INTRODUCTION

A review of DoD and Air Force policy documents identifies three overarching objectives that motivate Air Force concerns about globalization of the defense aerospace industrial base:

1. The need to equip aerospace forces with affordable yet highly capable weapon systems, both today and in the future (the economic and technological dimension);

2. The need to prepare the United States, its allies, and other friends to fight future wars as coalitions (the political-military dimension); and

3. The need to protect U.S. national security (the national security dimension).

These objectives are not necessarily presented in order of importance, and they do not necessarily conflict. In many cases, the same policy or policies can support all three. Policies promoting trade among allies in weapon systems and parts, for example, can lower costs, spur innovation, help close technology gaps, and enhance interoperability, thereby strengthening allied coalitions. Strong coalitions in turn strengthen national security. However, policies that create opportunities under some circumstances can create challenges in others; for example, if insufficiently monitored or controlled, trade can also facilitate weapon proliferation.
A review of recent studies of globalization reveals that most such analyses focus on the commercial sector. As a result, the standards these studies use to evaluate the pros and cons of globalization are often strictly economic. Consequently, these efforts—while useful for assessing the impact of globalization on the first objective listed above—do not and generally cannot address the second or third objectives listed above. Analyses of commercial sector globalization can help us assess globalization’s potential effect on the cost, quality, and technical innovation of weapon systems but not its effect on the interoperability of allied equipment or its implications for U.S. national security.

More promising for our purposes are the much smaller number of studies that have explored the implications of defense sector globalization, many of which have been produced by and for the U.S. government, particularly DoD.¹ These studies examine the national security as well as the economic dimensions of defense sector globalization but generally say little about its implications for coalition warfighting capability. They also tend not to make strong distinctions between markets for relatively low-value components and markets for high-value items such as defense aerospace systems, subsystems, structures, and major parts. This distinction is important because we believe that the globalization of high-value activities is both more promising in terms of coalition operations and more problematic in terms of national security.

Another important issue sometimes missed by studies of the defense sector is the distinction between globalization of supply and globalization of demand, each of which poses a different set of opportunities and challenges to the Air Force.² National security considerations aside, there is nothing structurally different about the design,

¹We acknowledge that as a practical matter, it is often difficult if not impossible to separate developments in the defense sector from developments in the commercial sector. Many Air Force contractors have direct ties to the commercial world through the sale of commercial products ranging from business jets to home appliances. Still more have indirect ties through the use of commercially derived technologies and inputs. Therefore, while this chapter—and, indeed, this report—focuses on the defense aerospace industry, the growing commercialization of that industry implies growing dependence on an already highly globalized commercial world.

²DSB (1999) does separately consider the globalization of demand, which it terms “product market globalization.”
development, and production of combat aircraft as opposed to most high-technology commercial manufactures. In principle, defense aerospace prime contractors and their suppliers could operate from facilities all over the world even if DoD were their only client. While the national security implications of such a global diversification of supply would be significant, the economic costs and benefits would be the same as those for any commercial industry. The Air Force would benefit to the extent that production costs are lower in other countries and would lose to the extent that transportation and monitoring costs are higher. Coalition warfighting ability would not be affected because the achievement of interoperability is primarily a function of globalized demand, not supply.

The nature of demand for the products of defense industries, however, is inherently different from that of most commercial industries. Unlike the demand for automobiles, for example, where global expansion offers firms the opportunity to reach millions of autonomous consumers worldwide who have no reason to know or care about each others’ resources or needs, the demand for weapons and weapon system platforms consists of a relatively small number of “consumers” made up overwhelmingly of national governments.3 These governments have considerable control over the follow-on marketing of platforms and systems for which they are the principal funders. Thus, many of the benefits of globalization can be realized only if two or more governments choose to coordinate their requirements or if one or more governments choose and are permitted to adopt a system or platform selected by a first.4

To cite an example, studies often identify economies of scale as a major benefit of globalization for consumers. In the commercial sector, this is reasonable in that the globalization of supply and that of demand almost always move together. Suppliers from around the world seek to enter a large number of markets and thereby lower their unit costs of production. If these markets are competitive, consumers worldwide benefit from the resulting price declines. If

3The market for small arms much more closely resembles commercial markets in this respect.
4This is somewhat less true for design, because design innovations may be applicable to a wide range of aircraft.
worldwide growth in demand is slow or stagnant, however, global-
ization’s potential for achieving economies of scale is limited. 
Because consumers have strong reasons not to want any individual
supplier to become dominant, antitrust laws in most countries re-
quire that at least two or more firms compete for any market. This
limits the potential for achieving full economies of scale in any single
market.

As shown in the previous chapter, global demand for defense
aerospace products—particularly for technologically advanced
weapons and weapon system platforms—is dominated by the United
States. Since U.S. demand for any particular system or platform is
unaffected by the existence of a global supply base, all else equal,
globalization of supply is not likely to offer the Air Force much in the
way of economies of scale. As we discuss below, however, globaliza-
tion of supply can offer a great deal in terms of labor cost and other
types of savings. Further, all else may not be equal: Under the right
circumstances, globalization of the supply base may actually encour-
age globalization of demand.

In this chapter, we use analyses presented in both the commercial
and defense sector literature to assess what the extent and character
of U.S. defense aerospace industry globalization may imply for all
three of the Air Force objectives listed above. Although we discuss is-
ues surrounding globalization of the low-value parts and compo-
nents supplier base, our focus is on the globalization of the design,
development, manufacture, and integration of high-value items.

ECONOMIC DIMENSIONS OF DEFENSE AEROSPACE
GLOBALIZATION

A large body of literature documents the economic benefits provided
by globalization of the U.S. economy. At the industry level, both the
broadly commercial and the specifically defense-oriented literatures
typically argue that market opening lowers costs, raises productivity,
improves quality, and promotes innovation.

Although some of these benefits are one-time, others, such as those
affecting productivity, have longer-term effects. Competitive
pressure is key to delivering all of these gains, creating incentives for
domestic firms either to improve or to go out of business. Foreign
competition, or the credible threat of competition, can help dilute domestic firms’ power in highly concentrated markets. Thus, from the Air Force’s perspective, globalization may help mitigate some of the less desirable consequences of aerospace consolidation by increasing the number of firms bidding on contracts.

Globalization also presents economic challenges. Featuring prominently in anti-globalization arguments, for example, are concerns about unemployed workers and about unprofitable and underutilized plants and equipment.

At the macro level, globalization causes some industries to expand while others contract as resources shift in response to opportunities abroad and foreign competition at home. Workers in declining industries may become redundant if their skills do not match requirements in rising industries; manufacturing facilities may become obsolete if they cannot be retooled or refitted. \(^5\) Although theory predicts that gains to the winners will outweigh losses to the losers, there is no assurance that losers will be compensated. Further, certain domestic design and manufacturing capabilities may be lost as foreign imports displace domestic products and U.S. firms relocate abroad. From a broad economic welfare perspective, this may not matter—although the point is heavily disputed. However, the loss of key defense industrial capabilities would have important national security implications, as discussed below.

**International Trade**

As we have seen in Chapter Two, total U.S. aerospace exports are high and imports quite low relative to the exports and imports of other high-technology manufactures. In stark contrast to the aerospace industry, for example, is the computer industry, where nearly half of all U.S. computer shipments are exported—yet imports account for more than 60 percent of the value of purchases. As described by CEA (2001, p. 146),

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\(^5\)Data from the 1980s show that competition from imports contributed at most 10 percent of the observed job displacements from manufacturing in the worst year of that decade (CEA, 1998, pp. 244–245).
The United States gains in both directions from two-way trade in computers and parts. U.S. computer firms can lower their costs by obtaining components from efficient foreign producers, and later profit from selling finished computers in the larger global markets.

By analogy to the computer industry, we would expect U.S. aerospace firms to take the lead in the design and integration of complete aircraft. Indeed, the data do show that U.S. exports of complete combat aircraft dominate the world market. This may be due to U.S. government promotion of defense aerospace systems through mechanisms such as the FMS and FMF programs as well as to “natural” comparative advantage. In any case, however—and with no attempt to analyze the cost-effectiveness of these types of export promotion programs—it is clear that strong exports are good for the Air Force on purely economic grounds. By allowing U.S. firms to achieve greater economies of scale in production, strong exports lower the costs of Air Force acquisition programs. They also help firms survive periods of low Air Force demand, making it possible to retain skilled employees and to maintain facilities that might otherwise be forced to close. They can, in addition, significantly lower the costs to the Air Force of holding legacy equipment in inventory by keeping production lines open (whether in the United States or elsewhere) for replacement parts and components. Finally, the potential for export sales lowers the risks to firms associated with failure to win particular Air Force contracts. This helps encourage new firms to enter the defense aerospace business and helps convince existing firms to stay in.

By the same computer industry analogy, we would also expect to see economically significant U.S. imports of aerospace products, especially at the level of components and small parts. These types of items are presumably less technically sophisticated than complete aircraft and should thus be well within the design and production capabilities of U.S. trading partners. In point of fact, however, we observe relatively few aerospace imports, whether of parts or complete aircraft, civil or military. This could be because our data do not capture major categories of imported inputs and therefore understate the true magnitude of foreign supply. Similarly, it could be that, for reasons of cost or quality or the desire to keep close control over suppliers, U.S. primes prefer not to work with foreign subcontractors. Yet it could also be the case that noneconomic factors—including
government regulations, policies, and practices—have discouraged U.S. primes from utilizing foreign sources of supply.

The data presented in Chapter Two do not allow us to discriminate between these alternatives. In particular, the lack of a breakdown between civil and military aerospace inputs constrains an important potential avenue of investigation. As we show in Chapter Four, policies governing military imports are more restrictive than those pertaining to civil imports. Therefore, if the primary reason for low aerospace imports is government policy, we might expect to see a significant difference in the magnitude of imports of civil versus military aircraft and aircraft parts and equipment. We do see quite a difference between civil and military imports in the complete aircraft category. As illustrated in Figure 2.3, for civil aircraft the average import share between 1997 and 1999 was 37 percent. For military aircraft it was less than 1 percent. These descriptive statistics are consistent with our examination of the historical trends in U.S. defense aerospace imports, which revealed that with one possible exception, the United States has never deployed a jet fighter/attack aircraft developed in another country. Even off-the-shelf imports of much less complex items such as missiles have been quite rare.

Those data that are available suggest that this low level of dependence on foreign sources of supply may be as true for military inputs as it is for finished products. A recent DoD study of FY 2000 subcontracts for eight large weapon system programs indicates that the value of parts, components, and materials obtained from foreign sources accounted for less than 2 percent of the value of total subcontracts.6 The only fighter included in the study, the F/A-18E/F Super Hornet, utilized foreign subcontractors for just $21.8 million of the $3.1 billion subcontractor effort, representing less than 1 percent

6This study, which was required under Section 831 of the FY 2001 National Defense Authorization Act, collected information on subcontracts valued at over $100,000 for U.S. suppliers and at more than $25,000 for non-U.S. suppliers, where a “U.S. supplier” was defined to be firms located in the United States or Canada (Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]), October 2001). The eight programs examined were the AH-64D Apache Helicopter Upgrade Program; the F/A-18E/F aircraft; the M1A2 Abrams Tank System Enhancement Package; the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM); the Patriot Missile Ground Station; the AGM-114L Longbow Hellfire Missile; the Joint Direct Attack Munition (JDAM); and the Advanced Amphibious Assault Vehicle (AAV).
of the total. The program with the highest percentage of foreign sub-contracts by value (18 percent), the Patriot missile ground station, uses imported computer hardware components, microcircuitry, and ceramics. According to DoD, these items could all be obtained from alternative domestic or foreign suppliers without “significant cost or risk” (USD[AT&L]), August 2001, p. 17).

The DoD foreign sourcing study is also instructive because it identifies some of the potential benefits and costs associated with the global diversification of defense-related production. With respect to economic objectives, DoD states that appropriate use of non-U.S. suppliers

- Permits DoD to access state-of-the-art technologies and industrial capabilities;
- Exposes U.S. industry to international competition, helping ensure that U.S. firms remain innovative and efficient; and
- Encourages the development of mutually beneficial industrial linkages that enhance U.S. industry’s access to global markets (USD[AT&L]), August 2001, p. 3).7

On the downside, the only economic concerns about foreign sourcing expressed in the study derive from possible negative impacts on the economic viability of the defense industrial base. According to DoD, such concerns are unfounded because of the small number and value of total program subcontracts let to foreigners. Of course, this argument cuts both ways: It is also hard to see how any significant benefits can be achieved with such a limited use of non-U.S. suppliers.

Is U.S. neglect of foreign aerospace suppliers due primarily to U.S. government policies that discourage imports? As we discuss in greater detail in the following chapter, there are relatively few direct formal legislative barriers to increased U.S. imports of foreign aerospace parts and components. “Buy national”—type legal provi-

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7This last point presumably refers to the export opportunities created as a result of foreign sourcing, which, as we state above, are of unambiguous economic benefit to DoD.
sions have for the most part been waived with respect to the defense sector. One possibility is that laws and regulations designed to restrict technology transfers abroad for reasons of national security—that is, export controls—actually have the added, unintended effect of discouraging imports. This is because of the informational constraints they may place on U.S. firms seeking contract bids from foreign companies. Or, alternatively, U.S. primes may simply have avoided foreign sources in the past in the belief that using domestically based subcontractors would improve their chances of winning U.S. government contracts.

International Investment and Business Relationships

Using the typology established in the previous chapter, we consider the economic opportunities and challenges associated with the international opening of capital markets through the following arrangements:

- U.S. direct investment abroad—that is, U.S. mergers with and acquisitions of foreign firms, including the establishment of new affiliates;
- Foreign direct investment in the United States; and
- Marketing agreements, teams, and joint ventures involving U.S. and foreign partners.

On purely economic grounds, the opening of capital markets, like the opening of goods markets, should in principle benefit the Air Force. The acquisition of foreign firms or the establishment of new foreign affiliates should allow U.S. firms to source inputs more cheaply and effectively. Perhaps more important, U.S. direct investment abroad should expand U.S. export and overseas licensing opportunities by improving access to foreign government procurement programs. At the same time, foreign acquirers of U.S. firms often invest in new technologies, plants, and equipment, thereby improving U.S. productivity. Under certain circumstances, growth in the number of U.S. affiliates of foreign firms is also likely to stimulate competition for Air Force contracts.

This last point is, however, key. Is foreign direct investment likely to force U.S. firms to increase their efficiency and hasten their innova-
tion, or will it tend to drive them out of the market? The answer depends on the type of transaction as well as the nature of the market. By definition, foreign direct investment can consist of either establishing new companies or acquiring or expanding existing ones. With respect to new establishments, Dunning (1990) argues that domestically owned firms are often well positioned to contend with foreign entrants if a country is technologically advanced. On the basis of this argument, new foreign direct investment in U.S. aerospace firms—including joint ventures with U.S. firms—seems likely to enhance domestic competition for Air Force contracts. On the other hand, the acquisition of existing operations by foreign firms may reduce the overall number of competitors. The U.S. Department of Justice and the Federal Trade Commission carefully monitor and control both foreign and U.S. domestic takeovers of U.S. firms in order to limit monopoly power in the defense as well as commercial sectors.

As we pointed out in Chapter Two, firms also create many business linkages that involve some degree of cross-border trade and investment but stop short of foreign direct investment, among which are subcontract arrangements, marketing agreements, and teams. How are these types of cross-border linkages likely to affect the Air Force’s ability to equip aerospace forces with affordable yet highly capable weapon systems?

There is little evidence and relatively little theory on the relative economic benefits to consumers of arrangements such as cross-border marketing agreements, teams, and joint ventures—or, for that matter, parent/subsidiary or prime/subcontractor relationships. As a general rule, however, any type of business relationship will help the Air Force achieve its economic objectives to the extent that it encourages participating companies to be more innovative and to use resources more efficiently.

International teams and joint ventures, for example, both allow aerospace firms to bring their best efforts to a particular project or program or, more broadly, to a product line or market segment, but teams seem to allow more flexibility. GAO (September 2000, pp. 2 and 18) reports that U.S. firms prefer the flexibility of teaming as an arrangement that can temporarily add capabilities to enhance their competitiveness; “that can allow companies to choose new partners
in each market in which they wish to compete”; and “that they can easily abandon should the alliance be unsuccessful in competing for new business or should an alliance with other companies offer greater potential for increased sales and revenue.”

If successful, however, a team may lead to further collaboration or, eventually, to the formation of a joint venture. Teams can provide a venue for aerospace firms to try out a new relationship before taking steps to solidify it. Moreover, like forms of direct investment but with less formal involvement, teams and marketing agreements can help firms enter new markets, potentially paving the way for more local sales and trade. Although marketing agreements probably afford less opportunity for technology transfer and information sharing than do teams, in cases where U.S. or foreign enterprises obtain rights to modify or produce equipment, there can be considerable opportunity.

There is some question as to whether cross-border teams and marketing agreements can be anticompetitive. Ultimately, as in the case of M&As, the outcome depends on the nature of the market and alliance. Teams can affect the market in several different ways. First, they can be anticompetitive if they result in fewer effective enterprises—that is, if firms that would have struck out on their own choose instead to ally themselves with a larger team enterprise. Second, they can reduce competition if they create barriers to entry, as may occur in an exclusive arrangement, by blocking other teams’ access to unique capabilities or otherwise monopolizing crucial expertise. These two concerns are not specific to international teams. Third, they can be procompetitive if opening them to foreign entrants encourages more firms to create teams or vie for membership. The extent to which the Air Force would benefit from more subtier competition depends in part on whether the system integrators are themselves competitive and pass on gains. Fourth, they can enhance

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8DoD (Under Secretary of Defense for Acquisition and Technology (USD[A&T]), 1999) raises this issue in a memo on anticompetitive teaming. Although not specifically addressing cross-border agreements, these concerns also apply to such agreements. Referring to exclusive agreements, the memo finds that “these teaming arrangements have the potential of resulting in inadequate competition for our contracts. While our preference is to allow the private sector to team and subcontract without DOD involvement, there are circumstances in which we must intervene to assure adequate competition.”
competition if they yield stronger—though not necessarily more—
teams, thereby fueling rivalries across teams.  

Finally, one factor to consider in evaluating the desirability of any of
these relationships is whether they were initiated by the companies
themselves. Generally speaking, industry-initiated relationships are
likely to be more efficient than government-initiated relationships
because they are presumably governed by economic as well as politi-
cal considerations. A second factor to consider in evaluating cross-
border business linkages is the extent to which they encourage the
cost-effective exploitation of imports and the promotion of exports.
As we have already suggested, two-way trade in defense aerospace
products helps the Air Force achieve low-cost, high-performance
combat aircraft. Mechanisms such as marketing agreements and
teams can be used to circumvent political, informational, and some-
times regulatory barriers to simple subcontracting arrangements that
send goods and services across national borders. For example, for-

t+9Likewise, the effects of marketing agreements can play themselves out differently.
+9Firms can use marketing agreements to gain access to local markets that might be
+9otherwise difficult to enter, thereby enhancing competition. However, they can also
+9use them to carve out discrete market territories or segments.

POLITICAL-MILITARY DIMENSIONS OF DEFENSE AEROSPACE GLOBALIZATION

The ability to conduct air operations as part of an effective interna-
tional coalition is a high priority for DoD—and for the NATO alliance

9Likewise, the effects of marketing agreements can play themselves out differently.
Firms can use marketing agreements to gain access to local markets that might be
otherwise difficult to enter, thereby enhancing competition. However, they can also
use them to carve out discrete market territories or segments.
and other key allies. Although the implications of globalization for coalition warfare are not widely discussed in the literature, various studies have identified intermediate political-military goals for acquisition policy, including the following:

- Technical interoperability through commonality of U.S. and allied weapons and weapon system platforms (standardization of equipment);
- System- and subsystem-level technical interoperability of independently designed and developed U.S. and allied defense aerospace platforms through compatibility in areas such as command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR) systems and munitions; and
- Narrowing of the defense technology gap between the United States and NATO Europe and other key allies.

In addition, DSB (1999, p. iii) argues that globalization in the form of closer defense industrial links between the United States and NATO Europe could help avert protectionist “Fortress Europe” and “Fortress America” tendencies, which weaken NATO political-military cohesion.

For the same reason that globalization can enhance competition, however, it could also result in the proliferation of alternative systems as a consequence of the improved capabilities—and hence competitiveness—of both European and non-European industry. According to Hura et al. (2000), as late as 1980 U.S. designs made up the vast majority of the fighter inventories of all NATO European air forces except for those of France, the UK, and Portugal. Yet despite general agreement on the desirability of equipment standardization among NATO countries—and despite U.S. policymakers’ long history of encouraging allies to purchase and field U.S.-developed equipment—NATO Europe has over time become increasingly reluctant even to coproduce U.S. aircraft designs, let alone import complete aircraft from the United States. Hura et al., for example, estimate that by the year 2010, the British and Italian air forces will have no
U.S.-designed fighter aircraft, while less than 20 percent of the German fighter fleet will be of U.S. design.\textsuperscript{10}

In response to European resistance to purchasing U.S.-designed weapons and weapon system platforms (and vice versa), a supposedly more politically palatable approach to achieving commonality through reciprocal trade was tried in the 1970s and 1980s. Under this approach, sometimes referred to as the “Two-Way Street,” U.S. and European industry were to specialize in different categories of finished weapons and weapon system platforms, each supplying each other’s governments. A variation on the Two-Way Street was the “Family of Weapons” concept, which promoted the transatlantic development and production of complementary weapon systems. In theory, both the Two-Way Street and Family of Weapons approaches would have allowed the NATO allies to preserve certain, probably different, defense industrial capabilities while at the same time providing the economic benefits of scale economies and comparative advantage and the political-military benefits of interoperability.

Unfortunately, reciprocal trade agreements have proved to be largely unworkable in practice. Differences over requirements and the desire of larger NATO members to retain a full spectrum of industrial capabilities are among the causative factors. In the 1980s, for example, differences over requirements helped doom an agreement between the United States, Germany, France, and the UK to develop and produce complementary air-to-air missiles. While the United States went ahead with plans for the U.S.-designed AMRAAM, DoD soon differed with its European partners over technical goals for AMRAAM’s short-range counterpart, the Advanced Short-Range Air-to-Air Missile (ASRAAM). In the end, France and Germany dropped out and ASRAAM became an all-British program. It was never purchased by the United States and thus far has not been taken up by any other NATO allies.\textsuperscript{11}

\textsuperscript{10}This is likely to change after 2010, when the UK, Italy, and other NATO allies and friendly nations start to bring the U.S.-designed JSF into inventory.

\textsuperscript{11}For a short discussion of the problems associated with the AMRAAM/ASRAAM program, see Lorell and Lowell (1995). Although the UK and Australia are the only countries to have committed to ASRAAM as of late 2001, Greece, Spain, Switzerland, and South Korea have reportedly expressed interest.
By the end of the 1980s, achieving commonality of major weapons and weapon system platforms through trade seemed to be a distant if not actually receding goal within NATO owing to leaner defense budgets and diverging rates of technological innovation among NATO members, as well as to the greater diversity of possible NATO missions. Yet greater interoperability, either through commonality of equipment or through system- or subsystem-level technical interoperability, remains an important NATO objective. Some observers have expressed the hope that closer integration of the U.S. and European defense industrial bases may finally move NATO closer to that objective.12

Mergers, acquisitions, and other forms of collaborative business relationships between U.S. and NATO European defense firms have the potential to encourage interoperability both through equipment commonality and through subsystem- and component-level interoperability. With respect to equipment commonality, such relationships can make joint equipment purchases by national governments politically and economically more attractive. In the past, for example, cross-border armaments cooperation programs have been characterized by governmental matchmaking between their respective national firms. With firms now initiating their own cross-border relationships, however, some of the economic inefficiencies introduced as a result of this matchmaking should be reduced. This is because firms are generally better able than governments to select partners on the basis of complementary capabilities. Moreover, work shares and technical responsibilities negotiated in the marketplace are likely to result in a more efficient allocation of resources than those negotiated by governments.13

Closer integration of national defense industrial bases may also make it more likely that the United States and its NATO allies will purchase similar or even identical systems within the context of purely national weapon system procurement programs. By blurring the national character of individual firms, governments may be more comfortable purchasing designs or even finished equipment from

12See, for example, DSB (1999).
abroad. Even arrangements that are relatively limited in scope, such as cross-border marketing agreements, may result in the unplanned coordination of equipment acquisition by national governments.

In addition to possibly encouraging international cooperation with respect to weapon system acquisition, purely economic considerations suggest that systems developed by firms involved in cross-border R&D teams and joint ventures—as opposed to simple marketing agreements—are likely to have important elements in common. This is because the sharing of design concepts, technology standards, and inputs is likely to be a major feature of these types of arrangements—provided, that is, that such arrangements are initiated by the firms themselves rather than by governments. The extent of the resulting interoperability will, of course, depend both on the nature of particular cross-border relationships and on the features of particular national programs, but subsystem-level solutions to achieving interoperability have several advantages over solutions that require commonality of major weapons and weapon system platforms. These include lower relative cost and greater flexibility of application, both of which are highly desirable in the post–Cold War era (see, for example, Hura et al., 2000).

These arguments notwithstanding, under certain circumstances globalization also has the potential to actually decrease NATO interoperability. As foreign firms become more capable as a result of increased access to U.S. technology and capital, competition between international supplier teams is likely to increase. The new consolidated pan European megafirms, for example, possibly working with U.S. subcontractors, may now have the capabilities and government backing to develop different but highly competitive systems in most market sectors. This could lead to the acquisition by European and other allied foreign governments of indigenously designed systems that are not standardized, and perhaps not even interoperable, with U.S.-developed systems. Chapter Five offers some evidence on this point.

Finally, it is important to stress that interoperability cannot be achieved without a NATO-wide commitment to defense modernization. Regardless of the form or character of transatlantic industrial cooperation, NATO European defense budgets must increase in
order to bridge the U.S.-European technological gap. This is a key element of NATO’s DCI. An onslaught of transatlantic teams, joint ventures, and other business partnerships all targeted toward the U.S. market will not overcome profound disparities in U.S.-European capabilities. Without proper controls, such an onslaught might, however, do damage to U.S. national security. One reason is the high degree of technology transfer—and the resulting potential for unauthorized resale to third parties—that is potentially involved in all of these cross-border relationships. For the United States, the greatest obstacle to making NATO forces truly interoperable may be the need to convince our allies to adopt the same type of export control regime as we ourselves have.

NATIONAL SECURITY DIMENSIONS OF DEFENSE AEROSPACE GLOBALIZATION

The Air Force faces at least four national security challenges associated with globalization of the U.S. defense industrial base:

- Loss of domestic defense capabilities and technologies and associated dependence on foreign sources of supply;
- Worldwide weapon proliferation;
- The acquisition of advanced conventional armaments by unfriendly nations or groups; and
- Foreign control over U.S. capabilities and potential lack of responsiveness to Air Force needs.

On the opportunities side of the ledger, globalization also

- Provides the Air Force with more “bang for the buck” as global competition forces costs down and quality up;
- Strengthens overall U.S. military capabilities by providing greater access to foreign technologies; and
- Strengthens overall U.S. military capabilities by improving the financial health of U.S. defense firms.
International Trade

The trade data presented in Chapter Two indicate that at current levels, there is little cause for concern over any broad loss of U.S. domestic defense aerospace capabilities and technologies resulting from imports. In fact, casual analysis suggests that if anything, U.S. industry is not taking full advantage of foreign technologies or possibly cheaper foreign sources of supply; there would appear to be ample opportunity to achieve more “bang for the buck” without compromising national security, especially at the level of parts and components.

From a national security perspective, however, this aggregate analysis could be cold comfort if even just a few militarily critical capabilities get transferred overseas, causing the Air Force to become dependent on foreign sources of supply. As a general rule, the United States should not depend on foreign suppliers if a supply disruption could seriously degrade its ability to field or operate military forces (Neu and Wolf, 1994). Fortunately, there is no evidence that this is the case: The DoD foreign sourcing study referenced above, for example, found no important classes of imported inputs that either could not be quickly and easily produced at home or were not being stockpiled in militarily significant amounts (USD[AT&L], October 2001). From 1962 to January 2001, there were just 25 “Section 232” investigations of the effects of imports on national security, only six of which concluded that imports did indeed threaten to impair national security, and all six of these cases involved crude oil and other petroleum products (BEA, 2001). These findings seem to confirm the arguments of Neu and Wolf (1994, p. 41), who state that “[t]he U.S. economy is very broad, and given enough time, it is undoubtedly capable of producing any product manufactured anywhere in the world.”

Of more concern, perhaps, is the potential for proliferation as U.S. industry continues to increase its dominance over world arms exports. Is the United States helping foster a worldwide arms race? Perhaps this may be the case, but the classic counterargument is that

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\(^{14}\)Two other cases did, however, lead to policy changes: increased stockpiling of chromium, manganese, and silicon ferroalloys, and the imposition of voluntary export restraints on metal-cutting and metal-forming machine tools.
if U.S. industry pulls back, other countries—particularly in Europe—will quickly step up to fill the breach. There is probably little that the United States alone can do to prevent countries from obtaining weapons and technologies that are available from multiple foreign sources. To counter this type of proliferation, an effective multilateral approach toward arms control is needed. The issues surrounding multilateral arms control are outside the scope of this report.

More important from a national security perspective is the extent to which the United States may be unintentionally arming its present and future enemies with advanced weapons and technologies that are not available elsewhere in the world. This speaks to the issue of technology transfer—that is, “the process of transferring, from an industry in one country to another or between governments themselves, technical information and know-how relating to the design, engineering, manufacture, production, and use of goods” (Defense Institute of Security Assistance Management [DISAM], 2000, Chapter 20). According to the U.S. government, the export of physical goods (including armaments) is a type of technology transfer. In addition, under U.S. law the term export can include activities such as transfers of technical information or know-how to foreign nationals within the United States (“deemed exports”), the electronic transmission of proprietary data to individuals abroad, or the return of foreign equipment to its country of origin after repair in the United States (15 CFR 730.5).

As we discuss at greater length in the following chapter, the United States imposes numerous restrictions on the type and nature of weapons, weapon system platforms, and parts and components that may be exported. The U.S. export control system also places clear restrictions on which countries or (rarely) subnational groups are authorized to receive them. The intent of these restrictions is not only to prevent unfriendly groups or nations from obtaining weapons they can use in the field, but also to prevent such entities from obtaining weapon technology through reverse engineering.

Globalization poses a threat to the U.S. export control system in large part because it increases the likelihood of third-party transfers—that is, the subsequent unapproved foreign resale of equipment and technology authorized for transfer to an approved party abroad. The
more acute threat is from third-party transfers of technology, not equipment. This is because technology transfers, which help build enemy defense industrial capabilities, are a greater long-term concern than enemy acquisition of materiel—and reverse engineering is difficult. It is cross-border investments and business relationships, not trade per se, that have the greatest potential for increasing undesirable third-party transfers of technology. There is also a potential threat of the third-party transfer of unique weapons developed indigenously by a legitimate recipient of U.S. systems or technologies—one who has developed those indigenous systems in part or in whole by reverse engineering U.S. systems or employing U.S. technologies.

International Investment and Business Relationships

Some observers worry about the potential loss of key U.S. domestic defense industrial skills as a result of the offshore relocation of development and manufacturing facilities by foreign investors in U.S. defense businesses (Denoon, 1979). Most, however, agree with DSB (1999), which argues that the United States is more likely to gain needed skills from foreign investment, as foreign investors usually seek to establish an industrial presence in the United States in order to penetrate the U.S. market. Nevertheless, there are at least two reasons a foreign firm might purchase U.S. manufacturing facilities and then relocate them abroad: to obtain technology or to shut down a competitor. Although such actions are certainly not typical, GAO (September 2000, p. 12) cites the case of a European firm that purchased two U.S. firms, closed their operations, and moved specialized hardware and software to its European facility. One goal of the CFIUS approval process, discussed at greater length in the chapter that follows, is to prevent this from happening in the defense sector.

A more serious concern for the Air Force is whether foreign owners will run their U.S. operations like “real” American firms.\(^{15}\) Will they be as responsive to Air Force needs as their U.S.-owned counterparts during a national emergency as well as during peacetime? Will they be less likely to engage in militarily important activities? With re-

\(^{15}\)To some extent, this concern may also apply to joint ventures, but likely less so because of U.S. firms’ participation.
spect to the first question, Neu and Wolf’s (1994) review of the empirical literature suggests that there is no evidence of systematic differences in behavior between U.S.-owned and foreign-owned firms during peacetime. Also in a peacetime context, DSB (1999, p. 21) argues that “[i]n cases where DoD is the sole consumer of a particular product, it is likely to retain the same influence over the foreign supplier as it does over the U.S. contractor.” In general, supplier responsiveness to DoD during peacetime is probably influenced more by the relative size of DoD contracts than by the nationality of the supplier.

Nevertheless, according to Moran (1993, p. 44), “[h]istory is full of attempts by governments to influence the sovereign activities of other nations by withholding supplies or issuing extraterritorial directives to the overseas affiliates of domestic firms.” Moran provides several examples: U.S. attempts in the 1960s to prevent a French subsidiary of IBM from selling computer technology that might have aided France’s nuclear program; the Reagan administration’s retroactive order to the European subsidiaries of Dresser Industries and General Electric to cancel contracts for supplying gas pipeline technology to the Soviet Union; and the Japanese government’s refusal to allow Dexcel, the U.S. subsidiary of Kyocera, to provide advanced ceramic technology to the U.S. Navy’s Tomahawk missile program. As pointed out by Moran (1993, p. 45), the credible threat of denial or manipulation “leads to legitimate national security exceptions to liberal doctrines of free trade and investment.”

Understandably, there is little empirical evidence to support conjectures about foreign supplier responsiveness during national emergencies simply because there have been so few. Under U.S. law, the President has the power to require that contracts in support of the national defense be accepted and performed on a preferential or priority basis over all other contracts (FAR Part 11.602). This means that foreign as well as U.S. domestic primes and subcontractors—including the U.S. subsidiaries of foreign firms—on authorized military programs may be required to drop other commitments in order to meet DoD demands. However, suppliers not connected with authorized programs have no such obligation.

A second question is whether the U.S. subsidiaries of foreign firms will be less likely to engage in militarily important activities. This is
clearly most relevant in cases where U.S. firms already conducting militarily sensitive activities are purchased by foreign interests. Are such activities likely to be stopped once ownership changes hands? As described in more detail in the next chapter, all foreign purchases of U.S. firms are subject to review by CFIUS, a government committee set up to monitor and evaluate new foreign direct investment. If a particular acquisition or merger is perceived to have the potential to threaten U.S. capability and capacity to meet the requirements of national security, the transaction may be disallowed, even retroactively. The question, therefore, is not so much whether foreign-owned firms are likely to engage in militarily important activities but rather whether they should be allowed to do so.16

Finally, the growth in cross-border investment flows and related business tie-ups has prompted legitimate concerns about the growing potential for undesirable overseas transfers of dual-use and military technologies. In fact, as is now frequently seen in the commercial aerospace sector, even “conventional” prime/subcontractor relationships are no longer conventional in that they often involve much more significant sharing of concepts, design elements, and technologies than was the case in the past.17 The very quality that is likely to make relationships such as teams and marketing arrangements most successful from the standpoint of economic and coalition warfighting benefits—a high degree of technology transfer—also poses the greatest challenges.

CONCLUSION

In sum, deeper economic integration and ensuing technology transfer is likely to be a double-edged sword for the Air Force: On the one hand, globalization presents an opportunity to enhance interoperability and strengthen coalitions, but on the other hand it poses significant security challenges. Overall, aerospace globalization is likely to promote important economic objectives such as lower

16They might be less interested in engaging in such activities if there were no compensating returns. Although addressing slightly different questions, Neu and Wolf (1994, p. 45) find “no evidence of systematic differences in behavior” between U.S.-owned and foreign-owned firms in the United States.

17See Lorell et al. (2000).
prices, higher quality, and increased innovation. Many different types of cross-border business relationships can help the industry realize those gains. For example, business partnerships such as marketing arrangements or international teams can help firms gain access to otherwise blocked markets, thereby achieving greater economies of scale. Even cross-border business relationships that target national programs may, almost inadvertently, promote interoperability of equipment.

On the demand side, formal collaborative purchase agreements between national governments—which may involve firms of different nationalities working together through joint ventures, teams, government-initiated work share arrangements, or various types of subcontract arrangements—expand markets as well, spreading production and sometimes RDT&E costs over a broader sales base. These business partnerships can also achieve important political-military objectives, such as enhancing interoperability and strengthening allied coalitions. They may also reduce costs, especially if they are industry-initiated.

However, there are also some economic, political-military, and national security–related hazards associated with globalization. For example, close cross-border business relationships, like close domestic business relationships, may serve to consolidate market power, thereby diminishing competitive incentives to reduce costs and to innovate. With respect to national security, ongoing economic integration may make it harder to control the spread of weapons and technology beyond our borders and those of our allies.

In the end, the key to success for any cross-border business relationship involving the United States as well as the larger NATO European countries, such as France, Germany, Italy, and the UK, will be the extent to which that relationship results in greater cooperative participation in design and development than would have been possible or practical in a world in which one slate of purely national firms competes against another. The legal, regulatory, and policy framework that governs the formation of such relationships is the subject of the following chapter.