CAPTURING FORTRESS EUROPE:

INTERNATIONAL COLLABORATION AND THE

JOINT STRIKE FIGHTER

Ethan B. Kapstein

INSEAD

Blvd. De Constance

77305 Fontainebleau Cedex France

ethan.kapstein@insead.edu

June 2005

For presentation to the NBER Summer Institute on Economics and National Security

Ethan B. Kapstein is Paul Dubrule Professor of Sustainable Development at INSEAD, a Research Associate at the French Institute for International Relations, and a Transatlantic Fellow of the German Marshall Fund of the United States. He wishes to thank the German Marshall Fund of the United States for its support of this project, and Dana Allin, Alex Nicoll, Barry Posen, Kareem Saleh, Cindy Williams, and seminar participants at Harvard Business School, the Czech Institute for International Affairs, the Italian Institute for International Affairs, and the Spanish Institute for International Affairs, for their comments on early drafts.

SUMMARY

Why did the U.S. Department of Defense take the route of international collaboration in developing and building its most advanced fighter aircraft, the Joint Strike Fighter (JSF)? And what are the economic and security implications associated with that decision? These are the questions I address in this paper. Briefly, I argue that international collaboration offered a way to ensure that the JSF would win foreign market share, particularly in Western Europe—markets that were deemed critical to the financial health of the American defense industrial base, with the sharply falling weapons procurement budgets of the 1990s. The price of capturing those markets, however, could be high in terms of work-share and technology transfer to foreign industries and governments. The costs and benefits of international arms collaboration need to be subject to more intensive policy analysis and public debate.

CAPTURING FORTRESS EUROPE: INTERNATIONAL COLLABORATION AND THE JOINT STRIKE FIGHTER

On October 26, 2001, U.S. Secretary of the Air Force James Roche announced the largest weapons acquisition contract in Pentagon history: the award for building the multi-service Joint Strike Fighter (JSF). The winner of the contest, following a five-year competition or "Concept Development Phase" (CDP), was Lockheed Martin Corporation, and its potential value has been estimated at over $200 billion, depending upon the number of planes that are actually built over the program's lifetime. In addition to Lockheed Martin, the JSF program also included a complex set of foreign partnership arrangements, which enabled friends and allies to influence the design of the aircraft, to bid for sub-contracts, and ultimately to buy the finished product. The JSF thus became the Pentagon's first cutting-edge acquisition program to be co-developed and co-produced by the United States in co-operation with foreign governments and industries.[1]

In adopting this collaborative approach, the Pentagon rejected calls, going back to the JSF's earliest days on the drawing board, that foreign participation in the program be strictly limited. To be sure, in 1994 a Defense Science Board task force had argued that the plane should be built with the "foreign market in mind," meaning that an export-oriented version might be developed in order to lengthen production runs, thereby reducing the average cost of each unit.[2] With respect to foreign participation in the actual design and production of the

aircraft, however, the DSB warned "*co-development should be minimized*," (italics added) in order to avoid all the complications that international collaboration would inevitably bring, including thorny technology transfer issues, greater management complexity, and the overruns in time and money that resolving these and other problems must create.[3]

Despite the DSB's advice, why has the Pentagon gone ahead and followed the route of international collaboration in developing and building the Joint Strike Fighter? And what are the economic and security implications associated with that decision, which could involve transferring some of America's most advanced defense technology? These are the questions I address in this paper.

Briefly, I argue that international collaboration provided a strategy for ensuring that the JSF would win foreign market share in Western Europe and elsewhere—markets that were deemed critical to the financial health of the American defense industrial base at a time of sharply falling domestic procurement budgets during the 1990s, following the end of the Cold War. The Pentagon and its contractors may have preferred to export the JSF "off-the-shelf" as the Defense Science Board had urged, but by the mid-1990s, that prospect looked increasingly dim. The Europeans were building three jet fighters themselves, namely the multinational *Eurofighter*, the French *Rafale*, and the Swedish *Gripen*. The European defense-industrial base was also in the midst of a major restructuring effort which was leading to the formation of a small number of big, trans-national firms, while the European Union was slowly beginning to articulate a more coordinated approach to defense acquisition.[4] All these developments raised fears in Washington that a "Fortress Europe" was being built, which would lock-out American weaponry.[5]

The Pentagon and its defense contractors therefore had to devise an industrial strategy for capturing the European market at this critical time.[6] That strategy was to offer foreign partners something of a Trojan Horse, as JSF would enter European (among other) arsenals

through co-development and co-production of the plane with local governments and firms, enticing them with the economic and technological benefits that international collaboration with the United States would bring.[7] Indeed, one of the elements of genius in the JSF's program design was to create strong domestic industrial support for the project in target markets, since local industries and workers would have so much to gain from participation. JSF's promise of creating jobs and transferring technology, in turn, made the plane attractive to politicians who had to vote the funds for its procurement. It is in the true political economy sense of the term "capture"—meaning the ability of strong economic lobbies to capture government decision-making—that JSF entered foreign markets.

The paper is in three sections. In the first section, I provide some background on the JSF program. In the second, I examine its complex international structure and offer an explanation for it, which emphasizes the interplay of government and industrial interests in shaping defense procurement strategies. The third section concludes with observations for public policy, focusing on the implications of international armaments collaboration for the proliferation of advanced defense technology.

Planning the Joint Strike Fighter

During the early 1990s, the Department of Defense faced a major acquisition headache when it came to military aircraft. The Air Force's A-10s and F-16s, the Navy's F/A-18E/Fs, and the Marine Corps's AV-8Bs and F/A-18A/C/Ds, were all facing the end of their operational lives, and replacements would soon be required. Anticipating these developments, the Air Force and Navy had already launched four new tactical aircraft programs—the F-22, F/A-18E/F, the AFX stealth fighter (a joint Air Force-Navy project), and the Multi-Role Fighter (MRF)—while the Navy had tasked the Defense Advanced Research Projects Agency

(DARPA) to examine designs for a new Short Takeoff and Vertical Landing (STOVL) platform that could replace the Marine Corps' AV-8Bs.[8]

But the timing for launching a series of major new weapons programs could not have been worse. The end of the Cold War had brought about sharp reductions in the defense budget, and this meant it would be impossible for each of the services to develop and purchase the new aircraft they sought. Coming to office in 1993, the Clinton Administration had quickly launched a "Bottom Up Review" of U.S. military strategy and its associated budgetary requirements, and the President sought total savings of $112 billion from the Pentagon during Fiscal Years 1994-1998.[9]

The Administration determined that "future budgets could not sustain new aircraft development programs for both the U.S. Air Force and the Navy, much less for the Marine Corps."[10] Between 1994-2000, the defense procurement budget alone fell by over $30 billion or some 37 percent, and total defense aerospace purchases fell by a similar percentage. These cuts resulted in the termination of the AFX and MRF programs with the FY 1995 defense budget, and sharp reductions in F-22 and F/A-18E/F procurement levels. More dramatically, reductions in defense spending led to a radical shrinking in the number of American prime defense contractors. During the 1990s, the number of aerospace firms competing for prime contracts from the Pentagon would shrink from six to three (i.e. Lockheed Martin, Boeing, and Northrop Grumman). And because of these cuts, defense exports assumed extraordinary importance to the firms that remained.

TABLE 1 About Here

Given this budgetary environment, in 1994 the Pentagon began to study the possibility of building a single "joint" advanced strike aircraft, which would provide the Air Force and Navy with their main fighter platform for the first part of the 21st century. That plane would likely become the last manned fighter aircraft that the United States would ever build. It

would be a complex program, in that it would have to meet the myriad fighter requirements of the two services, one of which relied on aircraft carriers to provide runways (the Marine Corps would only enter the program later, as we will see below). This unique platform, originally labeled Joint Advanced Strike Technology (JAST), eventually became known in 1995 as the Joint Strike Fighter (JSF).[11]

The Pentagon's decision to build a single fighter for the Air Force and Navy was not without its detractors. In 1996, Principal Deputy Under Secretary of Defense Noel Longuemare recalled his initial doubts about the proposal. "We've tried this before," he said. "The TFX program (of the 1960s) attempted to build a universal airplane that did everybody's job and wound up doing everybody's job poorly." Even the Air Force general put in charge of the JAST program office, George Muellner, stated "I was skeptical..." [12] In an interview with James Fallows of *The Atlantic Monthly*, he recalled telling Pentagon leaders: "I have to be honest—I really don't want to lead this program. I have some real misgivings about its likelihood of success." He noted that the program was "resented by all the military services," particularly at a time when many of their own procurement projects were being cut by the Secretary of Defense.[13]

As with every weapons acquisition program, JAST/JSF would be shaped by multiple political, military, financial, industrial, and technological factors and objectives. Politically, the new plane had to win friends in Congress in order to keep the procurement program on track over the many years and billions of dollars it would take to develop and build the airplane. Militarily, it had to meet multi-service requirements for a stealthy aircraft that could deliver precision weapons into high threat areas. Financially, it had to be produced under severe cost constraints, given the pressures on the procurement budget. Industrially, it had to provide enough work to maintain core competencies in the American defense-aerospace

sector. And technologically, it was expected to incorporate cutting-edge propulsion, avionics, and weapons systems into a composite structure airframe.[14]

On top of these programmatic influences, JAST was expected to incorporate another element into its design. As already noted, a 1994 Defense Science Board (DSB) report urged that the new aircraft should be developed "with the foreign market in mind."[15] To the DSB, this meant building a version of the plane that could be easily exported to foreign customers, along the lines of the fabulously successful F-16. That export-orientation was primarily driven by economic considerations, since foreign sales would permit longer production runs, resulting in a lower cost per aircraft as learning curve effects and economies of scale were realized.[16]

While the DSB actively encouraged exports, it did *not* want to see the JAST aircraft co-developed and co-produced with foreign partners. Collaborative armaments programs that involved one or more foreign nations inevitably resulted in a "suboptimal division of labor," a more complicated set of program requirements, and a more complex management structure. There were also difficult technology transfer issues that would have to be resolved. For all these reasons, "The Task Force concluded that foreign participation in co-development of next-generation strike fighters...would complicate the program to the point of reducing the probability of success."[17]

The DSB view on international collaboration was in line with initial Pentagon thinking about the plane back in the JAST program office. Even at this early development stage, it appeared likely that any future strike weapons system would contain a host of highly sensitive technologies, including low observables (stealthiness) and an advanced core engine system. As a result, the technology transfer issues alone would probably mean that deeper foreign collaboration on the project was doomed. Accordingly, JAST managers did not pursue foreign partnerships at this time.[18]

But a major turning point for the JAST program occurred in late 1994, when it was ordered by Congress to incorporate a Short Take-off and Vertical Landing (STOVL) capability that could be used by the Marine Corps and British Royal Navy as a replacement for their aging *Harriers*.[19] This Congressional decision was apparently made after heavy lobbying from the Marine Corps, which feared that it would lack a new fighter once the AV-8B was retired from service.[20] The Royal Navy shared a similar set of concerns with the British Government, which had already committed to buying the *Eurofighter* and was unlikely to fund a *Harrier* replacement. If the Marine Corps and Royal Navy were to get a new aircraft, therefore, it would have to be a version of the JAST, soon to be renamed as JSF.[21]

Given this shared interest in a future STOVL aircraft, on 20 December 1995, "the US and UK governments signed a memorandum of understanding (MOU) on British participation in the JSF program as a collaborative partner in the definition of requirements and aircraft design."[22] Under the MOU, the British agreed to contribute $200 million towards the cost of the 1997-2001 Concept Development Phase (CDP) of the project—the phase that consisted of a design competition among the rival firms, with the ultimate prize being the contract for building the plane. Since the British Government's commitment was on the order of 10 percent of the total CDP cost of 2 billion dollars, it naturally expected its nation's firms to reap their fair share of the development contracts awarded, and indeed BAE (the former British Aerospace) would be among the major subcontractors of the American primes (initially McDonnell Douglas, Boeing, and Lockheed Martin) that were competing to build the aircraft.

For Britain, JSF represented something of a windfall: a relatively inexpensive way of purchasing a new STOVL capability, while keeping domestic defense industries busy for many years to come (assuming the plane was built). As we will see in the following section, this expectation has been partly fulfilled, although problems over British (and other foreign)

work-share and technology transfer continue to plague the project. The central question that we will address, however, is whether international collaboration, first between the U.S. and U.K., and later with a number of other foreign partners, was even necessary to the successful building of the JSF, with or without a STOVL variant.

Between 1997-2001, two teams led by Boeing and Lockheed Martin vigorously pursued the CDP (an earlier downselect had already eliminated McDonnell-Douglas from the competition). Each company was required to build one conventional takeoff and landing (CTOL) variant of JSF for the Navy and Air Force, and a STOVL variant for the Marine Corps and Royal Navy (the Royal Navy's aircraft carriers have short flight decks which require vertical takeoff and landing capability). Lockheed Martin's JSF architecture represented an incremental or evolutionary improvement over existing platforms (with the exception of its complex STOVL technology), and it adopted a relatively conventional combat aircraft design. Boeing, in contrast, proposed a somewhat more radical, delta-wing jet fighter, and its plane looked rather odd and ungainly to many observers. It was following intensive study of these two programs by the U.S. Department of Defense and the British Defence Procurement Agency that Secretary Roche—alongside British procurement chief Lord Bach—made his October announcement, that Lockheed Martin had won the competition and would take the lead in building the JSF.

With the 2001 decision to build JSF, the airplane has moved into the "Engineering and Manufacturing Design" (EMD) phase of the program. During the EMD the "kinks" in JSF's architecture and production are supposed to get ironed out, while Lockheed Martin and its subcontractors enter into supplier agreements. The cost of this EMD is estimated at 20 billion dollars, and again the British Government has committed approximately ten percent of that amount. As a consequence, British firms expect to receive at least 10 percent of the work-share, including substantial technology transfer.[23] Whether Lockheed Martin and the United

States government will carry-through in fulfilling the hopes of friends and allies for work and for technology remains one of the crucial questions surrounding the entire JSF program, as I will discuss in the following section.

Why Collaborate?

The JSF is the first cutting-edge weapons platform procured by the Pentagon which relies on significant foreign participation in every aspect of the program, including financing, design, and project management.[24] During the CDP, the Pentagon invited foreign governments to seek participation at one of four levels: (1) Full Collaborative Partner; (2) Associate Partner; (3) Informed Partner; (4) Foreign Military Sales (FMS) Major Participant. Only the United Kingdom qualified as a full collaborative partner, with deep involvement in every aspect of the program. The Associate Partners included Denmark, the Netherlands, and Norway, all of which had participated in F-16 licensed co-production, an airplane that was approaching the end of its useful life. Naturally, having established an aerospace infrastructure to build F-16s, these governments and their defense contractors wanted to keep the lines busy in years ahead, and their firms hope to win contracts for the JSF as well. Thus far, however, they have been disappointed by their amount of work-share, leading the Norwegian parliament in April 2004 to threaten abandoning the program.[25] Canada and Italy joined as Informed Partners, meaning that they had minimal voice in setting requirements, but would still expect to receive work-share in return for buying the plane. Accordingly, several Canadian defense firms have won sub-contracts on JSF, and Italy, bargaining hard, even won the option to consider assembling its variant of the JSF in a domestic factory.[26] Still, Italy's Finmeccanica has "expressed concern" about the contracting process and its participation.[27] Finally, the three initial FMS partners for JSF include Turkey, Singapore, and Israel, again all

of which had F-16s in their arsenals, and again all of which were looking for JSF contract work.[28]

Why did the United States adopt this complex, multi-tiered structure of foreign participation during the JSF's Concept Development Phase? The conventional wisdom, as reported for example by the RAND Corporation, suggests that "Foreign government and industry participation have been included for the following reasons: to enhance equipment interoperability with allies, to promote foreign acquisition of the aircraft, to share the financial burden of development and production, and to gain access to unique technologies and capabilities from key allies."[29] All these factors undoubtedly *were* influential in shaping the program, but the question we must now raise concerns which ones were paramount in making the JSF a collaborative venture—rather than, say, simply an off-the-shelf export item—in light of the high costs that are also associated with foreign participation in the design and building of a cutting-edge weapons system.

Let us begin by assessing the interoperability argument, which is probably the longest-standing argument that one can find for armaments collaboration among allies. Indeed, ever since its inception in 1949, the North Atlantic Treaty Organization has sought to transform its national collection of weapons into a unified force.[30] That effort has largely proved elusive, as the allies continue to pursue their own idiosyncratic approaches to defense procurement.

In thinking about the issue of interoperability, it is useful to recall that it can mean one of four quite different things: *complimentarity* (country X provides the navy for an operation, country Y the air force); *commonality* (X and Y operate identical platforms); *interchangeability* (X can substitute its *F-16's* for Y's *Rafale's*); and *compatability* (X's air-based radars can communicate with Y's ground-based radars). As we can see, a country could rationally promote interoperability that does not involve platform or hardware commonality. For various reasons, countries may prefer to build their own nationally designed weapons

systems, even though they may attach some value to making them "interoperable" with those of allies. In short, interoperability arguments that are based on the necessity of platform commonality are overblown, particularly when the allies retain different communications, intelligence, and weapons systems.

Second, let us consider the technological argument for international collaboration: that it provides a mechanism for giving the United States access to foreign defense technology that government and industry otherwise lack. This view has become widespread in recent years, and is often associated with the so-called "globalization" of the defense-industrial base.[31] But this argument raises two separate questions: first, is the United States really becoming increasingly dependent on the international economy for access to advanced defense technology? Second, if so, does growing technological dependence necessitate industrial collaboration?

With respect to the first, the U.S. is undoubtedly sourcing more weapons components from abroad, especially so-called "dual-use" items like semi-conductors and other parts that constitute defense systems. Still, the amount is small; for the F/A-18 E/F fighter, for example, foreign contractors constituted less than 1 percent of the plane's total subcontractor cost.[32] At present at least, the U.S. imports very little by way of advanced defense technologies, much less entire platforms. As the Defense Science Board noted in its review of JAST/JSF technology, "Given the position of the U.S. in technology, we are more likely to export technology than to import needed technology. Even in most of the international ventures considered successful, US companies had little need for the foreign partners' technologies."[33]

It is interesting to note in this context that the European Union itself is currently bemoaning the state of the continent's defense-technology base. The EU writes in a recent report that "Europe's innovative performance remains too weak…EU should seek to improve its position in enabling technologies…where it often lags behind its main competitors."[34]

While it is undoubtedly true that EU defense contractors build some excellent platforms, statements like this one help us to see why European and other foreign partners might take a strong interest in American defense technology, while the opposite effect is only slight.[35]

But even if the United States did require some foreign technology to make the JSF a success, was it really necessary to develop the plane collaboratively in order to acquire it? With the AV-8B, for example, the United States licensed the STOVL technology from British Aerospace, which McDonnell Douglas then substantially modified to meet Marine Corps requirements. The AV-8B, with its STOVL capability, is probably the single most important case of the Pentagon relying on foreign technology in any major procurement program, yet it did not co-develop or co-produce the plane with the United Kingdom as a result; it simply bought a license for the technology it wanted. Why didn't it do so with JSF as well, if indeed the British or others had advanced technology to contribute?

This leaves us with the two economic arguments for international collaboration, one of which emphasizes risk-sharing among a group of partners, the other of which emphasizes foreign acquisition of the platform. As I will argue, it is the latter which provided the "winning argument" with respect to JSF.

The idea of risk-sharing simply suggests that an investor may be willing to share some of the potential gains associated with a project alongside others who are willing to assume part of its costs and any potential losses. For a defense firm, an investment in a project like JSF could be a "make or break it" proposition. If, for example, the United States government decided to terminate the JSF before production started, it could potentially bankrupt its manufacturer, given the fixed investments that it had to make in plant, equipment, and so forth. Indeed, McDonnell-Douglas invested so heavily in its bid for the JSF contract during the earliest selection stage (before the downselect to Boeing and Lockheed Martin), that the firm lost its independence and accepted a subsequent merger with Boeing. At a time when

U.S. defense procurement budgets were being slashed by Congress and any number of programs were at risk, broad financial participation in the program would provide a powerful risk management device, a way to reduce Pentagon and contractor losses if the project failed.

But does that mean *foreign* participation in the project was necessary? After all, the Pentagon could have decided to allow Lockheed Martin and Boeing—as opposed to Lockheed Martin and British Aerospace—to share the JSF contract, rather than running the competition as a "winner take all" exercise. Indeed, it appears that Boeing expected that it would receive some of the contract even after losing the CDP, for this very risk-sharing reason.

To be sure, foreign risk-sharing implies financial contributions from other *governments*, limiting the Pentagon's direct investment in the project. That participation could be especially valuable at a time of sharply reduced domestic procurement budgets. But as we will see below, those contributions have to be weighed against the costs, potentially quite heavy, associated with them.

However, foreign collaboration can be seen as a risk-sharing device not only economically, but even more to the point, *politically*. After all, a risk that every Pentagon acquisition manager and defense-industrial executive faces is that Congress will axe their program. This makes it prudent for firms to invest in political strategies like lobbying to keep projects alive. It is in this context that foreign participation could prove useful. Simply stated, the political costs associated with cutting an international program could prove higher than those associated with terminating a solely domestic platform, given the foreign policy externalities—the problems created with friends and allies—which would be associated with that decision. If the United States ended a collaborative venture like JSF, friends and allies would question its credibility as a defense partner, and would be more likely to develop national or other international approaches to weapons procurement. These "costs" of program

termination would also have to be calculated by Pentagon and Congress as the weapon's future was being debated.

But even if we assume that foreign participation makes it harder to cut a program, the price of that collaboration must not be overlooked. By co-developing and co-producing a weapons program, foreign partners might gain significant leverage over the Pentagon and its American defense contractors, by exploiting the classic "hold-up" problem of industrial organization. If a foreign partner is making, say, the tail of the JSF, it can "hold up" the prime contractor for more money, technology, work-share, and so forth, refusing to deliver its part of the plane until its demands are met, thereby slowing or halting the production process. Using foreign collaboration as a risk-sharing device is, therefore, a two-edge sword at best.

We finally turn to the issue of foreign acquisition of a platform, and here is where we get to the nub of the problem. Historically, the United States has shown itself more than willing to export its weapons to friends and allies around the world. These items are usually outdated, or they are variants of systems in the American arsenal, like the F-16. Export sales are often financed through the Pentagon's Foreign Military Sales (FMS) assistance program, which provides loans for such purchases.

While export sales are usually justified in terms of national security and foreign policy objectives, their economic appeal should not be overlooked. For the Pentagon and its defense contractors, exports provide a useful way of reducing the average cost per unit of a platform. If a firm can build 3,000 jet fighters instead of half that number, there are likely to be important learning curve and economies of scale effects that will lead to lower costs. The lower costs, in turn, are attractive to the Pentagon, which can make more efficient use of scarce procurement dollars, and to firms that are likely to find high profits in selling an additional unit of a platform. Exports, then, are probably the preferred or "first-best" way of selling weapons to foreign partners.

But countries often do not wish to import their weapons "off-the-shelf," because they prefer to maintain some autonomous defense-industrial capability. Indeed, as the European members of NATO revived their defense-industries following the end of the Second World War, reliance on American imports became less compelling to them. Between 1953 and 1964, for example, U.S. defense exports to NATO-Europe fell from $15 billion to $3.3 billion.[36] In order to win sales in an increasingly competitive market, the Pentagon and its contractors therefore offered licensed co-production (but not co-development) of weaponry, which gave the Europeans who so chose access to American production technology, while allowing them to maintain or even upgrade their own domestic defense industrial base, along with the jobs that local production created. This strategy of licensed co-production probably reached its zenith with the 1975 agreement between General Dynamics and four European Participating Governments (Belgium, Denmark, the Netherlands, and Norway) to build the F-16 lightweight fighter aircraft, an agreement that became known as the "Deal of the Century."[37]

By the time the JSF was on the drawing board in the 1990s, however, the economic environment for American defense firms was proving more difficult. Budget cuts around the world were reducing demand for military hardware, creating a "buyer's market." At the same time, European governments were committed to producing three new fighter aircraft, including the Swedish *Gripen*, the French *Rafale*, and the multinational *Eurofighter* (a collaboration among Britain, Germany, Italy and Spain). Many of Europe's leading defense firms, which had long been state-owned enterprises, were now being privatized by governments, and their senior management was adopting a commercial logic to weapons development and acquisition. Recognizing that national markets were too small if their firms were to survive, they carried out a spate of mergers and acquisitions that resulted in the creation of large, trans-national defense enterprises, like Britain's BAe and the Franco-German firm EADS, that nearly rivaled the size of their competitors in the United States.

The European Union was also slowly putting into place a more coherent approach to defense acquisition, with the creation in 1998 of an Organization for Joint Armaments Cooperation, known as OCCAR.[38] As defense analyst Gordon Adams remarked of these developments, "there is a pronounced 'fortress Europe' trend emerging in Europe, which is…the most important international market for U.S. defense products and technology."[39] In its internal study of international armaments collaboration, the Defense Science Board noted the "dangers of regional consolidations in the defense industry, namely 'Fortress U.S.' and 'Fortress Europe.'"[40] It was this fear of a Fortress Europe that would keep American defense firms and their weapons out of the market that provided the strongest impetus for international collaboration on the Joint Strike Fighter program.

The criticality of foreign acquisition and defense exports to the financial health of the American aerospace industry during the 1990s cannot be minimized. Defense exports rose from 22 percent of total defense-aerospace sales in 1994 to 37 percent in 2000, slipping from a peak of 44 percent in 1998. According to two close students of American defense exports, "In 1995 the Clinton Administration explicitly recognized the economic health of the U.S. arms industry as a criterion to be considered in evaluating arms sales."[41] Arms sales became so significant to the industry that a Clinton-era Pentagon official, Kenneth Flamm, would write in 1997 that "the United States today is in an...arms race with itself..."[42]

The Clinton Administration responded aggressively to the industry's need for political and economic support in its quest for foreign markets. First, the Administration used the Office of the President and the network of State Department embassies to help sell defense hardware. Second, reviews of export licenses were expected to consider consequences for the defense-industrial base if approvals were not forthcoming. Third, and of great significance, the Department of Defense agreed to waive Research and Development (R&D) recoupment charges for foreign military sales, providing export weapons with a direct subsidy—a subsidy

paid for by U.S. taxpayers.[43] Finally, the Foreign Military Sales (FMS) program was provided important additional financial support for extending low-interest loans—a program that made possible, for example, Poland's recent decision to purchase the F-16 from the United States over other competitors including the Swedish *Gripen* and French *Mirage*. According to Peter Evans, between 1992-2001 the United States sold $143 billion worth of arms, financing $39 billion through FMS while selling another $82 billion for cash through that program (the rest of the sales were made commercially without U.S. Government involvement).[44]

The greatest potential for capturing European markets, however, was found in the JSF program—potentially the largest weapons acquisition program in history. If the question facing the American defense industry was how to avoid being shut-out of a Fortress Europe, off-the-shelf exports did not provide a compelling long-term answer, especially in light of the veritable fighter glut that the continent was now facing. The challenge, then, was to devise a political-economic strategy for "locking-in" at least some European governments so that their dependence on American weaponry would continue for many years to come. The solution was found in co-development and co-production of the most advanced aircraft that the United States had ever built. As it was structured, the JSF project would provide foreign partners with a windfall opportunity to acquire American defense technology, while promoting aerospace-related jobs at home.

In order to understand the appeal of JSF and international collaboration to potential buyers, we need to consider a state's procurement choices. In building a stock of weapons, nations can choose either to allocate scarce resources towards domestic defense procurement, or they can import arms from friends and allies—or some combination of the two. All things being equal, domestic "arming" might be assumed to produce, as James Morrow has written, "a more reliable improvement in security," but at great cost, while the strategy of relying on allies through weapons imports produces "additional security quickly but with less

reliability."[45] States would thus seem to face a stark trade-off between defense autarky, which is expensive, and dependence on imports, which is risky. Interestingly, Morrow does not take up the third possibility, namely international armaments collaboration, in which two or more partners co-develop and/or co-produce a weapons system. Is it possible that international collaboration brings buyers the best of both worlds, a "third way" between autonomy on the one hand and foreign dependence on weaponry on the other?

National solutions to the problem of acquiring costly, high-technology defense goods depend upon the availability of two key resources: technological and financial assets.[46] Building on Morrow's realist logic, one might argue that states would always prefer to be autonomous in weapons research, development and production, but they are impeded from doing so by their inability to mobilize the necessary assets. Relying on imports, in contrast, is the least-preferred strategy, since it makes the state dependent on foreign sources for vital military supplies; supplies that might be easily cut-off during a conflict. In this respect it is notable that even some of the smaller NATO allies like Denmark and the Netherlands have sought to maintain a defense-industrial capability through national means and licensed co-production from abroad. Co-development and co-production are therefore what economists would call "second-best" solutions, in that they enable the state to continue building weapons domestically while obtaining precious military technology, if only in collaboration with foreign partners.

Co-development and co-production of sophisticated weapons systems can also bring important economic and technological benefits to recipient nations, and in so doing create an industrial lobby within foreign nations for such programs, which then pressure their governments to provide procurement funds. It is in this sense that we can think of the JSF as a "Trojan Horse," entering foreign markets with the promise of job creation and technology transfer.

During the Concept Development Phase of JSF, for example, Lockheed Martin and Boeing each relied on at least seven British defense sub-contractors in addition to British Aerospace; indeed there was considerable overlap among the subcontractors so that *they* would win no matter which American prime contractor was chosen to head the production phase! By putting foreign contractors on the design and development team, it would be more likely that their national governments would buy the JSF, if only for its job-creating properties. Lockheed Martin stressed that "In the United Kingdom alone...the JSF team will create approximately 3,400 jobs during System Design and Development; and during the 30 years production and support phase 8,400 direct, and many thousands indirect, long term, highly skilled, highly paid jobs will be created." The British defense procurement minister, Lord Bach, remarked that Britain's participation in the JSF program was "a major benefit both to Britain's Armed Forces *and* British Industry (italics added)."[47]

The United States also successfully wooed Italian participation in JSF through the lure of industrial contracts. During the negotiations, "Lockheed capitulated" on the role Italian engineers would play in the program, and on a commitment to assemble the plane there. In return for these commitments, the Italian government agreed to invest $1 billion in the JSF program.[48] As already noted, companies in Australia, Canada, and Denmark among others have also won or been promised JSF contracts.

As the RAND Corporation explained these industrial pressures during the CDP, "Both of the competing prime contractors recognize the importance of including significant industrial participation on their teams representing the countries that are participants in the Concept Development Phase and that are likely to play a major role in...production. Both prime contractors recognize that they would be politically at a competitive disadvantage in the downselect if their teams did not include equitable industrial representation from the key

foreign government participants in the program—particularly the United Kingdom, since the UK formally has been granted a position of influence over the final downselect."[49]

Indeed, the pressure on Lockheed Martin and Boeing to win the JSF contest was so great—it is perhaps the last competitively awarded contract for manned combat aircraft in American history[50]--that it resulted in a perverse outcome: the promise of more subcontract work to foreign firms than was proportional to the amount of the foreign government's contribution. In other words, in a traditional collaborative program, if Britain pledged 10 percent towards a weapon's development costs, its firms would be expected to receive 10 percent of the business as their "fair share." Given the intensive nature of the JSF competition, however, and the strong desire to sell the aircraft overseas, foreign firms may end up receiving more than the government's participatory contribution. Estimates suggest, for example, that BAE alone could obtain nearly one-quarter of the value of JSF's initial production contract.[51] This, of course, made the JSF even more inviting to foreign participants.[52]

Despite the appeal of co-production and co-development from an economic and security standpoint, however, in practice such programs have proved difficult to execute. Thus far, JSF appears to be no different from many other collaborative projects in the struggles it is facing. This approach to weapons procurement complicates project management for several reasons.

First, international collaboration requires that states and firms commit to building a common platform according to an agreed upon division of labor. They must then follow-through on that commitment by producing their part of the collective project on time and within a specified budget. But it may take 10 years or longer to go from basic research and development to prototype construction, and any number of variables could change during this time-period that would influence the program's likelihood of successful completion. Firms

may go bankrupt or simply fail to meet the technological challenges they face. A year 2000 General Accounting Office report on the development phase of the JSF project, for example, cast doubt upon the ability of the contractors to meet their technological targets on time and on budget, and urged the program be delayed and its technological demands revisited.[53] Some analysts, for example, have urged that the now-overweight and over-budget JSF simply drop its STOVL design.

Second, defense procurement budgets can fluctuate owing to changes in a country's economic and security environment, and the state's commitment to acquire a platform may be cancelled or reduced as a result. Europe's multinational *Eurofighter*, for example, has been plagued by frequent changes in orders—and thus of program costs—chiefly due to indecision in Germany over how many of the planes it wants to buy.[54] In the United States, the annual defense appropriation process means that weapons procurement decisions and budgets can always be revisited. Again, the JSF program has already been plagued by threats of budget cutbacks from Congress, and even the military services are reconsidering their own commitment to the project. This risk of cutting JSF, in turn, spills-over to foreign partners, who are now wonder about their own investment in the project and whether it will even moe forward to completion.[55]

Third, as previously noted, co-development requires the resolution of difficult technology transfer issues.[56] While the United States Department of State has taken a series of policy actions designed to facilitate technology transfer to friends and allies (an initiative known as the Defense Trade Security Initiative (DSTI)), especially with the JSF program in mind, Under Secretary of State Lincoln Bloomfield has recognized that it has only met with "mixed results," particularly in light of tightening technology controls in the wake of the 9/11 terrorist attacks.[57] Even the closest of allies, the U.S. and U.K., are facing ongoing difficulties

with technology transfer issues on JSF, creating tensions with respect to this collaborative venture.[58]

Fourth, international collaboration necessarily involves "incomplete contracts" that are constantly being re-negotiated. As already noted, when country X is making the tail of the aircraft it can "hold up" its partners for more money and more work, or else threaten the project's viability. This leads to new rounds of negotiation between governments, primes, and sub-contractors. I have already noted that several countries have expressed dissatisfaction with their slice of the JSF pie and have threatened cancellation of their orders. If domestic political pressures in the United States Congress, say, demand that American-based companies get more work at the expense of foreign firms, that could doom JSF, at least as an international program.

In short, international collaboration in the JSF program was primarily driven by an American concern with capturing foreign market share at a time when domestic defense procurement budgets in the United States were rapidly falling. Given the changing structure of the arms business, particularly in Western Europe, American firms became worried that they would no longer be able to export their weapons "off-the-shelf" or have the kits assembled abroad as they had done so successfully with the F-16. Now, buyers were demanding advanced technology as the price of their purchase. The industrial structure of the JSF program is a reflection of those market realities. Whether the program will succeed remains an open question given the issues associated with international collaboration that we have highlighted.

But assuming JSF goes ahead and gets built, we might well ask whether defense planners *should* respond to the financial needs of the industry by promoting international collaboration of advanced weaponry? That is the question I take up in the final section of the paper. As we will see, this strategy rests on a fundamental bargain: that nations that wish to

partner with the United States will control leakage of the defense technology they receive. The theory, then, is that collaboration actually supports and promotes counter-proliferation policies.

Collaboration and Proliferation

Since the end of the Cold War, defense collaboration and exports have grown in importance to American aerospace firms. Because the Pentagon worries about the financial health of its suppliers, it has generally supported this industrial strategy. But what are the security consequences of that policy? The answer to that question largely depends on how foreign governments and firms assess the costs and benefits associated with technology leakage.

Consider the problem facing a foreign partner in a weapons collaboration project like the Joint Strike Fighter. During the process of co-development and co-production, that partner obtains technological knowledge that is costly for "outsiders" (i.e. those outside the project) to obtain. Governments and firms thus come to possess a valuable good. The foreign partner, therefore, has some incentive to incorporate that technology into defense equipment that it can export to the outsiders, reaping all the benefits of that sale. Governments have to determine whether approving such exports over American objections, and the threat of possible sanctions, is profitable. One can readily see that a government which is focused on the short-term, say the next election, may decide to bolster defense jobs today at the risk of American sanctions tomorrow—sanctions, incidentally, that are also costly for the U.S. government to impose, especially on close friends and allies.

For the United States, using collaboration as an extension of its counter-proliferation regime is also a risky strategy, beyond the obvious problems associated with the spread of its technology to friends and allies, and the added containment risks that such diffusion must

bring. Fundamentally, an international collaborative project like JSF may be conceptualized as a defense cartel arrangement. From a security perspective, the cartel's "insiders" benefit from controlling cutting-edge technology, which gives them a military advantage over the "outsiders." From a purely military standpoint, therefore, collaboration might be a useful way of bolstering alliance capabilities.

But how do "outsiders" respond to this state of affairs? One might hope that they would be "defeated" by the prospect of competing against the American-led cartel, and give up their own efforts to develop costly defense technologies, in the way that the Soviet Union was "defeated" by President Ronald Reagan's "Star Wars" program. Alternatively, however, for some countries the incentive to invest even more in advanced weaponry could increase. One could imagine, for example, "outsiders" like China, Russia, India, or even certain European states like France, seeking to maintain advanced military capability in the face of the American-led cartel, perhaps by sharing capabilities with others who are like-minded. In that case, the cartel arrangement has actually provoked outsiders to do more, undermining its potential security benefits.[59]

Theory aside, international collaboration on the Joint Strike Fighter increases the likelihood of dissemination of some of America's most advanced defense technology to countries around the world. As already noted, elements within the U.S. have been uncomfortable with that aspect of the JSF program since its inception, and in a recent report the General Accounting Office warned that the JSF program would "push the boundaries of US disclosure policy."[60] These technology transfer issues and the risks they entail merit public debate.

In considering a fresh policy approach to international defense collaboration that takes seriously the downside risks associated with the proliferation of advanced technology, some basic principles are needed. The first principle should be that subsidies to support arms sales

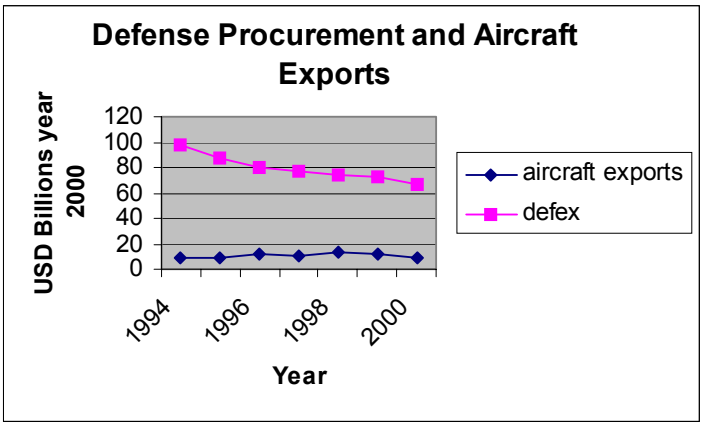
and technology transfer must be eliminated. Subsidies force American taxpayers to foot the bill for defense technologies sold abroad, and provide a windfall to foreign governments and industries, along with an incentive to purchase. If America's friends and allies wish to buy its technology, most of them are wealthy enough to do so without needing a subsidy. Indeed, providing greater economic transparency on international arms collaboration projects (and export sales) more generally is something that all democratically elected governments should adopt.

Second, the United States must make clear the costs associated with violation of its export control laws and regulations. What would happen to a Britain or an Italy if a British or Italian engineer—purposely or inadvertently—divulges critical JSF technology? What sanctions would be imposed in such cases? At present, there is also a remarkable lack of transparency regarding enforcement of the export control regime.

Third, the United States must reconsider its approach to international arms collaboration, recognizing that some of the time-worn arguments for it, like interoperability, are weak or specious. Exports and licensed co-production of weapons systems to friends and allies bring the same or even greater economic and security benefits without the associated costs. Again, the government should explain why it sells weapons the way it does.

In conclusion, the Joint Strike Fighter exemplifies the way in which economic forces have pressed down on military planners and the defense industry since the end of the Cold War. These economic forces have led to new approaches to weapons procurement, including a much heavier reliance by defense contractors on foreign sales of military hardware. As a result, officials and executives on both sides of the Atlantic have shown renewed interest in international armaments collaboration. The costs and benefits of these collaborative arrangements deserve greater policy analysis and public scrutiny then they have received to date.

TABLE 1


Defense Procurement and Aircraft Exports
USD Billions year 2000
120
100
80
60
40
20
0
1994
1996
1998
2000
Year
aircraft exports
defex

Notes

[1] A possible exception is provided by the British Aerospace Harrier aircraft, with its unique Vertical Take-Off and Landing (VTOL) technology. In this case the United States licensed the technology from BAe, but the plane was produced and substantially redesigned for the US Marine Corps by McDonnell-Douglas, and is currently in service as the AV-8B. It is one of the aircraft that the JSF would replace. The US-Japan FSX fighter project, in contrast, involved Japanese purchase of F-16 technology for an aircraft that would only serve the Japan Defense Forces.

[2] Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994), p. ES-7.

[3] Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994), p. 50.

[4] A good overview of these developments is provided in Jean-Paul Hebert, *La Consolidation de l'Europe de l'Armement Face Au Defi Transatlantique* (Paris: Ecole des Hautes Etudes en Sciences Sociales, 2001).

[5] See Dov S. Zakheim, *Towards a Fortress Europe?* (Washington, DC: Center for Strategic and International Studies, November 2000); note that Zakheim had served as Deputy Under Secretary of Defense in the Reagan Administration from 1985-1987, and remained a consultant to the Pentagon after leaving for the private sector. See also The Economist, "Getting it Together?," 20 July 2002.

[6] For a statement of that strategy, see Defense Science Board, *International Armaments Cooperation in an Era of Coalition Security* (Washington, DC: Department of Defense, August 1996).

[7] See General Accounting Office, *Joint Strike Fighter Acquisition: Cooperative Program Needs Greater Oversight to Ensure Goals are Met* (Washington, DC, GAO, July 2003).

[8] See Christopher Bolkcom, *Tactical Aircraft Modernization: Issues for Congress* (Washington, DC: Congressional Research Service, 14 February 2002); on the STOVL program, see DARPA, *JSF: A DARPA Perspective,* nd, downloaded at www.darpa.mil/body/legacy/docs/JSF-DARPAPerspective.doc.

[9] For a thorough analysis of the Bottom Up Review from a budgetary standpoint see Eric V. Larson, David T. Orletsky, and Kristin Leuschner, *Defense Planning in a Decade of Change: Lessons from the Base Force, Bottom-Up Review, and Quadrennial Defense Review*(Santa Monica, Ca: RAND Corporation, 2001).

[10] John Tirpak, "Strike Fighter," *Air Force* 79, 10 (October 1996), downloaded at www.afa.org/magazine/oct1996/1096stri.asp.

[11] Thorough introductions to the JSF program are found in Christopher Bolkcom, *Joint Strike Fighter: Background, Status and Issues* (Washington, DC: Congressional Research Service, 15 February 2002); and John Birkler, et.al., *Assessing Competitive Strategies for the Joint Strike Fighter: Opportunities and Options* (Santa Monica, CA: RAND Corporation, 2001).

[12] Cited in John Tirpak, "Strike Fighter," *Air Force* 79, 10 (October 1996), downloaded at www.afa.org/magazine/oct1996/1096stri.asp.

[13] James Fallows, "Uncle Sam Buys an Airplane," *The Atlantic Monthly*, June 2002, web edition at www.theatlantic.com, p.6.

[14] See Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994).

[15]Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994), p. ES-7.

[16] Interviews with Department of Defense officials, June 2003.

[17] Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994), p. 50.

[18] Interviews with Department of Defense officials, June 2003.
[19] The US and UK had a long history of collaboration on STOVL technology, which officially ended in 1991, only to restart in 1994.
[20] Telephone interview with Department of Defense official, 9 March 2004.
[21] On British involvement, See U.K. Ministry of Defense, Defense Procurement Agency, *Joint Combat Aircraft*, downloaded at http://www.mod.uk/dpa/projects/jca.htm.
[22] Christopher Bolkcom, *Joint Strike Fighter: Background, Status and Issues* (Washington, DC: Congressional Research Service, 15 February 2002), p. 12.
[23] Even though subcontractors are supposed to bid competitively for each part of the project, governments and firms based in foreign partner nations naturally expect to receive their "fair share" of the JSF program, according to how much the government has contributed to the CDP and EMD phases.
[24] European governments, in contrast, have had significant experience with collaborative armaments programs; how much the Pentagon has "learned" from that experience in shaping the JSF project remains unclear. I thank Alex Nicoll for highlighting this point.
[25] Renae Merle, "Norway Threatens to Revoke Support for Strike Fighter," *Washington Post,* 16 April 2004, p. E3.
[26] See Anne Marie Squeo and Daniel Michaels, "US Changes the Rules in High Stakes Venture of Selling Military Jets," *Wall Street Journal* 22 July 2002, p. 1.
[27] Renae Merle, "Norway Threatens to Revoke Support for Strike Fighter," *Washington Post,* 16 April 2004, p. E3.
[28] For a useful introduction to the JSF's international dimension see John Birkler, et.al., *Assessing Competitive Strategies for the Joint Strike Fighter: Opportunities and Options* (Santa Monica, Ca.: RAND Corporation, 2001), pp. 16-19. See also Christopher Bolkcom, *Joint Strike Fighter: Background, Status and Issues* (Washington, DC: Congressional Research Service, 15 February 2002.
[29] John Birkler, et.al., *Assessing Competitive Strategies for the Joint Strike Fighter: Opportunities and Options* (Santa Monica, Ca.: RAND Corporation, 2001), p. 16.
[30] See Ethan B. Kapstein, "International Collaboration in Armaments Production: A Second-Best Solution," *Political Science Quarterly* Winter 1991/92, p. 661.
[31] See Ethan B. Kapstein, *The Political Economy of National Security: A Global Perspective* (New York: McGraw-Hill, 1992).
[32] RAND Corporation, *Going Global: US Government Policy and the Defense Aerospace Industry* (Santa Monica, CA: RAND Corporation, 2002), p. 67.
[33] Defense Science Board, *Task Force on Joint Advanced Strike Technology Program* (Washington, DC: Department of Defense, September 1994), p. 48.
[34] European Commission, *European Defense—Industrial and Market Issues* (Brussels, March 11, 2003), p. 8.
[35] One reviewer of this paper has argued that European partners are providing some significant technology for JSF, and indeed, as already noted, the initial STOVL design for the AV-8A and AV-8B was British. I thank Alew Nicoll for highlighting this point.
[36] See Paul Ferrari, et.al., *US Arms Exports* (Cambridge, Ma.: Ballinger, 1988), p. 95.
[37] On the F-16, see Ethan B. Kapstein, "International Collaboration in Armaments Production: A Second-Best Solution," *Political Science Quarterly* Winter 1991/92, p. 665.
[38] See Bukhard Schmitt, ed., *European Armaments Cooperation: Core Documents* (Paris: Institute for Security Studies, Chaillot Papers no. 59, April 2003).
[39] Gordon Adams, "Fortress America in A Changing Transatlantic Defense Market," in Burkhard Schmitt, ed., *Between Cooperation and Competition: The Transatlantic Defense Market* (Paris: Institute for Security Studies, Chaillot Papers no. 44), January 2001, p. 3.
[40] Defense Science Board, *International Armaments Collaboration*, p. 7.
[41] William Keller and Janne E. Nolan, "Mortgaging Security for Economic Gain: U.S. Arms Policy In An Insecure World," *International Studies Perspectives* 2 (2001): 177-193, at 183.
[42] Kenneth Flamm, "An Economic Strategy to Control Arms Proliferation," *Issues in Science and Technology Online* (Winter 1997), downloaded at: www.issues.org/issues/14.2/flamm.htm., p. 2.
[43] For the details, see Kenneth Flamm, "An Economic Strategy to Control Arms Proliferation," *Issues in Science and Technology Online* (Winter 1997), downloaded at: www.issues.org/issues/14.2/flamm.htm.
[44] Peter C. Evans, "Competing for Foreign Military Contracts: The Financial Connection," unpublished manuscript, MIT Department of Political Science, downloaded at: web.mit.edu/ssp/spring03/evans.htm.
[45] James Morrow, "Arms versus Allies: Tradeoffs in the Search for Security," *International Organization* 47 (1993): 207-233.
[46] See Ethan B. Kapstein, "International Collaboration in Armaments Production: A Second-Best Solution," *Political Science Quarterly* Winter 1991/92, p. 661.

[47] Lockheed Martin Press Release, "Lockheed Martin Team Wins Joint Strike Fighter Competition," 26 October 2001.
[48] See Anne Marie Squeo and Daniel Michaels, "US Changes the Rules in High Stakes Venture of Selling Military Jets," *Wall Street Journal* 22 July 2002, p. 1.
[49] John Birkler, et.al., *Assessing Competitive Strategies for the Joint Strike Fighter: Opportunities and Options* (Santa Monica, Ca.: RAND Corporation, 2001), p. 87.
[50] Mark Lorell, *The U.S. Combat Aircraft Industry, 1990-2000: Structure, Competition, Innovation* (Santa Monica, Ca.: RAND Corporation, 2003).
[51] Lockheed Martin Press Release, "Lockheed Martin Team Wins Joint Strike Fighter Competition," 26 October 2001.
[52] It must be emphasized that JSF contracts are awarded on a competitive basis, including with foreign partners. Political pressures, however, have also figured into the contract award process.
[53] General Accounting Office, *Joint Strike Fighter Acquisition: Development Schedule Should Be Changed to Reduce Risks* (Washington, DC: General Accounting Office, 16 March 2000).
[54] See CIA, "Germany: National Security Situation," downloaded at http://www.cia.gov/nic/PDF_GIF_research/defensemkts/germany.pdf; and Joseph Fitchett, "From Bottom to Top of Political Agenda, Eurofighter May Finally Fly," *International Herald Tribune*, 17 June 1997, p. 13.
[55] Christopher Bolkcom, *Joint Strike Fighter: Background, Status and Issues* (Washington, DC: Congressional Research Service, 15 February 2002
[56] General Accounting Office, *Joint Strike Fighter Acquisition: Cooperative Program Needs Greater Oversight to Ensure Goals are Met* (Washington, DC: General Accounting Office, July 2003), p. 1.
[57] Lincoln Bloomfield, "Export Control," Remarks to the AIAA Conference, Washington, DC, 20 February 2002, downloaded at http://www.state.gov/t/pm/rls/rm/2002/8514.htm.
[58] Douglas Barrie, "Disjointed Strike Fighter," *International Defense,* v. 158, no. 20, p. 28.
[59] For a formal model of these arguments, see Paul Levine and Ron Smith, "Arms Export Controls and Proliferation," *Journal of Conflict Resolution*, v. 44, no. 6 (December 2000): 885-895.
[60] General Accounting Office, *Joint Strike Fighter Acquisition: Cooperative Program Needs Greater Oversight to Ensure Goals are Met* (Washington, DC: General Accounting Office, July 2003), p. 1.