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Joint Strike Fighter
Can a Multiservice Fighter Program Succeed?

by Christopher Preble

Executive Summary

For more than a decade, the Pentagon has been developing a multiuse fighter for the Air Force, Navy, and Marine Corps. Operational and functional requirements developed by the Joint Strike Fighter project will be used to guide the construction of three versions of the F-35 aircraft. The aircraft is scheduled to be delivered to the services near the end of this decade at a cost ranging between $40 and $50 million per plane.

This is not the first time that the Pentagon has tried to develop a single aircraft that could be used by more than one of the services; memories of the failed Tactical Fighter Experimental (TFX) project from the early 1960s have haunted the JSF project at every turn. It is wrong, however, to conclude that the JSF will fail because the TFX did so. Rather than assuming that the quest for achieving cost savings through common parts and systems (among different versions of the aircraft for different services) was rendered moot by the TFX, this paper compares and contrasts the history of the JSF with that of the TFX. The men and women involved in the JSF program have not repeated many of the mistakes that crippled the TFX.

But considerable time remains before the first F-35s will be delivered to the military. Therefore, there are still risks that the F-35 will ultimately run afoul of the same pitfalls that doomed the F-111—the plane spawned by the TFX project. Civilian leaders must guard against rival programs cutting into the resources and political support that will be needed to see the F-35 project through to completion. They must do so by engendering support for the F-35 on its merits, while resisting the temptation to build political support by turning the JSF into a jobs program in disguise. Finally, defense planners must remain focused on the overarching goal of transforming the nation's defenses to deal with the likely threats in the 21st century and beyond. The three services must be put on notice that the F-35 will be the last manned fighter ever developed, with subsequent weapons development focused on cutting-edge technologies that hold the promise of delivering great capability at relatively low cost (e.g., unmanned aerial vehicles).

Given that the JSF program has not repeated many of the mistakes of the past—including the most egregious errors of the TFX program—the Pentagon and JSF program officials deserve the political support necessary to make the F-35 a reality.

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Introduction

For more than 10 years, the Air Force, Navy, and Marine Corps have been involved in an ambitious project to design and develop a new, relatively low-cost aircraft to replace the aging planes in their current inventory. The Joint Strike Fighter project has now moved from the Concept Demonstration Phase to the Systems Design and Development phase, with Lockheed Martin the winner in a competition to build the new F-35 fighter. The SDD contract, worth $26 billion, calls for Lockheed Martin to begin delivering operational aircraft to the three services near the end of this decade at a cost ranging between $40 million and $50 million per plane. The total JSF contract, including the delivery of as many as 6,000 aircraft to the U.S. military and governments abroad over the next 25 years, may be worth more than $200 billion.

This is not the first time that the Pentagon has tried to develop a single aircraft that could be used by more than one of the services. In an earlier attempt, the Tactical Fighter Experimental (TFX) program, endorsed by Secretary of Defense Robert McNamara beginning in 1961, ended in failure. Military leaders resented McNamara's demand that the Air Force and Navy work together on the program despite their misgivings. The plane created as a result of this collaboration, the F-111A Aardvark, was never fully embraced by the Air Force. The service believed it to be an inferior aircraft for its needs, in part because of perceived shortcomings related to compromises made with the Navy during the early design phases of the program. Then, to make matters worse, the Navy refused to deploy even a single F-111B, the version designed to land on aircraft carriers. After several years of trial and error, the Navy chose instead to develop its own aircraft. In short, the TFX engendered animosity between the military services and between military and civilian leaders, while wasting hundreds of millions of taxpayer dollars.

The most notable similarity between the TFX and the JSF is that both projects promised to achieve cost savings for taxpayers by consolidating the needs of several services into one aircraft. The ability of different military branches to purchase similar systems, with comparable parts and maintenance requirements, represents potentially great cost savings. There are other similarities between the two programs. For one, the development contracts were enormous—each in its own time estimated to be the largest military contract ever awarded. Second, in both cases, the civilian leadership played a substantial role in selecting the prime contractor—at the risk of considerable political backlash given the widespread belief that the contract would make or break the respective bidding companies.

Memories of the TFX have haunted the JSF project at every turn. Ever since the TFX/F-111 debacle, many critics have assumed that the goal of commonality among the services in weapons development was doomed to fail. Given these persistent doubts, it is remarkable that the JSF program has survived to this point.

It is wrong, however, to conclude that the JSF will fail because the TFX did so. Putting superficial similarities aside, this paper compares and contrasts the history of the JSF with that of the TFX. Rather than assuming that the quest for cost saving through commonality was rendered moot by the TFX, this paper shows that the men and women involved in the JSF program have avoided many of the pitfalls that befell the TFX. But the hour is still early, and there is still time for the JSF project to be knocked off its apparent path to success. Therefore, this paper concludes by highlighting the warning signs on the horizon and by offering recommendations for political and military leaders to ensure that the JSF program fulfills its mission to provide effective, modern aircraft at a cost that is sustainable over the long term.

The History of the TFX

Beginning in the late 1950s, senior Air Force officers began to design a new aircraft that would combine the maneuverability of a

fighter with the range and payload capacity of a bomber. The initiative gained momentum thanks to a technical breakthrough, specifically the development of a variable swept wing, which proved instrumental in making the vision of a multiuse fighter a reality. The swept wing enabled the aircraft to fly efficiently at both supersonic and subsonic speeds. At the subsonic speeds at which bombers typically proceeded toward their targets, the wings were swept wide for maximum lift. However, when the aircraft accelerated to supersonic speeds, as in the final stages of a bombing run or to engage or evade enemy aircraft, the wings were swept back close to the fuselage in order to reduce drag.

Secretary of Defense Forces Interservice Cooperation

The TFX project, a joint initiative between the Air Force and the National Aeronautics and Space Administration, proceeded slowly at first. Reluctant to make a major decision on a new weapons system, President Dwight D. Eisenhower's administration deferred action on the TFX—leaving the decision to the incoming administration led by John F. Kennedy and his newly appointed secretary of defense, Robert McNamara.[1] Kennedy had criticized Eisenhower's military strategy throughout the late 1950s. He carried those criticisms into the presidential campaign of 1960, arguing repeatedly that the United States suffered from a missile gap with the Soviet Union and that a new, more flexible military strategy, which included the use of both conventional and nuclear forces, was needed to ensure national security.[2]

McNamara immediately took an interest in the TFX, in part because it embodied the very flexibility (it could be used in both conventional and nuclear missions) that Kennedy had pledged to achieve. The potential cost savings to be derived from a common aircraft for the different services also intrigued McNamara. Because common components were used to build different cars, the former auto industry executive reasoned that the same approach would work in building military aircraft.

In February 1961, less than a month after assuming office, McNamara directed Defense Department researchers and engineers to develop a new triservice aircraft for the Army, Air Force, and Navy. The VAX, a dual-mission aircraft with a close-air support role, spun out of this project and eventually became the A-7 Corsair II. A combination fighter/bomber for the Air Force and Navy remained in the works, however. Each service argued that in theory a dual-service plane could be built, provided the other service relaxed some of its requirements. But neither service agreed to do so.

McNamara remained committed to the project, even in the face of mounting evidence that the plane would not be acceptable to either service. Doubts about the dual-service fighter were reaffirmed in August 1961, when a report issued by the civilian secretaries of the Air Force and Navy determined that a joint plane was "not now technically feasible" and warned that forcing the services to adopt such a common plane would "place severe operational penalties upon the Air Force and Navy."[3] Another report by the Navy's civilian head of research and development argued that a common Navy–Air Force fighter was not "consistent with national defense interests."[4]

But McNamara disregarded these pessimistic reports. He believed that the Air Force and Navy were merely stonewalling the project because each wanted to build its own aircraft. Determined to assert his authority over the recalcitrant services, McNamara decreed that the Navy would work with the Air Force to develop an aircraft capable of landing on both runways and aircraft carrier decks. McNamara threw himself behind the project completely, believing that his experience in the business community could be translated into a success for the military and for the taxpayers. In many ways, McNamara's fortunes were tied to that of the TFX.

McNamara accelerated the Navy's collision course with the TFX by canceling the Navy's Missileer project. The Missileer was a relatively light aircraft that could take off

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from an aircraft carrier and loiter on station for extended periods of time. The plane would be capable of engaging approaching enemy aircraft at a safe distance from the fleet by using a new long-range air-to-air missile called the Eagle. McNamara's cancellation effectively foreclosed any other options for the Navy, and the service was compelled to work on the new joint project.

McNamara then exacerbated the Navy's animosity toward the TFX project. In June 1961, he assigned responsibility for the project to the Air Force, and he called on that service to work closely with the Navy to develop common requirements. A few months later, however, McNamara directed that changes to the basic aircraft that were intended to accommodate the Navy be "held to a minimum."[5]

Controversy Develops in Selecting a Contractor

Once the services had reluctantly settled on a common set of requirements, the process for selecting a prime contractor to build the TFX proved contentious and controversial. Six companies submitted plans on December 6, 1961. A panel of experts, comprising mostly Air Force personnel, determined that none of the six plans met the requirements, but they directed two of the six companies—Boeing and General Dynamics—to resubmit proposals. When the two companies complied with this request in April 1962, the Navy declared that neither of the revised designs was acceptable. The chief of Naval Operations, Adm. George Anderson, recommended that the project be scrapped; however, rather than heed Anderson's advice, civilians in the Pentagon gave the two contractors still more time to alter their designs in a third round and then later in a fourth round—much to the consternation of the two contractors and the two services. McNamara's deputy secretary of defense Roswell Gilpatric later explained that the delay was necessitated because, once again, neither design met the Navy's requirements.[6]

Following the fourth round of design revisions, Boeing's proposal claimed to achieve performance levels superior to specifications, including new capabilities favored by the military. Further, the company promised to achieve these improvements at a lower cost than specified by the established requirements. On November 2, 1962, the Source Selection Board, an ad hoc group that included three senior Air Force officers and one representative from the Navy, recommended that Boeing be awarded the TFX contract. Their unanimous recommendation was then seconded by a host of other senior Air Force and Navy officers, including Gen. Curtis LeMay, the chief of staff of the Air Force, and Admiral Anderson. Political scientist Robert Art, writing in 1968, noted, "In the fourth evaluation there was thus unanimity—absolutely no dissent—up through the entire military chain of command, in recommending the Boeing Company."[7]

But civilian officials in the Pentagon, including McNamara, Gilpatric, Secretary of the Air Force Eugene Zuckert, and Secretary of the Navy Fred Korth, doubted Boeing's cost estimates. The civilians favored the competing General Dynamics proposal because it promised to achieve a higher degree of commonality (84 percent) between the two aircraft and because its design seemed less risky and its cost estimates more realistic. McNamara signed a memorandum awarding the contract to General Dynamics on November 21, 1962.[8]

Boeing cried foul. The company had been the leading contender in the previous runoff rounds, and company officials were aware that military leaders favored their proposal. When Sen. Henry M. Jackson approached McNamara to lobby on behalf of Boeing, based in his home state of Washington, McNamara turned him aside. But Jackson was relentless. Knowing that his own self-interest would taint his claims that the contract had been awarded on faulty grounds, Jackson turned to the Senate Government Operations Committee to conduct an investigation. Democratic senator John L. McClellan of Arkansas, chairman of that committee's Permanent Subcommittee on Operations, complied with Jackson's request

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by calling McNamara and his deputies to testify before the committee in the hope of delaying the award of the TFX contract to General Dynamics. But McNamara ignored McClellan, signing the contract on the very day that McClellan asked him to wait.

McNamara seemed to be flouting the will of Congress. As the McClellan hearings proceeded, McNamara and his staff became embroiled in a contentious political battle. McNamara adopted a defiant tone, determined to defend his decision and his honor. McClellan's hearings continued through November 1963, and then recessed following President Kennedy's assassination. All of the material that McClellan and his committee staff had assembled showed that the TFX decision was McNamara's.

McNamara's fortunes were therefore tied to the controversial plane. He, and he alone, would be held politically accountable for his decision to override the advice of his military advisers by pushing for a single aircraft to meet the needs of the Air Force and Navy. Furthermore, because he had also rejected the unanimous recommendation of every senior military officer who had rendered an opinion on the contract award, McNamara was also held accountable for General Dynamics' ability to fulfill the terms of the lucrative contract.

The TFX Program Fails

Fulfilling the contract was a tall order. As General Dynamics attempted to build several prototypes, it struggled to cope with the Navy's repeated demands for design changes. The greatest of these challenges related to the aircraft's weight. By the summer of 1963, the company realized that the F-111 would weigh significantly more than had earlier been estimated. In December 1963, after the McClellan hearings had recessed, General Dynamics made these concerns known to the Pentagon—revealing that the weight of the Navy version of the plane had increased by more than 5,000 pounds. The Navy's Bureau of Weapons called for an immediate redesign to ensure that changes would be made before too much money had been invested in the program. But the draft report was changed to reflect McNamara's wishes—the project would not be halted. By this time, the aircraft's basic structure was firmly established and it could not be altered without significantly increasing program costs.

Loath to concede to McClellan and others that he had been wrong all along, McNamara refused to admit the error of his TFX decisions. By early 1964, "McNamara's stubbornness was creating a fatal pattern," according to McNamara biographer Deborah Shapley. "His . . . determination that the plane could be built if only the Navy would come to heel, and that General Dynamics had to build it, put . . . subordinates under tremendous pressure to distort reports and even lie."[9]

McNamara's nemesis, Senator McClellan, suspected as much. The senator was aware of the Navy's complaints surrounding the F-111B. He also knew that the British government, which had committed to buying the F-111B, was getting nervous. When the news media and members of Congress learned of a spate of F-111 crashes, McClellan reopened his hearings in 1967. McClellan was armed with a thick file documenting McNamara's alleged mismanagement and deceit. But by the time that McClellan had resumed his attack on McNamara and the TFX, the secretary had grown weary. McNamara resigned from office on February 29, 1968. Within a few short months, the Navy's TFX was dead.[10]

The Navy never deployed a single F-111B. Meanwhile, the record for the Air Force's F-111A was nearly as dismal. The Air Force ultimately procured seven different variants of the F-111, but the total numbered less than 600—a far cry from the more than 1,700 that it had planned to buy as late as March 1964. The planes did not meet specifications and were more than twice as expensive as originally budgeted. Furthermore, the first operational aircraft were delivered nearly two years late.[11] In his study of the F-111, Robert F. Coulam concluded:

> As the F-111 program began, it was the symbol of a new order in defense

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management. . . . Yet many years later, as it drew to completion, the F-111 was a symbol for the failures of that order. . . . The effort to achieve bi-service use of a single aircraft—to achieve "commonality"—had failed.[12]

The History of the JSF

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In many ways, the early stages of the JSF program mirrored those of the TFX. The JSF began as a research and development project organized to determine the feasibility of a multiservice aircraft; it became a full-fledged weapons development program involving the Air Force, Navy, and Marine Corps.

In the early 1990s, the process began in earnest after then-Defense Secretary Richard Cheney canceled the Navy's A-12 Avenger II fighter in 1991—leaving the Navy without a successor to the venerable A-6 Intruder, a popular and durable aircraft first delivered to the Navy in 1963. After an abortive attempt to develop a successor to the A-12, the so-called A-X or A/F-X, the Navy instead opted to develop a newer version of its F/A-18 Hornet. Dubbed the Super Hornet, the new aircraft improved upon the Hornet's limited range and had an increased weapons payload capacity, but the cost was more than 50 percent greater than that of its predecessor.[13]

Meanwhile, the Air Force had been working since the mid-1980s on the F-22, an advanced fighter to replace the F-15—another popular but aging aircraft that had been designed in the late 1960s. The F-22, however, was designed to fight the Soviet adversary during the Cold War. With the abrupt end of that decades-long conflict, the Air Force started searching for a low-cost option, ideally one that could be used in a high-end/low-end mix (the service cannot afford to buy a complete inventory of the top-of-the line fighter so it frequently purchases quantities of a lower-cost aircraft too). Such a high/low mix was similar to the high-end F-15 and the low-end F-16 used since the mid-1970s. In principle, the F-22 was also a joint program. But the Navy dropped its plans to buy the F-22, believing that the Air Force had had a hand in the demise of the A-12.[14]

At the same time, the Marine Corps was searching for a successor to the AV-8B Harrier, a short takeoff, vertical landing (STOVL) aircraft in use for years by the British on their smaller aircraft carriers and employed by the Marines beginning in 1985. The AV-8B was actually a successor to an earlier Harrier, the AV-8A/C, which had a troubled safety record and which was based on an airframe design dating to the late 1960s. Unfortunately, the AV-8B also had a high accident rate during its long service. Such propensity for calamity, combined with the aircraft's limited range and short on-station time, prompted the Marine Corps to seek out an alternative.

Origins of JSF Similar to Those of TFX

In January 1994, the Clinton administration launched the Joint Advanced Strike Technology program in an effort to stave off the impending crisis—widely characterized as the "train wreck"—in which the various services would have to replace their aging aircraft all at the same time and at great cost. The JAST program was based on the belief that a cost-effective, multiuse fighter could be produced through the use of new technologies and improved procurement practices. The JAST program later became the JSF.

In these ways, at least, the JSF's origins were similar to those of the TFX. The military services needed a new aircraft. This need was exacerbated by the cancellation of the Navy's preferred platform: the Missileer in 1961 and the A-12 in 1991. Just as Robert McNamara had hoped to control defense costs by developing a common aircraft for two or more of the services in 1961, the Clinton administration's defense secretaries, Les Aspin and later William Perry, hoped to avoid a budgetary "train wreck" by using new technologies to build a new joint aircraft.

From there, however, the JSF parted ways with the TFX in several crucial respects. The

differences began at the top with the military and civilian leaders who shepherded the JSF from concept to contract. Gen. George Muellner, a one-star Air Force general, was the first uniformed military officer assigned to manage the JAST project. Muellner accepted the job with many misgivings. His doubts about the project were shared by almost all of the senior military men with whom he spoke. Each service wanted something different. The Navy wanted a high-end, two-engine, two-seat aircraft, with large fuel capacity in order to fly great distances from aircraft carriers. The Air Force wanted a low-end, single-engine, single-seat aircraft and was concerned that Navy requirements would push up the cost of the JSF. Cost considerations were a major concern because the Air Force would be buying far more planes than the Navy.

The Marine Corps wanted an aircraft similar to that called for by the Air Force, but the Corps believed that its most likely missions in the 21st century would call on its pilots to land on unfinished runways in hostile territory or on smaller deck carriers. Therefore, the Marines added the caveat that their plane be able to land vertically, like a helicopter. This requirement matched well with the needs of the British Royal Navy, which was also looking for a replacement for its Sea Harriers and which joined the JAST effort in early 1996. Because the Royal Navy operated smaller aircraft carriers than those of the U.S. Navy, the British plane would have to be small enough to fit on these smaller ships.[15]

Drawing on that input, the JAST project team compiled requirements for the plane—or, more accurately, three planes—that would be built for the three services. The team emphasized affordability and commonality of parts for the three aircraft. Muellner stressed that theme in his very first speech after taking command of the JAST program by suggesting that the "A" in JAST stood for "affordability." A later program manager, Air Force Gen. Leslie Kenne, declared that "affordability is absolutely the centerpiece of this program."[16]

Companies Compete for the JSF Contract

Three companies—Boeing, McDonnell-Douglas, and Lockheed Martin—completed designs for the JAST program, which was renamed JSF in March 1996. In November 1996, from these three proposals, the Defense Department selected Boeing and Lockheed Martin to proceed to the Concept Demonstration Phase of the program. Eliminated from the JSF competition (the process of reducing the number of bidders is euphemistically known as a "downselect") and facing the end of its profitable business with the U.S. government, McDonnell Douglas merged with Boeing in August 1997.

Meanwhile Lockheed Martin—the other survivor of the first downselect—arranged with former McDonnell Douglas partners Northrop Grumman and British Aerospace (now BAE Systems) to combine their efforts to win the contract in the head-to-head competition with Boeing. Unlike the controversial TFX competition, in which the decision to award the contract to General Dynamics was based solely on wind-tunnel models and designs on paper (a "paper airplane"), Lockheed Martin and Boeing each received more than $1 billion from the government to build their prototype models—Boeing's X-32, and Lockheed Martin's X-35. In fact, each company would build and fly two full-scale prototypes—one a land-based, conventional take off (CTOL) version for the Air Force and one STOVL aircraft required by the Marine Corps and British Royal Navy.[17]

The STOVL variant of the Joint Strike Fighter posed the greatest technical challenge during the next phase of the JSF project. Each company adopted a different approach. Boeing's STOVL version built on existing Harrier technology, using engine exhaust directed downward through nozzles and ducts to build an air cushion beneath the aircraft. The technique, known as "direct lift," had the advantage of being based on an established, working technology. On the downside, however, were the environmental effects of blasting the ground with hot engine exhaust. There were also concerns

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about the X-32's power usage. The engines on the Boeing model, as in the earlier Harrier models, would be forced to operate at near peak capacity in order to achieve vertical takeoff. Finally, although Defense Department officials flatly denied that appearance was taken into account during the competition for the JSF, industry analysts and some pilots privately criticized Boeing's design as "chubby" or "ungainly."[18]

Lockheed Martin's aircraft, by contrast, bore many physical similarities to its sleek F-22 fighter. The outward appearance, furthermore, concealed an engineering innovation that separated Lockheed's X-35 from its competitor. Building on its own experiments in the early 1990s, Lockheed Martin used a lift fan to provide a cushion of air beneath the JSF for vertical landings. The X-35 used energy from the main engine to drive a shaft that turned a fan. The fan generated a cool air cushion, which was combined with vertical lift power from the main engine exhaust that was diverted through a three-bearing swivel nozzle. Because the X-35 combined hot engine exhaust with cool air from the lift fan, the design had less of an adverse environmental effect than did the direct vertical lift seen in the Boeing X-32 and the Harriers. The combination also boosted the aircraft's total power output: the X-35 is capable of directing about 35,000 pounds of downward thrust, compared with only 24,000 pounds for the Boeing model.[19]

On October 26, 2001, Secretary of the Air Force James Roche made the dramatic announcement—simulcast to audiences in Seattle, St. Louis, Fort Worth, and elsewhere—that Lockheed Martin would build the JSF. The contract, worth an estimated $200 billion, called for construction of as many as 6,000 airplanes—approximately 3,000 for the U.S. military and another 3,000 anticipated in foreign sales.

Boeing conceded defeat. Despite earlier claims that the loser in the second JSF downselect would be reduced to second-class status, Boeing refocused its efforts elsewhere. Unlike McDonnell Douglas before it, Boeing was sufficiently diversified to be able to survive the loss of the JSF contract. The company would be building F/A-18E/Fs for several years, as well as the C-17, and it retained a 30 percent stake in the F-22 program. Meanwhile, Boeing's dominance in the commercial aircraft sector provided a further cushion.[20]

JSF Program Runs into Difficulties

But warning signs developed for contract winner Lockheed Martin soon after the happy news was received in Fort Worth. Facing budgetary pressures, the Defense Department considered accelerating the JSF program in order to bring the plane on line faster. On the one hand, Navy secretary Gordon England and Pentagon acquisition chief Pete Aldridge were among those favoring an acceleration of the project in order to modernize the force in the fastest and most economical manner possible. On the other hand, some officials suggested dropping the STOVL variant, which the Marine Corps had sought, entirely.

Then, in late March 2002, Aldridge suggested that the Navy and Marine Corps might purchase fewer JSF aircraft than previously estimated. The specifics of the Navy proposal called for cutting the number of Marine Corps STOVL JSF jets from 609 to 350 and the number of the carrier version from 480 to 430. According to Loren Thompson, a defense analyst at the Lexington Institute, the Navy and Marine Corps's announcement of their intention to cut the program, issued so soon after the contract award, was an ominous sign for the entire JSF program. Thompson questioned the Bush administration's commitment to the project. "If the administration is as committed to this program as it claims," he said, "it shouldn't be considering major cuts in the first year of advanced development." Thompson urged the Pentagon leadership to "step in and say 'No' to the Navy because of the broader impact" of the Navy's decision to cut back on the JSF.[21]

Despite worries that the Navy cuts would push unit costs up by 5 to 10 percent, Pentagon officials did not say "no." Officials

also feared international reprisals because Great Britain might begin to doubt the level of commitment on the part of the U.S. military services and other potential international partners might delay a decision to invest in the project.[22] Those concerns were well founded. On the same day that Aldridge was urging the Dutch not to delay a planned announcement to join the JSF program, one senior British defense official told *Defense Daily International* of an "'I told you so lobby' in Britain that has always maintained that the United States simply isn't a reliable collaborative partner." "This episode," the official added, "takes the shine off the JSF apple."[23]

The Air Force was equally concerned about the Navy's decision, suggesting a domino effect as force cuts resulted in rising unit costs, prompting still more force cuts—the dreaded "defense death spiral." Less than a week after stories started circulating about the Navy's plans to cut purchases, the Air Force announced that it too would reconsider the number of JSF aircraft that it would purchase.[24]

These doubts, however, did not dissuade a number of countries from announcing their support for the JSF program in the late spring and early summer of 2002. Great Britain, which had been a major partner in the project since at least early 1996, agreed to invest an additional $2 billion during the $25 billion development phase of the project. The Dutch, Norwegian, and Danish governments had each signed a Memorandum of Understanding in 1997; Canada followed in 1998. By investing additional funds, those countries all reaffirmed their intention to participate in the project during the development phase. Italy invested $1 billion and the Dutch invested $800 million. Other potential customers include Turkey, Israel, Singapore, Germany, and Spain. And although Britain's Royal Air Force is likely to purchase the Eurofighter, manufactured by a European consortium, the service is considering a JSF purchase over the long term.[25]

The Dutch and Italian investments are a particularly encouraging sign of the Joint Strike Fighter's export potential. Italy, which invested the second largest amount of any foreign government (behind Great Britain), has plans to procure about 100 aircraft, and was pondering whether to purchase a mix of both STOVL and conventional variants. Meanwhile, in early February 2002, the Dutch explicitly noted that their $800 million investment indicated their strong intention to purchase the JSF, and subsequent reports suggest that they plan to buy as many as 85 F-35s.[26]

Comparing and Contrasting the TFX and the JSF

The similarities between the TFX and the JSF are apparent. But despite those superficial similarities, the JSF differs from the TFX in several critical respects: (1) accusations of a conflict of interest that swirled around the TFX from the moment the contract was awarded have been notably absent in the case of the JSF; (2) at a broader level, the JSF has avoided the politics that crippled the TFX; and (3) the "joint" aspects of the JSF project appear to be more genuine than McNamara's forced marriage of the Navy and the Air Force in the TFX project.

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Controversy over the Award: Charges of a Conflict of Interest

As is the case with nearly any government contract, critics suspected that politics played a role in the award of the TFX contract to Fort Worth, Texas–based General Dynamics. Vice President Lyndon Johnson was presumed to have exerted pressure on the Pentagon to award the contract to the company, but did not. Meanwhile, Secretary of the Navy Fred Korth was from Fort Worth. He may have favored General Dynamics because he knew that if General Dynamics did not win the TFX contract, its plant in his hometown was scheduled to close. But Korth was not deeply involved in the source selection process, in part because of his own concerns about possible conflicts of interest. Instead Eugene Zuckert, the secretary of the Air Force, reviewed the proposals in

detail. Zuckert recommended that General Dynamics be awarded the contract, and Korth seconded Zuckert's recommendation.[27]

Robert Art's study of the TFX controversy convincingly demonstrates that—appearances of conflict of interest notwithstanding—the selection of General Dynamics as the prime contractor for the TFX reflected sound, objective judgment.[28] That reality did not stop McNamara's political enemies, however, from calling the secretary's decisionmaking and rationality into question. And although Senator McClellan failed to prove the most damaging charge—that the TFX contract was awarded to General Dynamics for political reasons—the McClellan hearings did cause problems for civilian officials in McNamara's Pentagon. The casualties included McNamara's chief deputy Roswell Gilpatric, who resigned from the government in January 1964, and Korth, who was cleared of conflict of interest charges by the Justice Department but whose reputation was tainted nonetheless.[29]

Signs of a conflict of interest within the JSF program appeared to be even stronger than in the case of the TFX: President George W. Bush is a lifelong Texan with obvious ties to members of the business community in Fort Worth and elsewhere. Beyond that fact, however, it was revealed in the summer of 2001, several months before the October 2001 downselect, that Air Force secretary James Roche and Navy secretary Gordon England both had ties to the Lockheed Martin JSF team. Before joining the Bush administration in 2001, Roche had been a corporate vice president at Northrop Grumman, a key Lockheed partner in the JSF competition. Regulations normally bar, for more than a year, a government official from ruling on a matter affecting a former employer, but the Air Force counsel granted Roche a waiver so that he could participate in the JSF decision. Meanwhile, England had previously worked for Lockheed Martin and had once managed the plant where Lockheed's JSF fighter was to have been built.

Given the appearance of a conflict of interest, one industry insider questioned whether Boeing would raise objections if Lockheed Martin won the JSF contract. Before the contract was awarded, however, a Boeing spokesman declared that the company had no doubts about the ability of both Roche and England to make an objective decision based upon the published criteria, which were very detailed.[30] After the award was announced, Boeing raised no objections as to the nature of the source selection process and stated that it saw no reason to protest the government's decision to award the contract to Lockheed Martin.[31]

Likewise, the administration's political critics refused to openly question whether the contract was awarded to Lockheed Martin because of the Bush administration's strong ties to the company and to Texas. This silence seems all the more remarkable because some of the president's most vocal critics were Boeing supporters. For example, in a statement issued immediately after the announcement of the contract award, House Minority Leader Richard Gephardt (D-Mo.) declared that it was "unfortunate that the Department of Defense did not choose Boeing" and pledged to continue his efforts "to secure JSF work for Boeing and its St. Louis workforce," but did not accuse the Pentagon and the Bush administration of conducting an unfair competition.[32]

The Air Force announced that it too would reconsider the number of JSF aircraft it would purchase.

Politicization of the Project and the Boeing Faction

The JSF has avoided political controversy in other ways. The absence of a dominant faction within the government supporting Boeing seems to be the single greatest factor differentiating the TFX award from that of the JSF. Even among the congressional delegations of Washington and Missouri, where Boeing's operations are concentrated, criticism of the decision to award the JSF contract to Lockheed Martin was muted.

This lack of outrage can be partly attributed to evidence, building throughout the summer of 2001, suggesting that Lockheed Martin was the leading candidate. Less than a week before the announcement was made, an industry expert estimated that there was an 80 percent chance that Lockheed would

win.[33] Although Defense Department officials publicly stated that the proposals were both very good, a lengthy article in *Defense Daily*, published less than one week after the contract award was announced, revealed that Lockheed had won easily. Air Force secretary Jim Roche told reporters that "Lockheed Martin emerged clearly as the winner."[34]

According to veteran defense correspondent Vago Muradian, Lockheed Martin had emerged as the frontrunner in the JSF competition fully two years before the contract was awarded, but "senior Pentagon officials concluded that the contest between the two must continue to ensure against Lockheed becoming complacent and drive the companies to deliver better proposals." Muradian cited sources who argued "that the competition drove Lockheed Martin to achieve new performance highs to yield a solution more innovative and capable than Boeing's."[35]

Jacques Gansler, who served as undersecretary of defense for acquisition and technology until January 2001, confirmed this point of view. Gansler explained that the JSF program had used "the incentive of competition to steer innovation" and added, "that goal . . . has been driving this program." Gansler had counseled against an early termination in the competitive phase of the project despite evidence that Lockheed was clearly in the lead "because the benefits of competition would far outweigh an early downselect."[36]

In contrast, a key element of the controversy surrounding the TFX was the genuine surprise when the contract was awarded to General Dynamics. Boeing was the leading contender through the first three rounds of the TFX selection process. When the competition was extended to a fourth round in June 1962, critics charged that the process was delayed in order to allow General Dynamics to compete. Further, military leaders were unanimous in their recommendation that Boeing be awarded the TFX contract. According to Robert Art civilian leaders in the Pentagon had, for the first time, overruled the advice of the military chiefs.[37] On the JSF program, there was no comparable divergence of opinion between the military and civilian leaders.

Joint Development

Another key difference between the TFX and JSF projects is the degree of interservice cooperation between the military branches. Both the TFX and the JSF were joint programs—they included representatives from more than one military service. But the services appear to be far more committed to the JSF than they were to the TFX.

The Navy's opposition to the TFX was long-standing, vehement, and vocal. The service had opposed the program from its inception. It was left with no practical alternative when the Missileer was canceled, but it never liked the TFX. During the design competition, Navy leaders repeatedly argued that the plans did not meet their needs. McNamara dismissed those claims, however, believing that the Navy was merely trying to stonewall the project for parochial reasons.

The Navy then seized upon problems in the testing phase of the naval variant of the TFX, the F-111B, in yet another attempt to kill the project. According to Robert Coulam's influential study of the F-111, the Navy seized upon problems during the F-111's design and development to stall, and ultimately kill, a program that it never wanted in the first place. Later, when the Navy tested the F-14 fighter that took the place of the F-111B, the service relaxed a number of crucial requirements that it had been unwilling to relax in the case of the F-111B. Coulam argues that the Navy might have obtained a workable F-111B had it been more lenient in its requirements, but it refused to do so because it did not want the joint program to succeed.[38]

The evidence supports Coulam's claims. The Navy's true feelings about the TFX were well known. In 1963, a published articled quoted a Navy admiral telling an Air Force officer, "Young man, you'll never see this airplane [the F-111] fly off the deck of an aircraft carrier." McNamara knew of the Navy's opposition, but he stubbornly refused to consider the Navy's concerns. Therefore,

The F-111 was not designed concurrently by both services.

McNamara should not have been surprised when the Navy sabotaged the program.[39]

Although the Navy's behavior represented an attack on the principle of civilian control over the military, the service's concerns about the plane's shortcomings were not unfounded. The F-111 was not designed concurrently by both services. Rather, the TFX was an Air Force project, managed by Air Force personnel, with only limited input from the Navy. Even then, Robert McNamara had compelled the Navy to participate against its will. The Air Force's dominance of the program continued well after McNamara executed the arranged marriage and after the basic airframe of the F-111 was well established.

The JSF is more of a collaborative venture among the three services than was the TFX.

In sharp contrast to the TFX program, Air Force general Muellner decided that management of the JSF program would rotate between the three services. So, for example, a naval officer, Rear Adm. Craig Steidle, replaced Muellner. The post rotated back to Air Force leadership in 1996, when Maj. Gen. Leslie F. Kenne assumed the title of program manager, and then shifted to Marine Corps major general Michael Hough in 1999. Further, each program manager reported to a civilian leader from the other service, reinforcing the "jointness" of the JSF project.[40]

The JSF is more of a collaborative venture among the three services than was the TFX. This collaboration bodes well for American taxpayers who were ill served throughout the Cold War by the interservice battles that frequently spilled into the political realm. Today, the services work together in many ways, and "jointness" is no longer a dirty word in the halls of the Pentagon. The JSF program demonstrates that interservice cooperation has come a long way since the dark days of the TFX and the F-111.

Recommendations for Avoiding a Repeat of the FX Debacle

With the similarities and differences between the TFX and JSF projects established, it is possible to highlight areas of future concern. The military and civilian leaders at the JSF project have been rightly praised for their diligence, and the program has, so far, avoided some of the most serious pitfalls that befell the TFX. Much time remains, however, before the production model F-35s are delivered to the services. Here are some recommendations for ensuring that the program's success continues well into production and deployment of the aircraft.

Civilian Authority Must Remain Engaged and in Control

Robert McNamara was determined to translate into reality President Kennedy's vision for changing the focus of all branches of the military from nuclear war and its deterrence to limited, nonnuclear war. But McNamara's hands-on approach engendered the ire of both the military and civilians within the Pentagon. More important, McNamara became a lightning rod for political opponents put off by his manner. The TFX—tarred as McNamara's plane—got caught in this political firestorm.

In contrast, the JSF has not been tied to any individual or party. The aircraft has supporters and detractors on both sides of the aisle in Congress. The project has been boosted by Democratic and Republican presidential administrations and therefore can no longer be fairly labeled a partisan project. As Richard Aboulafia of the Teal Group points out, the F-35 is rapidly gaining momentum by acquiring its own political constituency.[41]

Meanwhile, there appears to be no consensus forming behind any other alternative. Some analysts still favor the F-22 Raptor, others are pushing the F/A-18E/F Super Hornet, and still others point to the promise of Unmanned Aerial Vehicles. But the services themselves continue to back such competing projects. According to Loren Thompson of the Lexington Institute, the Marine Corps wants the JSF more than the Air Force, and the Air Force wants it more than the Navy. "Only the Marine Corps has placed all its eggs in the Joint Strike Fighter basket," Thompson said. "Both the Air Force and, especially, the Navy

have other, higher-priority warplane projects—whose test planes are already flying."[42]

Political leadership is crucial at this juncture to keep the JSF project moving forward in a cost-effective and timely manner. The single greatest risk factor threatening to undermine the promise of the JSF is insufficient commitment on the part of the Navy. Senior Navy officials have repeatedly emphasized their vision of a service that would operate both JSFs and Super Hornets. In an interview with Defense Daily in 1998, then-Chief of Naval Operations Adm. Jay Johnson denied that the Super Hornet was "a bridge to the JSF." Johnson's vision for the future of Navy tactical aviation was of aircraft carrier flight decks "full of Super Hornets and JSF's." But Johnson emphasized that he didn't "have a clue what the numbers are. Neither does anyone else." In that same article, an unnamed Navy source said that if the JSF program suffered a schedule slippage, the service could make do by buying more Super Hornets.[43]

In other words, the Navy is hedging its bets. The reasons for the Navy's lukewarm support for the JSF are multifaceted, but they cannot simply be traced to opposition to the joint aspects of the program, as some have alleged. A key consideration might be the decision to make the JSF a single-engine aircraft to meet cost targets. Although the A-4, F-8, and A-7 were all single-engine planes that saw extended use by the Navy and Marine Corps, the Navy has usually favored planes with two engines. JSF program leaders justified the decision to delete the Navy's two-engine requirement by arguing that the new engines were more reliable. But Navy pilots might not be convinced; they operate over open ocean, even in peacetime, and an engine failure in a single-engine plane is certain to be a soggy affair. Meanwhile, Air Force pilots, even in the worst of scenarios, are more likely to eject over land where the prospects for survival—even in the midst of hostile territory—are far greater than for their counterparts in the Navy who eject over the sea. Even Scott O'Grady, the Air Force F-16 pilot who was shot down over Bosnia in 1995 and ejected into Serb-held territory, was rescued by U.S. forces. So the decision to create a single engine aircraft may be one of the emotional barriers preventing rank-and-file Navy pilots from embracing the JSF.[44]

Another factor is stealth. According to Loren Thompson, the Navy has always had serious doubts about the efficacy of stealth technology and has preferred to retain onboard electronic warfare and active jamming capabilities in the event that stealth fails. As the Navy sees it, the JSF places all of its defensive eggs in the stealth basket.[45] However, Richard Aboulafia counters that a faction within the Navy has begun to think that a bit more stealth "wouldn't have been a terrible thing" in operations over Afghanistan and that stealth technology would be useful over other likely trouble spots in the ongoing war on terrorism.[46] Although critics of the JSF have questioned the ability of manned aircraft to survive against surface-to-air missiles (SAMs), stealth technology should protect U.S. pilots from SAMs in most cases.[47] Accordingly, the Navy and Air Force should embrace the JSF because it provides some stealth capabilities at a fraction of the cost of the F-22 (which does employ stealth) and the F/A-18E/F (which has some aspects of low observability but which is not truly "stealthy").

However, if the Air Force and Navy continue to pursue competing projects costing hundreds of millions of dollars, the JSF may well fail. Therefore, an actively engaged civilian leadership in the Pentagon must step forward in order to ensure a firm commitment on the part of the Air Force and Navy to the JSF.

That outcome will not be easy to achieve. Naval aviators have a close attachment to the Super Hornet; and the Air Force still clings to the F-22, even as its costs have risen astronomically. In this regard, it is difficult to overstate the importance of a strong secretary of defense in a popular administration. Even though he was part of a popular administration and was praised by some for his Pentagon reforms, Robert McNamara was resented by many within the military and Congress. By contrast, Donald Rumsfeld has far more political prestige than McNamara.

The Marine Corps wants the JSF more than the Air Force, and the Air Force wants it more than the Navy.

The single greatest risk factor threatening to undermine the promise of the JSF is insufficient commitment on the part of the Navy.

With his approach to defense transformation in the first months of his tenure as secretary of defense, Rumsfeld aroused the ire of some on Capitol Hill and within the Pentagon. But September 11 changed all that. Now Rumsfeld has the political standing and the justification for demanding that the services get behind the JSF. He has not yet shown the will to do so, but he could reaffirm his commitment to defense transformation by compelling service support for the F-35 and, if necessary, canceling the F-22 and placing strict limits on the F/A-18E/F.[48]

Avoid Burdensome Politicization, but Maintain Political Support

The JSF has largely avoided the politicization that doomed the TFX. The program will have to continue to avoid the most egregious types of pork-barrel spending as it moves forward, while also maintaining political support to ensure that the F-35 survives into the next decade and beyond. Loren Thompson of the Lexington Institute warns that the JSF program may well be left to die on the vine if it does not cultivate the active support of those in the political community.[49]

It is logical to assume that politicians will continue to pressure the Pentagon to share the JSF pie to maintain a geographically diversified industrial base. For example, critics have claimed that the winner-take-all strategy employed by the JSF program managers will ultimately limit the range of choices available to taxpayers if only a single company survives to build fighter planes for the U.S. military.

Boeing is the leading candidate to receive JSF monies as a result of political meddling to shore up the industrial base. Boeing enjoys the support of powerful people in Washington, D.C., as shown by Congress's hasty decision to award Boeing a development contract for two new Air Force tanker aircraft shortly after the company was denied the JSF contract. Congress is also considering a plan to lease another 100 Boeing tanker aircraft, even though independent observers, such as Steven Kosiak of the Center for Strategic and Budgetary Assessments, question the merits of such an arrangement.[50]

Boeing will also fare well if political support for the JSF wavers. The company stands to gain from several of the programs that are competing with the JSF. In this respect, in spite of all of the talk that the award of the JSF contract was a winner-take-all competition, the Navy's F/A-18E/F Super Hornet may be a form of "the loser still wins" in disguise. The aircraft, formerly built by McDonnell Douglas, is now part of Boeing's portfolio of defense products. Ironically, despite having lost the JSF contract, the Navy's commitment to buy the F/A-18E/F may put Boeing in a stronger financial position, at least in the near term. The JSF program will not generate considerable revenue for Lockheed Martin until late in the decade. Further, Boeing holds a substantial stake (30 percent) in the F-22, another program that is competing with the JSF for finite defense-budget dollars. Contrary to reports that the loser of the JSF competition would be relegated to second-class status, the Super Hornet and F-22 programs will enable Boeing to keep a foot in the fighter market for many years to come.

Critics predicted that Congress and the Pentagon would have difficulty awarding the JSF contract to only one company. Bert Cooper, an analyst with the Congressional Research Service, told the *National Journal* that the "shoot-out" between two companies in a winner-take-all competition was no more than "a useful myth."[51] And although Boeing's supporters in Congress failed to compel Lockheed Martin to incorporate Boeing into the Systems Design and Development phase of the project, other aspects of the F-35 program suggest the persistence of industrial policy.

For example, the program provides funding to both Pratt and Whitney and General Electric for the F-35's engines, even though the Pratt and Whitney's F-135 engine is considered the baseline engine for the JSF. This dual funding, according to the Teal Group's Aboulafia, "makes sense from an industrial base standpoint" because the F-35 aircraft

will be "the only game in town after 2012." Similar plans exist to allow Raytheon to compete for the F-35's radar systems, even though Northrop Grumman's partnership with Lockheed Martin should have ensured that company's place as the preferred subcontractor for that crucial subsystem. The radar project, according to Aboulafia, is all about teamwork between Raytheon and Northrop Grumman—that is, about "bringing mortal enemies together."[52]

These plans are precisely the kinds of distractions that threaten the JSF program's ability to deliver on its promise of cost savings. The Pentagon should continue to resist attempts by politicians to force production sharing and coalition building the JSF program that would, in effect, turn the F-35 into a jobs program in disguise. Such efforts would surely increase program costs by impeding manufacturing efficiency and would produce no tangible benefit in terms of improving the plane's operational characteristics. Instead, the program should continue to encourage genuine competition between subcontractors and should employ market incentives to reward the continued use of successful practices that have been used in private industry to improve efficiency and drive down costs.[53]

Remain Focused on Defense Transformation

The JSF is a long-term project. Officially started in 1994, the program will not deliver its first operational aircraft until 2008 at the earliest. These planes are then expected to remain in the nation's arsenal for decades. In this regard, patience is a virtue. The Navy was able to end its involvement in the TFX project by waiting out Secretary of Defense McNamara. The service had long been plotting to cancel the F-111B; these preparations were put into action before the ink was dry on McNamara's letter of resignation. By the summer of 1968, less than five months after McNamara left office, the F-111B was dead. Freed from the legacy of the TFX project, the Navy put its energy behind its preferred fleet-air-supremacy aircraft, the F-14. The Navy had been developing this competing platform for some time, and the existence of the F-14 program granted naval leaders an easy alternative following the cancellation of the F-111B. Likewise, the Air Force, troubled by the shortcomings of the F-111A, deployed an alternative fighter, the F-15—which further cut into production totals planned for the F-111A. Cutting F-111A production, in turn, increased unit costs.

A similar situation exists with respect to the JSF. The Air Force remains committed to the F-22. The Navy began buying F/A-18E/F's in 1997 and has plans to buy hundreds more. There are still other programs competing with the JSF for taxpayer dollars. A report by the Center for Strategic and Budgetary Assessments issued in January 2001 called for abandoning the JSF and other weapons systems in favor of a transformational military strategy that would embrace new technologies, including more long-range missiles, expanded military use of space satellites, and unmanned aerial vehicles (UAVs).[54] In addition to their stake in the F-22 and the F/A-18E/F discussed above, leaders at Boeing have thrown themselves into the development of UAVs. These new unmanned aircraft are revolutionary. They represent the future of aerial combat, and they meet the definition of a transformational technology. But although the UAV is attractive because it is expected to be far less costly than manned aircraft and because it can be used for dangerous missions at no risk to pilots, the future is not here yet. UAVs have been used effectively in recent wars in limited roles, but no consensus has emerged that they can replace manned aircraft for all missions.

Other proposals call for canceling the F-35B, the STOVL variant of the JSF program. But there are risks with this proposal as well. Cancellation of the F-35Bs would leave the Marine Corps without an effective aircraft for the future. In anticipation of the F-35B, the Marine Corps declined to buy the F/A-18E/F or modernize the AV-8B. Furthermore, such a decision would alienate Great Britain, which is depending on STOVL aircraft to replace its Sea Harriers. If the F-35B is ever built, the Royal

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Navy's involvement virtually ensures an international market for the STOVL variant. A number of other nations have also expressed an interest in the STOVL JSF. And, if the F-35B is canceled, the JSF project will likely be seen as yet another in a long string of failed efforts to jointly develop military hardware on a multinational scale.

Rather than cancel the F-35B, the Pentagon should place a greater emphasis on this truly transformational aircraft. The Marine Corps deserves credit for getting behind the JSF project. Now the Marine Corps's STOVL F-35B is the most advanced platform within the entire JSF program and merits the continued support of the Pentagon and the other two services.[55] As Williamson Murray, professor emeritus of history at Ohio State University, argued in a Cato study published in February 1999, important commonalities exist between the Air Force and the Marine Corps's F-35 variants. Murray postulated that it might be possible to consolidate the three JSF variants down to two, in effect canceling the Air Force conventional takeoff variant, the F-35A. In addition to the international political reasons for continuing the STOVL F-35 discussed earlier, Murray's strategy is sound on tactical military grounds as well. The uncertain operational environment in future wars raises questions about the availability of survivable, hardened runways from which conventional takeoff and landing aircraft can operate. According to Murray, the ability of the F-35B to take off from short, unfinished runways might prove invaluable to defense planners of the future.[56] Political and military leaders should give careful consideration to this recommendation as they struggle to control program costs.

The JSF program has been praised for efficiency and celebrated for the amicable collaboration of the three services and the civilian staff. Likewise, it has, avoided many of the political controversies that swirled around the TFX.

Conclusion

The TFX program was troubled from its very beginnings. The military resented McNamara's decision to develop a dual-service aircraft over the objections of the Air Force and Navy. Military leaders further doubted the judgment of the civilian leadership in the Pentagon when that leadership rejected the military's recommendation—representing the unanimous opinion of military leaders—that the TFX contract be awarded to Boeing. And, finally, the military precipitated a political crisis by drawing Congress into the internecine squabble, subjecting McNamara and the civilian leadership to a withering round of criticism during grueling congressional testimony.

So far, the JSF has fared much better. At a comparable stage in the development cycle, the JSF program has been praised for efficiency and celebrated for the amicable collaboration of the three services and the civilian staff. Likewise, it has, avoided many of the political controversies that swirled around the TFX.

The controversies surrounding the TFX intensified after the development contract was awarded to General Dynamics in November 1962 and after the F-111 was first built and tested. By then, both the Air Force and the Navy had taken their doubts about the entire TFX project to McNamara's political critics in Congress. This congressional opposition helped to provide momentum to a sustained campaign to develop alternative aircraft for both services.

The same thing could happen in the case of the JSF—although the risks of a repeat performance were mitigated by the requirement imposed during the competitive Concept Demonstration Phase that both Boeing and Lockheed Martin develop working prototypes. We should expect that far fewer operational and performance-related difficulties with the F-35 will be seen than with the TFX because of the rigorous testing conducted on these prototypes before the lucrative development contract was awarded to Lockheed Martin.

Nonetheless, only time will tell if the JSF project can succeed where the TFX project failed. The keys for taxpayers are commonality of parts and technical capability. If the three different versions of the plane have a considerable number of common components (some estimates call for as much as 90

percent commonality between the three variants) then that should—all other factors being equal—translate into lower costs for taxpayers. And the plane must fly—and fly well. If any of the services doubt the capabilities of their given JSF variant, they will be sure to focus their attention on other options. And they may appeal to political allies to force a change in direction, as happened in 1968 with the F-111B and the F-14.

That outcome would be unfortunate, because the JSF explicitly addresses the problem of rising costs within U.S. military procurement. Robert McNamara justified his decision to award the TFX contract to General Dynamics by factoring costs into the equation. McNamara's subsequent troubled relations with congressional power brokers for the balance of his tenure in office says much about the political nature of military procurement during the height of the Cold War.

But times have indeed changed. The JSF program has proceeded from its origins with a close eye on controlling per unit costs. In fact, rather than criticize the Pentagon for paying attention to costs, critics have attacked the JSF cost estimates for being overly optimistic. In this case, the critics have history on their side. However, cost estimates for the F-35 have risen, but not to the level predicted by the most pessimistic claims.[57] However, if costs continue to increase, taxpayers should be concerned, and both the military and the politicians should be taken to task. In the meantime, there are grounds for optimism. Because the JSF program has, to date, succeeded in avoiding many of the mistakes of the past, the F-35 might actually deliver on its promise of low cost and high performance.

The JSF will be worth the taxpayers' support if the aircraft meets the Pentagon's aggressive cost estimates. These cost targets will be met if the services—and foreign governments—buy a sufficient number of planes to keep the per unit costs low and if Lockheed Martin and its subcontractors are held to the same stringent standards imposed during the earlier stages of the JSF project. Finally, a sufficient number of aircraft will be procured only if all three services—the Air Force, Navy, and Marines—throw their full support behind the program. These are three big "ifs." It is now up to the civilian leadership of the Pentagon to see to it that these "ifs" become "whens." If they do not, or they cannot, then it will be time to pull the plug on all three fighter programs (F-22, F/A-18E/F, and the JSF) and move into the future.

Critics of the JSF have grounds for skepticism, and the critics are numerous. Given that no nation can match the capabilities of the fighter aircraft in the U.S. arsenal, the need for a new fighter plane—any fighter plane—is open to considerable debate. However, the JSF program should move forward on the understanding that this aircraft will be the last manned fighter ever developed. The services must eventually modernize their inventories of fighter aircraft, and the JSF, if it is more successful than the TFX, has the revolutionary potential to allow the services to customize their aircraft designs, while saving the taxpayer significant sums of money by using common parts. Following the JSF, modernization will employ unmanned vehicles, space-based weaponry, and precision-guided munitions (delivered by both bombers and missiles). All three services must be put on notice to make the JSF work. If the F-35 fails, the Air Force should be compelled to terminate the F-22 and make do with the F-15s and F-16s, the Navy should be forced to scale back its Super Hornet program, and the Marines, through no fault of their own, will be forced to live with a mix of Harriers and F/A-18C/Ds. In the meantime, all money that would have been spent on the F-22 and additional Super Hornets should be diverted to rapid development and deployment of unmanned vehicles and other transformational technologies.

The promise of commonality, the holy grail of true military acquisition reform for the past 40 years, is too important to abandon at this stage. To date, the military and civilian officials in the Pentagon who have guided the JSF program have had remarkable

The JSF program should move forward on the understanding that this aircraft will be the last manned fighter ever developed.

success at delivering on their promises. The stubborn insistence on maintaining a winner-take-all competition for the program and the adoption of cost control as an explicit goal of the effort are just two examples of the ways in which the JSF program has defied conventional wisdom and historical precedent. The men and women managing the JSF program deserve the support needed to make this project a reality. In the end, both the taxpayers and the military will benefit.

Notes

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36. Ibid.

37. Art, pp. 5–6.

38. Shapley, p. 221; Coulam, p. 271.

39. "New Plane Seen More Costly, Little Better Than F-111," *Congressional Quarterly Weekly Report*, May 3, 1968, p. 1008; quoted in Coulam, p. 254. Robert McNamara told Walt Rostow in an oral history interview that the F-111 program was "sabotaged." Adm. Thomas Moorer, who was chief of naval operations at the time that McNamara left office, told McNamara biographer Deborah Shapley, "I sabotaged it." Shapley, p. 664.

40. Fallows, p. 68.

41. Aboulafia, p. 8.

42. Sydney J. Freedberg Jr., "A Three-Ring Flying Circus," *National Journal*, October 31, 1998, p. 2564.

43. Frank Wolfe, "Johnson: Super Hornet Not a 'Bridge' to JSF," *Defense Daily*, Oct 13, 1998.

44. But Vago Muradian argues that this might not be a major factor in such reluctance because the Navy's two-engine planes, such as the F-14 and the F/A-18, do not perform well if a single engine fails. Muradian, interview with the author, August 5, 2002.

45. Loren Thompson, interview with the author, August 1, 2002.

46. Richard Aboulafia, interview with author, August 2, 2002.

47. Steven Kosiak, Andrew Krepinevich, and Michael Vickers, "A Strategy for a Long Peace," Center for Strategic and Budgetary Assessments, January 30, 2001. See also Ann Roosevelt, "Kill Joint Strike Fighter, Crusader, Think Tank Says," *Defense Week*, February 5, 2001, p. 6.

48. David Isenberg and Ivan Eland, "Empty Promises: Why the Bush Administration's Half-Hearted Attempts at Defense Reform Have Failed," Cato Institute Policy Analysis no. 442, June 11, 2002, and Eliot A. Cohen, "A Tale of Two Secretaries," *Foreign Affairs*, May/June 2002, pp. 33–46.

49. Thompson, interview with the author.

50. Steven Kosiak, "Proposed Tanker Leasing Arrangement Unlikely to Be Most Cost-Effective Option for Air Force," Center for Strategic and Budgetary Assessments Backgrounder, June 14, 2002. See also Harvey M. Sapolsky and Eugene Gholz, "The Defense Industry's New Cycle," *Regulation*, winter 2001, p. 47.

51. Freedberg, p. 2564.

52. Aboulafia, pp. 7, 9, and interview with the author.

53. On the need to employ market forces to reform military procurement, see Ivan Eland, "Reforming a Defense Industry Rife with Socialism, Industrial Policy, and Excessive Regulation," Cato Institute Policy Analysis no. 421, December 20, 2001; Sapolsky and Gholz, pp. 44–49.

54. Kosiak et al., "A Strategy for a Long Peace." See also, "Changing, Yes—but Fast Enough? The Pentagon," *The Economist*, November 3, 2001.

55. "Critics Say JSF Cuts Could Mean Killing Marine STOVL Version," *Navy News and Undersea Technology*, April 8, 2002.

56. Williamson Murray, "Hard Choices: Fighter Procurement in the Next Century," Cato Institute Policy Analysis no. 334, February 26, 1999. Andrew Krepinevich offered a variation on this theme, calling for the cancellation of the land-based JSF variant and production of only the variant for aircraft carriers. Funds made available by this dramatic reduction in the number of JSFs could then be directed toward UAVs and other more futuristic systems. See also, "Changing, Yes—But Fast Enough?"

57. Congressional Budget Office estimates from 1997 were as much as 50 percent higher than those of DoD. See Mathews and Rothstein, p. 26.

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