquisition process, the potential impact of foreign dependencies on critical weapon systems. Participants in the JLC report and DOD officials told us that this report received limited attention, except from defense groups specifically concerned with mobilization or industrial preparedness, and its contents and recommendations, therefore, were not fully considered or addressed.

It is noteworthy, in the context of DOD's handling of the JLC study recommendations, that in April 1990 the Logistics Management Institute issued a report, Implementing Industrial Base Study Recommendations, stating that the majority of the recent studies and reports on the defense industrial base have not been comprehensively evaluated, nor have their recommendations been prioritized. The report also states that sound recommendations have received only passing attention or have been ignored completely by DOD. The Institute recommended that the Secretary of Defense make a senior-level group responsible for evaluating and prioritizing such recommendations, establishing schedules for review and implementation of selected initiatives, and holding specific individuals or organizations accountable for meeting the schedules. DOD officials that we interviewed told us that the Institute's report has not yet been seriously considered, therefore, DOD has not assigned responsibilities to any individual or group.

Limited Use of Buy American Restrictions on Selected JLC-Identified Items

Buy American restrictions focus on protecting segments of the DOD contract market from foreign-source competition to address trade and structural problems of certain industries. Depending on the nature of the restriction, U.S. market segments may be closed entirely to foreign participation, or foreign access to these segments may be limited on the basis of certain requirements. Each buy American restriction is different in terms of its impact and effectiveness and the particular industrial sector, class, or commodity it affects.

In response to our inquiries about the use of buy American restrictions on the M1 Abrams tank and the F/A-18 aircraft, program officials and contractors commented that such restrictions (1) are incorporated into the procurement contracts by reference to several different clauses from procurement regulations and (2) are of limited impact because of the many exceptions allowed under various international agreements and legislative mandates. These exceptions address other policy goals such as NATO's rationalization, standardization, and interoperability objectives. Other comments about the application of buy American restrictions on JLC-identified items are included in appendix II.

DOD officials have stated that generally buy American restrictions are not the right mechanisms to accomplish broad industrial base objectives because, in many instances, even when the total DOD demand for a given item is reserved for domestic sources, the demand is insufficient to stabilize a failing domestic industry or to preserve a healthy one. However, DOD officials said that the restriction on ejection seats is an example of Congress supporting DOD to ensure that U.S. firms receive reciprocal access to foreign defense procurements.

DOD's Efforts to Assess the Significance of Foreign Dependence on the U.S. Defense Industrial Base

DOD has ongoing efforts to (1) improve its information on the U.S. defense industrial base and (2) revise the DOD acquisition directive and procedures to include early consideration of foreign sourcing and dependency issues.

DOD efforts to systematically collect information on foreign sourcing does not address the issue of foreign sources used at the subcontractor level. DOD has acknowledged that its Defense Industrial Network (DINET), a "prototype" defense industrial data base, has many limitations. DOD has a proposal to develop a "full-scale system" to address industrial base issues, but there are no DOD-approved plans for its implementation.

According to DOD officials, planned revisions to acquisition and industrial preparedness regulations would require assessment of the capabilities of the U.S. defense industrial base, including consideration of foreign sourcing and dependencies. However, defense industrial base experts we spoke with expressed concerns about whether these revisions would result in effective assessments of the capabilities of the U.S. defense industrial base. These data base and regulatory improvement efforts are discussed in appendix III.

Recommendations

We recommend that the Secretary of Defense

- assign responsibility to an individual or group within the Office of the Secretary of Defense for identifying, reviewing, evaluating, prioritizing, and, when decisions have been made to take action, following up on timely implementation of the recommendations of major reports and studies on the defense industrial base to better enable DOD to take advantage of potentially valuable ideas and
- after consulting with other agencies and private sector experts and considering existing studies regarding critical technologies, critical and strategic industries, and foreign dependencies, (1) determine the key issues and policy questions for which information is needed, (2) develop a plan for a viable management information system to provide visibility on foreign dependencies for weapon system components throughout the lower production tiers, and (3) submit, within a reasonable time, a program proposal to Congress for effectively addressing the key issues and policy questions.

Scope and Methodology

We reviewed completed and ongoing studies related to critical industries, critical technologies, and foreign sources/dependencies/vulnerabilities, including DOD's July 1989 report to Congress The Impact of Buy American Restrictions Affecting Defense Procurement; interviewed and analyzed information provided by representatives from the National Defense University, Defense Manufacturing Board, industry experts, and officials from DOD's Office of Industrial Base Assessment, and Commerce's Office of Industrial Resource Administration. We also interviewed and analyzed information provided by DOD and military service officials, including program/contracting officials, and prime contractor and subcontractor officials for the selected weapon systems; and obtained advice and assistance from leading experts on defense issues.

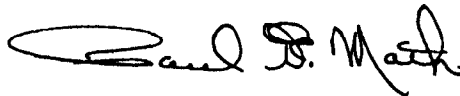
Our work was performed in accordance with generally accepted government auditing standards between September 1989 and July 1990.

As requested, we did not obtain written agency comments on this report. However, we discussed our findings with DOD program officials and have included their views where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time, we will send copies to the Secretaries of Commerce and DOD, the Director of the Federal Emergency Management Agency, and to interested congressional committees. Copies of the report will also be made available to other interested parties upon request.

If you or your staff have any questions, I can be reached on (202) 275-8400. Major contributors to this report are listed in appendix IV.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Paul F. Math". The signature is written in a cursive style with a large, sweeping initial "P".

Paul F. Math
Director of Research, Development,
Acquisition, and Procurement Issues

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Abbreviations

DINET	Defense Industrial Network
DOD	Department of Defense
GDLS	General Dynamics Land Systems Division
JLC	Joint Logistics Commanders
MOU	Memorandums of Understanding
NATO	North Atlantic Treaty Organization
OTA	Office of Technology Assessment.
TASC	The Analytic Science Corporation

Studies on the Benefits and Risks Associated With Foreign Dependence

Several studies that we reviewed relate to foreign dependency issues, the need for more information and proposals on how to weigh or measure the risks to national security that a foreign dependency may create.

According to the 1987 National Defense University report, the national security risks associated with foreign dependencies may be assessed from two perspectives: surge and mobilization, and technology base.¹

The risks to surge and mobilization² relate to production in quantities under time constraints. Surge and mobilization risks are primarily short-term problems, in that they may interfere with activities that occur over a few months (surge) to several years (mobilization). Others who have studied these problems stated that the risk to surge and mobilization relates to the lack of qualified sources, lack of available substitutes, insufficient production capacity from domestic sources, or a need for substantial production lead time that would inhibit the prompt replacement of overseas supply. As a result, the rapid increase in production of weapon systems is hindered.

Concern about mobilization has often been dismissed as “unrealistic” mainly because of the belief that the probability of a long war appears remote, especially after the recent economic and political changes that have taken place throughout Europe. However, a February 1990 draft report by the Industrial College of the Armed Forces³ states:

“Henceforth, America’s position of strength vis-a-vis its foremost prospective adversaries increasingly will be a function of the latent capabilities (industrial, technical, scientific, and manpower potential) both sides possess, the speed and effectiveness with which these latent capabilities can be converted to immediate use, and the willingness to activate such capabilities. Mobilization could well become the overriding determinant in any future balance of power calculation.”

The report identifies five major trends that could significantly affect the role of mobilization. These include: (1) the changing character of the

¹In addition, a leading expert on industrial base issues noted a third perspective, the risk of a simple peacetime disruption of supply.

²The University uses the Joint Chiefs of Staff’s definitions of these terms: Surge is the accelerated production, maintenance, and repair of selected items and the expansion of logistics support services to meet contingencies short of a declared national emergency utilizing existing facilities and equipment. Mobilization is the act of preparing for war or other emergencies through assembling and organizing national resources, and the process by which the Armed Forces, or part of them, are brought to a state of readiness for war or other national emergency.

³This draft report entitled National Security Emergency Preparedness Mobilization Policy Review was submitted to the National Security Council.

threat; (2) the reduced resources available for defense; (3) the changes in the U.S. defense industrial base, including, among other things, increased dependence on foreign production, changing composition of the U.S. economy, and increased foreign investment; (4) increased international interdependence; and (5) the expected evolution of the U.S. force structure to one based on lighter, more mobile weapon systems.

Because of these trends, the report states that contingencies that, in the past, required little mobilization planning now will have to be reexamined and planned for, especially if military stocks are lowered and domestic production capabilities, previously at a higher level of readiness, are reduced. Such an environment underscores the need for adequate defense industrial data bases and models to effectively plan for surge and mobilization.

Technology base vulnerability deals with U.S. access to the most advanced technology in either war or peacetime for the development and production of weapons and for maintenance of the U.S. technological edge over other countries. This vulnerability is a long-term problem, in that it interferes with the continued capability of the United States to achieve its national security goals.

In its most recent technology reports, the Office of Technology Assessment (OTA) expressed concern about dependencies on foreign technologies.⁴ OTA states that while some foreign dependencies may be tolerable, others may require action to ensure the future military security of the United States; however, before taking action, data must be collected to determine the extent of foreign dependence and decisions made about how much and what kinds of dependence can be tolerated.⁵ OTA also states that another approach is for the United States to selectively keep research and development and industrial capacity in certain technologies to maintain the country's economic vitality as well as its military defense. OTA explains that building defense systems increasingly depends on developments that take place in the civilian sector, a sector that is driven by the international marketplace, and that in this marketplace, DOD has little or no leverage over industry developments. In OTA's opinion, this means that defense developments and production will

⁴Holding the Edge: Maintaining the Defense Technology Base, April 1989, and Arming Our Allies: Cooperation and Competition in Defense Technology, May 1990.

⁵Foreign Vulnerability of Critical Industries, a report by The Analytic Science Corporation (TASC), March 1, 1990, discusses a quantitative measure of relative vulnerability to foreign firms and foreign sources.

depend increasingly on the health of the domestic civilian sector and the ability of DOD and its contractors to develop and gain access to the products and technologies needed for both our defense and the civilian sector.

Demonstrating that a dependency exists and that it results in a risk to national security requires the systematic collection of data as well as an analysis of various factors, such as (1) the reliability of the foreign supply source,⁶ (2) substitutability between unreliably supplied foreign goods and alternative goods, including the length of time needed before alternatives become available, (3) the importance to the defense mission of the final products affected, and (4) the likelihood of a national security contingency in which the availability of the item might be critical.

The Defense Manufacturing Board Critical Industries Task Force, in its draft report A Strategy for Strengthening the National Defense: The Role of Its Industrial Base,⁷ states that the United States might be able to tolerate dependence on multiple, open foreign sources that possess multinational perspectives. Dependence on a single, closed, and centralized foreign source that maintains a national perspective is more dangerous. For instance, a tight network of foreign industries and supporting institutions that dominates key technologies could exercise global power by setting the terms on which technology is traded.

According to the 1990 TASC study on foreign vulnerability, market concentration is an important indicator of foreign vulnerability risk. The study proposes a particular quantitative measure of market concentration, which takes into account national origin of firms.⁸

The TASC report states that (1) economists describe the competitive nature of industries by using measures of market concentration, (2) a long empirical tradition has established a high correlation between high levels of market concentration and the ability of producers to increase

⁶For planning purposes, a source of supply, manufacture and/or technology located outside the United States and Canada can be considered a less reliable source for any or all of the following reasons: distance to the United States, geographic proximity to potential battle site(s), political and economic instability in the source's country.

⁷The Defense Manufacturing Board is now part of the Defense Science Board, which is reviewing this draft report.

⁸A study by Professor Theodore H. Moran, The Globalization of America's Defense Industries, What is the Threat? How Can it be Managed?, also uses a quantitative measure of concentration in examining foreign supply vulnerability.

profits by effectively limiting entry of competing firms, and (3) empirical evidence also supports a contention that is extremely important to the analysis of risk or vulnerability: that market outcomes (e.g. availability or denial of access) can be predicted on the basis of market indicators, such as the distribution of firms' market share.

According to several defense industrial base experts, systematic data collection efforts and remedial actions addressing risks should be selective, concentrated on those weapon systems, technologies, and/or industries identified by DOD as critical to national security. Further, the experts stated that when the level of risk associated with foreign dependence is determined to be unacceptable, DOD should evaluate options to reduce this risk.

The studies that we reviewed presented options to reduce the risks arising from DOD's dependence on foreign sources for materials and components of major weapon systems. Some of these options involve broad policy decisions relating to such things as tax incentives and anti-trust law revisions. Other options are more program-specific and include advanced procurement and subsidization for the stockpiling of critical, foreign-sourced components and materials; creation and funding of domestic research and development and or production capacity; funding government-owned facilities; substitution with domestically sourced items; component redesign to use domestically available items; and domestic licensing of foreign design. Options on manufacturing technology and products include import restrictions, consortia, and dual use requirements.

Assessment of DOD's Actions to Address Previously Identified Foreign Dependencies

Our review provided some insights on selected items from the M1 Abrams tank and the F/A-18 Hornet aircraft previously identified as foreign dependent by the JLC report A Study of the Effect of Foreign Dependency. General Dynamics Land Systems Division (GDLS) and McDonnell Douglas Corporation have the production contracts for the Abrams and the F/A-18, respectively.

Awareness of Foreign Dependencies

Acquisition and industrial preparedness personnel associated with the Abrams tank and F/A-18 aircraft programs have no systematic method for identifying or collecting data on foreign sources or foreign items used in their respective weapon systems. The most often mentioned source of information on vendors was the prime contractors' vendor list. These officials stated that the vendor lists required by clauses in the procurement contracts show only those suppliers to the primes, but do not identify vendors as foreign sources, if such foreign sources appear on the list. Both GDLS and McDonnell officials were able to supply us with some information about foreign sourcing below their immediate subcontractors, but said this information is not kept systematically. A GDLS official said such lower tier information is largely dependent on the expertise and experience of the particular buyer.

The Abrams tank and F/A-18 aircraft program office officials we interviewed were not familiar with the JLC study. The officials explained that this was because of (1) the limited distribution of the JLC report and (2) the lack of contact between industrial preparedness planners and procurement officials. This lack of interaction was described to us as the "stovepipe effect" created by the separation of the industrial preparedness planning process and the acquisition process within DOD.

Abrams program personnel were familiar with several of the specific JLC-identified items, but their awareness was usually the result of ad hoc information gathering efforts and production problems caused by some of the items. Due to the high visibility of the F/A-18 ejection seat, virtually everyone we interviewed was aware that it is sourced from overseas.

Abrams tank and F/A-18 aircraft officials were not aware of any actions (1) taken in response to the JLC study or (2) taken on any item for their respective weapon systems to specifically reduce production risk from exposure to foreign sourcing or dependency. In some instances, program officials and contracting officials took action on production problems associated with foreign-sourced items, but often they discovered that

the item was foreign sourced only after its loss had threatened production schedules.

Discussions with General Dynamics contracting officials confirmed that the company has no policy for dealing with foreign dependency, such as requiring that a percentage of the foreign-sourced dependent parts or components be purchased from domestic sources. McDonnell contracting officials said that (1) McDonnell does have a "50-percent rule" which requires that 50 percent of the structural components, such as wings or fuselage pieces, be domestically sourced, (2) this requirement is passed down through company subcontracts, (3) the rule does not extend to "black box" items or electromechanical devices and is waived in certain circumstances such as the coproduction arrangement with British Aerospace on the AV-8B Harrier II jet, and (4) McDonnell does not police implementation of the rule by subcontractors. According to McDonnell officials, this company rule is derived from "buy American" contract clauses.

Neither GDLS nor McDonnell mitigate foreign dependency or vulnerability by maintaining "buffer stocks" or "rolling inventories." McDonnell personnel said that (1) independently maintaining such extra stocks makes little economic sense for their company and (2) if the government considered maintenance of such stocks important, the government would have to require and pay for them.

Whether and Why JLC-Identified Foreign Dependencies Still Exist

In general, the items we reviewed on the Abrams and F/A-18 that were dependencies in 1986 continue to be so. Government officials and contractors said that most of the dependencies could be overcome given time and money, the dependency usually being a function of lack of production capacity rather than lack of significant technological capability. In addition to creating or increasing domestic production capacity, contractors suggested alternative solutions, including redesign of components or weapon systems to use domestically available items, use of items available commercially that do not currently meet military specifications, and sourcing from alternative foreign sources. The time required to take these actions may affect DOD's ability to meet weapon systems production goals.

The Abrams Tank

The JLC-identified dependencies on the Abrams tank that we reviewed included (1) optics in the gunner's primary sight, (2) Trimer, an ingredient in the plenum seal—the seal connecting the engine and the air

intake system—used to increase the heat and flexibility tolerances of the seal, (3) a Z-shaped, specialty-steel extrusion used in the louvers of the ballistic doors above the engine compartment, (4) the ammunition storage racks, and (5) microcircuits in the ballistic computer, a component of the target acquisition/fire control system.

Most of the optical glass in the gunner's primary sight identified in the JLC study as foreign dependent continues to be foreign sourced and appears to be foreign dependent. Determining whether the gunners' primary sight subcontractors to GDLS are dependent on foreign sources for the optical glass poses the question of availability—whether domestic production capacity can meet potential domestic demand after loss of some or all foreign sources. Foreign sourcing of these types of optics by domestic industry appears to be widespread, therefore, loss of foreign sources is likely to greatly increase demand for such optics from domestic producers. If domestic producers cannot meet this broader and more intense demand, the Abrams is dependent on foreign sources.

In almost every case, low cost was the reason for foreign sourcing of optical glass. An executive at one of GDLS optics suppliers estimated that if his company had to purchase equal quality optical glass from domestic sources, the cost of optics would increase by a factor of two or three.

Trimer continues to be foreign dependent because it is not available domestically. According to officials at the Army's Tank and Automotive Command, potential American producers have the technical knowledge to develop a domestic production facility at an estimated initial investment cost of about \$1.5 million. However, DOD could not guarantee more than \$1 million in purchases over a 5-year period. Thus, the Army's Tank and Automotive Command and the potential producers determined that it would not be economical to develop a domestic facility.

According to the domestic company that mills the Z-shaped extrusion used in the louvers of the ballistic doors of the Abrams, the unmilled specialty-steel extrusion is done by a firm in Great Britain. A company executive said that the British firm provides the quality of product that can be consistently finished to meet Abrams design tolerances and that a dependency exists because the company has been unable to find a domestic source that could do the same. He further said that, given his conversations with potential domestic sources, if American firms tried to produce an extrusion with equal specifications, they would have to charge twice as much.

The ammunition storage racks for the Abrams' 120mm cannon are foreign dependent. At the direction of the government, GDLS currently has a sole-source contract with Wegmann and Company, a German firm, for production of the ammunition storage racks. Although a U.S.-based, wholly owned subsidiary of a German company owned by Wegmann assembles and tests the ammunition racks in Virginia, and parts of the rack are made in the United States, most of the assembly is shipped in from Germany by Wegmann. A GDLS contracting official described the parts sourced from domestic firms as insignificant. GDLS could not identify an immediately available alternative source, but said that the production technology was not difficult. The challenge was in the design of the complex racks. Some domestic manufacturers have experience producing other ammunition storage racks, but the GDLS official estimated that, with the complete technical data package for the storage racks, it would take approximately 10 to 12 months to establish a domestic source.

According to a 1987 DOD Inspector General's report,¹ Wegmann won the design competition for the ammunition rack based on technical merit, but the production contract was awarded to Wegmann, mostly because of its claims of extensive proprietary data rights to the rack design. Wegmann based those rights on its development work on similar 120mm ammunition storage racks for the Bundeswehr's Leopard II main battle tank. Upon review, the Inspector General concluded that Wegmann's rights were quite limited and recommended that the rack production contract be broken out from the GDLS contract and competed. Because of the advanced nature of contract talks for a multiyear procurement then underway, Army officials decided not to make the recommended changes.

The JLC study found that the semiconductor firms that manufactured a selected number of the microcircuits used in the Abrams tank's ballistic computer, had foreign dependencies. For the microcircuits we reviewed, the semiconductor firms are dependent on foreign sources for ceramic packaging, which also appears to be true for lead frames and bonding wire. In addition, we found that the production equipment and materials used for the fabrication of dies (the etched silicon chips) as well as the actual assembling of the microcircuits are increasingly foreign sourced.

¹Final Report on the Audit of the Procurement of Ammunition Storage Racks for the M1A1 Tank by the Office of the Inspector General, U.S. Department of Defense, No. 87-142, May 7, 1987.

The ballistic computer used in the Abrams is built by Computing Devices Company of Canada. In analyzing the extent of foreign dependency associated with the production of some of the microcircuits used in the manufacture of the ballistic computer, we had to determine where these microcircuits are assembled and where the four essential piece parts of the microcircuits—the die or chip, the ceramic packaging, lead frames, and bonding wire—are manufactured.²

Assembly of the microcircuits that we examined occurs off-shore because of cost considerations, such as lower overhead expenses and labor rates. However, all the representatives that we interviewed stated that the testing and assembly of these particular microcircuits could be transferred to a domestic plant if a situation arose in which domestic production were mandated and economic considerations were deemed secondary. Depending on the particular microcircuit and the particular company, production could begin from almost immediately to within a year.

The production of dies takes place in domestic facilities owned by the three semiconductor companies that we contacted. However, industry officials pointed out that U.S. companies are producing less and less of the equipment and materials needed to make the dies.

The semiconductor companies that we examined are dependent on foreign sources for ceramic package piece parts because there are few U.S. firms that can satisfy demand and specification requirements. Japanese-owned firms control over 90 percent of the U.S. ceramic packaging market and the percentage of foreign control is even higher if other foreign suppliers are included. Only one domestically located ceramic package manufacturing facility was identified as a current or potential vendor for the companies we interviewed. This firm, Kyocera America, Inc., is a subsidiary of a Japanese company and the sales from its San Diego operations represent about 13 percent of sales in the U.S. ceramic packaging market, according to a company official.

Lead frames and bonding wire are purchased from foreign firms because of a combination of factors that include cost, quality, availability, and

²Using a vendor and piece parts list provided to the JLC researchers, we contacted three semiconductor firms to determine the extent of foreign sourcing associated with the purchase and assembly of component piece parts for selected microcircuits used in the ballistic computer. We did not contact all of the listed vendors; we updated the sourcing status of many, but not all, of the microcircuits reviewed by JLC researchers.

proximity to foreign-based plants. Although the Computer Devices Company's semiconductor vendors rely less on foreign sources for these parts than they do for the ceramic packaging, questions remain about whether, in the event of a loss of access to foreign sources, domestic sources of lead frames and bonding wire have the capabilities to supply a quality product in the requisite volume and product specifications.

The F/A-18 Aircraft's Ejection Seat

The ejection seat for the F/A-18 is currently foreign dependent. No readily available domestic alternative exists. However, a new ejection seat is being used for F/A-18 (and F-14D) production and will be used in other new production naval aircraft.³ The procurement plans for the new seat will end, or at least mitigate, the current foreign dependency. The prime contractor for both the old and new ejection seats for the F/A-18 is Martin Baker Aircraft Company of the United Kingdom.

The new ejection seat program, called the Navy Aircraft Common Ejection Seat, began in 1982 as a response to criticism by Congress and by us about the multiplicity of naval aircraft ejection seats and the resulting high cost of small procurements and logistics support. The then Navy Secretary ordered replacement of the various unique ejection seats with a single seat that would have a high level of component commonality across aircraft applications without requiring redesign of aircraft cockpits. Martin Baker won the competition against three domestic manufacturers by meeting the modest performance standards, providing a high degree of commonality, and beating the competition on cost. Current management of the procurement program is handled by the Navy's Aircrew Systems program office.

Foreign sourcing of the new F/A-18 ejection seat was apparently not a primary concern of the Navy but competition and second sourcing were. As a result, the Navy's procurement strategy for new seats will mitigate against dependence on Martin Baker. First, the Navy adopted a leader-follower procurement strategy. The contract requires Martin Baker to establish a second source for the seat. That second source is a New York firm, East West Industries. The technology transfer is occurring, and Aircrew Systems program officials expect Martin Baker and East West Industries to compete annually for shares of the Navy's new ejection seats procurements beginning in 1992. Martin Baker also had to find a second source for the high cost expendables, principally the pyrotechnics. That company, UPCO, is also located in the United States.

³The Navy does not intend to retrofit the seat to older aircraft.

Second, to have control over any technology transfer, the government procured the complete technical data package for the new seats. This sometimes means little since having a technical data package does not necessarily result in the capability to produce the design. But according to Aircrew Systems program officials, the "metal bending" technology required to build the new seats is readily available domestically. If access to Martin Baker were suddenly lost, shifting production to a domestic firm would be greatly facilitated by government possession of the complete technical data package. According to Aircrew Systems officials, those few items that pose some technological production challenge are, at this time, sourced by Martin Baker from American suppliers.

An additional mitigating factor is the existence of several domestic manufacturers of ejection seats. Program officials believe that under crisis circumstances, the seats built by these manufacturers might be adapted to fulfill the need. McDonnell officials concurred with this observation, noting that both they and domestic competitors could provide ejection seats, though the switch would take an unknown amount of time.

When and How Were Buy American Restrictions Used

In both the Abrams tank and F/A-18 aircraft production contracts, buy American restrictions are incorporated by reference to the applicable government acquisition clauses, but the clauses allow exemptions under certain conditions.

The Abrams Tank

The M1A1 Abrams ammunition storage rack procurement was not covered by specific statutory or DOD-sponsored restrictions and was generally exempt from buy American restrictions. Memorandums of Understanding (MOU) between the United States and Germany left Wegmann's ability unencumbered to compete to design and produce the ammunition rack. For example, as part of the standardization and interoperability objectives for NATO programs, one MOU states that the United States and Germany will use common components, including the main gun and ammunition, on their respective tanks when possible. Other bilateral MOU's grant NATO allies, such as Germany, access to the United States' domestic defense market, devoid of the price penalty of buy American restrictions so long as the partner country reciprocally waives its similar laws and regulations.

The F/A-18 Aircraft's Ejection Seat

The procurement of the F/A-18 aircraft ejection seat has been restricted through legislation. A specific congressional buy American restriction prohibiting procurement of all foreign-sourced ejection seats was first passed by Congress in the Fiscal Year 1983 Appropriations Act. According to DOD, this restriction was established after successful lobbying efforts by the domestic firm, Stencel Aero Engineering, and was directly aimed at keeping Martin Baker out of the new ejection seats competition. Stencel's future business health was based on a successful bid for the new seats contract, and Martin Baker began the competition with the advantages of a long-standing relationship and excellent reputation with the Navy.

Congress' action was protested by the U.S. Navy and the government of the United Kingdom. In deliberations on the Fiscal Year 1984 Defense Authorization Act, members of the House Armed Services Committee stated that (1) the restriction contradicted policy expressed in the Fiscal Year 1977 Defense Authorization Act (P.L. 94-361) on NATO rationalization, standardization and interoperability and was contrary to the United States' government-to-government agreements with NATO allies guaranteeing reciprocal access to our respective defense markets, (2) Congress was setting a dangerous precedent by crossing an historical threshold against congressional interference in the source selection process by directing, in law, that certain manufacturers may not compete, and (3) by apparently applying the appropriation restriction to future funds, the legislation exacerbated the problem of legislation in an appropriations bill by appearing to establish permanent law.

The Fiscal Year 1984 Appropriations Act changed the restriction by exempting from the restriction any foreign country that allowed American firms to compete for ejection seat contracts in that country. The United Kingdom later certified that it would allow U.S. ejection seat firms to compete for their procurements.

DOD's Efforts to Assess the Significance of Foreign Dependence on the U.S. Defense Industrial Base

DOD identified two major efforts to assess the significance of foreign dependence on the U.S. defense industrial base: the defense industrial base information system and the revisions to DOD Directive 5000.1, Major and Non-major Defense Acquisition Programs, and DOD Instruction 5000.2, Defense Acquisition Program Procedures.

U.S. Defense Industrial Base Information System

Our November 1989 report stated that DOD efforts underway to systematically collect information on foreign sources were not addressing foreign sourcing at the lower production tiers. We elaborated on this in our March 1990 testimony before the Senate Committee on Banking, Housing, and Urban Affairs,¹ stating that an improved approach to defense industrial base data collection and coordination, especially at the subcontractor levels of production, is necessary for DOD to properly plan and be in a position to take appropriate action regarding the domestic industrial base, including the economic, trade, and technology security implications of procuring components of major weapon systems from foreign sources.

According to DOD, the Defense Industrial Network (DINET), has been redesigned to provide more useful and timely information on foreign sourcing and other defense industrial base matters. However, DOD acknowledged that this system has many limitations. There are proposals to develop "a full-scale system," a broader, more efficient and effective database to address defense industrial base issues. According to DOD, this proposed network would provide an industrial data base relating to a given weapon system. DOD is considering a contract to develop technical specifications for the full-scale system. The work under this contract is expected to be completed by the end of September 1991. However, there are no DOD approved plans for the full-scale system.

Revisions to Acquisition and Industrial Preparedness Regulations

DOD is revising Directive 5000.1, Major and Non-Major Defense Acquisition Programs, and DOD Instruction 5000.2, Defense Acquisition Program Procedures, to require program managers to analyze, from the early stages of the acquisition process, the capability of the U.S. industrial base to meet production requirements for weapon systems, including surge and mobilization requirements. According to DOD officials, the revisions to require an assessment of the capabilities of the U.S. defense

¹Comments Relating to Reauthorization of the Defense Production Act, GAO/T-NSIAD-90-10.

industrial base explicitly include consideration of foreign sourcing and dependency.

However, a civilian expert on defense industrial base issues, who has analyzed DOD directives over the years, said that (1) specific guidance on how to assess industrial base issues, including foreign sourcing and dependency, will appear in DOD's Industrial Base Program Manual,² DOD 4005.3-M, which is currently being revised and (2) while the proposed acquisition directive would indirectly refer to the industrial base manual, he is concerned about whether the chain-of-command within the acquisition community will adequately ensure enforcement of these revisions. Other defense industrial base experts that we spoke to expressed concern about whether program managers, without assistance from those officials responsible for industrial preparedness planning, would effectively assess the capabilities of the U.S. defense industrial base, including the risks inherent in foreign sourcing, to produce their weapon systems.

²Formerly referred to as Industrial Preparedness Planning Manual.

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