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U.S.-Japan FS-X Codevelopment Program

Statement of
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Before the
Committee on Science, Space and Technology
House of Representatives

Mr. Chairman and Members of the Committee:

I am pleased to be here today to discuss our review of the proposed FS-X codevelopment program between the U.S. government and the government of Japan. We initiated our review at the request of Senators Helms, Dixon, Bingaman, and Ford and focused on assessing the government-to-government and commercial licensing agreements, assessing U.S. and Japanese composite and radar technologies and analyzing cost data.

The FS-X will be a Japanese-designed fighter aircraft based on the current U.S. F-16. It will be significantly modified to meet specific Japanese military requirements. The program that is under review by the Congress is limited to the development phase of the FS-X. During this phase, Japan will build, with U.S. assistance, six prototype aircraft--two for ground testing and four for flight testing. General Dynamics and Mitsubishi Heavy Industries are the two principal contractors responsible for developing the FS-X. If Japan decides to proceed with the program, a separate production agreement will be negotiated.

We conducted our work primarily at the Department of Defense (DOD), but we also met with officials from the Departments of State, Commerce, Energy, and Labor, and NASA. In addition, we met with various U.S. contractors, including General Dynamics, Texas Instruments, Hughes, Westinghouse, and McDonnell Aircraft.

We did not have complete access to various government agencies. The Department of State released only a limited number of documents to us, stating that many documents fall into the "deliberative" or pre-decisional category and are not releasable; we disagree with this position. Also, officials from the U.S. Trade Representative's Office, the White House Office of Science and Technology Policy, and the Central Intelligence Agency would not meet with us, giving as their reason the program's sensitivity.

Due to the continuing bilateral negotiations to clarify segments of the program, we did not visit Japan to obtain the views of appropriate government and industry officials.

DOD AND STATE DID NOT COORDINATE FS-X WITH OTHER AGENCIES

In negotiating the FS-X program, DOD and State did not coordinate with or solicit the views of the Commerce Department or other economic policy-making agencies. The Defense Authorization Act of 1989, effective October 1988, requires DOD to consider the effects of each government-to-government Memorandum of Understanding (MOU) on the U.S. industrial base and to regularly solicit and consider information and recommendations from the Secretary of Commerce. In response to the law, DOD provided a cursory briefing to Commerce in late October 1988 near the conclusion of the bilateral negotiations. DOD officials told us that it was inappropriate to bring Commerce into full consultation and coordination at that time because the MOU negotiations were virtually complete. The MOU was

signed by the two governments on November 29, 1988. Subsequently, serious questions were raised about the equity of the proposed agreement and the technology to be transferred to Japan. Commerce and other civilian agencies had the opportunity to comment on the program during an interagency review, which began in early February 1989. On April 28, 1989, the United States and Japan agreed on certain clarifications to the MOU.

This is not the first time that DOD and State handled the transfer of a major defense item to Japan in this manner. In 1982 we reported that when negotiating a coproduction agreement with Japan on the U.S. F-15, DOD separated the U.S. defense and foreign policy interests from domestic economic, industrial, and labor considerations. We found that DOD and State did not systematically draw upon the available expertise of other federal agencies when considering the F-15 coproduction request or when negotiating and implementing this program. We concluded that DOD and State had too narrow a perspective to adequately address the economic, industrial, trade, and labor interests and perspectives and that increased interagency and government-industry coordination was needed prior to making coproduction commitments.

Although national security interests were said to be of paramount importance in the FS-X program, during the negotiations DOD recognized U.S. economic and industrial interests as well. U.S. industry--contractors, subcontractors, and vendors--will receive 40

percent of the value of the total FS-X development budget. Also, it is important to note that General Dynamics will obtain the technology from Japan to produce four composite wings at no cost. In fact, the entire development program is being funded by Japan. The recent clarification agreed to by the two governments provides that in the event the production MOU is signed, the U.S. work share in this phase will be about 40 percent.

JAPANESE FS-X TECHNOLOGIES

According to DOD, the FS-X program was not pursued with the primary objective of obtaining access to Japanese technology or balancing the exchange of technology. Other strategic and national priorities dominated. However, once Japan agreed in principle to codevelop the FS-X--and a negotiating position was developed--the United States stressed the importance of obtaining access to the new aircraft's technologies. DOD officials have emphasized the potential value of these technologies in a general sense and are impressed with Japan's overall manufacturing capabilities, particularly its cost-effective electronics production. DOD believes that the FS-X program sets a precedent for two-way exchanges of military technology, an area that has previously produced limited returns from Japan.

We focused our assessment on two of the technologies that the United States will be able to acquire from the FS-X program--composite wings and phased array radar. Our preliminary

observations are that, overall, the United States has superior composites technology and appears to be ahead in radar development. These observations have to be qualified because the United States still has limited information from which to make meaningful comparisons about these Japanese technologies.

Composite Technology

Japan is planning to place composite wings on the FS-X using a process known as co-curing. Essentially, the internal wing support structures, which are made from composites, will be bonded together with a composite bottom wing skin in an autoclave, or oven. Such composites are termed thermosets. The upper wing skin also has to be cured, either alone or in conjunction with the structure, and then probably fastened to the structure if cured alone. With this design, the Japanese hope to save about 25 percent in weight compared to a new, all-metal wing.

DOD and industry officials do not have solid information as to whether or not Japan can really produce the wing as planned. The Japanese appear confident because they are not planning an alternative wing design. The United States does not know exactly what composites will be used or how the Japanese plan to tool for production.

Numerous structural and design engineers told us the Japanese approach is high risk. The United States expended significant

amounts of research and development funds in the 1970s to test the basic co-cured composite designs now being considered by Japan for the FS-X. According to Air Force structural engineers, this approach, tested on small structures, was rejected for large primary structures due to costs and risks.

The proposed Japanese design has both advantages and shortcomings. If Japan is successful, the composites may have the advantage over metal wings because of reduced weight and maintenance. The design may also be cheaper in the long run because it requires fewer parts. There are potential problems: it is difficult to maintain quality control with respect to the bonds over a long production run, tooling for production at low cost is very complex, production inspection requires innovation, there is a lack of access to fuel control equipment, and damage repair is limited.

The U.S. industry's basic knowledge of advanced composites is superior to Japan's. The United States has a demonstrated and proven capability in composite production and application to military aircraft. The biggest difference between the U.S. work and that planned for FS-X lies in co-curing the substructure to the bottom skin. While secondary structures and tails have been co-cured, wings of combat aircraft require a substantially different consideration. The latter must withstand far more stress (g's) and are "wet." The X-29 and the A-6, which have composite skins, were designed with some metal substructure because of their loads.

While the AV-8B has some composite spars and ribs, they are fastened to the bottom and top skins to ensure high confidence in the joints.

We would like to make one final point about the Japanese composite process. To meet the higher temperature requirements for future U.S. military aircraft, the U.S. trend is toward a different type of material from that proposed for the FS-X by the Japanese. This material, called thermoplastics, does not require autoclaves for molding.

The U.S. military requirement for the Japanese composite technology appears to be modest. The Air Force has indicated that the prime use for this technology would be on future versions of the F-16, if the wing proves affordable.

Composite requirements for civilian airliners are more difficult to assess because so many customers are involved. Since the near-term airliners like the MD-80 and the B-757/767 are being produced at a high rate now, it is not likely that the Japanese technology would be applied to them. For the year 2000 airliners, such as the MD-91X and the B-7J7 propjets, there may some application (for example, the tails), if the costs are low. Thermoset composites are not expected to be widely used for the next generation supersonic aircraft replacing the Concorde due to the high temperatures at high speed. For the same reason, the thermosets

would not be applicable to the future hypersonic aircraft, of which the X-30 is a technical demonstration experiment program.

Phased Array Radar Technology

Japan is developing a phased array radar for the FS-X, and DOD is interested in acquiring the manufacturing technology for the transmitter/receiver modules that are located in the radar's antenna. The antenna is a circular structure, about 3 feet in diameter, that fits into the nose of the aircraft. An antenna with a full array has about 2,000 modules. The modules are quite small, less than 6 inches long.

U.S. industry is developing similar radar technology for the next-generation fighter aircraft. Currently, the modules are very expensive to produce, and both the United States and Japan are working to develop a manufacturing process that produces efficient, quality modules that are also affordable.

It is unclear what the Japanese module costs are estimated to be at this time because the United States has limited information about their technology. Air Force avionics engineers told us in March that Japan appeared to have less overall radar experience than the United States and lacked vital knowledge in terms of defining module performance. However, the Deputy Director of the Air Force's Wright Research and Development Center told us that it would be wrong to assume that the United States is significantly

ahead of Japan. He noted that the Japanese have a proven capability in electronics and stressed the importance of obtaining access to Japanese module manufacturing technology to evaluate its usefulness for U.S. application.

Lacking adequate data, U.S. industry officials expressed reservations about Japan's ability to bring down the module costs quickly, but they remained open-minded. For example, officials from one company that is producing limited quantities of modules were divided as to Japan's capabilities. They recognized that without firsthand knowledge of Japan's radar it was difficult to make a meaningful assessment.

It's important to note that U.S. industry is not standing still and is making considerable strides to reduce module costs. According to one company's estimates, the unit cost of the modules has been reduced from about $12,000 per module to about $8,300 over the past 4 years. The company anticipates that the cost will continue to decline as production increases. For example, by 1992, the unit cost is estimated to be about $3,100. Anticipated full-rate production costs are estimated at about $400 per module by an undetermined date.

Given the state of U.S. industry module development, it is unclear what benefits can be derived from the Japanese technology. We believe that without firm Japanese data, it is impossible for the

U.S. government or industry to make a reasonable assessment at this time. It is important to note that the Japanese radar technology is considered non-derived: that is, the United States will have to pay to acquire it. The cost of this technology has not been determined.

SAFEGUARDING U.S. TECHNOLOGY

The design and development of the FS-X will be complicated processes that will incorporate technologies from both countries. The FS-X will clearly involve a greater degree of technical data flow to Japan than previous coproduction programs, particularly in the areas of software and other design data. It appears that DOD is taking precautions to limit the release of F-16 technical data. According to DOD officials, particular consideration has been given to the release of sensitive software source codes. This information will be released only after critical deletions have been made, limiting Japan's access to how the codes or programmer operations were developed.

A Technical Steering Committee has been established to monitor key aspects of the FS-X program, including the transfer of technology. This Committee is co-chaired by high ranking U.S. and Japanese military officers. It is our understanding that Commerce will have a representative on the Committee, although not all the procedural details have been ironed out. According to U.S. officials, the Committee will be the repository for all requests for technical

data made by Japan during the course of the development program. We were informed that requests for data will be channeled to the appropriate Air Force technical officials for review. Those requests that fall outside the Air Force's release guidelines will be reviewed within the Office of the Secretary of Defense and the Department of Commerce. According to DOD, this process will elevate technology releasability issues to better ensure adequate reviews and reduce the opportunities for imprudent disclosures.

COMMERCIAL APPLICATION OF TECHNOLOGY IS UNCERTAIN

Japan will be responsible for designing the aircraft. The Japanese have had limited experience designing and developing modern military aircraft. It is clear that the program will provide Japan valuable systems integration skills, an area in which some experts believe the Japanese are deficient.

We did not assess the commercial application of the FS-X codevelopment program. However, knowledgeable U.S. industry and government officials informed us that the skills and knowledge acquired from this program can generally be applied to other aerospace programs. Japanese engineers will gain experience in aircraft design and integration. The extent to which these skills are directly transferrable to commercial aircraft development is uncertain. Although no individual project in the series of coproduction programs with Japan over time transfers the technological keys to bridge the competitive gap, the broad range

of successful joint projects will reduce the time and expense it would have taken Japanese firms to catch up and become meaningful competitors in the aerospace/aircraft manufacturing industry.

COST

The cost of FS-X will be greater than the cost of purchasing F-16s through Foreign Military Sales procedures. According to an Air Force estimate, the F-16 (most advanced version) would cost about $26 million per aircraft in 1985 dollars, assuming deliveries begin in the mid-1990s. FS-X costs are not well defined at this time. Based on limited information, it is estimated that FS-X unit costs will significantly exceed F-16 costs, perhaps by twice as much.

This concludes my statement. I will be happy to respond to any questions.