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U.S.-JAPAN COOPERATIVE DEVELOPMENT

Progress on the FS-X Program Enhances Japanese Aerospace Capabilities

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The Honorable Newt Gingrich
Speaker of the House of
Representatives

The Honorable Strom Thurmond
President Pro Tempore
United States Senate

This is an unclassified version of a classified report issued to you earlier this year, on the progress made in implementing the U.S.-Japanese agreement on the FS-X program. We have updated information concerning the release of F-16 technical data and FS-X technology visits to reflect more current conditions. This report was prepared in response to the conference report on the fiscal year 1990 appropriations act for the Departments of Commerce, Justice, and State; the Judiciary; and related agencies.

This report contains recommendations to improve the U.S. government's review of FS-X related export licenses to Japan and to establish an FS-X Technology Transfer Evaluation Task Force under the Defense Science Board to improve U.S. government and industry evaluation of transferred Japanese FS-X technologies.

We are sending copies of this report to interested congressional committees and to the Secretaries of Defense, State, and Commerce.

This report was prepared under the direction of David E. Cooper, Director, Acquisition Policy, Technology, and Competitiveness Issues, who may be reached on (202) 512-4587 if you or your staff have any questions. Major contributors are listed in appendix VII.

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Executive Summary

Purpose

In November 1988, the United States and Japan agreed to cooperatively develop the FS-X fighter aircraft. The FS-X is a significantly modified derivative of the U.S. Air Force's F-16 Block 40 fighter aircraft. Congress has been concerned about the transfer of U.S. technology to Japan through the FS-X program and whether the program will provide the United States with useful technology. Consequently, the conference report on the fiscal year 1990 appropriations act for the Departments of Commerce, Justice, and State; the Judiciary; and related agencies called for GAO to monitor and periodically report on the implementation of the FS-X program. GAO has issued several reports on the FS-X program since 1989.

For this report, GAO examined (1) the program's status, (2) U.S. government and contractor controls over technical data and hardware provided to Japan for the program, (3) the transfer of program technology from Japan to the United States, and (4) benefits the program has provided to the Japanese and U.S. aerospace industries.

Background

The U.S.-Japan FS-X program, funded by Japan, involves the cooperative development of a fighter aircraft and the manufacture of six prototypes. The FS-X is planned as the replacement for Japan's aging, domestically developed F-1 fighter. Japan is obtaining U.S. design and development assistance based primarily on F-16 technical data. Japan is also purchasing certain items and services from U.S. firms for the development program, including engines for the prototype aircraft.

Under the FS-X agreements, the value of the U.S. work share is to reach 40 percent of Japan's FS-X development budget. According to Department of Defense (DOD) officials, the United States should receive, at no cost, all FS-X technologies essentially developed (derived) from U.S. technical data. Under these agreements, the United States must pay for FS-X technologies that are not essentially developed from U.S. technical data (non-derived), although the United States may obtain some information about the non-derived technologies at no cost. The FS-X agreements allow Japan to submit technologies to the United States for possible reclassification to non-derived status.

The government of Japan has overall FS-X program responsibility, and Mitsubishi Heavy Industries is the prime contractor. Lockheed Fort Worth Company (formerly General Dynamics Fort Worth Division), the manufacturer of the F-16, is the principal U.S. subcontractor. Lockheed will manufacture eight left wings for the FS-X test articles and prototypes

using composite design and manufacturing processes transferred from Mitsubishi. The U.S. Air Force monitors day-to-day program activities for the U.S. government and has delegated much of this responsibility to the F-16 System Program Office.

Results in Brief

The FS-X development program entered the prototype production phase in April 1993. The first prototype flight is currently scheduled for late summer 1995, a delay of about 2 years from earlier estimates. U.S. officials believe the only serious technical obstacle to a successful first flight test is Japanese development of the digital flight control software. The current estimated value of the U.S. work share is over $1 billion and is linked to the Japanese government's FS-X budget. Total FS-X development costs may exceed the FS-X budget. The United States cannot determine the overall cost of FS-X development because the FS-X agreements do not provide U.S. access to Japanese contractors' FS-X related cost data. DOD and Lockheed officials believe that the FS-X program will proceed into the production phase and are beginning to plan for production negotiations.

The adequacy of U.S. controls of the transfer of technology and hardware to Japan has varied. U.S. Air Force review of F-16 technical data for release to Japan seems adequate, while Japan continues to request certain F-16 data previously denied for release. In addition to the F-16 data, Japan is obtaining technologies and FS-X subsystem items from U.S. companies under export licenses. However, there is inadequate sharing of licensing information among U.S. government entities on these and related exports to ensure (1) compliance with DOD releasability guidelines or (2) that FS-X items are properly categorized as derived or non-derived.

The United States has gained more access to Japanese FS-X technologies since GAO's June 1992 FS-X review, although some issues remain unresolved. Japan has been reluctant to transfer data for certain systems to the United States and is seeking to limit technology transfer to the United States for those systems by reclassifying them as non-derived.

No one currently knows what benefits, if any, Japanese technologies will provide to the United States. In addition, U.S. evaluation has been incomplete and ineffective. Lockheed and U.S. officials believe that better coordination between U.S. defense contractors is necessary to effectively evaluate and apply Japanese FS-X technologies. Some limited U.S. efforts are underway to improve evaluation.

The FS-X program is helping strengthen Japan's aerospace industry. Japanese FS-X engineers are acquiring valuable design and systems integration experience applicable to other military and commercial aircraft projects. By making extensive changes to the F-16 baseline, Japan has maximized its use of indigenous design concepts and technologies, and has ensured an important role for Japanese companies. As a result, the FS-X program will reduce Japan's dependence on U.S suppliers for future Japanese military, and possibly commercial, aircraft programs. The program is also providing some benefits to U.S. companies that are now acting as subcontractor or suppliers. The technological contribution to the U.S. aerospace industry overall is currently unknown.

Principal Findings

FS-X Program Is in Prototype Phase

Japanese and U.S. contractors are working on the FS-X prototype aircraft and the first flight test is currently scheduled for late summer 1995. Air Force and U.S. industry officials have expressed concerns about Japan's ability to develop its digital flight control software. The FS-X aircraft cannot fly safely until the digital flight control software is operational.

Under the FS-X agreements, the U.S. work share is linked to the Japanese government's FS-X development budget rather than total Japanese expenditures or costs. DOD officials stated that the United States has access to Japan's FS-X budget figures. Current Japanese figures show that the value of the U.S. work share exceeds 40 percent of the development budget. The United States is attempting to validate these figures.

According to U.S. program officials, under the FS-X agreements, the United States does not have complete access to Japanese contractors' FS-X related cost data. At least one Japanese company has spent more on FS-X development than it has received from the Japanese government. Therefore, the United States may never know the total cost of the development program or whether total FS-X development costs exceed the FS-X budget.

DOD believes Japan will probably produce between 50 and 130 FS-X aircraft to (1) replace its outdated F-1 aircraft and (2) maintain its good security relationship with the United States.

Adequacy of Controls for U.S. Provided Items Varies

The F-16 System Program Office completed its review of the F-16 technical data package, which served as the baseline for the FS-X design, and continues to review supplemental F-16 data for release. GAO's examination of selected cases indicated that the Program Office was adequately screening F-16 data to ensure adherence to DOD releasability guidelines. However, Japan persists in seeking F-16 data the U.S. government has previously denied for release.

In addition to the F-16 related data, U. S. companies provide other technologies and hardware to Japan for FS-X subsystems under export licenses. The number of State Department FS-X related munitions export licenses to Japan has increased nearly 600 percent from 75 to 518 since June 1992. The State Department is approving munitions export licenses for FS-X prototype items. In addition, the Department of Commerce has approved export license applications for dual-use (military and civilian) items that could contribute to Japan's FS-X development program.

Inadequate sharing of information between licensing agencies and with DOD hampers U.S. oversight of FS-X related exports to Japan. Since agencies do not routinely share all FS-X related licensing information, DOD is unable to ensure compliance with releasability guidelines established for national security reasons. In one case the Department of State improperly approved an export license for a very sensitive F-16 item without coordinating with DOD. Further, GAO's analysis indicates that the Department of Commerce approved export licenses for military aircraft items that may be under the jurisdiction of the Department of State.

Additionally, poor coordination in the licensing process can impair the U.S. ability to properly categorize FS-X items as derived or non-derived. For example, before August 1992, the Air Force did not provide complete FS-X license information to the F-16 System Program Office, limiting its oversight of and insight into FS-X related exports to Japan.

Technology Transfer From Japan Is of Uncertain Value

Japanese transfers of FS-X technologies to the United States have increased during the past 2 years. DOD and Lockheed have received thousands of FS-X technical documents, including drawings, photographs, and video tapes. Japanese subcontractors have also begun providing FS-X technologies to the United States.

To date, Japan and the United States have agreed to classify five technologies as non-derived: the active phased array fire control radar,

mission computer hardware, inertial reference/navigation system, integrated electronic warfare system, and radar absorbing material. DOD has conducted technical visits in Japan for all of these technologies except radar absorbing material.

During GAO's review, the United States and Japan were negotiating the appropriate degree of U.S. access to certain other FS-X technologies. In December 1993, Japan submitted 12 items as candidates for reclassification to non-derived status. The U.S. government evaluated the 12 to determine if Japan developed them with minimal or insignificant U.S. input, as Japan claimed. In September 1994, the U.S. government told Japan that the United States would agree to reclassify 4 of the 12 items. U.S. officials said the Japan Defense Agency has limited technology transfers to the United States for some of the 12 candidate technologies pending resolution of the reclassification issue.

Through technology transfers and visits, the United States is learning about certain Japanese FS-X technologies. Preliminary analyses of the performance of these systems indicate that Japanese technologies, while strong in some areas, do not match U.S. capabilities. U.S. government and industry officials believe, however, that Japanese design and production methods may be more promising than the technologies themselves. For example, Japan designs and builds some avionics components that are lighter and smaller than similar U.S. equipment.

U.S. government and industry officials told GAO that they do not know what, if any, benefits will accrue to the United States from transfers of Japanese FS-X technology, because:

- Until the FS-X flies a test mission, no one can know if the Japanese modifications to F-16 systems are successful.
- U.S. sources believe that FS-X systems are based on technologies that the U.S. Air Force should surpass with its latest generation systems.
- It is not clear that Japan will transfer key manufacturing data that would most benefit U.S. industry.
- U.S. companies do not know what markets might exist for Japanese FS-X technologies.

There have been only limited efforts to systematically evaluate transferred Japanese FS-X technologies, and DOD has provided very little FS-X information to U.S. industry. However, DOD plans to establish an FS-X database at the Defense Technical Information Center that could improve

dissemination of Japanese technologies. During the course of GAO's review, the U.S. Air Force developed a plan for analyzing Japanese modifications to U.S. F-16 data.

Program Provides Different Benefits to Japanese and U.S. Aerospace Industries

Japan's aircraft engineers are improving their skills by designing and developing the FS-X fighter aircraft, according to U.S. and Japanese officials. Japan's FS-X experience also increases the likelihood of future autonomous Japanese aircraft development projects. U.S. officials stated that Japanese engineers are learning systems integration skills during the FS-X program that are also applicable to commercial aircraft projects.

According to U.S. officials, the Japanese government has provided Mitsubishi Heavy Industries extensive financial support for improving its aerospace composite capabilities. Japanese FS-X contractors can also use some of the equipment acquired for the FS-X program for other aircraft programs, including commercial projects.

Japan's substantial changes to the F-16 design ensure that Japan's aircraft industry will benefit from the program. Japan modified the F-16 to meet its stated operational requirements and to maximize opportunities for Japanese suppliers. Consequently, Japanese firms are supplying over half of the configuration items for the FS-X prototype aircraft. GAO's analysis of about 25 percent of these items indicated that Japanese firms obtained more FS-X contracts than U.S. firms for items with commercial applications.

While the program has enhanced the technical capabilities of the Japanese aerospace industry, to date program benefits to the United States have been mainly economic. The estimated value of U.S. work share has grown from initial projections of $480 million to over $1 billion as cost estimates for the overall FS-X development budget increased. The FS-X agreements specifically reserved certain tasks for Lockheed and General Electric while other U.S. firms had to compete with Japanese companies for FS-X work. Most of the U.S. work share is reserved for Lockheed, which is guaranteed between 30 and 31 percent of the value of the FS-X development budget. As of May 1994, Japan had awarded over $1 billion of contracts to over 200 U.S. firms for the development program.

Recommendations

To ensure compliance with FS-X releasability guidelines, oversight of FS-X related exports to Japan, and proper categorization of derived and

non-derived technologies, GAO makes recommendations in chapter 3 to the Secretaries of Commerce, Defense, and State regarding the development and implementation of written, formal procedures for sharing information about FS-X related export licenses and applications to Japan.

To assist DOD in developing and implementing a program to evaluate transferred Japanese FS-X technologies and determine how the United States may benefit from them, GAO makes recommendations in chapter 4 to the Secretary of Defense regarding the establishment of an FS-X Technology Transfer Evaluation Task Force under the Defense Science Board.

Agency Comments and GAO's Evaluation

GAO obtained comments on a draft of this report from the Departments of Defense, State, and Commerce (see apps. IV, V, and VI, respectively). DOD and State concurred with GAO's recommendations for establishing and implementing procedures to improve the sharing of export licensing information. DOD indicated that it planned to monitor current activities to identify, evaluate, and disseminate Japanese FS-X technologies and if they proved to be unsatisfactory, it would consider other actions such as establishing an FS-X Task Force under the Defense Science Board. GAO believes that once adequate development and testing of FS-X technologies has occurred, DOD should establish the Task Force because current U.S. efforts are probably too limited to provide sufficient evaluation and dissemination of FS-X technologies.

DOD commented that the U.S. contribution to substantially enhancing Japanese aerospace capabilities is not as significant as the GAO draft implied. DOD added that it has effectively limited Japanese access to sensitive U.S. aerospace technologies. GAO did not attempt to measure the significance of the U.S. contribution to enhanced Japanese aerospace capabilities through the FS-X program. Although DOD has limited Japanese access to certain U.S. technologies such as some software design and systems integration know-how, a number of experts have concluded that the Japanese aerospace industry has acquired significant technology from the United States during the program that it could not have acquired otherwise without considerable investments of time and money.

State and Commerce interpreted the draft report as advocating an inappropriate use of the U.S. export licensing system to restrict FS-X related exports. State pointed out that economic concerns are not mentioned in the Arms Export Control Act as a criterion on which a

license may be granted or withheld. While that statement is correct, GAO's draft did not propose withholding licenses for economic reasons. Commerce also commented correctly that if statutory and regulatory requirements are met, the fact that an export item may be used for FS-X purposes does not provide a basis for it to deny an export license. GAO notes, however, that the draft report recommended only that State and Commerce share licensing information about FS-X related exports with DOD. In GAO's view, this exchange of information is needed to ensure that licensing decisions take into account government-to-government agreements and DOD releasability guidelines established for national security reasons. This information is also needed to properly categorize FS-X technologies as derived or non-derived.

Commerce commented that DOD would have to make a formal request for historical information on export license applications to ship to Japan equipment or data that could be used on military aircraft and Commerce would have to determine that the release of such information was in the national interest. Commerce also stated that under a proposed executive order, DOD would be able to review all dual-use license applications processed by Commerce, before approval, if DOD chose to do so. GAO has not examined the draft executive order, but if properly constructed and implemented, it could improve the sharing of licensing information among involved executive branch agencies. This could help to ensure that licensing decisions are made in accordance with the FS-X government-to-government agreements and DOD's releasability guidelines, and that FS-X technologies are properly categorized as derived or non-derived from U.S. sources.

Contents

Abbreviations

DOD	Department of Defense
DDV	Direct Drive Valve
EPU	Emergency Power Unit
GAO	General Accounting Office
MELCO	Mitsubishi Electric Corporation
MITI	Ministry of International Trade and Industry

Introduction

In November 1988, the U.S. and Japanese governments signed a memorandum of understanding establishing the FS-X cooperative development program. Japan had seriously explored the option of developing its own aircraft to replace its aging fleet of domestically produced F-1 fighter support aircraft. Japanese industry and elements of the Japan Defense Agency advocated Japanese domestic development of the FS-X. In 1985, the Japan Defense Agency's research and development arm, the Technical Research and Development Institute, announced that, except for the engine, Japan possessed the domestic capability to develop an advanced fighter for about $1 billion. However, after extensive discussions with the U.S. government, Japan agreed to develop the aircraft with U.S. assistance by basing its design on Lockheed's[1] F-16 Block 40 fighter aircraft. The block number refers to a specific stage of the F-16's development. In contrast to previous F-16 coproduction programs, the United States agreed to release certain F-16 design and software data during the FS-X program.

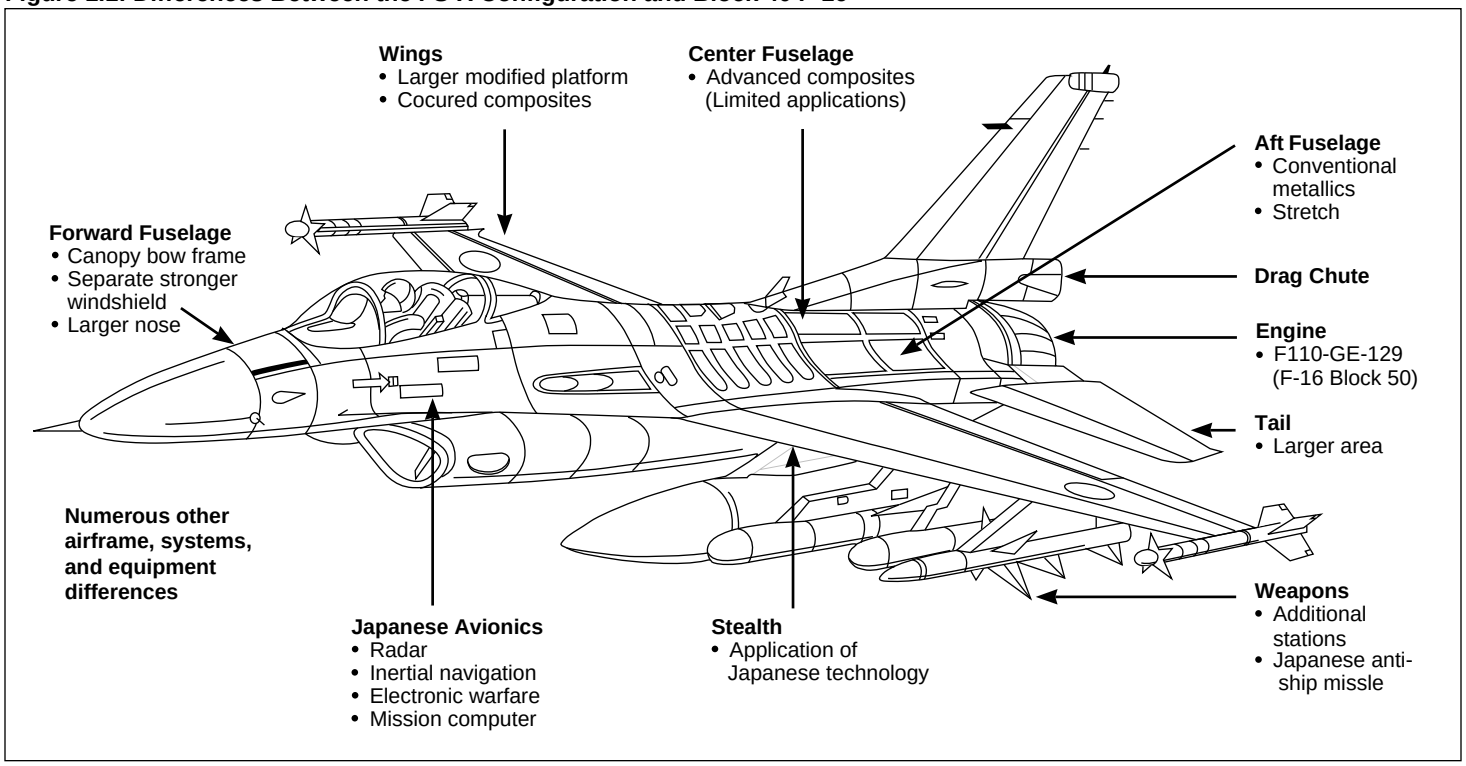
Japan has significantly modified the F-16 design for the FS-X program. While similar in appearance, the FS-X will be larger and heavier than the F-16. For example, the FS-X design calls for a 25-percent larger wing, longer fuselage, and longer horizontal and vertical tails. The FS-X will also have the same engine used in the latest U.S. version of the F-16 aircraft. The FS-X will incorporate five technologies defined by FS-X agreements as Japanese (non-derived):[2] active phased array fire control radar, integrated electronic warfare system, inertial reference/navigation system, mission computer hardware,[3] and radar absorbing material. Japan is also developing a co-cured composite wing for the FS-X. Figure 1.1 shows the major differences between the FS-X and the F-16.

[1]In 1993, General Dynamics sold its Fort Worth Division, which developed and produced the F-16, to Lockheed Corporation.

[2]Given the large amount of technology the United States has provided to Japan since the 1950s, it is likely that some of these systems are based to a certain extent on U.S. technology.

[3]The FS-X mission computer performs the functions of the F-16 Block 40 fire control computer. The mission computer integrates various on-board systems that enable the pilot to effectively aim and fire weapons at a target.

Figure 1.1: Differences Between the FS-X Configuration and Block 40 F-16



Japan Provides Program Leadership and Funding

Under a series of government-to-government and commercial agreements on the FS-X program, Japan funds the development program and is responsible for program leadership. It also has final authority over the aircraft's configuration, scheduling, and cost. Six prototype aircraft are planned—two for ground testing and four for flight testing. The United States is guaranteed 40 percent of the value of the total development work share budget and approximately 40 percent of the value of the total production budget, if the program proceeds into that phase. If Japan decides to undertake a production program, between 50 and 130 aircraft will likely be built.

The FS-X program agreements provide the United States access to technologies introduced into the program. According to the Department of Defense (DOD) officials, under the FS-X agreements, the Japan Defense Agency will transfer to the United States, at no cost, all FS-X technologies essentially derived from U.S. technical data. Under these agreements, the U.S. government and U.S. companies may negotiate purchases of FS-X technologies that are not essentially developed from U.S. technical data

(non-derived) at a cost to be determined at the time of transfer. The United States may also obtain some information about the non-derived technologies at no cost.

Japanese and U.S. Industry Play Roles in Program

U.S. and Japanese companies share FS-X design and manufacturing responsibilities. Mitsubishi Heavy Industries, a Japanese company, is the prime contractor and is responsible for portions of the airframe, some avionics, digital flight controls, and support equipment. Mitsubishi is also responsible for overall FS-X systems integration. Systems integration is critical to a successful advanced aircraft program and refers to all of the aircraft components working together to perform mission-related functions. U.S. government officials have noted that Japan has limited experience in advanced aircraft systems integration.

Key Japanese industry subcontractors include Fuji Heavy Industries and Kawasaki Heavy Industries. Fuji is responsible for developing the aircraft nose, composite wing upper skin, and tail assembly; Kawasaki is responsible for the center fuselage. Ishikawajima Harima Industries, another Japanese participant, will perform engine testing and maintenance during the development phase and is expected to manufacture portions of the U.S. engine under license if the program proceeds into production. Certain engine manufacturing tasks will likely be reserved for U.S. industry because of U.S. government technology release restrictions. Many other Japanese firms participate in the program as subcontractors and suppliers.

Lockheed Fort Worth Company is the major U.S. industry participant and is guaranteed between 30 and 31 percent of the value of the total FS-X development budget. Although Lockheed is a subcontractor, it is providing technical assistance to Japan and will design and produce certain parts of the FS-X, including the aft fuselage and leading edge wing flaps. Lockheed is manufacturing eight co-cured composite left wings for the FS-X test articles and prototypes. Lockheed is also designing and manufacturing certain avionics equipment and avionics test equipment. General Electric, another key U.S. participant, is manufacturing the engines for the prototype aircraft. Japan is also buying various items for the FS-X from over 200 U.S. companies. The more significant items include external fuel tanks, armament equipment, and certain avionics equipment.

FS-X Program Encountered Delays in Approval and Implementation

The FS-X program was initially delayed because of congressional and executive branch scrutiny of the proposed arrangement in early 1989. Congress and executive branch agencies raised concerns about (1) protecting sensitive U.S. technology, (2) minimizing Japan's opportunities to use the technology to advance its commercial aerospace industry, (3) guaranteeing U.S. industrial participation beyond the development program, and (4) ensuring U.S. access to and transfer of Japanese technology. In response to these concerns, President Bush ordered an interagency review of the program in February 1989, and Japan agreed to clarifications to the basic agreement that

- ensured a production work share of approximately 40 percent for the United States if the program proceeds into production,
- increased safeguards for U.S. technology, and
- confirmed U.S. access rights to Japanese FS-X technologies.

Lockheed and Mitsubishi planned to begin the first phase of the program in October 1989. However, contract negotiations deadlocked in August 1989 due to fundamental differences over the transfer, use, and payment for Japanese technology. During that time, the Air Force suspended transfers of F-16 technical data to Japan. These highly complex issues were finally resolved in February 1990 when the two governments signed a clarifying agreement that cleared FS-X technology for transfer to the United States.

U.S. and Japanese Governments Jointly Oversee the FS-X Program

An FS-X Technical Steering Committee, composed of government officials from the United States and Japan, is responsible for general program management and oversight. The Committee is cochaired by representatives from the U.S. Air Force and the Japan Defense Agency's Technical Research and Development Institute. Four subcommittees are responsible for managing specific aspects of the program, including work share, budget, technology transfer, interoperability, logistics, and technical support. The Department of Commerce is an adviser to the Committee, and Commerce officials attend meetings of the subcommittee that oversees work share, budget and technology transfer policy. The Technical Steering Committee refers issues it cannot resolve to higher levels in the defense agencies of both countries for resolution.

The Air Force's F-16 System Program Office, located at Wright-Patterson Air Force Base, Dayton, Ohio, monitors the day-to-day activities of the FS-X program for the U.S. government. The Program Office also

(1) approves the release of most Lockheed F-16 and FS-X technical data, (2) monitors work share issues, and (3) coordinates DOD's collection and evaluation of Japanese technologies. Two program office liaison officers stationed in Japan facilitate program management and exercise oversight. DOD officials from the Office of the Secretary of the Air Force, the Defense Security Assistance Agency, and the Defense Technology Security Administration monitor the program and participate in Steering Committee activities.

Previous GAO Reports

Since November 1989, we have issued a number of reports dealing with the FS-X program. In general, these reports concluded that

- the development program cost estimate had increased by 70 percent from initial estimates and the date for the first flight test had changed from 1993 to 1995,
- the United States was adequately controlling the release of F-16 related technical data to Japan, and
- little technology had been transferred from Japan to the United States.

A list of GAO products on this subject is on pages 111 and 112. In addition, we have four classified reports on the FS-X development program.

Objectives, Scope, and Methodology

In response to a requirement in the conference report on the fiscal year 1990 appropriations act for the Departments of Commerce, Justice, and State; the Judiciary; and related agencies, we have continued to monitor implementation of the FS-X program. Specifically, during this review we examined

- the program's status, including schedule, cost, work share, and production issues;
- U.S. government and contractor controls over technical data and hardware the United States provided to Japan for the program;
- the transfer of program technology from Japan to the United States; and
- benefits the program has provided to the Japanese and U.S. aerospace industries.

We reviewed pertinent schedule, cost, and work share data from U.S. government and industry sources. We did not evaluate the accuracy of the estimates. We obtained information on production issues from U.S. and Japanese government and industry sources.

We converted FS-X development cost estimates from yen to U.S. dollars at intervals that corresponded with the Japanese government's fiscal years. We did this because the Japanese government funds the FS-X program with annual budgets based on the Japanese fiscal year.

To assess the adequacy of U.S. controls over the release of the F-16 technical data to Japan, we reviewed data release policies and procedures established by the U.S. Air Force, the Defense Technology Security Administration, and Lockheed Fort Worth Company. We also reviewed technical data released or authorized for release, determined if the release was consistent with established U.S. guidelines, and discussed the release criteria with appropriate U.S. government and industry officials. Given the amount of data that has been transferred to Japan, we made spot checks of certain types of data, such as supplemental F-16 technical data, to evaluate compliance with releasability guidelines and procedures. We also observed document security systems at Lockheed and Mitsubishi Heavy Industries.

To evaluate U.S. government export licenses for technical data and hardware related to the FS-X program, we obtained data lists from DOD, State, and Commerce. We also met with officials from DOD, Air Force, State, and Commerce responsible for reviewing and approving these licenses. We were unable to determine the exact number of FS-X licenses State approved because State's database did not identify specific FS-X related munitions license cases.[4] The list of FS-X license cases we obtained from DOD may not be complete because State may not have provided all FS-X cases to DOD.

To address technology transfers from Japan to the United States, we reviewed pertinent government-to-government agreements and held discussions with officials from DOD, the U.S. Air Force, Commerce, State, and U.S. Embassy, Japan, as well as U.S. industry representatives in Japan and the United States. We met with representatives from Lockheed Fort Worth International Corporation (Nagoya, Japan) and Lockheed Fort Worth Company. We had discussions with representatives from Texas Instruments, General Electric, Hughes Airborne Radar Systems, Westinghouse Electric Corporation, and Norden Systems as well as from the Rand Corporation, a research organization. We also met with officials from the Naval Air Warfare Center and the Air Force's Wright Laboratory,

[4]We asked State officials to help us identify FS-X license cases in State's database for this review and our prior FS-X review (see U.S.-Japan Codevelopment: Update of the FS-X Program (GAO/NSIAD-92-165, June 5, 1992)), but that database was not programmed to identify FS-X license cases. However, State officials agreed to add a code to mark FS-X licenses processed after March 1994.

Dayton, Ohio, to discuss specific technical aspects of Japan's FS-X radar development and other technology issues.

We met with representatives from the Japan Defense Agency, and the Japanese Ministries of Foreign Affairs and International Trade and Industry to address technology transfer and other program issues. We also held discussions with officials from Mitsubishi Heavy Industries, Ltd./Nagoya Aerospace Systems; Mitsubishi Electric Corporation (MELCO) Headquarters; MELCO Communications Equipment Works; and MELCO Kamakura Works; and Fuji Heavy Industries, Ltd./Aerospace Division.

To ascertain the benefits provided to the U.S. and Japanese aerospace industries, we examined U.S. government and industry documents, spoke with and reviewed literature from U.S. experts in Japanese industrial and aerospace policy, and analyzed allocations of FS-X work among U.S. and Japanese companies. We also addressed industrial base issues in our discussions with U.S. and Japanese government and industry officials.

We obtained written comments from DOD and the Departments of State and Commerce on a draft of this report. We incorporated their comments where appropriate.

We conducted our primary review from April 1993 through June 1994. For this report, we updated information pertaining to the release of F-16 technical data and FS-X technology visits to reflect more current activities as of March 1995. We performed our review in accordance with generally accepted government auditing standards.

Status of the FS-X Program

FS-X contractors are working on the prototype aircraft, which is currently scheduled for its first flight test in late summer 1995. U.S. officials believe the only serious technical obstacle to a successful first flight test is Japanese development of the digital flight control software. In March 1992, the Japan Defense Agency imposed a limit on the FS-X development budget. This forced Lockheed to modify some of its tasks. According to a Japan Defense Agency estimate, the current value of the U.S. FS-X development work share, which is linked to the Japanese government's FS-X budget, is over $1 billion. At the time of our review, the U.S. Air Force was trying to validate U.S. work share data. The United States may never learn the true cost of the development program because the FS-X agreements do not provide U.S. access to Japanese FS-X contractors' cost data. DOD and Lockheed officials believe that the FS-X program will probably enter a production phase and are planning for production agreement negotiations.

FS-X Program Is Progressing, but Faces Some Challenges

Japan and the United States have made considerable progress in developing the FS-X aircraft, according to both U.S. and Japanese officials. Despite difficulties in the initial stages of the program, Lockheed and Mitsubishi Heavy Industries officials said their companies are now cooperating satisfactorily to meet FS-X cost and schedule goals. The FS-X program entered the prototype production phase in April 1993. Prototype production drawings are complete, and Japan has selected equipment suppliers for all major items. On January 12, 1995, the Japan Defense Agency introduced the first FS-X prototype to the public (see fig. 2.1).

Figure 2.1: First Japanese FS-X Prototype Aircraft at Mitsubishi Heavy Industries Aerospace Systems Works Facility in Nagoya, Japan

The first FS-X prototype flight test is scheduled for late summer 1995, a delay of about 2 years from earlier estimates.

FS-X Schedule Is Very Aggressive

DOD, Air Force, and Lockheed officials described the FS-X development schedule as aggressive, with tight deadlines for contractor tasks. Despite the compressed schedule, the Air Force had no evidence the program would encounter significant delays. Lockheed officials stated that Lockheed would meet deadlines for its tasks as long as Japan continued to provide Lockheed with required resources, such as composite wing data, on a timely basis. Japanese officials told us that the FS-X program was on schedule and had no major technical problems.

Japan Must Overcome Some Significant Technical Risks

Japanese officials and U.S. government reports have identified several areas of significant technical risk. In February 1993, Japanese officials identified three FS-X systems that pose great technical challenges: the co-cured composite wing, the leading edge flap drive system, and the

digital flight control software.[1] According to a U.S. official, in October 1993, the Japan Defense Agency also said that the integration of the avionics systems would be technically challenging. Additionally, U.S. government reports state that Japan has had technical problems with the radar and electronic warfare system. Japan has been simplifying some aspects of its original FS-X design and equipment to reduce potential technical problems and meet the revised first flight schedule, according to Air Force and Lockheed officials.

Concerns About Digital Flight Control Software

U.S. Air Force and U.S. industry officials and some Japanese military officials are concerned that Japanese problems with their digital flight control software could lead to significant schedule delays and possibly jeopardize continued Japanese government support for the program. Japan chose to develop its own software after the U.S. government said Japan could not have the F-16 flight control software for the FS-X unless Lockheed developed it in the United States with minimal Japanese participation. The F-16 flight control software is considered state-of-the-art, is unique in its sophistication, and can have direct application to commercial aircraft.

Japanese government officials believe it will be technically challenging to develop a safe digital flight control system. While the other FS-X avionics systems do not have to be fully operational for the aircraft to achieve its scheduled first flight date, the FS-X cannot fly safely until the digital flight control software functions properly. U.S. Air Force and industry officials have expressed concerns about Japan's ability to develop the software. Air Force officials based their concerns largely on indirect evidence such as difficulties experienced developing digital flight control software for other aircraft. They also noted Japan's limited experience with digital flight control software development. Because Japan is developing the software without U.S. assistance, the United States has had limited insight into its progress.

According to Lockheed officials, in August 1993, the Air Force asked Lockheed to begin assessing how to respond to a possible Japanese request for assistance in testing the digital flight control software. Additionally, a U.S. Air Force official said that in October 1993 the Air Force briefed Japanese officials on how to reduce flight control development risks and offered to test the Japanese flight control software

[1]Digital flight control computer software enables inherently unstable aircraft such as FS-X to fly and maneuver quickly and safely.

on Air Force test aircraft. However, Japanese officials reportedly said that U.S. assistance would be unnecessary.

Japan Caps FS-X Development Phase Costs

In early 1992, the Japan Defense Agency established a limit on the FS-X development budget in response to significant growth in its program cost estimates. In 1992, we reported that the estimate of FS-X development costs had increased by about 70 percent to 280 billion yen from a 1987 cost estimate of 165 billion yen. According to an Air Force official, the Technical Steering Committee's Japanese co-chairman told U.S. government and Lockheed officials that the program could be canceled if the contractors did not limit their costs to meet the budget limit. Subsequently, Lockheed agreed to modify some of its tasks to reduce program costs. Mitsubishi Heavy Industries and Lockheed then signed a March 1992 agreement limiting Lockheed's development budget costs to $735 million.[2]

Lockheed achieved its greatest cost savings by agreeing, with the concurrence of the U.S. government, to (1) produce left-hand co-cured composite wings, instead of both left and right hand wings and (2) provide Mitsubishi with less capable avionics test equipment. By producing only left-hand wings, Lockheed will not need separate tooling for right-hand wings. Despite its modified wing tasks, Lockheed should not suffer any loss of work quality or composite wing technology, according to Lockheed and Air Force officials.

United States Seeks to Validate FS-X Work Share

In October 1993, Japan estimated the value of U.S. work share at over $1 billion and told the United States that this figure exceeded the 40-percent U.S. share specified in an FS-X agreement. The Japanese estimate of U.S. work share ranged from 41 to 46 percent of the value of the FS-X development budget.[3] Under the FS-X agreements, the U.S. work share is linked to the Japanese government's FS-X development budget, not to Japan's total FS-X development expenditures or costs. DOD officials stated that the U.S. government has access to the Japanese government's FS-X development program budgets. At the time of our review, the Air Force was trying to validate the Japanese data for the value of U.S. work

[2]According to Lockheed officials, the $735 million Lockheed budget did not include a $60-million licensing fee paid by Mitsubishi Heavy Industries, costs incurred to support FS-X development phase ground and flight test activities, and certain other costs.

[3]The Japan Defense Agency estimate of U.S. work share varied according to the exchange rate used. For the October 1993 estimate, the agency used yen to dollar exchange rates ranging from 130 to 100 yen per dollar.

share by contacting all U.S. companies Japan identified as holding FS-X contracts to verify the dollar value of the contracts.[4]

U.S. government officials do not know if the program's total costs equal the Japanese government's FS-X development budget figures. At least one Japanese company is spending more on FS-X development than it has received from the Japanese government. These added costs are not included in FS-X budget data the Japanese government reports to the United States nor are they included in work share calculations. DOD officials stated that under the FS-X agreements, the United States does not have access to the Japanese contractors' cost data that would be needed to determine the total cost of the FS-X development program. However, it is clear that Japan will spend far more developing and producing the FS-X than it would have purchasing F-16s from the United States.

Production Appears Likely

U.S. government and industry officials believe the Japanese government will fund production of the FS-X aircraft. DOD believes Japan will probably produce the FS-X because Japan (1) needs to replace its outdated F-1 aircraft and (2) does not want to risk harming its security relationship with the United States by abandoning production. An Air Force official noted that Japan has never terminated a major defense program before production. However, U.S. officials said that FS-X production might not occur if

- the estimated production costs of the aircraft increase significantly;
- a major technical problem, such as failure of the digital flight control software, prevents the aircraft from flying safely;
- a prototype aircraft crashes during flight tests; or
- a drastic change in Japanese defense policy eliminates military requirements for the FS-X.

U.S. officials expected formal production discussions to begin in 1994. However, a DOD official stated that the U.S. government will not begin formal negotiations for an FS-X production agreement with Japan until DOD agrees that the United States has received sufficient technology transfer from Japan during development. Current Japanese plans call for FS-X production activities to begin in 1996.

[4]The United States and Japan agreed that any deviations from the 40-percent development phase target, in either direction, would be considered in the production phase work share.

U.S. and Japanese government officials believe Japan will probably produce between 50 and 130 aircraft. However, Lockheed officials, citing Japan's history of producing more aircraft than originally estimated, felt that Japan might ultimately produce as many as 200 FS-X aircraft.

U.S. Production Work Share Target Will Be Difficult to Attain

In 1989, the U.S. and Japanese governments agreed that the United States would receive a work share of about 40 percent of the value of any FS-X production program. However, U.S. government program officials believe that goal will be very difficult to achieve because

- the decline of the dollar against the yen, since the work share percentage was agreed to, makes U.S. work cheaper;
- changes in DOD policy have eliminated nonrecurring cost recoupment charges[5] Japan would pay to the U.S. government during the production phase;
- Japan's selection of many Japanese suppliers for the development phase did not account for U.S. production work share; and
- many U.S. companies providing end items for development might not want to bear the costs of maintaining production capability for the projected small quantities of FS-X aircraft (a maximum of 24 aircraft annually), and instead choose to accept lower licensed production payments from Japan.

A U.S. government memorandum stated that, to attain a 40-percent U.S. production work share, U.S. companies would need to build some parts during the production phase that Japanese firms manufactured for the development phase. Such a shift could disrupt the program's schedule and increase its costs.

Allocation of FS-X engine work share is another potentially difficult production issue. General Electric is selling its F110-129 "improved performance" engine, which the U.S. Air Force uses on its latest F-16s, to Japan for the development program. Japanese agency officials responsible for FS-X production have indicated that Japan will want to maximize its share of engine licensed production.

Japan seeks to maximize its engine work because its jet engine design and development capabilities lag behind the United States. Japan would like to use an FS-X production program to improve its aircraft engine technology and move toward its national goal of independently developing and

[5]According to a DOD official, nonrecurring cost recoupment charges are payments made by foreign purchasers for DOD's investment in the development and production of major defense equipment.

producing advanced aircraft engines. U.S. government officials acknowledged that Japan's desire to maximize its share of engine work and the difficulty of reaching a 40-percent U.S. production work share will make the engine an important production agreement issue.

Program Officials' Views on Lessons Learned to Date

U.S. program officials said their development program experiences can help the United States develop strategies for negotiating a production agreement. They said that the United States should try to minimize the number of government-to-government production agreements. Nine separate agreements—in addition to the memorandum of understanding—governed the development phase. Elements of the agreements are contradictory and extremely difficult, if not impossible, to interpret. The two governments spent considerable time trying to resolve differing Japanese and U.S. interpretations of the agreements. The governments could limit this problem by resolving conflicts and ensuring adequate specificity and consistency before signing production agreements, and by minimizing the number of agreements.

U.S. program officials also suggested that the United States should require Japan to clearly define the elements that comprise the production phase work share to avoid delays, confusion, and subsequent disagreement during the production phase. During development, the United States learned, contrary to initial expectations, that Japan's FS-X budget did not include certain costs.

The United States would benefit from a formal statement of U.S. goals and improved U.S. government interagency coordination during production negotiations, according to U.S. program officials. At various times during the development program, there were significant disagreements within the U.S. government on program issues that led to delays and awkward shifts in U.S. positions. U.S. program officials stated that the lack of unified U.S. positions created ill will with Japan and led Japan to be very cautious about undertaking other cooperative defense programs with the United States. The officials said that the U.S. government should resolve internal differences before negotiating production agreements so that it presents a consistent, united position to Japan.

Agency Comments

In commenting on a draft of this report, DOD generally concurred with this chapter. DOD agreed that:

- Under the FS-X agreements, the U.S. work share is linked to the Japanese government's FS-X development budget.
- The United States should require Japan to define clearly the elements comprising the U.S. work share for a production phase. DOD plans to identify each element of a U.S. production phase work share explicitly in the production memorandum of understanding projected for early 1996.
- The United States would benefit from a formal statement of U.S. goals and improved interagency coordination before negotiating production phase agreements. A formal statement of U.S. goals relating to the production phase has been prepared for interagency coordination. DOD stated that steering and working groups have been established to consider all relevant viewpoints during the drafting and negotiation of production phase agreements.

United States Is Providing Technology to Japan for the FS-X Program

The adequacy of U.S. controls over the transfer of technology and hardware to Japan has varied. U.S. controls over F-16 and Lockheed generated FS-X technical data seem adequate, while Japan has continued to seek the release of previously denied F-16 technical data. The U.S. government has delegated release authority to Lockheed for certain FS-X data. Lockheed's release decisions appear consistent with U.S. government releasability guidelines. After extensive review, the U.S. government released some F-16 related production information to Japan.

In addition to the F-16 and FS-X technical data, Japan has obtained FS-X subsystem items and technologies through the U.S. export licensing process. Although U.S. government agencies review export license applications for Japan, they do not adequately share licensing information for certain items. Furthermore, there is no comprehensive interagency information on U.S. technologies and hardware exported to Japan for FS-X subsystems. As a result, the United States is not adequately monitoring and controlling the release of FS-X subsystem items and technologies to Japan.

U.S. Air Force Review of the F-16 Data Appears Adequate

The Air Force's F-16 System Program Office completed its review of the F-16 technical data package, which served as the baseline for the FS-X design, and approved release of over 90 percent of the package and supplemental data documents to Japan in complete or modified form. However, the United States continues to withhold sensitive software and design data. The Program Office continues to review supplemental F-16 data for release. Our examination of selected cases indicated that the Program Office was adequately reviewing F-16 data to ensure adherence to DOD releasability guidelines.[1]

Lockheed continues to generate data to supplement the F-16 technical data package, which the Air Force reviews for release to Mitsubishi. The supplemental data includes:

- Technical assistance requests, which clarify, complete, or complement the F-16 technical data Lockheed has provided to Mitsubishi.
- Engineering or technical interface memorandums, containing supplemental technical data, that Lockheed personnel use to support ongoing program activities.

[1]The Air Force, in coordination with the Defense Technology Security Administration, drafted a Delegation of Disclosure Authority Letter, which provides criteria on what technical data and hardware the United States can and cannot release to Japan in support of the FS-X program.

- Technical data requests for missing or illegible pages of previously released F-16 data. Mitsubishi can also obtain data referenced in previously released F-16 documents through technical data requests.
- Engineering change proposals, which transmit information about certain design or engineering changes proposed for items found on the F-16 Block 40 aircraft.

When these types of requests and proposals generate technical data not previously approved for release, the Air Force is required to review the information in accordance with Lockheed's State Department approved commercial agreements with Mitsubishi. Our test checks of these F-16 supplemental data release records provided no indication that the Air Force or Lockheed was not adhering to established releasability procedures and policies. Appendix I shows the status of the review of the F-16 technical data package and supplemental F-16 data requests as of February 1, 1994.

Japan Repeatedly Requests Previously Denied Data

Japan has persisted in seeking certain F-16 data that the U.S. government has repeatedly declined to release. In June 1992, we reported that the System Program Office, in response to a Mitsubishi request, had reevaluated about 250 F-16 documents it had previously denied and that it again declined to release about 200 of them.[2] After completing the reevaluation exercise, the Program Office told Mitsubishi to request the specific data it required, rather than entire documents. Mitsubishi again submitted requests for 24 of the denied documents. The Program Office, working with Lockheed, completed its reevaluation of these requests in the summer of 1992. Table 3.1 shows the results of the review.

Table 3.1: Reevaluation of Previously Denied F-16 Technical Data Package Documents

Document status	Number	Percent
Releasable or modified	3	13
Alternate data provided for FS-X	13	54
Not releasable	8	33
Total	**24**	**100**

The types of data the Program Office authorized for release in complete, modified, or alternate form included pre-Block 40 data and an engine support document. The Program Office modified pre-Block 40 information and approved its release when Block 40 documents did not sufficiently explain changes to the F-16 Block 40. The United States released the

[2]U.S.-Japan Codevelopment: Update of the FS-X Program (GAO/NSIAD-92-165, June 5, 1992).

engine document after Japan selected General Electric as the FS-X engine contractor. At the end of our review, a Program Office official told us that Mitsubishi had again submitted requests for some of the denied technical data.

U.S. Government Delegates Release Authority for Some FS-X Data to Lockheed

With the transfer of virtually all of the releasable portions of the Lockheed F-16 technical data package to Mitsubishi, the principal flow of technology between Lockheed and Mitsubishi now involves data produced during the FS-X program, known as foreground data.[3] Starting in September 1992, the Air Force, with the concurrence of DOD's Defense Technology Security Administration and the State Department, delegated release authority to Lockheed for certain types of foreground data Lockheed generates for the program. Air Force and Lockheed officials stated that the delegations were necessary because (1) most of the foreground data is not sensitive because Lockheed creates it from previously released data or Japanese-provided data and (2) the program's tight schedule required expediting the flow of foreground information to Mitsubishi.

The delegation of foreground data review and release responsibilities to Lockheed has occurred in stages, with program office personnel training and testing Lockheed engineers in releasability review procedures and policies for specific items or technologies. Program Office officials said that they trained Lockheed personnel to adopt a conservative approach to data release decisions and to consult with the Program Office on questionable cases. In the final stage, Lockheed officials make release decisions and ship data judged releasable immediately to Japan. Subsequently, Lockheed provides the Program Office with periodic reports on the released data.

As of February 1, 1994, the Air Force and Lockheed had released 1,456 foreground data documents, withheld 26, and modified 12. According to Program Office officials, Lockheed's decisions have been consistent with U.S. government release guidelines. Our limited review of Lockheed and Air Force records of delegated release decisions revealed no evidence that either party was not conforming to applicable releasability procedures and policies.

[3]As defined in the FS-X memorandum of understanding, foreground data is "technical data and computer software, including any invention, process, or discovery, whether or not patentable, conceived or first actually reduced to practice in the performance of work under the program."

U.S. Government Approves Release of Some Production Data

In late 1991, in response to Japanese requests and after a DOD review, the U.S. government authorized the release of some F-16 related production data for items that Japan said were essential for completing the FS-X design. DOD's review was prompted by Japanese industry requests in the summer of 1991 for proposals from U.S. and Japanese companies to provide licensed production data for 122 FS-X subsystems. The Japan Defense Agency justified the requests by stating that it needed production information to ensure the safety of the FS-X design and to avoid schedule delays.

According to U.S. program officials, the Japanese requests caused concern within the U.S. government because many U.S. officials believed that licensed production of U.S. items would not be discussed at least until negotiations for a government-to-government FS-X production agreement began. One DOD official also saw the Japanese request for production information as a means of circumventing the FS-X development agreement and obtaining U.S. technology. An Air Force official stated that Japan wanted licensed production information to avoid having to purchase end items from U.S. firms. This would increase the number of jobs for Japanese workers and ensure an adequate level of contractor support during the program. The Japan Defense Agency had complained about the support it received from U.S. companies on other programs and believed it could obtain more timely assistance from Japanese firms.

In July 1991, at a meeting of the FS-X Technical Steering Committee, the U.S. position was that, in general, the United States could not approve licensed production before production negotiations. The United States asked Japan to reduce its license production requests to the minimum required to ensure the safety of the FS-X design. In August, DOD told the Japan Defense Agency that the United States would consider Japanese requests for licensed production information on a case-by-case basis. DOD also said that U.S. companies should not, as called for in one of the Japanese requests, be expected to transfer intellectual property rights to participate in the FS-X program and that Japan should give U.S. companies more time to respond to the requests. The Japan Defense Agency accepted DOD's offer and suggestions and subsequently reduced its requests from 122 to 96 items.

DOD, in consultation with Commerce and U.S. industry, analyzed the Japanese requests and approved 22 items for full or partial licensed

production.[4] Items approved for licensed production included the windshield, a fuel tank, and main and nose landing gear assemblies. The United States offered 74 other items to Japan as end items, including the head-up display unit, 600-gallon fuel tank, bomb ejector unit, radar altimeter, and high frequency radio.

In May 1992, Japan announced most of the source selections for FS-X subsystems. Japan selected U.S. companies for 19 of the 22[5] items offered by the United States for complete or partial licensed production. Of the 74 items offered as end items, Japan selected 48 from U.S. companies. The Japanese co-chairman of the FS-X Technical Steering Committee told DOD that one factor in Japan's selection of some Japanese firms was U.S. restrictions on the release of licensed production information during the development phase. DOD officials stated that the United States would probably allow more licensed production by U.S. firms upon completion of an FS-X production agreement.

Japan Is Obtaining Data and Items Through U.S. Export Licensing Process

In addition to F-16 and Lockheed FS-X technical data, Japan has obtained technology and items from U.S. firms through the export licensing process. As of March 18, 1994, State had issued at least 518 export licenses for items on the U.S. Munitions List to U.S. companies to provide technologies and items to Japan for the FS-X program.[6] In addition, between 1988 and 1993, Commerce approved at least one export license for the program. We were unable to obtain a definite count of FS-X related export licenses due to difficulties in analyzing State and Commerce licensing data. Further, while licensing procedures have improved since our last review, inadequate sharing of licensing information between State, DOD, and Commerce remains a concern and has resulted in inadequate monitoring and controls of program technology and hardware releases to Japan.

[4]The United States offered licensed production for the 22 items to Japan on a "build-to-print" basis. This means that U.S. companies could provide Japanese firms with the technical drawings and associated specifications to replicate a specific item. However, the U.S. companies could not provide any detailed design, development, or production data. The United States included this "build-to-print" restriction as a proviso in the export licenses for these items.

[5]The Japan Defense Agency eliminated one of these items, the vertical canard actuator, from the FS-X.

[6]We did not confirm that companies actually exported items under these approved licenses.

Several U.S. Government Entities Review FS-X Export Applications

Both the State and Commerce Departments review and approve export license applications for the FS-X program. State has jurisdiction over items and services on the U.S. Munitions List while Commerce maintains jurisdiction over dual-use items (items with both civil and military uses). Neither State nor Commerce are required to refer FS-X related license applications to DOD or share information with DOD about these cases. However, State frequently provided FS-X related license applications to DOD while Commerce generally did not share licensing information with State or DOD. As a result, no U.S. government agency or office has complete information on approved FS-X related licenses to Japan. Program officials said that the separate systems of license application review lead to gaps in knowledge that prevent them from fully monitoring FS-X transfers to Japan.

Number of Approved Munitions Licenses Has Increased

The number of approved FS-X munitions export licenses to Japan has increased from 75 to at least 518 since our June 1992 report. Most of these licenses cover hardware for the development and production of prototype aircraft. As table 3.2 shows, 54 percent of the approved munitions licenses to Japan for the FS-X program are for program hardware. In contrast, our 1992 review showed that most of the approved licenses were for marketing purposes. U.S. companies continued seeking approval for marketing presentations to Japan, and State has approved 109 licenses for marketing purposes since 1987.

Table 3.2: Types of Exports Approved Under FS-X Munitions Licenses to Japan

	Approved licenses	
Type of export	**Number**	**Percent**
Development or prototype aircraft hardware	278	54
Marketing information (brochures, presentations, and plant visits)	109	21
Technical data, drawings, or consultations	61	12
Maintenance and testing data or equipment	23	4
Castings and toolings	18	3
Technical Assistance Agreements	29	6
Total	**518**	**100**

Japan Has Obtained Dual-Use Item Licenses With Possible FS-X Applications

Under the Export Administration regulations, the vast majority of dual-use goods and technologies are exported to Japan under general licenses and require neither applications nor Commerce-issued documents. Many dual-use items that may have utility in the FS-X program can be exported to Japan under general licenses. Consequently, it was difficult to identify many exports that may contribute to the FS-X program. We identified, and Commerce confirmed, only one Individual Validated License[7] for exporting U.S. goods to Japan specifically for use in the FS-X program.

However, Commerce approved additional licenses to Japan for dual-use items that, according to knowledgeable Commerce officials, may contribute to the FS-X program. For example, during our search of Commerce licensing data, we found approved Individual Validated Licenses to Japan for materials and technical data for radomes, parts for military inertial reference/navigation systems, material useful for radar absorbing purposes, and military aircraft testing equipment. Commerce and State Department officials have conflicting views on which department has jurisdiction over some of these items. Moreover, Commerce officials told us Commerce is not obligated to coordinate its review of these licenses or share information on these cases with State or DOD. We found that Commerce did not coordinate or share information on the licenses we examined. DOD officials are concerned that certain Commerce-approved licenses may be inconsistent with U.S. releasability guidelines for the FS-X program. However, Commerce officials said they have no legal basis for denying most licenses to Japan and that Commerce is not legally obligated to follow DOD FS-X program releasability guidelines. Commerce also stated that the dual-use items it has jurisdiction over would not make significant contributions to the development of an advanced weapon system such as the FS-X, but did not provide evidence to support this statement.

State and DOD Coordinate Review of FS-X Munitions License Applications

State's Office of Defense Trade Controls reviews applications to export items and services on the U.S. Munitions List. To help ensure full consideration of technical, national security, and foreign policy concerns, Defense Trade Controls sends license applications that require additional scrutiny to bureaus within the State Department and other U.S. government agencies, principally DOD. State and DOD officials said that Defense Trade Controls sends nearly all FS-X applications to DOD for review. However, we were unable to verify this and found one case where

[7]Commerce requires U.S. companies to obtain Individual Validated Licenses for the export of certain categories of goods to Japan. These items include stealth technology, inertial reference/navigation equipment, and other aircraft subsystems.

Defense Trade Controls did not send an application for an especially sensitive item to DOD for review.

Within DOD, three units routinely review FS-X related license applications—the Defense Technology Security Administration, the Air Force, and the Defense Security Assistance Agency. The Defense Technology Security Administration coordinates DOD's reviews of military export license applications and establishes the DOD position in consultation with other DOD reviewing entities. It conducts a technical and policy review and ensures that other units review each FS-X license.

In June 1992, we reported that the Air Force did not routinely forward the FS-X munitions applications to the F-16 System Program Office. This situation has improved during the past 2 years. The System Program Office is the DOD entity most familiar with the FS-X program. It uses the FS-X releasability guidelines to determine what items the United States can release to Japan. We found that the Air Force forwarded about 61 percent of the FS-X munitions license applications to the Program Office for review and comment between September 25, 1992, and February 16, 1994. In another 14 percent of FS-X cases, the Air Force found license applications that clearly should be approved and did not require Program Office review. Nonetheless, the Air Force provided information on these cases to the Program Office after license approval. In total, Program Office officials have seen about 75 percent of FS-X munitions licenses since September 1992. Since August 1993, however, the Program Office has reviewed or received nearly all incoming FS-X munitions license applications.

Commerce Does Not Share Information About Dual-Use Applications

Our analysis of Commerce licensing data showed that Commerce had not, except for one occasion, shared information on licenses for items with possible FS-X applications with DOD or State. Commerce did provide some of its licensing information to the Program Office for analyzing whether certain technologies are non-derived; however, we found that information to be incomplete. DOD FS-X program officials said they know very little about items Commerce approves for export to Japan. As a result, they are unable to monitor all transfers to Japan that may contribute to the FS-X development. It is possible, therefore, that Japanese companies are obtaining U.S. technology for the FS-X program through licenses for other programs. In addition, since licenses are not required for most commercial exports to Japan, Commerce officials stated they are unable to monitor most of these exports.

Licensing Irregularities Pose Risk of Improper Releases to Japan

During our review, we encountered irregularities in U.S. export license processing that may undermine efforts to control the release of technology to Japan during the FS-X program. For example:

- State approved a munitions export license for a very sensitive item related to the FS-X program without referring the application to DOD for review. U.S. Air Force officials believe State should have denied this license because export of the item is strictly limited. U.S. officials intercepted this item at a port and were able to prevent shipment.
- State approved an FS-X engine license without the limitations required by DOD's FS-X releasability guidelines. This license permitted a U.S. company to (1) export some data without government review and (2) discuss prohibited production issues with the Japanese importer. Program office officials had recommended, including limitations based on a previously approved engine license.
- Program Office personnel did not always review referred license applications within the allotted time. As a result, DOD processed the applications without the Program Office input. Program Office officials said they often receive unrealistic deadlines for reviewing proposed licenses.

Management Information System Could Improve Flow of Licensing Data

In June 1992, we reported that the Program Office's insight into the licensing process could improve with installation of a computer terminal with access to DOD's Foreign Disclosure and Technical Information System. The system contains a database that lists the status of DOD's review of all military export license cases State refers to DOD, including the DOD position on applications. As of May 1994, Air Force officials were not aware of any specific plans to install the terminal.

Conclusions

The FS-X program involves the transfer of certain sensitive U.S. technology to Japan. Monitoring this transfer is critical for ensuring compliance with U.S. releasability guidelines. Inadequate sharing of information between licensing agencies and with DOD hampers U.S. oversight and control of FS-X related exports to Japan. There is no centralized source of interagency information on FS-X related licenses to Japan. As a result, program officials are unable to fully monitor the release of FS-X items and technologies to Japan.

Recommendations

To ensure compliance with FS-X releasability guidelines and oversight of FS-X related exports to Japan, we recommend that the Secretaries of State, Commerce, and Defense direct the appropriate offices within their departments to develop and implement written, formal procedures for sharing information about export license applications to Japan that are potentially related to the FS-X program. These procedures should, among other things,

- require State to refer all FS-X munitions license applications to DOD for review,
- provide sufficient information for F-16 System Program Office personnel to adequately monitor FS-X related export license applications to Japan,
- provide program office personnel on-line access to DOD's Foreign Disclosure and Technical Information System, and
- require Commerce to provide DOD information on Individual Validated Licenses for exports to Japan of equipment or data with existing or potential uses on military aircraft.

Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD and State agreed with our recommendations. Commerce stated that it could, as we recommended, provide historical information to DOD on Individual Validated License applications for exports to Japan of equipment or data with existing or potential uses on military aircraft. However, Commerce said DOD would have to make a formal request and Commerce would have to determine that the release of such information is in the national interest. Commerce also stated that under a proposed executive order, DOD would be able to review all dual-use license applications processed by Commerce if DOD chose to do so. We have not examined the draft executive order, but if properly constructed and implemented, it should enhance sharing of licensing information among executive branch agencies, which would help to ensure that licensing decisions take into account both the FS-X government-to-government agreements and DOD's FS-X releasability guidelines, which were established for national security reasons. This exchange of information is also needed to properly categorize FS-X technologies as derived or non-derived.

State and Commerce interpreted the draft report as advocating an inappropriate use of the U.S. export licensing system to restrict the export of items and technologies to Japan for the FS-X program. State commented that economic concerns are not mentioned in the Arms Export Control Act as a criterion on which a license may be granted or

withheld. While that statement is correct, our draft did not propose withholding licenses for economic reasons. Commerce also commented correctly that if statutory and regulatory requirements are met, the fact that an export item may be used for FS-X purposes does not provide a basis for it to deny an export license. However, we note that the draft report only recommended that State and Commerce share licensing information about FS-X related exports with DOD. In our view, this exchange of information is needed to ensure that licensing decisions take into account the FS-X agreements and DOD guidelines, and that FS-X technologies are properly categorized.

Commerce commented that current law and regulations do not authorize it to deny export license applications for dual-use items to Japan on the basis of their potential use in the FS-X program. This point is valid if the applications in question fall under Commerce's jurisdiction. As noted in the report, Commerce may have processed some license applications for Japan that fall under State's jurisdiction. Commerce stated that all but one of 12 licensing cases we identified as potentially falling under State's jurisdiction were clearly under Commerce's jurisdiction. We note that Commerce can not unilaterally make a commodity jurisdiction determination; such determinations are reached by State after coordination with DOD and Commerce. Furthermore, these 12 cases represent only a sample of a larger number of items licensed by Commerce that could have potential applications for the FS-X or fall under State's jurisdiction.

Technology Transfer From Japan Is Improving, but of Uncertain Value

Although transfers of both derived and non-derived Japanese FS-X technologies to the United States have increased since our June 1992 report, it is unclear how much the United States will benefit from these transfers. U.S. evaluation of Japanese FS-X technologies has been limited and the U.S. government has done little to help U.S. industry obtain information about FS-X technologies. Questions remain about Japanese technical capabilities and the value of Japanese technologies to the United States. Japanese design and manufacturing techniques could be useful, but the United States may not obtain these technologies under the FS-X program. In addition, U.S. and Japanese industry officials do not know what markets exist at this time for transferred Japanese FS-X technology.

Progress Made on Technology Transfers From Japan, but Some Problems Remain

Overall, Japanese efforts to transfer FS-X technical information to the United States have improved since 1992 and U.S. program officials are generally satisfied with the transfers. The United States has collected information on the FS-X wing and the four Japanese non-derived avionics systems: the active phased array fire control radar, the mission computer hardware, the inertial reference/navigation system, and the integrated electronic warfare system. Japan has provided increasing levels of access to these technologies as they reach key development points. However, program officials are uncertain if Japan is transferring all the data it should. The United States and Japan also disagree on how the United States may use some Japanese FS-X technology.

United States Is Receiving FS-X Technology From Japan

The United States had received thousands of FS-X technical documents, including drawings, photographs, and video tapes as of early 1994. Japanese subcontractors have also begun providing FS-X technologies to the United States. Japan has provided English translations of technical documents that Lockheed officials believe are complete and accurate. Japan has also hosted U.S. government technology visits for Japanese non-derived FS-X avionics technologies.

A U.S. Air Force official stated that technology transfers will continue throughout the development program and that the number of U.S. companies receiving Japanese technology should increase further, now that Japan has selected about 200 U.S. firms to participate in the program. Under the FS-X agreements, a U.S. firm is entitled to Japanese FS-X technologies that incorporate changes, modifications, or improvements to technical data the U.S. firm supplied to Japan for the program.

The United States Is Obtaining Some Japanese FS-X Data Through Technology Visits

The FS-X agreements specify that DOD may request technology visits to obtain information about Japanese non-derived FS-X systems. At the time of our review, Japan had hosted 11 U.S. government technology visits. The U.S. strategy is to have at least one technology visit during both the design and prototype production stages of the development program to ensure that DOD collects information about Japanese design and production approaches. During each visit, U.S. and Japanese engineers

- discuss design philosophy and technical specifications of the system;
- review test methodology, test data, and evaluate the system's test performance;
- review the development schedule for the item as well as key dates for integrating the item into the FS-X aircraft;
- examine system hardware; and
- tour applicable Japanese Defense Agency research and development sites, as well as the design and manufacturing facilities of the associated Japanese manufacturer(s).

Upon its return, the DOD team produces a technology visit report that will be available to DOD agencies and certain U.S. DOD contractors. Table 4.1 shows the dates of prior and planned FS-X technology visits.

Table 4.1: Dates of FS-X Technology Visits

Japanese non-derived system	Date	Purpose of visit
Active phased array fire control radar	March 1990	Assess Japanese design
	May 1991	Assess Japanese development/ manufacturing facilities
	June 1992	Commerce/DOD/Mitsubishi Electric Corporation radar symposium in Washington, D.C.
	July 1993	Test Module Controller
	May 1994	Share/compare testing results
	November 1994	Commerce/DOD/industry assessment; company discussions
Mission computer	November 1991	Assess Japanese design
	May 1993	Assess Japanese development/ manufacturing facilities
Integrated electronic warfare system	July 1993	Assess Japanese design
	September 1994	Assess Japanese development/ manufacturing facilities
Inertial reference/navigation system	November 1993	Assess Japanese design
	September 1994	Assess Japanese development/ manufacturing facilities
Radar absorbing material	May 1995 (planned)	Assess Japanese design

U.S. and Japanese officials told us they have been satisfied with the most recent technology visits. U.S. team members reported that the Japanese have provided good access to FS-X facilities and responded completely to U.S. inquiries about the non-derived technologies. The Air Force intends to continue monitoring development of the Japanese non-derived FS-X systems.

Air Force officials have indicated that they are seeking U.S. industry participation in upcoming avionics technology visits. Commerce officials have also discussed additional industry visits to Japan to facilitate

discussions between U.S. and Japanese industry on the non-derived systems. Parts of the technology visit reports will be available to qualified users of the Defense Technical Information Center[1] and from Commerce through electronic databases and industry associations. However, as of June 1994, all of these efforts to share FS-X information outside DOD were still in the planning stages.

Lockheed and DOD Need Additional Data to Assess Novel Japanese Wing Design

According to Lockheed officials, they are receiving sufficient data and technical assistance from Mitsubishi Heavy Industries to build FS-X wings that meet Japanese technical specifications. Lockheed has produced co-cured composite wing sections according to the Mitsubishi design. However, at the time of our review, Mitsubishi had not yet provided all the information Lockheed needed to apply the composites technology to other programs. Nevertheless, Lockheed continues to receive wing data from Mitsubishi, and officials were optimistic that Lockheed would receive sufficient data to consider using the co-cured composite technology for other applications.

Some U.S. officials are concerned about the capabilities of the Japanese FS-X co-cured composite wing design. Sections of Lockheed and Mitsubishi wings meet testing specifications. However, the overall wing design has several unique features such as (1) extensive application of composite materials,[2] (2) a novel configuration of internal wing support structures, and (3) a complex Japanese manufacturing process. Japan must prove this design on a flying prototype. Since the Japanese design represents a departure from typical U.S. approaches, some U.S. officials are uncertain whether the composite wing will meet all FS-X mission requirements.

U.S. program officials have requested full access to Japanese FS-X flight testing, which will ultimately verify the capabilities of the wings. These officials stressed the importance of participating in the flight test program and obtaining as much testing data as possible from Japan. Flight testing will (1) verify the wing's performance characteristics, (2) allow Lockheed to better evaluate Japanese composites design and processes, and (3) provide insight into other potential (non-FS-X) uses of this technology.

[1]A DOD computerized defense information service available to qualified government and industry personnel.

[2]Composite materials include carbon based fabrics and resins that, when heated under high pressure, bond to create a single structure.

During our review, members of the FS-X Technical Steering Committee had been negotiating U.S. involvement in flight testing.

Questions About FS-X Radar Remain Following 1992 Symposium

Following two DOD technology visits to Japan, Commerce and DOD sponsored a symposium on the FS-X active phased array fire control radar in June 1992. Mitsubishi Electric Corporation (MELCO), which is developing the radar, provided a technical overview to over 150 U.S. industry and government attendees in Washington, D.C. Reviews of the symposium varied. U.S. government and some industry officials said that Japanese willingness to participate in the symposium was unprecedented and provided a possible model for future technology exchanges. Other radar industry officials, on the other hand, said MELCO provided very limited information about the FS-X radar. Consequently, they were unable to adequately evaluate Japanese radar technology.

There has been little follow-up to the symposium by either Commerce or MELCO, although some U.S. firms have been expecting such efforts. MELCO officials told us they had contacted several U.S. companies about commercial applications for FS-X radar technology. When we contacted some of these companies, however, officials said that MELCO has been reluctant to discuss its radar technology. This is partly because Japanese companies are generally prohibited from exporting goods for military use. MELCO officials said this prohibition interferes with efforts to export its modules that MELCO believes have both commercial and military applications. Japan's Ministry of International Trade and Industry has told MELCO it must demonstrate a commercial application of the modules before receiving approval to export them.

Interest in the FS-X radar among the U.S. radar companies we contacted is mixed. Some U.S. radar industry officials told us they would like to visit MELCO's FS-X facilities in Japan to learn more about their radar modules.[3] U.S. companies produce similar modules and believe they could benefit from knowledge of Japanese production methods. However, some of these companies believe U.S. radar technology itself is more advanced and therefore they cannot learn much from Japan. Radar experts are also uncertain about the potential market for this technology especially since current module costs preclude widespread commercial applications. Commerce officials told us that a government-sponsored radar industry visit to Japan would help resolve these questions. Such a visit occurred in

[3]These approximately 3.5x1.1x.0.3 inch modules incorporate state-of-the-art gallium arsenide monolithic microwave integrated circuit technology. Each FS-X active phased array radar antenna will use about 800 individual modules.

November 1994 and involved more than a dozen U.S. companies, according to a Commerce official.

In the spring of 1994, DOD completed testing of five radar modules the United States purchased from Japan. Appendix II describes the U.S. testing program and module costs.

United States and Japan Continue to Consider Technology Transfer Issues

Under the FS-X agreements, Japan may submit evidence and requests to change the technology transfer status for specific FS-X technologies. If Japan demonstrates it developed a technology with insignificant or no U.S. input, the United States may agree to reclassify the technology as non-derived. Under non-derived classification, Japan may limit certain technology transfers to the United States. Japan may also sell non-derived technologies to the United States. In contrast, Japan is required to provide complete technology transfers for changes, modifications, or improvements to derived technologies free of charge to the United States.

In February 1993, the United States agreed to reclassify radar absorbing material to non-derived status. According to DOD officials, the U.S. decision was primarily based on DOD's export license records, which showed that no U.S. licenses referred to DOD had been approved for transfer of radar absorbing material to Japan. However, we identified two approved Commerce licenses to Japan for an item classified as radar absorbing material. An official from the U.S. company that obtained these licenses told us that his firm had exported the item to Japan on at least two occasions under Commerce Department export licenses. He also said that the Japanese importers could use the imported material for FS-X radar absorbing applications.

This company official told us that his firm attempted to obtain a State Department munitions export license for this material, but that State, in coordination with DOD, determined that the item was not controlled under the U.S. Munitions List. As a result, the company obtained export licenses from Commerce. The company official was surprised about State's response because State had previously controlled a similar item under the Munitions List and the company had obtained munitions export licenses for the item. Commerce provided us with documents showing that State had passed jurisdiction for these cases to Commerce.

We asked DOD to inquire about Commerce's licensing jurisdiction over this item. At the time of our review, DOD was seeking information on these

cases from Commerce and had not completed its review. From the information we obtained for these cases, it appears that DOD lacked complete information when it decided to reclassify radar absorbing material.

In December 1993, Japan requested non-derived classification for 12 FS-X items.[4] The United States conducted an analysis to determine the level and significance of U.S. input into the 12 candidate items and to assess the technology transfer consequences of agreeing to non-derived status. For example, DOD searched for military licenses—and some dual-use and commercial export licenses—State and Commerce issued for Japan that contributed to any of the 12 candidates. We encouraged DOD to work with Commerce and State to obtain and analyze all pertinent U.S. export licenses approved for Japan. DOD officials agreed that a thorough analysis was needed because changing the classification of these items could limit U.S. program benefits. Additionally, if improperly classified as non-derived, the United States could later buy technology derived from U.S. data. In September 1994, the U.S. FS-X Technical Steering Committee co-chairman informed his Japanese counterpart that the United States had agreed to change 4 of the 12 candidate items to non-derived status. At the time of our review, the Japan Defense Agency was studying the U.S. decision.

Japan May Not Be Transferring All FS-X Data

The Japan Defense Agency has been holding up transfers for reclassification candidate technologies pending the resolution of the December 1993 reclassification request. The agency is reluctant to transfer candidate technologies before the U.S. evaluation is complete, because it believes they are not essentially developed from U.S. technology. On the other hand, U.S. officials contend that all FS-X technology is derived until classified otherwise and that Japan is obligated to transfer data until classification negotiations end. At the time of our review, the United States and Japan had not resolved this issue.

[4]Among the 12 candidates for reclassification are the map generator, cockpit displays, the aircraft video tape recorder, the radar liquid cooling system, and the digital flight control software.

Japan Is Disputing U.S. Rights to Use Some FS-X Technology

The two countries also disagree on how the United States may use some transferred Japanese FS-X technology. The FS-X agreements state that DOD may use certain Japanese data for defense purposes.[5] U.S. officials believe this allows the U.S. government to share Japanese data with companies not involved in the FS-X program for use in other defense programs. Japanese companies are concerned that this arrangement may reveal company secrets. By the end of our review, DOD had received several requests for Japanese FS-X wing data from U.S. companies that are not participating in the program. As a result, the two governments were working to resolve differences over how the U.S. government could distribute Japanese data.

Efforts Are Underway to Evaluate Japanese Technologies but Obstacles Remain

Overall, U.S. efforts to evaluate Japanese-provided FS-X technologies have been limited and uncoordinated. This is partly because the U.S. government did not originally consider technology transfer from Japan as a primary program goal and did not have an established infrastructure to evaluate transferred technology. As late as 1993, Air Force, Commerce, and Lockheed officials told us they lacked the resources to evaluate Japanese FS-X technology transfers.

DOD and several U.S. firms were evaluating three Japanese FS-X technologies at the time of our review: the co-cured composite wing, the digital flight control computer, and Japanese radar modules (see app. II for further information on the radar evaluation). In addition, following our inquiries, the Air Force began an analysis to determine which FS-X technologies might be of interest to U.S. industry. According to an Air Force official, DOD plans to distribute the results of this analysis within DOD and to most U.S. FS-X contractors. Preliminary results of this analysis show that the United States may be interested in several Japanese FS-X technologies listed in table 4.2.

[5]Specifically, the FS-X memorandum of understanding essentially states that the Japan Defense Agency grants to the U.S. government a non-exclusive and irrevocable license to use the technical data essentially developed from U.S. technical data (derived technology) for its defense purposes (including Grant Aid) and defense sales (including Foreign Military Sales).

Table 4.2: Japanese FS-X Technologies of Potential Interest to the United States

Technology/system	Important characteristics
Four Japanese non-derived avionics systems: Active phased array fire control radar Mission computer hardware Integrated electronic warfare system Inertial reference/navigation system	Represent a culmination of years of Japanese avionics development work. Gallium Arsenide Monolithic Microwave Integrated Circuit technology in the radar is of special interest because the United States currently produces and uses this technology.
Active matrix standby and multi-function displays	Display manufacturing technologies and dual-redundancy of the multi-function display system.
Emergency Power Unit (EPU)	The FS-X EPU will use JP-4 fuel, a less hazardous substance than the hydrazine that powers the F-16 EPU.
Airframe sections	Material properties, material and process specifications, and tooling concepts.
Nose radome	Knowledge of material properties, coatings, and processing techniques.
Direct drive valve (DDV) cartridges	DDV cartridges are a relatively new technology and the United States could learn from Japanese test results.
Possible replacements for F-16 equipment including: Fuel/oil heat exchanger Variable delivery hydraulic pump Rate of fuel flow transmitter	Substitution of Japanese equipment could increase the performance capability of certain U.S. F-16 systems.

United States Lacks an FS-X Technology Evaluation Strategy

U.S. program officials and observers told us the United States has not done much to evaluate Japanese FS-X technologies with potential value to the United States due to a lack of resources. These include flat panel displays, the co-cured wing, and beta titanium technology, according to a former program official. Ideally, one observer said, the United States should have begun evaluating these technologies and considering uses for them as soon as Japan provided technical data on them.

Lockheed Fort Worth officials further explained that they cannot fully evaluate Japanese FS-X technologies without input from other experienced U.S. defense companies. Because Lockheed and other manufacturers guard their industrial secrets very closely, Lockheed does not know all of the capabilities of other companies in areas such as composites. Lockheed officials believe that Commerce and DOD must lead overall evaluation efforts because competing U.S. defense companies are very unlikely to do so on their own.

U.S. officials contend that there are limited opportunities to use Japanese FS-X technologies without military requirements for them. For example, with the pending closure of F-16 production lines, a program official stated the company will not have a program that could readily incorporate Japanese technology.[6] This official also noted that the next generation U.S. F-22 fighter aircraft currently in development is unlikely to benefit from transferred FS-X technology. However, the United States will not know if Japanese FS-X technologies will benefit U.S. programs without further evaluation of those technologies.

The lack of a comprehensive U.S. evaluation program several years into FS-X development could hamper subsequent use of Japanese FS-X technologies. During FS-X development, the United States can obtain virtually any technical document for Japanese systems essentially derived from U.S. technical data. However, this opportunity could end with completion of the development phase. Until DOD and U.S. industry examine Japanese technology transfers, they cannot know what additional information the United States should request from Japan.

Plans for Disseminating Japanese FS-X Technology Are Limited

As discussed in one of our prior reports, the United States is generally less effective in disseminating foreign technology among its government institutions and industry than Japan.[7] This seems to be the case with the FS-X program. Although certain Lockheed and DOD officials have had access to Japanese technical data for over a year, we found little evidence of measures to share the data outside of Lockheed and the F-16 System Program Office. The limited distribution of Japanese data within the United States partially explains, in our opinion, the limited evaluation of Japanese FS-X technology by U.S. government and industry.

U.S. FS-X officials made little progress in distributing Japanese technical information during our review. In May 1993, F-16 System Program Office officials disclosed plans to distribute Japanese data through the Defense Technical Information Center. However, a year later no FS-X data was available on the system. A Center official told us that in April 1994, the Center and the Air Force had agreed to add bibliographies of Japanese FS-X technical reports to the system. Qualified users could also order

[6]Although Lockheed is involved in the F-22 program, program officials believe that transferred FS-X technology would be of little use in this program.

[7]Foreign Technology: Collection and Dissemination of Japanese Information Can Be Improved (GAO/NSIAD-93-251, Sept. 30, 1993).

specific documents in those bibliographies from the Center or the Program Office.

The only FS-X data publicly available from the U.S. government is a video providing an overview of the fire control radar. The Department of Commerce's National Technical Information Service began selling this video in February 1994. Certain DOD FS-X technical reports developed in cooperation with Japan are available within the U.S. government and to some industry officials. For example, a U.S. Air Force official said the U.S. government is distributing a report of its radar module testing results to all attendees of the 1992 radar symposium.

Commerce would like to develop opportunities for U.S. companies interested in Japanese FS-X technology. Commerce could organize industry visits to Japan to examine non-derived technologies, for example. Commerce is also considering a composites conference similar to the radar symposium of 1992. During 1993, however, Commerce officials told us that, due to the transition between administrations and staff cuts, they encountered delays in developing and proceeding with these efforts. As of mid-1994, Commerce was still developing plans for industry outreach for the FS-X program.

Ultimate Value of Japanese Technologies Is Unknown

U.S. program officials do not know how the United States will benefit from transfers of Japanese FS-X technologies because (1) many Japanese FS-X technologies are unproven, (2) the United States may not seek or obtain information on Japanese production methods, and (3) program officials do not yet know how the United States can apply or market Japanese technologies. Further, until the FS-X successfully completes flight testing, neither the United States nor Japan can know how new systems will perform.

Preliminary U.S. evaluations of some Japanese FS-X technologies yielded mixed reviews. For example:

- While U.S. engineers believe that U.S. radar modules are more advanced than Japanese modules overall, the Japanese module matches U.S. capabilities in certain areas and may prove innovative in another. However, one U.S. radar expert noted that the United States does not yet know how well complete Japanese FS-X radar arrays (as opposed to individual modules) will perform.

- The other Japanese non-derived avionics systems represent conservative yet proven and competitive designs.
- In a few areas, Japanese technologies use novel design or manufacturing approaches. In particular, U.S. engineers have noted certain Japanese innovations for designing the FS-X mission computer hardware and the inertial reference/navigation system. Moreover, some avionics components are lighter and smaller than similar U.S. equipment.

There is general agreement among U.S. program officials and observers that insight into Japanese manufacturing techniques would be useful to the United States. However, it is not clear how or when Japan might transfer production information to the United States for three reasons: (1) Japanese companies may be unwilling to give proprietary derived technology to the United States, (2) a U.S. company must build something to obtain and test Japanese manufacturing technology, and (3) under the FS-X agreements, U.S. firms must pay for certain Japanese technologies. Therefore, the company would have to buy rights to the technology and then make a large capital investment for the necessary production equipment. According to an Air Force program official, this scenario seems unlikely.

Regardless of the ultimate value of Japanese technology itself, the United States could benefit from transfers of Japanese technology for two reasons. First, the FS-X program set precedents and provided lessons for technology transfers from Japan that may prove useful in the future. Second, U.S. program engineers are gaining experience with Japanese design and development methods that may be valuable in other aircraft programs. However, the United States may not recognize the value of this information. Program officials explained that some U.S. engineers are skeptical of high technology not invented or developed in the United States. This "not invented here" syndrome may contribute to unwarranted skepticism about Japanese technology that could interfere with U.S. attempts to fully exploit transferred Japanese FS-X technologies.

Conclusions

Although the United States continues to receive a large volume of Japanese FS-X technical data, to date the efforts to evaluate and use this data have been limited and ineffective. U.S. government and industry have been unwilling or unable to fully analyze or use Japanese FS-X technologies outside the program. As a result, the United States may not be receiving the full benefits accorded its participation in the FS-X development program.

The development program thus offers an important lesson to U.S. policy makers as they approach a production program. As our previous work shows,[8] Japan's coordinated approach to technology management can foster new uses for existing technologies, as well as the development of new technologies. We believe the United States has an opportunity to improve management of transferred Japanese technology during an FS-X production program.

Recommendations

To ensure effective evaluation of transferred Japanese FS-X technologies, we recommend that the Secretary of Defense direct the Defense Science Board to establish and convene an FS-X Technology Transfer Evaluation Task Force. To the extent the FS-X agreements and Defense Science Board Charter permit, this Task Force should include U.S. government and industry FS-X officials. To the maximum extent possible, consistent with the agreements, representatives of the four services and of leading U.S. aerospace companies who have expertise in fighter aircraft (including the F-22), composites applications, or potential commercial uses for FS-X technologies should be included on the Task Force.

Such a task force could (1) assist DOD in developing and implementing a program to more thoroughly evaluate transferred Japanese FS-X technology and (2) determine how the United States can most benefit, if at all, from transfers of Japanese FS-X technologies. In particular, the Task Force could:

- Determine if and how Japanese technology improves upon or surpasses U.S. technology.
- Identify Japanese FS-X design, technology, or manufacturing approaches that differ from U.S. experience and that could provide instructive lessons for the United States.
- Develop a strategy for identifying, obtaining, managing, and applying useful or promising Japanese FS-X technologies.

Agency Comments and Our Evaluation

DOD did not believe that the establishment of a Defense Science Board FS-X Task Force was currently warranted. DOD stated that it would consider establishing such a task force or taking other actions, if its ongoing FS-X technology identification, evaluation, and dissemination activities proved unsuccessful. DOD officials also told us DOD did not want

[8]In our 1993 report on foreign technology, we reported that Japanese experts collect information in specific areas of interest, which is targeted to the needs of users, and then use extensive and multiple channels to disseminate the data.

to commit additional resources at this time to evaluate FS-X technologies because most of them, such as the co-cured composite wing, were not yet fully developed or had not been adequately tested.

We believe that once adequate development and testing has occurred, DOD should establish the Task Force because current U.S. efforts are probably too limited to ensure sufficient evaluation and dissemination of FS-X technologies. The Task Force would ensure that more aerospace experts from outside of the FS-X program are allowed to evaluate FS-X technologies and Japanese design and manufacturing approaches. It would also provide DOD with an overall assessment of the value of Japanese FS-X technologies. Such an assessment would provide DOD and Commerce with guidance as to the level of resources that should be committed to disseminating FS-X technologies.

Japanese and U.S. Aerospace Industries Receive Different Program Benefits

Overall, Japan has received technological benefits from the FS-X program, while to date, U.S. aerospace firms have obtained primarily contract orders. The program is consistent with the Japanese government's strategy of making defense development and production as indigenous as possible. Our analysis of a limited number of FS-X supplier selections indicated that Japanese firms obtained more work than U.S. firms for items with commercial applications. Japan has obtained proven F-16 design data and the program has strengthened Japan's aerospace industry by providing Japanese engineers with valuable experience and skills they can use for future military and commercial aerospace projects.

Japanese aerospace firms have acquired new equipment and, according to U.S. government and industry officials, received Japanese government financial assistance through the program that will be useful for other aerospace projects. Substantial Japanese modifications to the F-16 design and the terms of the FS-X agreements ensure that Japanese firms will produce over half of the FS-X configuration items.[1] Changing the F-16 design made it easier to incorporate Japanese design ideas into the FS-X and for Japan to justify awarding contracts to Japanese firms. The cumulative effect of the program has been to help improve Japanese firms' ability to compete for future aircraft projects.

To date, program benefits to U.S. aerospace firms have primarily consisted of additional work and payments. Cost increases in the FS-X budget have resulted in an increase of the estimated value of the U.S. work share from $480 million to over $1 billion. Most of the U.S. FS-X work share is reserved for Lockheed, which is guaranteed between 30 and 31 percent of the value of the FS-X development budget. Although over 200 U.S. firms have received FS-X contracts from Japan, about 90 percent of the value of the U.S. work share will go to three U.S. firms—Lockheed, General Electric, and Allied Signal. U.S. officials believe that, in overall terms, U.S. firms received an acceptable share of FS-X development work.

FS-X Program Conforms to Japanese Defense Acquisition Strategy

Japan views its defense programs not only as weapon acquisitions, but, more importantly, as technology acquisitions. The FS-X program contributes to this strategy by providing work and learning opportunities to many Japanese subcontractors and suppliers, increasing the skills and experience of Japanese aerospace engineers, and prompting Japanese

[1]An item the Japan Defense Agency or Mitsubishi Heavy Industries designates for monitoring by inclusion on the FS-X baseline configuration lists.

firms to purchase new equipment and construct facilities that can be used for future projects.

During the FS-X program, Japanese firms have sought to sever their dependence on U.S. licensed production and position themselves to be suppliers for future aircraft programs. A comparison of F-16 and FS-X manufacturers provides evidence of Japan's intention to use the FS-X program to increase Japanese aerospace capabilities. A list of F-16 and FS-X configuration item manufacturers in appendix III shows that, of the 249 items common to both aircraft, Japanese firms are responsible for providing over half of them for the FS-X. This increase in capabilities will make it easier in the future for Japan to develop a completely indigenous military aircraft and for Japanese firms to compete more effectively with U.S. suppliers for military, and possibly commercial, aircraft-related sales. Japanese firms have replaced U.S. companies to become key suppliers or even sole sources for certain commercial and military products, which in some cases, Japan originally licensed from U.S. firms.

Japanese Companies Appear to Obtain High Quality Work Share

To determine the quality of the FS-X work share obtained by Japanese and U.S. companies, we examined data the U.S. Air Force used to evaluate Japan's 1991 licensed production requests. This data, covering about 25 percent of FS-X configuration items, does not represent a random sample of FS-X items. Our analysis of this group of items indicates that Japan will manufacture about 77 percent of the items with commercial applications. The results of this limited analysis are consistent with U.S. government and other assessments of Japanese industrial policy that contend that Japan consistently seeks to develop and manufacture items with the greatest commercial applications.

FS-X Program Helps Enhance Japanese Aerospace Industry

The FS-X program has increased the capabilities of Japan's aerospace industry. Unlike previous F-16 international coproduction programs, which released only operations, maintenance, and production data, the United States has released F-16 design data for the FS-X program. As part of a $60-million licensing fee, Lockheed provided Mitsubishi Heavy Industries with the rights to use large volumes of F-16 design and manufacturing data proven by years of F-16 production. This F-16 design data provides Japanese aerospace engineers with valuable information that will increase the knowledge level of the Japanese aerospace industry.

Japanese and U.S. officials agreed that a major program benefit for Japan is the experience Japanese aircraft engineers have gained in design and in system development and integration. Mitsubishi Heavy Industries seeks to use the FS-X program to develop an engineering work force capable of future independent Japanese aircraft development projects. The program is particularly important to the Japanese aerospace industry and engineers because of decreasing Japanese licensed production of F-15 aircraft and the lack of any other full-scale aircraft development projects.[2] The program addresses a weakness in Japan's military aerospace capabilities by providing Japanese engineers the experience of working through all the phases of the aircraft concept-to-design cycle. A lack of knowledge and experience in the concept-to-design process can lead to major mistakes in aircraft development program and design acceptance decisions. A U.S. Air Force official noted that the overall experience of developing a modern fighter aircraft and integrating its sophisticated systems will be even more valuable to Japan's aerospace industry than the knowledge derived from developing specific FS-X technologies. Japan is unlikely to obtain such experience through its current participation in civil aircraft programs.

According to U.S. government officials, the most valuable experience for Japanese engineers will be in systems integration. Systems integration consists of combining various aircraft components to work with each other successfully to perform mission-related functions. U.S. government officials stated that Japan has had limited experience in advanced aircraft systems integration, which these officials believe it is an art only learned through costly trial and error. According to U.S. officials, any systems integration skills Japanese engineers acquire during the FS-X program will be applicable to future commercial, as well as military, aerospace projects. A Mitsubishi Heavy Industries official stated that the FS-X experience has confirmed that Japanese aerospace engineers have systems integration skills comparable to those of Lockheed's F-16 engineers.

The program is also enhancing Japan's avionics capabilities and may enable Japanese avionics firms to sever or reduce their ties with U.S. industry, according to a U.S. Air Force official. For example, because Japan is independently developing the FS-X inertial reference/navigation system, U.S. government experts believe Japanese firms will enhance their competitiveness with U.S. firms in this market. The increase in Japanese inertial navigation systems capabilities has commercial significance because this technology is applicable to both military and commercial

[2]Although they are not coequal partners with Boeing, Japanese aerospace firms are significantly involved with the design and development of Boeing's 777 commercial aircraft.

aircraft. Because of the redundancy built into the FS-X inertial navigation system, it is highly useful for commercial applications that generally require higher safety standards than military applications. A U.S. industry official stated that Mitsubishi Electric Corporation, the Japanese firm responsible for the FS-X advanced phased array fire control radar, may use its FS-X experience to provide upgrades for the radar on Japanese F-15 aircraft.

Japan Defense Agency officials acknowledged that the FS-X program will give Japan the opportunity to lead the development of a complex aircraft, but added that their agency views the program's primary goal as fulfilling certain Japanese defense requirements. In our June 1992 report, Japan Defense Agency officials rejected the idea that the FS-X program promotes Japan's commercial aviation industry. However, according to a U.S. observer of the Japanese aerospace industry, the president of Mitsubishi Heavy Industries and Japanese engineers have acknowledged the link of FS-X design and manufacturing experience to future commercial aircraft such as hypersonic and supersonic transports. Further, a U.S. Air Force official stated that Japanese officials have also indicated that if Japan opts to develop its YSX passenger aircraft, Japan will use as much FS-X co-cured composite technology as possible on that aircraft.

U.S. government officials believe that while the FS-X program is advancing Japanese aerospace capabilities, Japan is obtaining more commercially useful benefits from programs with Boeing such as the 777 program. U.S. aerospace experts in Japan noted that during the Boeing 777 program, about 200 Japanese engineers were trained and allowed to work for about 2 years in Boeing design facilities in the United States.[3]

Japanese Firms Make Capital Investments and Obtain Government Financial Assistance to Improve Their Industrial Capabilities

Mitsubishi Heavy Industries has improved its capabilities by making certain capital investments for the FS-X program that will be useful for other aerospace projects. For example, Mitsubishi purchased sophisticated, expensive composites tape-laying equipment, contour measuring machinery, and established composite test facilities for producing the FS-X co-cured composite wings. Mitsubishi also established a testing and integration facility for the FS-X aircraft's avionics systems. U.S. and Japanese officials stated that the composite and avionics-related equipment and facilities will be used for other aircraft projects.

[3]Technology Transfer: Japanese Firms Involved in F-15 Coproduction and Civil Aircraft Programs (GAO/NSIAD-92-178, June 10, 1992).

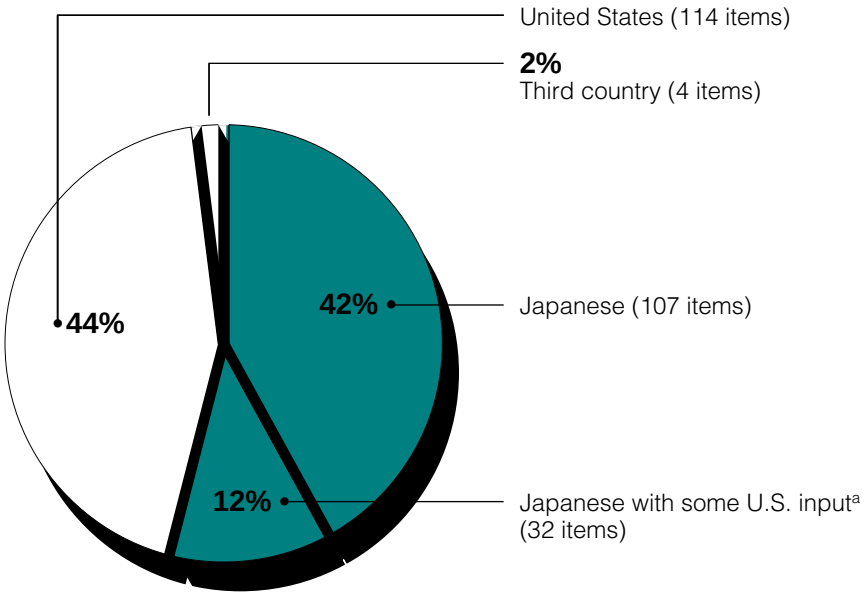
Mitsubishi officials said that they purchased the composite-related machinery and avionics and composite testing facilities with the firm's own funds and officials from Japan's Ministry of International Trade and Industry (MITI) said that their ministry had not made expenditures for the FS-X program. However, U.S. government and industry officials noted that before the FS-X program formally began, the Japanese government had provided extensive funding to Mitsubishi and other Japanese firms for developing technologies intended for use on the FS-X aircraft, including those related to the co-cured composite wing and the active phased array radar. A U.S. Air Force official stated that MITI saw the FS-X program as a means of increasing the composite capabilities of Mitsubishi.

Japanese industry officials did not provide us figures on the costs of investments made for the FS-X program. They said that because their firms use the equipment and facilities for other programs, they could not determine the costs incurred exclusively for the FS-X program.

Japanese Suppliers Have Major Role in Program

Japanese firms are responsible for providing over half of the configuration items for the FS-X prototype aircraft. Figure 5.1 shows the extent to which Japanese, U.S. and third country firms are providing FS-X items.

Figure 5.1: Responsibilities for FS-X Configuration Items



Note: Lockheed and Mitsubishi are both producing one FS-X configuration item, the left wing. Therefore, the total number of items here is one greater than the 256 items listed in the F-16/FS-X Baseline Configuration List.

[a]This category covers instances in which the designated supplier is a Japanese company, but the Japanese supplier received either end item hardware or significant technical assistance from a U.S. firm.

The substantial Japanese role in supplying FS-X configuration items resulted from several factors. Because FS-X agreements left Japan with about 60 percent of the total value of the FS-X development budget, it was inevitable that many Japanese firms would be selected to provide FS-X items. Furthermore, Japan claimed that because of previous negative experiences with U.S. suppliers on coproduction programs, it wanted to select Japanese firms for certain items to ensure timely contractor support if any modifications or repairs were needed during the development phase. More importantly, major modifications to the F-16 baseline also led to a prominent Japanese industry role in providing FS-X items.

FS-X Design Changes Contribute to Significant Japanese Industry Role

Contrary to U.S. views in the early years of the program that the FS-X aircraft would be a lightly modified version of the F-16, the FS-X aircraft has evolved to be a significantly modified aircraft, with basic changes in the F-16 design leading to many changes in the configuration items. Under the terms of the FS-X memorandum of understanding, Japan did not have to purchase items for the FS-X from U.S. F-16 suppliers if the U.S. items did not satisfy Japanese FS-X performance requirements or if it was not cost-effective to do so. After finalizing the general configuration of the FS-X aircraft and the program budget, the Japan Defense Agency concluded that many of the F-16 items available from U.S. manufacturers did not meet Japanese FS-X requirements for factors such as cost, schedule, performance, design, and engineering risk.

Although Japanese defense operational requirements caused many of the modifications to the F-16 baseline, the desire of the Japanese military and industry to incorporate as many of their own design concepts as possible into the FS-X aircraft and to maximize the participation of Japanese subcontractors and suppliers also led to many changes. For the most part, Japan selected Japanese firms to provide FS-X items that were significantly modified from the equivalent F-16 items. Conversely, Japan tended to select U.S. firms to provide those FS-X items that were identical to those found on the F-16.

Throughout the development process, Japan, particularly Japanese industry, sought to achieve many of the objectives of an indigenous development program that it was denied as a result of the political compromise that led to U.S. involvement in the program. Furthermore, according to Japanese government and industry officials, Japanese firms were playing a smaller role in the FS-X program than originally planned because of the need to shift certain FS-X tasks to U.S. companies. Changing the F-16 design made it easier to incorporate Japanese design ideas into the FS-X and for Japan to justify awarding certain tasks to Japanese firms. Consequently, Japanese industry partially obtained its goal of an indigenous aircraft development effort. Air Force officials acknowledged that FS-X agreements did not provide the United States with adequate authority to control changes to the F-16 baseline.

U.S. Firms Have Received Over $1 Billion in FS-X Contracts

To date, the benefits provided to the U.S. aerospace industry through the FS-X program have consisted primarily of contracts to U.S. companies to act as subcontractors or suppliers. As discussed in chapter 4, it is not yet clear if U.S. firms will acquire significant technological benefits from the program. As of May 1994, Japan had awarded over $1 billion of contracts to over 200 U.S. firms for the program.

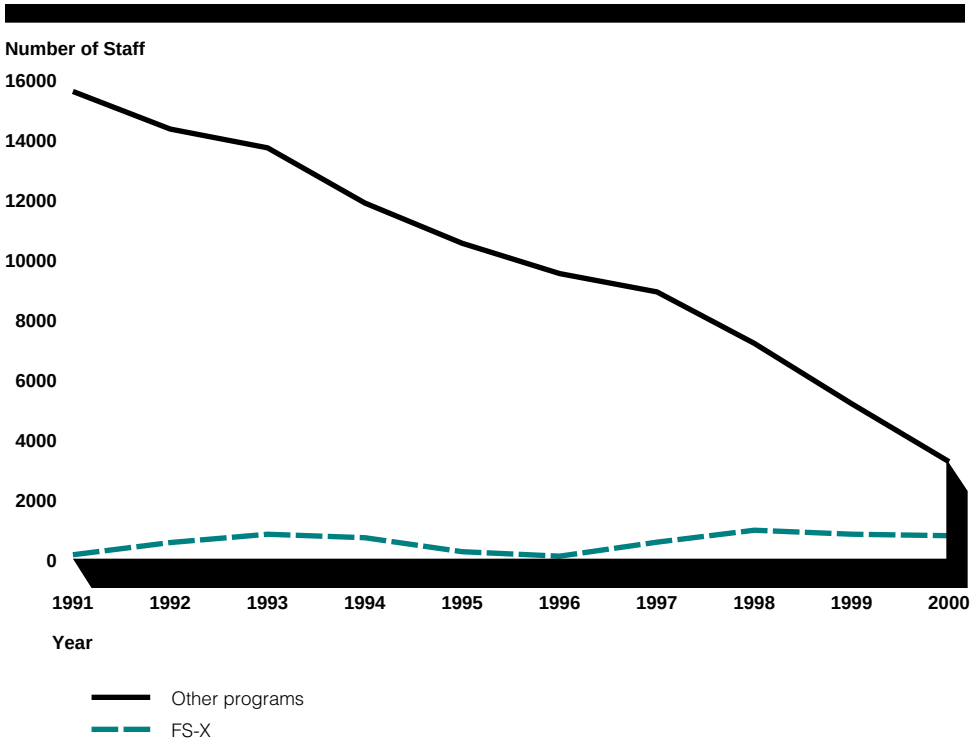
Lockheed Is Primary U.S. Program Beneficiary

FS-X agreements reserved specific development phase work for only two U.S. firms—Lockheed and General Electric, the company selected to supply the engines for the FS-X prototype aircraft. Furthermore, FS-X commercial agreements guaranteed that Lockheed would receive work valued between 30 and 31 percent of the FS-X development budget, the largest share for any U.S. company. At the time of our review, Lockheed had received over $849 million and General Electric over $60 million of FS-X contracts.

According to U.S. government and industry officials, the economic importance of the FS-X program for U.S. contractors has increased in recent years as sales of military items to DOD have declined. With F-16 production rapidly declining, the FS-X program has become increasingly valuable to Lockheed in terms of sales and jobs, according to Lockheed officials. According to U.S. government and industry officials, Lockheed could earn hundreds of millions of dollars in sales if the program enters production.

Figure 5.2 shows the number of Lockheed Fort Worth Company personnel that have and are projected to work on the FS-X program and other assignments, including the F-16 program.

Figure 5.2: Lockheed Fort Worth Company Personnel Assigned to FS-X and Other Programs



Note: These employment figures do not include Lockheed staff time for functions such as accounting and contracting that are not directly related to the actual design, manufacture, and testing of aircraft. According to Lockheed officials, if such indirect labor is included, the employment figures would increase by over 30 percent.

According to Lockheed, FS-X employment figures for 1996 to 2000 and beyond assume that (1) the FS-X program will enter production in 1996 and (2) the Japanese government will commit to procuring 130 FS-X aircraft at a rate of 2 per month. At the time of our review, Lockheed did not provide us with employment figures beyond 2000; however, a Lockheed official subsequently told us that Lockheed anticipates that its FS-X production activities would go well beyond 2000. According to Lockheed, figures for other programs assume (1) Lockheed will deliver about 750 F-16 aircraft between 1994 and 2000 and (2) Lockheed will have a certain level of F-22 work.

U.S. suppliers have also benefited from subcontracts awarded by Lockheed for FS-X work. According to Lockheed data, as of June 1994, approximately 800 U.S. firms were supplying items or services to Lockheed for the FS-X program. The value of these subcontracts was over $49 million, according to Lockheed officials. Most of these companies were also subcontractors or suppliers for the F-16 program. Lockheed data indicated that approximately 80 U.S. firms had provided unique FS-X items (not used for the F-16) and services to Lockheed. Using Lockheed data, we identified about $2.7 million of Lockheed purchase orders issued to U.S. firms for unique FS-X structural parts.

According to Lockheed officials, their firm has made no capital investments for the FS-X program and used existing equipment as much as possible. Lockheed has procured two major pieces of equipment valued at nearly $3 million with FS-X funds—a coordinate measuring machine and a wing roll-over fixture—used, respectively, for checking and manufacturing composites. Lockheed will likely use this equipment during for FS-X production if the program proceeds into that phase. Mitsubishi can reclaim these items following Lockheed's contractual use of the equipment.

U.S. Generally Satisfied With Japanese FS-X Selections, but Questioned Some Choices

U.S. government officials involved with the FS-X program were generally satisfied with Japan's selection of over 200 U.S. companies for FS-X contracts. They believed there were cases where U.S. companies were not chosen even though they offered superior products; however, the officials stated that, in overall terms, U.S. firms obtained an acceptable share of FS-X work considering that the program was completely funded by Japan and subject to a U.S. 40-percent work share.

During our review, we found 11 cases where the U.S. government formally questioned the Japan Defense Agency's selections of suppliers for FS-X items. For example, in July 1992, the U.S. Air Force told the Japan Defense Agency that the United States was disappointed with Japan's apparent emphasis on not selecting U.S. companies when licensed production was not permitted. In several cases where Japan had requested licensed production, Japan did not select U.S. companies because of U.S. government restrictions on the release of detailed design data. The Japan Defense Agency believed it required this data to integrate items into the aircraft with acceptable risk. Japan justified the questioned selections to the United States on the basis of criteria found in the FS-X memorandum of understanding. The memorandum stipulated that work share selections should be based on such factors as cost effectiveness, schedule, engineering risks, and Japanese performance requirements. A DOD official

said that Japan generally chose U.S. firms when the U.S. government was willing to transfer some technology, and Japanese firms otherwise.

DOD questioned Japan's choice to license produce two FS-X items with British and French companies. DOD stated that the FS-X memorandum of understanding was intended to prohibit third country involvement unless Japan proved U.S. or Japanese solutions were unacceptable and that U.S. policy was to review such selections on a case-by-case basis. In the British case, Japan responded to DOD's concerns by providing further justification for purchasing the British item.

In the French case, Japan justified its selection by indicating that the U.S. firm competing for the contract did not meet Japanese engineering risk and performance requirements. However, the U.S. contractor stated that the selection process was unfair because it had not been provided a reasonable time in which to submit a proposal to meet a late change in Japan Defense Agency technical specifications. An Air Force review of the case could find no definitive evidence of Japanese unfairness in making the selection and concluded that the selection had been in accordance with criteria agreed upon by the United States and Japan.

Conclusions

Generally, the FS-X program provides different benefits to the Japanese and U.S. aerospace industries. The information we collected during our review indicates that the primary benefit to the Japanese aerospace industry is an increase in the level of its technological capabilities. Conversely, the benefits to the U.S. aerospace industry, because they have come primarily in the form of payments and work orders rather than new technologies, tend to preserve existing U.S. aerospace capabilities, rather than enhance them. It is not yet clear if U.S. firms will acquire significant technological benefits from the program.

Agency Comments and Our Evaluation

DOD agreed that the FS-X program will enhance Japanese aerospace capabilities in certain areas. However, DOD commented that the U.S. contribution to substantially enhancing Japanese aerospace capabilities is not as significant as we implied. DOD added that it has effectively limited Japanese access to sensitive U.S. aerospace capabilities. We did not attempt to measure the significance of the U.S. contribution to enhanced Japanese aerospace capabilities through the FS-X program. Although DOD has limited Japanese access to certain U.S. technologies such as some software design and systems integration know-how, we note that some

experts on these matters believe that the Japanese aerospace industry has acquired significant technology from the United States during the program that it could not have acquired otherwise without considerable investments of time and money.

Data Review Statistics

The following tables show the status of the F-16 System Program Office's review of the F-16 Technical Data Package and F-16 supplemental data as of February 1, 1994.[1]

Table I.1: Results of the F-16 Technical Data Package Review

Document status	Number	Percent
Releasable[a]	9,757	93
Not releasable	568	5
Releasable with modifications	201	2
Total	**10,526**	**100**

[a]Includes approximately 7,900 technical drawings the Air Force and Lockheed do not consider sensitive.

Table I.2: F-16 Supplemental Data Review Status

Document status	Number	Percent
Releasable	2,127	71
Not releasable	653	22
Releasable with modifications	224	7
Total	**3,004**	**100**

[1]According to a Lockheed official, one F-16 Technical Data Package item was shipped to Japan in June 1994.

United States Is Evaluating Japanese Radar Modules Although Potential Uses Are Uncertain

The United States has obtained more information on the Japanese active phased array fire control radar than any other non-derived FS-X technology. In August 1992, DOD purchased five Japanese FS-X radar transmit/receive modules, supporting connectors, and technical data for testing purposes. DOD paid the then current Japan Defense Agency/Mitsubishi Electric Corporation prototype module contract price of $4,800 per unit and about $70,000 for technical data and additional items required to test the modules.

Mitsubishi Electric officials reported in November 1993 that they had reduced module unit costs to about $3,300. Mitsubishi Electric officials would like to reduce module costs even further by increasing the module production run to at least 20,000 units annually. Mitsubishi Electric's cost goal is about $1,400 per unit for the FS-X program, assuming production of 120,000 units (or enough for about 130 aircraft). Mitsubishi Electric officials noted that they do not expect to reach the $1,400 per module goal until 2 years into full-rate FS-X production.

Mitsubishi Electric officials said they will pursue commercial applications for FS-X transmit/receive modules that could reduce module costs during FS-X production. Mitsubishi Electric officials noted, however, that commercial applications are not practical at this time because of the modules' high cost. Commercial applications could include air traffic control antennas, satellite and mobile communications, and anticollision automobile radars.

In August 1993, U.S. engineers at the Wright Laboratory Solid State Electronics Directorate began testing the five radar modules DOD purchased from Japan. By February 1994, the United States had finished a complete set of verification tests for module performance. The tests indicated that the modules perform according to specifications and will meet Japanese FS-X radar requirements. A U.S. engineer involved in the testing said that the performance of Japanese modules was very good and in one area are on a par with the best U.S. modules.

In May 1994, a U.S. radar module testing team visited Japan to compare and verify U.S. and Japanese test results. U.S. engineers may conduct additional tests to assess the performance of FS-X radar modules relative to U.S. modules planned for use on the F-22 aircraft.[1] DOD was preparing a

[1]Japan has also tested a complete FS-X radar array on the ground and in flight aboard a specially modified Japanese C-1 electronics testbed aircraft. Japan had not shared its radar array testing data with the United States as of March 1994, according to a radar expert, nor would Japanese officials permit us to observe ground-based radar array testing during our November 1993 trip to Japan.

report summarizing the results of the radar testing at the time of our review.

F-16 and FS-X Configuration Item Manufacturers

This appendix lists the manufacturers of certain F-16 and FS-X configuration items. For the FS-X program, configuration items are items the Japan Defense Agency or Mitsubishi Heavy Industries designates for monitoring by inclusion on the FS-X baseline configuration lists. The first column of this appendix lists items that are common, unless otherwise noted in the second column, to both aircraft. The second column lists the qualified manufacturer[1] of the item for the F-16 aircraft, and the third column the FS-X manufacturer. Non-U.S. manufacturers are also noted in the second and third columns.

Of the 256 items listed in this appendix, 249 are common to the FS-X and F-16. Japanese companies will provide 132, or over half of the FS-X configuration items common to the F-16. The list provides evidence of Japan's ability to produce indigenously many of the items needed for modern fighter aircraft. For example, instead of purchasing the F-16 fire control radar (item 180) from the U.S. firm Westinghouse Electric Corporation, the Japan Defense Agency chose Mitsubishi Electric Corporation to develop and produce the FS-X fire control radar.

	Configuration item	F-16 manufacturer	FS-X manufacturer
System: Air vehicle			
1.	F-16C Air vehicle (1 seat)	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
2.	F-16D Air vehicle (2 seat)	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
System: Airframe			
3.	Forward fuselage assembly (1 seat)	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
4.	Forward fuselage assembly (2 seat)	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
5.	Center section fuselage assembly (1 seat)	Lockheed Fort Worth Co.	Kawasaki Heavy Industries, Ltd.[a]
6.	Center section fuselage assembly (2 seat)	Lockheed Fort Worth Co.	Kawasaki Heavy Industries, Ltd.[a]
7.	Aft fuselage assembly	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
8.	Ventral fin support fitting	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
9.	Right ventral fin	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
10.	Left ventral fin	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
11.	Right wing box assembly	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
12.	Left wing box assembly	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.,[a] and Lockheed Fort Worth Co.
13.	Right wing leading edge flap maneuver assembly	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.

(continued)

[1]A qualified F-16 manufacturer is a company that has demonstrated that it can produce an item that meets all designated specifications for use on the F-16 aircraft. However, not all qualified F-16 suppliers have actually provided items for the F-16. For example, CLA-VAL company is a qualified F-16 supplier for the ground refuel adaptor (item 86), but it has not yet supplied this item for the F-16, according to an Air Force official.

	Configuration item	F-16 manufacturer	FS-X manufacturer
14.	Left wing leading edge flap maneuver assembly	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
15.	Right wing assembly	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
16.	Left wing assembly	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
17.	Wing flaperon assembly (right)	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
18.	Wing flaperon assembly (left)	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
19.	Vertical stabilizer assembly (1 seat and 2 seat	Lockheed Fort Worth Co.)	Fuji Heavy Industries, Ltd.[a]
20.	Vertical stabilizer fairing assembly (1 seat and 2 seat)	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
21.	Rudder assembly	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
22.	Horizontal stabilizer assembly	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
23.	Windshield panel	Item not found in F-16	Mitsubishi Rayon Co., Ltd.[a]
24.	Nose radome assembly	Brunswick Corporation	Sumitomo Electric Industries[a]
25.	Canopy transparency (1 seat)	Sierracin-Sylmar, and Texstar Inc.	Mitsubishi Rayon Co., Ltd.[a]
26.	Canopy transparency (2 seat, forward)	Sierracin-Sylmar, and Texstar Inc.	Mitsubishi Rayon Co., Ltd.[a]
27.	Canopy transparency (2 seat, aft)	Sierracin-Sylmar, and Texstar Inc.	Mitsubishi Rayon Co., Ltd.[a]
28.	Fixed canopy transparency assembly (F-16C, aft)	Texstar Inc.	Mitsubishi Rayon Co., Ltd.[a]
System: Landing gear			
29.	Drag chute actuator assembly	Kaiser Fluid Technologies	Kaiser Fluid Technologies
30.	Hydraulic actuator for main landing gear door & uplock (right)	Arkwin Industries Inc.	Arkwin Industries Inc.
31.	Hydraulic actuator for main landing gear door & uplock (left)	Arkwin Industries Inc.	Arkwin Industries Inc.
32.	Hydraulic actuator assembly for nose landing gear door	Arkwin Industries Inc.	Arkwin Industries Inc.
33.	Single acting pneumatic actuator for arresting hook	GST Industries Inc.	GST Industries Inc.
34.	Valve assembly for emergency landing gear control	Sterer Engineering & Manufacturing Co.	Sterer Engineering & Manufacturing Co.
35.	Arresting hook assembly	Lockheed Fort Worth Co.	Sumitomo Precision Products Co., Ltd. [a]
36.	Forward landing gear control assembly	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
37.	Aft landing gear control assembly (2 seat)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
38.	Nose landing gear sequence valve assembly	Sterer Engineering & Manufacturing Co.	Sterer Engineering & Manufacturing Co.
39.	Landing gear door sequence valve assembly	Sterer Engineering & Manufacturing Co.	Sterer Engineering & Manufacturing Co.
40.	Hydraulic valve assembly for nose wheel steering	Sterer Engineering & Manufacturing Co.	Sumitomo Precision Products Co., Ltd.[a]
41.	Valve assembly for arresting hook control	Sterer Engineering & Manufacturing Co.	Sterer Engineering & Manufacturing Co.

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
42.	Control box for nose gear steering	Sterer Engineering & Manufacturing Co.	Sumitomo Precision Products., Ltd.[a]
43.	Valve assembly for main landing gear brake control	Lockheed Fort Worth Co.	Kayaba Industry Co., Ltd.[a]
44.	Hydraulic solenoid-operated valve for landing gear selector	Sterer Engineering & Manufacturing Co.	Sterer Engineering & Manufacturing Co.
45a.	Brake control box assembly	Loral Corp.	Sumitomo Precision Products Co., Ltd.[a]
45b.	Skid control box assembly, brake control box	Aircraft Braking Systems Corp.	Sumitomo Precision Products Co., Ltd.[a]
46.	Valve assembly for drag chute control	E.G.&G. Wright Components Inc.	E.G.&G. Wright Components Inc.
47.	Steerable shock strut assembly for nose landing gear	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
48.	Drag brace assembly for nose landing gear (upper and lower)	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
49.	Nose landing gear wheel assembly	Marc Avenue Corp., and B.F. Goodrich Co.	Marc Avenue Corp.
50.	Main landing gear tire	B.F. Goodrich Co., and Goodyear Tire & Rubber	Michelin[b]
51.	Nose landing gear tire	Goodyear Tire and Rubber Co., Michelin, and Dunlop Ltd. Precision Rubber Div.	Michelin[b]
52.	Drag chute assembly	Irvin Industries Inc.	Irvin Industries Inc.
53.	Hydraulic actuator assembly for nose landing gear retract	Arkwin Industries Inc.	Arkwin Industries Inc.
54.	Main landing gear shock strut assembly	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
55.	Drag brace assembly for main landing gear (upper and lower)	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
56.	Main landing gear tension strut assembly (right)	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
57.	Main landing gear tension strut assembly (left)	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
58.	Anti-skid wheel speed sensor for main landing gear brake (left)	Goodyear Aerospace Corp.	Sumitomo Precision Products Co., Ltd.[a]
59.	Main landing gear increased capacity wheel assembly	Aircraft Braking Systems Corp.	Kayaba Industry Co., Ltd.[a]
60.	Main landing gear increased capacity brake assembly	Aircraft Braking Systems Corp.	Kayaba Industry Co., Ltd.[a]
61.	Hydraulic retract actuator assembly for main landing gear	Menasco Aerosystems	Sumitomo Precision Products Co., Ltd.[a]
System: Propulsion			
62.	Engine monitor computer	General Electric Co.	General Electric Co.
63.	Turbine power unit for emergency power unit (EPU)	Allied Signal Aerospace Co.	Mitsubishi Heavy Industries, Ltd.[a]
64.	EPU controller	Allied Signal Aerospace Co.	Mitsubishi Heavy Industries, Ltd.[a]
65.	Lube oil-fuel heat exchanger, EPU	Allied Signal Aerospace Co.	Mitsubishi Heavy Industries, Ltd.[a]

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
66.	Jet fuel starter assembly	Sundstrand Aerospace	Sundstrand Aerospace
67.	Hydraulic jet fuel starter actuator for air inlet/exhaust doors	Crissair Inc.	Crissair Inc.
68.	Airframe-mounted drive shaft accessory	Lucas Western Inc. Power Transmission	Lucas Western Inc. Power Transmission
69.	Engine starting system gearbox assembly	Sundstrand Aerospace	Mitsubishi Heavy Industries, Ltd.[a]
70.	Engine starter assembly	Sundstrand Aerospace	Mitsubishi Heavy Industries, Ltd.[a]
71.	Hydraulic start motor	Sundstrand Aerospace	Mitsubishi Heavy Industries, Ltd.[a]
72.	Engine starting controller	Sundstrand Aerospace	Mitsubishi Heavy Industries, Ltd.[a]
73.	Fuel control assembly	Sundstrand Aerospace	Mitsubishi Heavy Industries, Ltd.[a]
74.	Regulator & shutoff valve, EPU	Whittaker Controls Inc.	Whittaker Controls, Inc.
75.	Regulator & shutoff-nacelle ejector valve	Whittaker Controls Inc.	Whittaker Controls, Inc.
76.	Fire detection sensing element	Fenwal Safety Systems	Fenwal Safety Systems
77.	Overheat sensing element	Fenwal Safety Systems	Fenwal Safety Systems
78.	Overheat sensing element	Fenwal Safety Systems	Fenwal Safety Systems
79.	Turbofan engine	General Electric Co.	General Electric Co.
80.	Ice detection system	DNE Technologies Inc.	DNE Technologies Inc.
System: Fuel			
81.	Motor operated valve	Teleflex Control Systems	Teleflex Control Systems
82.	Single ply forward fuel cell assembly (F-16C)	American Fuel Cell, and Goodyear Aerospace Corp.	The Yokohama Rubber Co., Ltd.[a]
83.	Single ply forward fuel cell assembly (F-16D)	American Fuel Cell, and Goodyear Aerospace Corp.	The Yokohama Rubber Co., Ltd.[a]
84.	Aerial refueling receptacle assembly	XAR Industries Inc.	XAR Industries Inc.
85.	Hydraulic actuator (aerial refuel)	GST Industries Inc.	GST Industries Inc.
86.	Ground refuel adaptor	CLA-VAL Co., and Parker Hannifin Corp.	Shaw Aero Devices, Inc.
87.	Vent & pressurization valve for external fuel tank	HR Textron Inc.	HR Textron Inc.
88.	Shutoff valve (refuel)	J.C. Carter Co. Inc.	J.C. Carter Co., Inc.
89.	Refuel/transfer float valve	J.C. Carter Co. Inc.	J.C. Carter Co., Inc.
90.	Refuel shuttle valve	J.C. Carter Co. Inc.	J.C. Carter, Co., Inc
91.	Control valve for inerting fuel tank	Parker Hannifin Corp.	Parker Hannifin Corp.
92.	Halon reservoir	Walter Kidde Aerospace	Walter Kidde Aerospace
93.	Fuel tank pressure & vent control valve	Parker Hannifin Corp.	Parker Hannifin Corp.
94.	Fuel ejector pump	Parker Hannifin Corp.	Parker Hannifin Corp.
95.	Fuel ejector pump (2 seat)	Parker Hannifin Corp.	Parker Hannifin Corp.
96.	Remote sensing fuel pressure relief valve	J.C. Carter Co. Inc., and Parker Hannifin Corp.	J.C. Carter Co., Inc.
97.	Cross feed fuel valve	XAR Industries Inc.	XAR Industries Inc.
98.	Cross feed fuel valve (jet fuel starter bypass)	XAR Industries Inc.	XAR Industries Inc.

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
99.	Single inlet fuel transfer pump	Argo-Tech Corp.	Argo-Tech Corp.
100.	Fuel flow proportioner assembly	J.C. Carter Co., Inc.	J.C. Carter Co., Inc.
101.	Dual inlet power driven centrifugal fuel pump assembly	Argo-Tech Corp.	Argo-Tech Corp.
102.	Fuel-oil heat exchanger	Parker Hannifin Corp., and Hughes-Treitler Manufacturing Corp.	Parker Hannifin Corp.
103.	Flexible engine feed line/disconnect	Aeroquip Corp., and IMPCO Technologies Inc.	Aeroquip Corp., and IMPCO Technologies Inc.
System: Environment control			
104.	Cooling turbine	Allied Signal Aerospace Co.	Shimadzu Corp.[a]
105.	Primary and secondary air to air heat exchanger	Hamilton Standard Corp.	Shimadzu Corp.[a]
106.	Regenerative heat exchanger	Hamilton Standard Corp.	Shimadzu Corp.[a]
107.	Digital environmental and electrical equipment cooling set sensor controllers	Dynamic Controls Corp.	Shimadzu Corp.[a]
108.	Liquid pump package	Item not found in F-16	Shimadzu Corp.[a]
109.	High pressure air pressure regulator and shutoff valve	Allied Signal Aerospace Co.	Shimadzu Corp.[a]
110.	Intermediate pressure air pressure regulator and shutoff valve	Whittaker Corp.	Shimadzu Corp.[a]
111.	Aircraft cabin air pressure regulator	Allied Signal Controls and Accessories	Allied Signal Controls and Accessories
112.	Cabin air pressure relief and dump valve	Allied Signal Controls and Accessories	Allied Signal Controls and Accessories
System: Crew			
113.	Liquid oxygen converter	The Aro Corp.	Tokyo Aircraft Instrument Co., Ltd.[a]
114.	Oxygen diluter demand regulator	The Aro Corp., and Litton Systems Inc.	Tokyo Aircraft Instrument Co., Ltd.[a]
115.	Forward seat assembly	McDonnell Douglas Aerospace	Daicel Chemical Industries, Ltd.[a]
116.	Aft seat assembly	McDonnell Douglas Aerospace	Daicel Chemical Industries, Ltd.[a]
117.	Electromechanical actuator for rotary canopy (1-place)	Teleflex Control Systems, and Datron Systems Inc.	Teleflex Control Systems
118.	Electromechanical actuator for linear canopy (2-place)	Teleflex Control Systems, and Datron Systems Inc.	Teleflex Control Systems
119.	Anti-gravity valve	Alar Products Inc.	Alar Products Inc.
120.	Detonation transfer assembly for canopy jettison (right)	Lockheed Fort Worth Co., and ET Inc.	Daicel Chemical Industries, Ltd.[a]
121.	Detonation transfer assembly for canopy jettison (left)	Lockheed Fort Worth Co., and ET Inc.	Daicel Chemical Industries, Ltd.[a]
122.	Rocket assembly for canopy remover (right and left)	OEA Inc.	Daicel Chemical Industries, Ltd.[a]
123.	Emergency canopy release (right and left)	ET Inc.	Daicel Chemical Industries, Ltd.[a]
124.	Release-canopy actuator bolt	OEA Inc.	Daicel Chemical Industries, Ltd.[a]
System: Flight Control			

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
125.	Digital flight control computer assembly	Allied Signal Aerospace Co.	Japan Aviation Electronics Industries, Ltd.[a]
126.	Flight control rate gyro assembly	Lockheed Fort Worth Co.	Tamagawa Seiki Co., Ltd.[a]
127.	Force transducer assembly	Lear Astronics Corp.	Lear Astronics Corp.
128.	Flight control panel assembly	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
129.	Manual trim panel assembly	Lockheed Fort Worth Co.	Tokyo Aircraft Instrument Co., Ltd.[a]
130.	Servoactuator assembly for horizontal tail & flaperon	Abex/National Waterlift	Teijin Seiki Co., Ltd.[a]
131.	Servoactuator assembly for horizontal tail & flaperon	Abex/National Waterlift	Mitsubishi Heavy Industries, Ltd.[a]
132.	Servoactuator assembly for rudder	Abex/National Waterlift	Kayaba Industry Co., Ltd.[a]
133.	Leading edge flap drive system		Mitsubishi Heavy Industries, Ltd.[a]
	Rotary actuator gearbox for leading edge drive system (stations 1 - 4)	Curtiss-Wright Flight Systems, and Allied Signal Aerospace Co.	
	Power drive unit assembly for leading edge drive system	Lockheed Fort Worth Co.	
134.	Hydraulic control valve for speed brake	Tactair Fluid Controls Inc.	Tactair Fluid Controls Inc.
135.	Lateral & normal accelerometer assembly	Lockheed Fort Worth Co.	Tokimec Inc.[a]
136.	Rudder pedal position sensor	Kavlico Corp.	Kavlico Corp.
137.	Hydraulic actuator assembly for speed brake (right)	Arkwin Industries Inc.	Arkwin Industries Inc.
138.	Hydraulic actuator assembly for speed brake (left)	Arkwin Industries Inc.	Arkwin Industries Inc.
System: Hydraulic			
139.	Variable delivery hydraulic pump (emergency)	Vickers Inc.	Vickers Inc.
140.	Variable delivery hydraulic pump (main system)	Abex/National Waterlift	Abex Japan, Ltd.[a]
141.	Hydraulic reservoir assembly (system A)	Parker Hannifin Corp.	Parker Hannifin Corp.
142.	Hydraulic reservoir assembly (system B)	Parker Hannifin Corp.	Parker Hannifin Corp.
143.	High pressure pneumatic reservoir (brake/jet fuel starter)	Tavco Inc., and HR Textron Inc.	Tavco Inc.
144.	Drag chute accumulator	York Industries Inc.	York Industries Inc.
145.	100-cubic inch hydraulic accumulator	Parker Hannifin Corp.	Parker Hannifin Corp.
146.	Self-sealing hydraulic ground service coupling half (ground test manifold, system A)	Aeroquip Corp.	Aeroquip Corp.
147.	Self-sealing hydraulic ground service coupling half (ground test manifold, system B)	Aeroquip Corp.	Aeroquip Corp.
148.	Self-sealing hydraulic ground service coupling half (hydraulic fill connector)	Aeroquip Corp.	Aeroquip Corp.

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
149.	Pressure filter manifold assembly (system A)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
150.	Pressure filter manifold assembly (system B)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
151a.	Return filters and bypass valve for filter manifold assembly (system A)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
151b.	Return filters and bypass valve for filter manifold assembly (system B)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
152.	Hydraulic valve assembly for cooler thermal bypass	Standard-Thomson Corp.	Standard-Thomson Corp.
153.	Hydraulic reservoir accumulator	York Industries	York Industries
154.	Hand pump	FCD Corp., Teledyne Republic Manufacturing, and Crane Co.	FCD Corp.
155.	Hydraulic accumulator (brake and jet fuel starter)	Parker Hannifin Corp.	Parker Hannifin Corp.
156.	Hydraulic pressure switch assembly (EPU pump)	Eaton Corp.	Eaton Corp.
157.	High pressure 200-cubic-inch pneumatic reservoir	Tavco Inc.	Tavco Inc.
System: Armament			
158.	M-61A1 20mm automatic gun	Martin Marietta Armament Systems	Martin Marietta Armament Systems
159.	Ammunition handling unit	Martin Marietta Armament Systems	Martin Marietta Armament Systems
160.	Gun control unit	Dynamic Controls Corp.	Dynamic Controls Corp.
System: Weapon delivery			
161.	Guided missile launcher assembly	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
162.	AIM-7 under wing launcher	Item not found in F-16	Japan Aircraft Mfg. Co., Ltd.[a]
163.	Modified triple ejection rack-9A	Lockheed Fort Worth Co.	Marvin Engineering Co., Inc.
164.	Wing missile launcher adapter	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
165.	Rack ejector	Warner Robins Air Logistics Command	EDO Corp.
166.	Alternate fuel pylon assembly	Lockheed Fort Worth Co.	Japan Aircraft Mfg. Co., Ltd.[a]
167.	Weapon pylon assembly (left)	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
168.	Weapon pylon assembly (right)	Lockheed Fort Worth Co.	Fuji Heavy Industries, Ltd.[a]
169.	Centerline fuselage pylon assembly	Lockheed Fort Worth Co.	Japan Aircraft Mfg. Co., Ltd.[a]
170.	370-gallon external fuel tank	Sargent-Fletcher Co.	Sargent-Fletcher Co.
171.	300-gallon center line external fuel tank	Sargent-Fletcher Co.	Sargent-Fletcher Co.
System: Avionics			
172.	Enhanced central interface unit assembly	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
173.	Advanced missile remote interface unit for Stores Management System (SMS)	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
174.	Advanced conventional remote interface unit (SMS)	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
175.	Jettison & release remote interface unit (SMS)	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
176.	RT-1300/ARC-186(V) receiver/transmitter (VHF/UHF)	Rockwell International Corp.	NEC[a]
177.	RT1159A TACAN receiver/transmitter	Rockwell International Corp.	Rockwell International Corp.
178.	HF radio	Item not found in F-16	Kokusai Electric Co., Ltd.[a]
179.	R-1781/ARN-108 instrument landing system receiver	Rockwell International Corp.	Toshiba Corp.[a]
180.	Fire control radar (APG-68)	Westinghouse Electric Corp.	Mitsubishi Electric Corp.[a]
181.	Identification friend or foe receiver/transmitter	Teledyne Electronics	Hazeltine Corp.
182.	General avionics computer	Teledyne Systems Co.	Mitsubishi Electric Corp.[a]
183.	Electronic warfare computer for integrated electronic warfare system (IEWS)	Tracor Corp.	Mitsubishi Electric Corp.[a]
184.	Electronic support measures for IEWS	Loral Corp.	Mitsubishi Electric Corp.[a]
185.	Electronic countermeasures for IEWS	Westinghouse Electric Corp., and Raytheon Corp.	Mitsubishi Electric Corp.[a]
186.	Countermeasures dispensers for IEWS	Tracor Corp.	Mitsubishi Electric Corp.[a]
187.	Advanced interference blanker unit	SCI Systems Inc.	SCI Systems Inc.
188.	Map generator	Item not found in F-16	Toshiba Corp.[a]
189.	Angle-of-attack transmitter (right and left)	Teledyne Avionics	Japan Aviation Electronics Industries, Ltd.[a]
190.	Inertial navigation set	Litton Systems Inc.	Japan Aviation Electronics Industries, Ltd.[a]
191.	Crash-survivable flight data recorder signal acquisition and memory units	Smith Industries Inc.	Kanto Aircraft Instrument Co., Ltd.[a]
192.	Airborne video tape recorder	Teac Corp. of America	Teac Corp.[a]
193.	Central air data computer	Honeywell Inc.	Tokimec Inc.[a]
194.	Head-up display set: electronics and display units	GEC Avionics Ltd.[c]	Shimadzu Corp.[a]
	Aft seat head-up display monitor	Astronautics Corp. of America	
195.	Rate sensor unit	Honeywell Inc., and GEC Avionics Ltd.[c]	Honeywell Inc.
196.	Fuselage-mounted air data probe	Rosemount Aerospace Inc.	Rosemount Aerospace Inc.
197.	Combined altitude radar altimeter receiver/ transmitter unit	Gould Defense Systems Inc.	Japan Radio Co., Ltd.[a]
198a.	Engine warning control unit	SCI Systems Inc.	Shinko Electric Co., Ltd.[a]
198b.	Voice message unit	SCI Systems Inc.	Shinko Electric Co., Ltd.[a]
199.	Extended capability data entry electronic unit	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
200.	Pilot fault list display	Litton Systems Canada, Ltd.[d]	Litton Systems Canada, Ltd.[d]
201.	Data entry display power supply	Litton Systems Canada, Ltd.[d]	Litton Systems Canada, Ltd.[d]

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
202.	Data entry display	Litton Systems Canada, Ltd.[d]	Koito Manufacturing Co., Ltd.[a]
203.	Aft station integrated control panel assembly (2 seat)	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
204.	Nose mounted pitot static tube	Rosemount Aerospace Inc.	Rosemount Aerospace Inc.
205.	Standby display set	Item not found in F-16	Yokogawa Electric Corp.[a]
206.	Data link set	Item not found in F-16	Hitachi, Ltd.[a]
207.	Auxiliary communication panel	Lambda Novatronics Inc.	Lambda Novatronics Inc.
System: Electricity			
208.	10KVA AC generator	Westinghouse Electric Corp.	Shinko Electric Co., Ltd.[a]
209.	10KVA generator control unit	Westinghouse Electric Corp.	Shinko Electric Co., Ltd.[a]
210.	10KVA frequency converter	Westinghouse Electric Corp.	Shinko Electric Co., Ltd.[a]
211.	Constant speed drive	Sundstrand Aerospace	Teijin Seiki Co., Ltd.[a]
212.	5KVA AC Emergency power generator	Lucas Aerospace, and Pacific Scientific Co.	Shinko Electric Co., Ltd.[a]
213.	Electrical converter and 5KVA generator control unit	Aerospace Avionics Inc.	Shinko Electric Co., Ltd.[a]
214.	60KVA AC generator	Westinghouse Electric Corp.	Shinko Electric Co., Ltd.[a]
215.	60KVA AC generator control unit	Westinghouse Electric Corp.	Shinko Electric Co., Ltd.[a]
216.	Converter regulator	Aerospace Avionics Inc., and Lockheed Fort Worth Co.	Mitsubishi Electric Corp.[a]
217.	Nickel-cadmium aircraft storage battery	Marathon Power Technologies, and Saft America Inc.	The Furukawa Battery Co., Ltd.[a]
218.	Battery charger/control unit	Aerospace Avionics Inc.	The Furukawa Battery Co., Ltd.[a]
219.	External power receptacle	Burton Electrical Engineering Corp.	Burton Electrical Engineering Corp.
220.	Ground electrical receptacle	Avibank Mfg. Inc.	Avibank Mfg. Inc.
221.	DC converter	Lockheed Fort Worth Co.	Mitsubishi Electric Corp.[a]
System: Instrumentation			
222.	ABU-11/A aircraft mechanical clock	Aerosonic Corp., Macleod Instrument Corp., and Waltham Clock Co., Inc.	Tokyo Aircraft Instrument Co., Ltd.[a]
223.	ARU-42/A1 attitude indicator	Jet Electronics & Technology, Inc.	Jet Electronics and Technology, Inc.
224.	Multi-function display set: AQU-13A/A horizontal situation indicator and ARU-50/A flight attitude indicator AAU-34/A servo control altimeter Multi-function programmable display generator	Astronautics Corp. of America, and Litton Systems Inc. Litton Systems Inc., and Sequa Corp. Honeywell Inc.	Yokogawa Electric Corp.[a]
225.	AN/AXQ-16(V)-1 TV cockpit sensor	Loral Fairchild Corp.	NAC Inc.[a]
226.	Pilot's controller grip assembly	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
227.	TRU-63/A-3 fuel flow transmitter	Ametek Aerospace Products Inc., and Gull Electronic Systems Div.	Ametek Aerospace Products Inc.
228.	Engine control and aft station throttle quadrant assembly	Lockheed Fort Worth Co.	Koito Manufacturing Co., Ltd.[a]
229.	Light assemblies	Aerospace Avionics Inc.	Koito Manufacturing Co., Ltd.[a]
	Master caution light assembly	Grimes Aerospace	
230.	AAU-3A/A pressurized compartment altimeter	Aerosonic Corp., and Kearflex Engineering Co., Inc.	Aerosonic Corp.
231.	Total temperature deiceable probe	Rosemount Aerospace Inc.	Rosemount Aerospace Inc.
232.	Fuel quantity measuring system	BF Goodrich Military Fuels & Integrated Systems	Yokogawa Electric Corp.[a]
System: Operational software			
233.	Stores management computer software	Lockheed Fort Worth Co.	Lockheed Fort Worth Co.
234.	Up front control software	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
235.	Programmable display generator software	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
236.	Mission computer software	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
237.	Flight control computer software	Lockheed Fort Worth Co.	Mitsubishi Heavy Industries, Ltd.[a]
Mitsubishi Heavy Industries Configuration Control Items			
238.	RT-1168b UHF receiver/transmitter	Magnavox Co.	Magnavox Co.
239.	AM1963/AIC-1 intercommunication amplifier	Andrea Radio Corp.	Andrea Radio Corp.
240.	C6624/AIC-25 intercommunication station	Andrea Radio Corp., Melcor Electronics Corp., and Monmouth Industries Inc.	Andrea Radio Corp.
241.	Data transfer unit	Fairchild Defense Co.	Fairchild Defense Co.
242.	Data transfer cartridge assembly	Fairchild Defense Co.	Fairchild Defense Co.
243.	TRU-2A/A rate gyro transmitter	Aircraft Instr. & Dev. Inc.; Honeywell Inc.; Smith Industries Inc.; Abex/National Waterlift; Condor Pacific Industries Inc.; and Jet Electronics and Technology Inc.	Aircraft Instrument and Development Inc.
244.	AGU-1B/U hydraulic pressure indicator	Allied Signal Inc. Courter Operations	Allied Signal Inc. Courter Operations
245.	EHU-49/A fan turbine inlet temperature indicator	Gull Electronic Systems Div., and Ametek Aerospace Products Inc.	Tokyo Aircraft Instrument Co. Ltd.[a]
246.	Rate of fuel flow indicator	Ragen Data Systems Inc.	Tokyo Aircraft Instrument Co., Ltd.[a]
247.	ALU-16/A nozzle position indicator	Litton Special Devices, and Gull Electronic Systems Div.	Litton Special Devices
248.	EGU-12/A oil pressure indicator	Allied Signal Inc. Courter Operations	Allied Signal Inc. Courter Operations
249.	Electrical tachometer indicator	Aero Mechanism Inc., and Ametek Aerospace Products Inc.	Tokyo Aircraft Instrument Co., Ltd.[a]
250.	Emergency fuel quantity indicator model 1822	Ametek Aerospace Products Inc., and Aerosonic Corp.	Ametek Aerospace Products Inc.
251.	ABU-4A/A accelerometer	QED Inc.	QED Inc.

(continued)

	Configuration item	F-16 manufacturer	FS-X manufacturer
252.	Landing/taxi light	Grimes Aerospace Co., and Godfrey Engineering Inc.	Koito Manufacturing Co., Ltd.[a]
253.	Landing/taxi light transformer	Grimes Aerospace Co., and Godfrey Engineering Inc.	Grimes Aerospace Co.
254.	Anti-collision light system: anti-collision light power supply, strobe light	Grimes Aerospace Co. ,	Koito Manufacturing Co., Ltd.[a]
255.	Navigational aircraft formation light (left and right)	Grimes Aerospace Inc., and Specialty Lighting Inc.	Koito Manufacturing Co., Ltd.[a]
256.	Aircraft formation light	Grimes Aerospace Co., and Specialty Lighting Inc.	Koito Manufacturing Co. Ltd.[a]

[a]Indicates a Japanese company.

[b]Michelin is a French company.

[c]GEC Avionics is a British company.

[d]Indicates a Canadian Company.

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

DEFENSE SECURITY ASSISTANCE AGENCY

WASHINGTON, DC 20301-2800

22 MAY 1995

I-004169/95

Mr. Henry L. Hinton, Jr.
Assistant Comptroller General
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Hinton:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "U.S.-JAPAN COOPERATIVE DEVELOPMENT: Progress on FS-X Program Enhances Japanese Aerospace Capabilities," dated April 1995 (GAO/NSIAD-95-145), OSD Case 9773-X. The DoD concurrences and comments are enclosed.

The FS-X program is beneficial to the United States in that it has provided jobs and income, has helped to sustain the U.S. defense industry during a particularly difficult period of drawdown, and has avoided the consequences associated with Japan's development of an indigenous fighter. With respect to the GAO view that the FS-X program has substantially enhanced Japanese aerospace capabilities, the U.S. contribution to any such enhancement has not been as significant as the report implies. Throughout the program, the DoD has effectively limited Japanese access to sensitive U.S. aerospace technologies, including those relating to software design and systems integration.

The DoD fully recognizes the importance of managing the development phase of the FS-X program in a responsible manner that adequately protects sensitive U.S. technology, meets U.S. workshare objectives, and ensures proper flowback of and access to Japanese technologies for DoD purposes. The Air Force has taken action to ensure that the System Program Office has sufficient information to adequately monitor license applications for Japan. Other actions are also underway to evaluate Japanese FS-X technology and ensure its availability to U.S. industry.

The detailed DoD comments on each of the draft report's findings and recommendations are provided in the enclosure. The DoD appreciates the opportunity to comment on the draft report.

Sincerely,

H. Diehl McKalip
Acting Director

Enclosure

**GAO DRAFT REPORT - DATED MAY 2, 1995
(GAO CODE 705102) OSD CASE 9773-AX**

"U.S.-JAPAN COOPERATIVE DEVELOPMENT: FS-X PROGRAM ENHANCES JAPANESE AEROSPACE CAPABILITIES"

DEPARTMENT OF DEFENSE COMMENTS

*** * * * ***

FINDINGS

- **FINDING A: History of the FS-X Program.** The GAO reported that, in November 1988, the U.S. and Japan agreed to develop cooperatively the FS-X fighter aircraft, a modified derivative of the U.S. Air Force F-16 Block 40 fighter aircraft. The GAO observed that the program was delayed initially, because the Congress raised concerns about the transfer of U.S. technology to Japan through the FS-X program and whether the program will provide the U.S. with useful technology. The GAO explained that the FS-X program, funded by Japan, involves the cooperative development of a fighter aircraft and the manufacture of six prototypes intended to replace Japan's aging, domestically developed F-1 fighter. The GAO also noted that the value of the U.S. work share is to reach 40 percent of Japan's FS-X development budget, and that the U.S. should receive, at no cost, all FS-X technology essentially developed (derived) from U.S. technical data provided for the FS-X program. Further, the GAO noted that the U.S. must pay for FS-X technologies that are not essentially developed from U.S. technical data (non-derived), although the U.S. may obtain some information about the non-derived technologies at no cost.

  The GAO also explained that the Government of Japan has overall FS-X program responsibility, and that Mitsubishi Heavy Industries is the prime contractor. The GAO also noted that Mitsubishi is responsible for overall FS-X systems integration--which is critical to a successful advanced aircraft program--and that Japan has limited experience in systems integration. The GAO also explained that the Lockheed Fort Worth Company, the manufacturer of the F-16, is the principal U.S. airframe subcontractor for the FS-X, and that the Air Force monitors day-to-day program activities for the U.S. Government--primarily from the F-16 System Program Office. The GAO also observed that the FS-X development program entered the prototype

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Now on pp. 2-4 and 14-18.

production phase in the summer of 1993. (pp. 2-5, pp. 15-20/GAO Draft Report)

DOD RESPONSE: Concur.

- **FINDING B: FS-X Program Is Progressing, But Faces Some Challenges.** The GAO observed that Japanese and U.S. contractors are producing parts for the FS-X prototype aircraft, which is currently scheduled for its first flight test in late summer of 1995--about two years later than planned. The GAO also found that U.S. officials (i.e., Air Force and industry) are concerned about Japan's ability to develop the digital flight control software and other technical challenges, such as (1) the co-cured composite wing, (2) the leading edge flap drive system, and (3) the radar and electronic warfare system. In addition, the GAO observed that U.S. officials are concerned that Japan may be unable to fit all of the proposed avionics equipment into the FS-X aircraft. The GAO concluded that, although the other FS-X avionics systems do not have to be fully operational for the aircraft to achieve its scheduled first flight date, the FS-X cannot fly safely until the digital flight control software functions properly. The GAO also noted Japan's limited experience with digital flight control software development and indicated that, because Japan is developing the software without U.S. assistance, the U.S. has limited insight into its progress.

  The GAO also found that, in March 1992, the Japan Defense Agency imposed a 330 billion yen limit on the FS-X development budget in response to significant growth in program cost estimates. The GAO pointed out in its January 1992 report (OSD Case 8560-AX) that the estimate of FS-X development costs had increased by about 70 percent to 280 billion yen from a 1987 cost estimate of 165 billion yen. Consequently, the GAO observed that Lockheed identified cost savings and agreed to modify some of its tasks, and that the Lockheed development budget was limited to $735 million. (p. 6, pp. 25-30/GAO Draft Report)

Now on pp. 3-4 and 21-24.

DOD RESPONSE: Concur.

- **FINDING C: U.S. Seeks to Validate FS-X Work Share.** The GAO observed that, under the FS-X agreements, the U.S. work share is linked to the Japanese Government's FS-X development budget rather than to Japanese expenditures.

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The GAO noted that, in October 1993, Japan estimated the value of the U.S. work share at over $1 billion--ranging from 41 to 46 percent of the development budget--which exceeds the 40 percent share specified in the FS-X agreement. The GAO found that, although the U.S. is attempting to validate those figures, the U.S. does not have complete cost information and some U.S. officials believe Japan has consistently understated the total costs of the program. The GAO asserted that some Japanese industry officials indicated their companies are spending more on FS-X development than they have received from the Japanese Government, and that those costs are not included in the FS-X budget data or the work share calculations the Japanese Government reports to the U.S.

The GAO concluded that Japan will spend far more developing and producing the FS-X than if it had purchased F-16s from the U.S. The GAO also concluded that Japan will probably produce between 50 and 130 FS-X aircraft to (1) replace its outdated F-1 aircraft and (2) maintain its good security relationship with the U.S. However, the GAO indicated that FS-X production might not occur if (1) the estimated production costs of the aircraft increase significantly; (2) a major technical problem, such as failure of the digital flight control software, prevents the aircraft from flying safely; (3) a prototype aircraft crashes during flight tests; or (4) a drastic change in Japanese defense policy eliminates military requirements for the FS-X.

The GAO also found that the production agreement with Japan may not be signed until the U.S. has received sufficient technology transfer from Japan during development. In addition, the GAO observed that the U.S. production work share target will be difficult to attain, because (1) the decline of the dollar relative to the yen (since the work share percentage was agreed to) makes U.S. work cheaper; (2) changes in DoD policy have eliminated non-recurring cost recoupment charges Japan would pay to the U.S. Government during the production phase; (3) Japan's selection of many Japanese suppliers for the development phase did not account for the U.S. production work share; and (4) many U.S. companies providing end items for development might not want to bear the costs of maintaining production capability for the projected small quantities of FS-X aircraft (i.e., a maximum of 24 aircraft annually), and instead choose to accept lower licensed production payments from Japan. The GAO concluded that the U.S. should require Japan to clearly define the elements that comprise the production phase work share to avoid delays, confusion, and subsequent disagreements, and that the U.S. would benefit from a formal statement of U.S.

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Now on pp. 3-4 and 24-27.

See comment 1.

goals and improved U.S. Government interagency coordination before negotiating production agreements. (pp. 6-7, pp. 30-35/GAO Draft Report)

DOD RESPONSE: Partially concur. The DoD agrees that, under the FS-X agreements, the U.S. workshare is linked to the Japanese Government's FS-X development budget. Like their counterparts in the U.S., Japanese firms frequently make autonomous decisions to risk corporate funds in financing infrastructure improvements, research and development initiatives, etc., aimed at maximizing their chances of winning new military contracts. However, since the Japan Defense Agency (JDA) is not responsible for any such decisions by its FS-X contractors, it would be unreasonable and inappropriate to expand the U.S. workshare denominator to include such expenditures.

The DoD agrees that the U.S. should require Japan to define clearly the elements comprising the production phase U.S. workshare. The DoD plans to identify each element of the U.S. production phase workshare explicitly in the production Memorandum of Understanding projected for early 1996.

The DoD also agrees that the U.S. would benefit from a formal statement of U.S. goals and improved interagency coordination prior to negotiating production phase agreements. A formal statement of U.S. goals relating to the production phase has been prepared for interagency coordination, and steering and working groups have been established to take into account all relevant viewpoints during the drafting and negotiation of production phase agreements.

- **FINDING D: Adequacy of Controls for U.S. Provided Items Varies.** The GAO found that the adequacy of U.S. controls over the transfer of technology and hardware to Japan has varied. The GAO concluded that U.S. controls over F-16 and Lockheed-generated FS-X technical data seem adequate; however, the GAO found that Japan has continued to seek release of previously denied F-16 technical data. The GAO observed that the F-16 Program Office has completed its review of the F-16 technical data package, which served as the baseline for the FS-X design, except for one item, a computer program containing vast quantities of logistics data on most F-16 systems. The GAO also noted that the F-16 System Program Office continues to review supplemental F-16 data for release, and that Lockheed continues to generate data to supplement the F-16 technical data package, which the Air Force reviews for release to Mitsubishi.

The GAO found no indication during its test checks of supplemental data release records that the Air Force or Lockheed was not adhering to established releasability procedures and policies.

The GAO also found that the U.S. Government authorized the release of some F-16 related production data for items that Japan said were essential for completing the FS-X design in late 1991. The GAO noted that the DoD review was prompted by Japanese industry requests for proposals from U.S. and Japanese companies to provide licensed production data for 122 FS-X subsystems. The GAO also noted that the Japan Defense Agency justified the requests by stating that it needed production information to ensure the safety of the FS-X design and to avoid schedule delays. The GAO observed that the Japanese requests caused concern within the U.S. Government, because many U.S. officials believed that licensed production of U.S. items would not be discussed until negotiations for a government-to-government FS-X production agreement began. The GAO also observed that at least one DoD official saw the Japanese request for production information as a means of circumventing the FS-X development agreement and obtaining U.S. technology. The GAO also noted that some officials indicated that Japan wanted licensed production information to avoid having to purchase end items from U.S. firms, which would increase the number of jobs for Japanese workers and ensure an adequate level of contractor support during the program. The GAO also found that the Japan Defense Agency had complained about the support it received from U.S. companies on other programs and believed it could obtain more timely assistance from Japanese firms.

The GAO indicated that the U.S. ultimately approved 22 items out of 96 for full or partial licensed production, and offered 74 other items to Japan as end items, because the U.S. believed that production data for those items was not needed to ensure the safety of the FS-X design. The GAO found that Japan selected U.S. companies for 19 of the 22 items offered by the U.S., and selected 48 other items (out of the 74 offered) from U.S. companies. The GAO also noted that Japan's selection of some Japanese firms was due to the U.S. restrictions on the release of licensed production information during the development phase. However, the GAO indicated that the U.S. would probably allow more licensed production by U.S. firms upon completion of an FS-X production agreement. (p. 7, pp. 36-44/GAO Draft Report)

Now on pp. 5 and 29-33.

DOD RESPONSE: Concur. It should be noted, however, that the U.S. approved 22 items for full or partial licensed

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Page 5 of 14

production on a "build-to-print" basis only, thereby significantly limiting the scope of technology transfer.

- **FINDING E: Japan Is Obtaining Data and Items Through the U.S. Export Licensing Process.** The GAO observed that, in addition to the F-16 and Lockheed FS-X technical data, Japan has obtained technology and items from the U.S. through the export licensing process. The GAO found that the number of State Department FS-X related munitions export licenses to Japan has increased nearly 600 percent from 75 to 518 since June 1992. In addition, the GAO found that the State Department is approving munitions export licenses for FS-X prototype items. In addition, the GAO observed that the Department of Commerce has also approved export license applications for dual use (military and civilian) items that could contribute to Japan's FS-X development program.

  The GAO concluded that the lack of coordination between the Departments of State, Defense, and Commerce has hampered U.S. oversight and control of FS-X related exports to Japan. Consequently, the GAO asserted that the U.S. is unable to ensure compliance with releasability guidelines. For example, the GAO noted that the Department of State improperly approved an export license for a very sensitive F-16 item without coordinating with the DoD, and that the Department of Commerce approved export licenses for FS-X related items that may be under the jurisdiction of the Department of State. The GAO also concluded that poor coordination in the licensing process can impair the U.S. ability to properly categorize FS-X items as derived or non-derived. For example, before 1992, the GAO observed that the DoD did not provide complete FS-X license information to the F-16 System Program Office, limiting its oversight and insight into FS-X related exports to Japan.

  The GAO also found that the Department of Commerce does not require any application for most exports to Japan, nor does it issue any licensing documents. Consequently, the GAO asserted that it was unable to identify many exports that may contribute to the FS-X program. The GAO indicated that Commerce officials stated they are not obligated to coordinate its review of licenses with the DoD or the State Department, or to comply with DoD FS-X program releasability guidelines. In addition, the GAO observed that Commerce and State Department officials have conflicting views on which Department has jurisdiction over some of the items. Finally, the GAO found that the Department of Commerce does not coordinate dual use applications with the DoD or the

Now on pp. 5 and 33-37.

See comment 2.

State Department. The GAO concluded that the licensing irregularities pose a risk of improper releases to Japan. (pp. 7-8, pp. 44-51/GAO Draft Report)

DOD RESPONSE: Concur. The DoD agrees that reasonable steps should be taken to ensure that each license application applicable to the FS-X is reviewed by all interested U.S. Government elements, consistent with available resources. The GAO indicated that, prior to 1992, the DoD did not provide complete FS-X license information to the F-16 System Program Office. It should be recognized that it was the Air Force, not the Office of the Secretary of Defense (OSD), that failed to provide complete information to the System Program Office.

- **FINDING F: Progress Made on Technology Transfers from Japan, But Some Problems Remain**. The GAO found that Japanese efforts to transfer FS-X technical information to the U.S. have improved since 1992, and that U.S. program officials are generally satisfied with the Japanese transfers. The GAO observed that the DoD and Lockheed have received thousands of FS-X technical documents, drawings, photographs, and video tapes, and that Japanese subcontractors have also begun providing FS-X technologies to the U.S. The GAO also observed that the U.S. has collected information on the FS-X wing and the five Japanese non-derived avionics systems, i.e., the active phased array fire control radar, the mission computer hardware, the inertial reference/navigation system, the integrated electronic warfare system, and the radar absorbing material. The GAO noted that the DoD has conducted technical visits to Japan for all of those technologies except the radar absorbing material. The GAO also noted that Japan has provided increasing levels of access to the technologies as the Japanese reach key development points. However, the GAO found that program officials are uncertain if Japan is transferring all the data it should.

  The GAO also observed that Lockheed is receiving sufficient data and technical assistance from Mitsubishi to build FS-X wings; however, the GAO found that Lockheed had not received sufficient information to apply the composites technology to other programs. In addition, the GAO found that some U.S. officials are concerned about the capabilities of the innovative Japanese FS-X co-cured composite wing design, primarily because of its several unique features. The GAO noted that the U.S. has requested full access to Japanese FS-X flight testing that will ultimately verify the capabilities of the wings. The GAO also observed that

Now on pp. 5 and 33-37.

questions remain about the FS-X radar following a 1992 symposium, and because Mitsubishi provided very limited information, the U.S. was unable to adequately evaluate the radar technology. The GAO also found that interest in the FS-X radar among U.S. companies is mixed. The GAO observed that, while some U.S. companies produce similar modules and believe they could benefit from the knowledge of Japanese production methods, others believe that U.S. radar technology is more advanced and are uncertain about the potential market for the technology, since current module costs preclude widespread commercial applications. The GAO also found that the U.S. and Japan disagree on how the U.S. may use some Japanese FS-X technology. (pp. 8-9, pp. 53-61/GAO Draft Report)

DOD RESPONSE: Concur. Under the FS-X program great strides have been taken with respect to transfers of Japanese technology to the United States. Concerning the adequacy of existing wing technology for application to other DoD programs, it is not yet known whether the substantial amount of co-cured composite wing technology received from Japan to date is sufficient for application to other DoD programs. Detailed technical assessments are necessary in order for interested U.S. companies to determine the applicability and sufficiency of all or a portion of that technology to the specific DoD program(s) each in pursuing.

The DoD and the Japan Defense Agency (JDA) agree that derived technologies transferred to the United States may be used, free of charge, for the U.S. Government's defense purposes (including Grant Aid) and defense sales (including Foreign Military Sales). However, the DoD and JDA have had disagreements as to whether particular FS-X item should be categorized an derived or non-derived.

- **FINDING G: The U.S. and Japan Continue to Negotiate Transfer Rules.** The GAO observed that, under the FS-X agreements, Japan may submit evidence and requests to change the technology transfer status and rules for specific FS-X technologies. The GAO found that, if Japan demonstrates it developed a technology with insignificant or no U.S. input, the U.S. may agree to reclassify the technology as non-derived--which means Japan may limit certain technology transfers or sell non-derived technologies to the U.S. In contrast, the GAO noted that Japan is required to provide complete technology transfers for changes, modifications, or improvements to derived technologies free of charge to the U.S.

Now on pp. 6 and 45-47.

See comment 3.

The GAO indicated that the U.S. and Japan were negotiating the appropriate degree of U.S. access to certain other FS-X technologies at the time of the GAO review. The GAO noted that, in December 1993, Japan submitted 12 items as candidates for reclassification to non-derived status, and that the U.S. evaluated the 12 candidates to determine if Japan developed them with minimal or insignificant U.S. input, as Japan claimed.

The GAO observed that the Japan Defense Agency has limited technology transfers to the U.S. for some of the 12 candidate technologies pending resolution of the reclassification issue. The GAO encouraged the DoD to work with the Commerce and State Departments to obtain and analyze all pertinent U.S. export licenses approved for Japan to help ensure that the U.S. does not buy technology derived from U.S. data. (p. 9, pp. 62-63/GAO Draft Report)

DOD RESPONSE: Nonconcur. The U.S. and Japan are not negotiating transfer rules. Under the FS-X agreements, all Japanese-developed technical data that in based essentially upon U.S. technical data must be transferred to the U.S. automatically and free of charge, including any background data necessary to make such transfers effective. The U.S. Government has reviewed the twelve items proposed by Japan for recategorization to nonderived status, and has determined that eight of the twelve are essentially based upon U.S. technical data and, therefore, must remain derived.

- **FINDING H: Efforts Are Underway to Evaluate Japanese Technologies, But Obstacles Remain.** The GAO found that, overall, U.S. efforts to evaluate Japanese-provided FS-X technologies have been limited and uncoordinated, partly because the U.S. did not originally consider technology transfer from Japan as a primary program goal and did not have an established infrastructure to evaluate transferred technology. The GAO also noted that the Air Force, the Department of Commerce, and Lockheed lacked the resources to evaluate Japanese FS-X technology transfers, and that no efforts were underway to thoroughly analyze transferred FS-X data. The GAO indicated that U.S. program officials acknowledged they could be doing more to evaluate certain key Japanese FS-X technologies with potential value to the U.S. However, the GAO noted that Lockheed officials indicated they cannot properly evaluate Japanese FS-X technologies without input from other experienced U.S. defense companies, and that U.S. officials contended there

are limited opportunities to use Japanese FS-X technologies without military requirements for the technologies.

The GAO concluded that, although the U.S. is learning about certain Japanese FS-X technologies through technology transfers and visits, preliminary analyses of the performance of those systems indicate that Japanese technologies, while strong in some areas, do not match U.S. capabilities. However, the GAO also concluded that Japanese design and production methods may be more promising than the technologies themselves. For example, the GAO indicated that Japan designs and builds some avionics components that are lighter and smaller than similar U.S. equipment.

The GAO also found that U.S. Government and industry officials do not know what benefits, if any, will accrue to the U.S. from transfers of Japanese FS-X technology because:

-- Until the FS-X flies a test mission, no one can know if the Japanese modifications to F-16 systems are successful;

-- U.S. sources believe that FS-X systems are based on older technologies which the U.S. Air Force should surpass with its latest generation systems;

-- It is not clear that Japan will transfer key manufacturing data which would most benefit U.S. industry; and

-- U.S. companies do not know what markets might exist for Japanese FS-X technologies.

The GAO concluded that there has been only limited efforts to systematically evaluate transferred Japanese FS-X technologies, and that the DoD has provided very little FS-X information to U.S. industry. However, the GAO noted that the DoD plans to establish an FS-X database at the Defense Technical Information Center that could improve dissemination of Japanese technologies. The GAO also concluded that, regardless of the ultimate value of Japanese technology itself, the U.S. could benefit from transfers of Japanese technology because (1) the FS-X program has set precedents and provided lessons for technology transfers from Japan that may prove useful in the future, and (2) U.S. program engineers are gaining experience with Japanese design and development methods that may be valuable in other aircraft programs. However,

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Now on pp. 5-7 and 47-52.

the GAO indicated that the "not invented here" syndrome may contribute to unwarranted skepticism about Japanese technology that could interfere with U.S. attempts to fully exploit transferred Japanese FS-X technologies. (p. 9, pp. 64-72/GAO Draft Report)

DOD RESPONSE: Concur. With the exception of technologies of interest to the DoD (for example those relating to the FS-X wing and radar transmit/receive modules), evaluation of the bulk of the substantial amount of technical data received from Japan to date has been limited. As indicated by the GAO, the DoD has established an FS-X database at the Defense Technical Information Center for the purpose of enhancing the visibility, and promoting disseminations of FS-X technologies to U.S. industry for DoD purposes.

- **FINDING I: FS-X Program Provides Different Benefits to Japanese and U.S. Aerospace Industries.** The GAO found that, overall, Japan has received technological benefits from the FS-X program whereas U.S. aerospace firms have obtained primarily contract orders. The GAO also found that the program is consistent with the Japanese Government's strategy of making defense development and production as indigenous as possible. The GAO observed that Japan views its defense programs not only as weapons acquisitions, but, more importantly, as technology acquisitions. The GAO concluded that the FS-X program contributes to that strategy by providing work and learning opportunities to many Japanese subcontractors and suppliers, increasing the skills and experience of Japanese aerospace engineers, and prompting Japanese firms to purchase new equipment and construct facilities that can be used for future projects. The GAO also noted that Japanese engineers are learning systems integration skills that are also applicable to commercial aircraft projects, and that Japanese FS-X contractors can use some of the equipment acquired for other aircraft programs, including commercial projects.

  The GAO also found that the Japanese changes to the F-16 design ensure that Japan's aircraft industry will benefit from the program. The GAO noted that Japan modified the F-16 to meet its stated operational requirements and to maximize opportunities for Japanese suppliers. Consequently, the GAO indicated that Japanese firms are supplying over half of the configuration items for the FS-X prototype aircraft. The GAO concluded that Japanese firms obtained more FS-X contracts than U.S. firms for state-of-the-art technology and items with commercial applications. The GAO also concluded that, while the program has enhanced the

Now on pp. 7 and 54-64.

technical capabilities of the Japanese aerospace industry, to date program benefits to the United States have been mainly economic. The GAO also estimated that the value of the U.S. work share payments has grown from initial projections of $480 million to over $1 billion as cost estimates for the overall FS-X development budget increased. The GAO found that the FS-X agreements specifically reserved certain tasks for Lockheed and General Electric, while other U.S. firms had to compete with Japanese companies for FS-X work. The GAO also found that most of the U.S. work share is reserved for Lockheed, which is guaranteed 31 percent of the value of the FS-X development budget. As of May 1994, the GAO noted that Japan had awarded $1.07 billion of contracts to over 200 U.S. firms for the development program. (pp. 10-11, pp. 75-89/GAO Draft Report)

DOD RESPONSE: Concur. The DoD agrees that the FS-X program will enhance Japanese aerospace capabilities in certain areas. However, it should be recognized that this enhancement will be limited, since the U.S. did not provide sensitive systems integration know-how and software source code data. The enhancement of Japan's aerospace capabilities resulting from development of an F-16 derivative will probably not be nearly an great as it would have been had the U.S. acquiesced to Japan designing and developing its own fighter from scratch, perhaps with the assistance of European countries.

* * * * *

RECOMMENDATIONS

- **RECOMMENDATION 1:** To ensure compliance with FS-X releasability guidelines, oversight of FS-X related reports to Japan, and proper categorization of derived and non-derived technologies, the GAO recommended that the Secretaries of State, Commerce and Defense direct the appropriate offices within their departments to develop and implement written formal procedures for coordinating the review of FS-X export license applications to Japan. The GAO suggested the procedures should, among other things:

  -- require State to refer all FS-X munitions license applications to the DoD for review;

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-- provide sufficient information for F-16 System Program Office personnel to adequately monitor FS-X related export license applications to Japan;

-- provide program office personnel on-line access to the DoD Foreign Disclosure and Technical Information System; and

-- require Commerce to provide the DoD Individual Validated License applications for exports to Japan of equipment or data with existing or potential uses on military aircraft. (p. 12, p. 52/GAO Draft Report)

Now on pp. 8 and 37-38.

DOD RESPONSE: Concur. Since the Departments of State and Commerce are the U.S. Government executive agents for licensing, the DoD will ensure adequate review of all FS-X licenses once they have been provided to the DOD. The U.S. Air Force is providing sufficient information to all System Program Office (SPO) personnel to enable them to adequately monitor FS-X related export license applications for Japan including on-line access to the DoD Foreign Disclosure and Technical Information System.

- **RECOMMENDATION 2**: To ensure effective evaluation of transferred Japanese FS-X technology, the GAO also recommended that the Secretary of Defense direct the Defense Science Board to establish and convene an FS-X Technology Transfer Evaluation Task Force. (p. 12, p. 73/GAO Draft Report)

Now on pp. 8 and 52.

DOD RESPONSE: Partially concur. The DoD has already implemented procedures designed to identify significant FS-X technologies in cooperation with U.S. industry. Specifically, an FS-X technology data base was established in July 1994 by the Defense Technology Information Center (DTIC). The existence of this data base has been advertised in the Commerce Business Daily, and it will be accessible by any interested U.S. firms for DoD purposes. Also, there is an ongoing series of visits to Japan by joint DoD/Commerce/industry teams to assess the usefulness of FS-X nonderived technologies, including those applicable to the FS-X radar, Integrated Electronic Warfare Suite, Inertial Reference System, and Mission Computer. There also are ongoing DOD-sponsored investigations of specific technologies considered to be of high potential value. These ongoing activities represent the most resource-efficient approach to the problem. The DoD will continue to implement these plans aimed at identifying, evaluating and disseminating FS-X technologies for DoD purposes. The DoD will monitor the

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success of those ongoing actions. If the results prove unsatisfactory, the DoD will then consider other actions, such an those included in GAO Recommendations 2 through 4.

- **RECOMMENDATION 3:** The GAO further recommended that, to the extent the FS-X agreements and Defense Science Board Charter permit, the Task Force should include U.S. Government and industry FS-X officials. (p. 12, p. 73/GAO Draft Report)

Now on pp. 8 and 52.

DOD RESPONSE: Partially concur. An discussed in the response to Recommendation 2, the DoD does not agree that establishment of a separate Task Force for the sole purpose of evaluating FS-X technologies is warranted at this time. The DoD will consider other actions, such as a Task Force, should ongoing actions prove unsuccessful.

- **RECOMMENDATION 4:** The GAO also recommended that, to the maximum extent possible, consistent with the agreements, representatives of the four Services and of leading U.S. aerospace companies who have expertise in fighter aircraft (including the F-22), composites applications, or potential commercial uses for FS-X technologies should be included on the Task Force. The GAO suggested that the Task Force could (1) assist the DoD in developing and implementing a program to more thoroughly evaluate transferred Japanese FS-X technology and (2) determine how the U.S. can most benefit, if at all, from transfers of Japanese FS-X technologies. In particular, the Task Force could:

  -- Determine if and how Japanese technology improves upon or surpasses U.S. technology;

  -- Identify Japanese FS-X design, technology, or manufacturing approaches that differ from U.S. experience and that could provide instructive lessons for the U.S.; and

  -- Develop a strategy for identifying, obtaining, managing, and applying useful or promising Japanese FS-X technologies if the program enters production. (p. 12, pp. 73-74/GAO Draft Report)

Now on pp. 8 and 52.

DOD RESPONSE: Partially concur. See the DoD response to Recommendations 2 and 3, above.

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The following are GAO's comments on the Department of Defense's letter dated May 22, 1995.

GAO Comments

1. We revised the report to clarify the distinction between the FS-X budget, which is paid for by the Japanese government, and the total costs of the FS-X development program, which include Japanese government funds and any costs paid by Japanese firms with their own corporate funds. We also added language indicating that U.S. officials do not know the total FS-X development costs or whether FS-X costs exceed the FS-X budget.

2. We modified the report's text in response to this comment.

3. We revised our report to indicate that it is the status of 12 FS-X technologies that is in question. We also added updated DOD-provided information on the status of the reclassification process. We note that while the rules governing the reclassification process are established, the technology transfer required for derived technologies is greater than that for non-derived items.

Comments From the Department of State

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

United States Department of State

Chief Financial Officer

Washington, D.C. 20520-7427

MAY 26 1995

Dear Mr. Hinton:

Thank you for the opportunity to provide Department of State comments on your draft report, "U.S.-JAPAN COOPERATIVE DEVELOPMENT: Progress on FS-X Program Enhances Japanese Aerospace Capabilities," GAO/NSIAD-95-145, GAO Job Code 705102.

If you have any questions concerning this response, please call Ms. Julie Kavanagh, PM/EXP, at (202) 647-4231.

Sincerely,

Richard L. Greene

Enclosure:
As stated.

cc:
GAO/NSIAD - Ms. D'Agostino
State/PM/EXP - Ms. Kavanagh

Mr. Henry L. Hinton, Jr,
Assistant Comptroller General,
National Security and International Affairs,
U.S. General Accounting Office.

UNCLASSIFIED

GAO Draft Report:
"U.S.-JAPAN COOPERATIVE DEVELOPMENT:
Progress on FS-X Program Enhances
Japanese Aerospace Capabilities,"
GAO/NSIAD-95-145, GAO Job Code 705102

The Department of State has performed a security review of the subject report and has no objection to its release as an UNCLASSIFIED document. The Department notes that such release should not be undertaken before obtaining concurrence from the Department of Defense.

We also note that the comments provided previously with regard to the classified report and with regard to the specific recommendation are relevant to the unclassified report. For your convenience we have consolidated those comments (updating the specific page numbers to correspond to the unclassified draft report) below:

General Comments

See pp. 8-9 and 38-39.

The fundamental issues raised by this report are twofold: first, can and should the U.S. government use the export licensing process to control the flow of FS-X technology to Japan for economic competitiveness reasons; and second, should the U.S. government, as the report implies, determine that commercial and economic security grounds warrant the restriction of technology flows at all?

Legal authorities for controlling exports provide for the U.S. government to evaluate proposed exports on the basis of foreign policy and national security concerns. The Department believes that if restrictions on transfer of FS-X-related technology to Japan are determined by the USG to be warranted on commercial or economic security grounds, the appropriate mechanism for such restrictions is through more effective government-to-government arrangements which provide the guidelines for licensing provisos and technology safeguards in specific cases. It is not appropriate to reopen the evaluation which led to the government-to-government agreement through the denial of individual export licenses.

With specific reference to our authorities pursuant to Section 38 of the Arms Export Control Act (AECA), the President is authorized to control the import and export of defense articles and defense services "in furtherance of world peace and the security and foreign policy of the United States." Economic interests were not included in this statutory list of factors for consideration in the licensing process. Thus,

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while commercial considerations are not factored out of munitions licensing decisions altogether, they cannot be the sole basis for decisions to deny or approve licenses under current law. The issue of basing a license denial or approval on economic considerations has arisen several times before. The Department of State, pursuant to the AECA, has consistently insisted that there be an affirmative, adequate linkage of commercial considerations to valid national security or foreign policy concerns.

Restrictions on technology, for example, can provide commercial protection and competitive benefits in one sector while denying opportunity for growth and development in another. The advocacy of blanket technology restrictions for commercial purposes implied in the GAO report assumes that such restrictions will have a uniform and beneficial impact on protecting U.S. economic security and promoting U.S. commercial interests. The Department does not believe that technology restrictions in all cases are to the benefit of economic security, and notes that an effort to use the licensing process to such ends also would complicate efforts to obtain greater technology flow from Japan.

Specific Comments

1. Derived and Non-Derived Technology:

Now on p. 3.
See comment 1.

Page 4, paragraph 1 of this report reflects a misperception that the U.S. will have no access to technology classified as non-derived. Both derived and non-derived technology, under the FS-X agreements may be made available to the U.S. Derived technology will be available at no cost, while the U.S. must pay for non-derived technology, and this cost factor and related factors may make access more difficult.

2. FSX and Export Control Decision Making:

See comment 2.

With regard to the adequacy of U.S. controls over the transfer of technology and hardware to Japan, the report equates tracking and centralization of information with "control", implying incorrectly that the lack of a central register of information on licenses approved for FS-X subsystems provides conclusive evidence of poor controls over that technology and equipment by the U.S. Government. License applications for FS-X-related technology and equipment on the USML, like any other USML export license application, are reviewed thoroughly and strictly in accordance with regulatory, national security, and foreign policy guidelines.

The Department of State follows the same review procedure for the FS-X program as for other such programs, consistently coordinating with other cognizant agencies for review of export license requests related to the program. As a matter of practice, the Department of State continues to ensure that all staffing requirements are met and that any and all restrictions

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and provisos recommended by reviewing offices are included in licenses and are adhered to by licensees.

The report cites one case where a license was not referred to DOD for review; however the State Department is confident that this case was an exception in an otherwise consistent practice of referring FS-X cases to appropriate offices and agencies for thorough policy and technical review.

3. Recommendation for the Department of State:

The Department concurs with the recommendations contained in the subject GAO report.

The Department's Office of Defense Trade Controls (DTC) has jurisdiction for licensing the commercial export of commodities or services on the United States Munitions List (USML). DTC has had a policy of staffing all licenses for the FSX program to DoD since December 4, 1992. This policy is contained in the country policy book of every licensing officer in DTC. In addition, DTC has, since February 2, 1994, developed standardized language for the provisos that accompany all approved licenses "after favorable DOD review". The guidance also contains the instruction that "all FSX cases must be staffed to DoD/USAF". DTC will, by June 1, 1995, reissue the FSX notice for the country handbooks to ensure that all licensing officers have a copy in their handbooks.

DTC only accepts license applications that enumerate in detail each item to be exported under that license. This ensures that DoD receives detailed information for its review. License applications that list case lots or other ambiguous descriptions are returned to the applicant without action. DTC will, by June 1, 1995, clarify this policy in operating procedures for all licensing officers.

4. FSX Control Register:

The State Department agrees that a coordinated, central register of all USML and CCL export licenses for FS-X-related exports would assist the FS-X program office to monitor program developments. Information on USML licenses is already provided to DOD via the license review process.

5. F-16 Technical Data:

The fact that Japan continues to seek release of previously denied F-16 technical data (chapter 3) is irrelevant to the adequacy of U.S. controls over the transfer of technology and is not unique to the FS-X program or to Japan.

See comment 3.

UNCLASSIFIED

The following are GAO's comments on the Department of State's letter dated May 26, 1995.

GAO Comments

1. While both derived and non-derived technologies may be made available to the United States, Japan can limit U.S. access to technologies classified as non-derived. In contrast, under the FS-X agreements, derived technologies must be transferred to the United States automatically and free of charge, including any background data necessary to make such transfers effective.

2. State's failure to refer a sensitive case to DOD and possible Commerce licensing of munitions items, demonstrate that the U.S. government's FS-X related licensing activities could be improved. As stated in the report, we believe that increased sharing of licensing information between DOD, State, and Commerce would improve the U.S. government's ability to monitor the flow of U.S. items and technologies to the FS-X program. This, in turn, would enhance the quality of FS-X related licensing decisions and the U.S. government's examination of Japanese requests to reclassify FS-X technologies to non-derived status. We note that State in its comments on our draft report agreed that a central registry would assist the U.S. FS-X program office to monitor program developments.

3. We believe Japan's repeated requests for previously denied F-16 data demonstrate the continued need for adequate U.S. controls over the transfer of U.S. technology for the FS-X program.

Comments From the Department of Commerce

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUN 20 1995

Mr. Henry L. Hinton, Jr.
Assistant Comptroller General
United States General Accounting Office
National Security and International
Affairs Division
Washington, D.C. 20548

Dear Mr. Hinton:

Thank you for the opportunity to review for classification and provide comments on the General Accounting Office's (GAO) report titled U.S.-Japan FS-X Cooperative Development: Progress on FS-X Program Enhances Japanese Aerospace Capabilities (GAO/NSIAD-95-145).

We have reviewed the portions of the report related to the Department of Commerce and concluded that they can be released as unclassified. We also request that our enclosed comments be incorporated in this report.

We thank you for the opportunity to comment on this draft report.

Sincerely,

Ronald H. Brown

Enclosure

See pp. 8-9 and 38-39.

Now on p. 3.

See comment 1.

Now on p. 5.

See pp. 8-9 and 38-39.

COMMENTS

I. General Comments

GAO continues to overlook Commerce's main comment on the classified version of this report. As Commerce noted earlier, the dual-use export control system does not, given our current close relationship with Japan, provide for control and denial of exports of dual-use items to Japan simply because they will, or can, be used in the FS-X program. Such a control and denial policy would be inconsistent with the requirements of the Export Administration Act of 1979, as amended (EAA). The relevant provisions of the EAA authorize the U.S. government to control and deny the export of dual-use items: 1) if they could prove detrimental to U.S. security; and 2) to further significant foreign policy interests or to fulfill international obligations.

Thus, for the United States to control items which currently can be exported to Japan without individual licenses and to deny items which can be exported to Japan with an individual license simply because they will, or could be, used in the FS-X program, the United States would have to conclude that their export would prove detrimental to U.S. security or that control and denial would further significant U.S. foreign policy interests or fulfill the United States' international obligations. In light of our current relationship with Japan, including the very existence of the FS-X agreement, it is very unlikely that the U.S. would make such determinations. Without such determinations, items going to Japan cannot be controlled and denied simply because they will, or may, be used in the FS-X program.

II. Specific Comments

o Results in Brief:

* **Page 5, Paragraph 1, Sentence 4:** GAO has not indicated that any dual-use items controlled by Commerce are even covered by Defense's FS-X releasibility guidelines. To the extent any are covered, compliance with those guidelines would mean pre-approval review of license applications with FS-X potential and denial of those applications that would be inconsistent with the releasability guidelines. Without the determinations noted above, however, Commerce could not deny applications for items going to Japan solely on the basis of Defense's FS-X releasability guidelines.

* **Page 9, Lines 2-4:** Without the determinations noted above, Commerce could not deny export license applications for

items solely because they could contribute to Japan's FS-X program.

Now on p. 5.

See pp. 8-9 and 38-39.

*** Page 9, Paragraph 1, Sentence 2:** Without the determinations noted above, however, Commerce could not deny applications for items going to Japan solely on the basis of Defense's FS-X releasability guidelines.

Now on p. 5.

See pp. 8-9 and 38-39.

*** Page 9, Paragraph 1, Sentence 4:** GAO provided Commerce with a list of 12 licenses GAO believed were FS-X related and possibly under the Department of State's jurisdiction. Commerce reviewed these 12 licenses and confirmed that all but one were clearly under Commerce jurisdiction and most had little or no FS-X utility. Commerce discussed the results of its review with GAO. GAO did not dispute Commerce's findings but stated, in its response to Commerce's comments in the classified version of this report, that it found other applications that may have been under State's jurisdiction. GAO has not, however, identified which applications these are or otherwise provided Commerce any evidence to support its assertion.

Now on p. 8.
See comment 2.

See pp. 8-9 and 38-39.

*** Page 14, Paragraph 1:** GAO's recommendation fails to take into account Commerce's previous comments. In addition, it also fails to take into account Commerce's response to the same recommendation in the classified version of this report. In its response, Commerce noted that under the Administration's proposed executive order on license processing, Defense will be able to review all dual-use license applications, prior to approval, if it chooses to do so. Commerce also noted that Defense can always request information on historical license applications and Commerce can provide it after making the required determination that doing so is in the national interest.

o **Chapter 3**

Now on p. 33.

See pp. 8-9 and 38-39.

*** Page 50, Lines 1-3:** Without the determinations noted above, Commerce cannot control the release of program technology and hardware to Japan.

Now on p. 33.

See pp. 8-9 and 38-39.

*** Page 50, Paragraph 1, Sentence 3:** Again, without the determinations noted above, there would be no reason to refer license applications that may be FS-X related to Defense, because such applications could not be denied solely on FS-X grounds. In addition, Defense and State can always request historical licensing information from Commerce and Commerce can provide it after the required national interest determination.

Now on p. 35.

See comment 3.

Now on p. 53.
See pp. 9 and 39.

Now on p. 36.
See pp. 8-9 and 38-39.

Now on p. 37.
See pp. 8-9 and 38-39.

Now on pp. 37-38.
See pp. 9 and 38.

*** Page 53, Paragraph 1:** Commerce again notes that all the pertinent departments participate in determining which dual-use items require individual licenses and which can be exported under general licenses. There is no way to know, nor would it matter for licensing purposes, whether general license exports are FS-X related.

*** Page 53, Paragraph 2:** Of the validated licenses GAO cited, only one was directly for use in support of the FS-X program. It was a commercial item used not on the FS-X but to develop a sensor that would be used on the FS-X. The materials licenses were approved after confirmation of Commerce jurisdiction and were not for FS-X related end-uses. The radome technology was unique to a helicopter configuration and not, therefore, applicable to the FS-X. The inertial navigation systems and parts approved were civil certified and unsuitable for a high performance system such as the FS-X. Finally, the aircraft testing equipment authorized was for civil aircraft and would have only limited utility for the FS-X.

As noted earlier, Commerce confirmed that it clearly had jurisdiction over these items. Moreover, the important point is not simply that Commerce is not obligated to coordinate license applications with State and Defense merely because they involve FS-X related items, but that there is no reason to do so, given that FS-X use would not be grounds for denial and that the EAA requires license applications to be processed within strict time frames.

*** Page 56, Paragraph 1:** Once again, GAO fails to note that Commerce has no authority to review or coordinate interagency analysis of cases solely because they may be used in the FS-X program. In addition, Defense always has been able to request historical licensing data from Commerce which Commerce can provide after the required national interest determination.

*** Page 58, Paragraph 1:** Without the determinations noted above, Commerce cannot control FS-X related exports to Japan. On the other hand, a mechanism for sharing historical licensing data for FS-X analysis has always existed.

o Recommendations

*** Pages 58-59:** In its response to the same recommendation in the classified version of this report, Commerce noted that under the Administration's proposed executive order on license processing, Defense will be able to review all dual-use license applications, prior to approval, if it chooses to do so, although, absent the determinations noted above, FS-X use alone

would not be grounds for denying a license application. Commerce also noted that Defense can always request information on historical license applications and Commerce can provide it after making the required determination that doing so is in the national interest.

The following are GAO's comments on the Department of Commerce's letter dated June 20, 1995.

GAO Comments

1. We do not have the responsibility for determining what items are covered by DOD's FS-X releasability guidelines. If Commerce were to consistently share licensing information with DOD, DOD could assist Commerce in determining a license application's significance and potential utility for the FS-X program. Such sharing would permit DOD to determine if its FS-X releasability guidelines and the FS-X government-to-government agreements were consistent with Commerce's interpretations of the requirements of the Export Administration Act, improve DOD's ability to properly categorize FS-X technologies as derived or non-derived from U.S. sources, and facilitate DOD's compilation of FS-X work share data.

2. We responded to Commerce's October 12, 1994, comments on the classified version of this report.

3. We agree that there is no way to know whether general license exports are FS-X related.

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GAO Related Products

U.S. Military Coproduction Programs Assist Japan in Developing Its Civil Aircraft Industry (GAO/ID-82-23, Mar. 18, 1982).

Industrial Policy: Japan's Flexible Approach (GAO/ID-82-32, June 23, 1982).

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Support for Development of Electronics and Materials Technologies by the Governments of the United States, Japan, West Germany, France, and the United Kingdom (GAO/RCED-85-63, Sept. 9, 1985).

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U.S.-Japan FS-X Codevelopment Program (GAO/T-NSIAD-89-31, May 11, 1989).

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Investment in Foreign Aerospace Vehicle Research and Technological Development Efforts (GAO/T-NSIAD-89-43, Aug. 2, 1989).

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