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AN EVALUATION OF LOGISTICS  
FOR F-16 AIRCRAFT OWNED  
FOREIGN COUNTRIES

THESIS

Paul Lyons, B.S.

AFIT/GLM/LS/91S-45

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AN EVALUATION OF LOGISTICS SUPPORT  
FOR F-16 AIRCRAFT OWNED BY FOREIGN COUNTRIES

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

Paul Lyons, B.S.

September 1991

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## Preface

The purpose of this research was to examine the logistics support provided by the United States Air Force (USAF) for F-16 aircraft owned by foreign countries. Logistics support of the weapons systems of America's allies and friends contributes directly to the effectiveness of U.S. defense allies.

While the sale of major weapons systems such as the F-16 are highly publicized and attract much media and congressional attention, the logistics support for these weapons systems does not receive nearly so much attention. Therefore, it is important to compile the issues and evaluate the trends to determine how well the U.S. is doing in providing responsive support to its allies. The research draws from historical trends and personal experiences to examine the ability of the U.S. to provide logistics support for F-16 aircraft owned by U.S. allies.

In writing this thesis, I am deeply indebted to my thesis advisor, Professor Emeritus Jerome F. "Jerry" Peppers, for his thoughtful advice, patience, and help. Also I would like to thank Captain Jack King for being a reader as well as a friend.

Paul J. Lyons

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## Abstract

The purpose of this thesis was to examine the logistics support provided by the United States Air Force (USAF) for F-16 aircraft owned by foreign countries. The research drew from historical trends and personal experiences to examine the ability of the U.S. to provide logistics support for F-16 aircraft owned by U.S. allies.

The study found that timely, efficient support of FMS customers possessing F-16 aircraft does not appear to be a principal concern of the USAF logistics system. Complexity of processes, untimely responses, and failure to consider customer needs are common failings on the part of the USAF.

# AN EVALUATION OF LOGISTICS SUPPORT FOR F-16 AIRCRAFT OWNED BY FOREIGN COUNTRIES

## I. Introduction

The purpose of this research is to examine the logistics support provided by the United States Air Force (USAF) for F-16 aircraft owned by foreign countries. These countries become USAF "customers" and are entitled to, and expect, responsive service to technical problems such as spare parts acquisition, training, and support equipment. Logistics support of the weapons systems of America's allies and friends contributes directly to the effectiveness of U.S. defense allies and related cooperative defense arrangements and, therefore, is important to the overall defense strategy of the United States.

## Chapter Overview

This chapter provides a brief review of the history of U.S. foreign military sales and grant programs or, as they have lately come to be known, security assistance programs. The general issue, research problem, and scope of the research are also described. The chapter concludes with an explanation of terms used throughout the research.

## Historical Review

Arms sales have been part of the international scene as long as man has been preparing for, and engaging in war.

One of the primary methods used to carry out foreign and national policy has been and still remains the transfer of defense articles, defense services, military training, and economic assistance; or stating it another way, by providing security assistance. (Samelson, 1990:1-5)

Within the United States, the transfer of arms and articles of warfare can be traced back through American history to the Revolutionary War when France provided the colonial revolutionaries with arms and other support (Samelson, 1990:1-10).

During World War I, the United States became a major force in the arms trade. For example, in 1916, the United States shipped more than \$1 billion of arms to Europe. By the year 1920, the United States accounted for more than 52% of global arms exports (Pierre, 1982:16).

During World War II, the phenomenal effort of the U.S. industrial base fueled the allied war effort. In March 1941, despite protests from U.S. isolationists, Congress initiated the Lend-Lease program to aid the British. Under Lend-Lease, the United States loaned materials to the British, and subsequently to all other allies including the Russians and Chinese. The Lend-Lease program eventually supplied more than \$50 billion of arms, food, and other aid to our allies (Pierre, 1982:17).

After World War II, the United States war machine was disassembled. Soldiers were sent home, and huge stockpiles of surplus war materials were left behind. These surplus arms were provided to U.S. friends and allies under what was to become known as the Military Assistance Program (MAP) (Samelson, 1990:1-14). The transfer of U.S. surplus war material was instrumental in building the North Atlantic Treaty Organization (NATO) forces.

In 1948, the United States Senate passed the Vandenberg Resolution, named after Republican Senator Arthur H. Vandenberg of Michigan. The resolution expressed the desirability of a collective European system of self defense, and resulted in the creation of the North Atlantic Treaty Organization (NATO).

The U.S. offered not only military aid, but economic assistance as well. Although initially separate from military aid, the assistance programs shared a common purpose. Both sought to promote the security and well being of nations friendly to the United States (Samelson, 1990: 1-15).

In 1947, Secretary of State George C. Marshall proposed a plan of American aid to help rebuild war-torn European countries. The European Recovery Plan, more popularly referred to as the Marshall Plan, was responsible for 15 billion dollars in loans and grants to 16 nations of western Europe (Samelson, 1990: 1-14).

As the stockpiles of World War II surplus arms diminished, U.S. security assistance was provided on a grant basis, i.e., paid for by the United States.

During the 1960s, the Vietnam War experience, coupled with an increasing awareness of the enormous costs of the arms race with the Soviet Union, created enormous internal dissension within the United States. The costs of the Vietnam War, both in human life and money, changed forever U.S. policies for security assistance. The major change in policy involved the use of U.S. forces.

The Nixon Doctrine stated the U.S. would continue to provide deterrence for nuclear and general war, but countries would be expected to assume primary responsibility for their own defense, including the marshaling of the necessary manpower and resources. The intent was to decrease reliance on U.S. forces and to transfer immediate self defense responsibility to indigenous forces. Under President Nixon, the concept of self-sufficiency increased the emphasis on military sales as opposed to grants. Also, all security-related military and economic assistance programs came to be known under the umbrella term of security assistance (Samelson, 1990:1-20,21).

By 1975, U.S. arms sales had increased from less than 2 billion dollars in 1970 to over 15 billion dollars. During the 1976 presidential campaign, presidential election candidate Carter criticized U.S. arms policy as both

"cynical" and "dangerous." The critics charged that U.S. arms policy was out of control, and that the U.S. arms manufacturers were pushing arms sales without adequate restraints.

In May 1977, President Carter announced a major change in the attitude of U.S. foreign policy. Presidential Directive 13 decreed that henceforth, the sale or transfer of arms would be viewed as an exceptional instrument of U.S. foreign policy, and would only be used in instances where the transfer clearly contributes to U.S. security interests. The burden of persuasion would be on those who favored the sale. Although special exceptions were made for NATO allies and Israel, Presidential Directive 13 clearly represented a new direction for U.S. arms sales (Pierre, 1982:45-53).

The U.S. attitude toward arms sales changed again under President Reagan. On July 8, 1981, President Reagan formally approved a new United States "Conventional Arms Transfer Policy" which superseded Presidential Directive 13.

The new policy stated that the United States viewed arms transfers as "an essential element of our global defense policy and an indispensable component of U.S. foreign policy" (Theme of The Quarter, 1981:1-2). In a 3 March 1983 statement before the Committee of Foreign Affairs of the House of Representatives, William Schneider Jr., then Undersecretary of State for Security Assistance, Science and Technology, stated,

Arms transfers are inherently neither good nor evil. A given weapons system is not stabilizing nor destabilizing as an abstract proposition. Arbitrary restraint and unrestricted transfers are equally unrelated to U.S. national interests. There is no virtue in arms transfers, or increasing them, in the aggregate. Transfers can be fairly evaluated only in terms of their impact on specific U.S. interests in specific countries and regions, taking into account military, political, and economic realities at that time. (Samelson, 1990: 1-28)

The Reagan administration further insisted that U.S. security assistance policy must be guided by practical necessity as well as principle. Frances J. West, Assistant Secretary of Defense for International Security Affairs (ASD/ISA), stated,

We can not stand idly by while the Soviets or their surrogates continue to surge ahead in their own arms transfer and security assistance activities in the Third World. If we fail to be responsible, we will reinforce--not remedy--the perception of others that the United States is an unresponsive friend and supplier. (Theme Of The Quarter, 1981:22)

Under President Bush, United States arms transfer policy remained essentially the same as under President Reagan. However, two developments had a substantial impact on the U.S. Security Assistance Program; the value of annual Foreign Military Sales (FMS) declined, and Congressional appropriations for security assistance programs were reduced.

FMS sales declined from a 1982 high of 19.2 billion dollars in new sales agreements to 7.1 billion dollars in new sales agreements in FY 88 (Samelson, 1984:1-29). Lt Gen Charles W. Brown, U.S. Army, noted the decline was greatest



in major systems sales, and stated the concern "that declining sales could signal a diminution of the U.S. image" (Brown, 1989A:41). Brown further noted that to a certain extent, the factors behind declining sales were cyclical or economic. The economic problems of many countries with large debt burdens contributed to declining sales. Another cause of the decline was increased international competition from newly industrialized countries like Brazil, Korea, and Taiwan. Brown also noted the impact of Gramm-Rudman-Hollings deficit reduction legislation on security assistance funding. In Fy 87, for example,

aggregate funding took a 13 percent cut while Egypt and Israel were restored to pre-sequester levels. After earmarks for Israel, Egypt, Pakistan, Greece, and Turkey, funding for the rest of the world was cut by more than 45 percent. Several countries had to be zeroed out. (Brown, 1989A:42-43)

The overall effect of reduced sales to foreign countries and reduced funding for domestic programs was quickly felt in the U.S. defense industry. Lost sales meant lost jobs and lost profits. In the FY 90 Congressional Presentation for Security Assistance Programs, the impact of arms sales, or in the larger sense, security assistance upon the domestic economy is described as follows:

Security Assistance is not a philanthropic effort, but one which produces direct economic benefits. These assistance and sales programs have a positive net impact upon our domestic economy. For example, that part of the production of U.S. defense industry which is composed of arms sales abroad provides jobs for American workers and needed experts to help balance U.S. trade with foreign nations. In addition, these sales provide economies of scale (eg., longer

production runs) which reduce the costs of weapons systems of continued interest to the U.S. armed forces. (Congressional Presentation, 1991:3)

### General Issue

Arms exports to our friends and allies contribute directly to the defense of the U.S. While the sale of major weapons systems such as the F-16 are highly publicized and attract much media and congressional attention, the logistics support for these weapons systems does not receive nearly so much attention. Therefore, it is important to compile the issues and evaluate the trends to determine how well the U.S. is doing in providing responsive support to its allies. The research draws from historical trends and personal experiences to examine the ability of the U.S. to provide logistics support for F-16 aircraft owned by U.S. allies.

### Research Question

Security Assistance and Foreign Military Sales (FMS) programs involving aircraft weapons systems usually include follow-on logistics support as well. Annual sales of spare parts, services, and training remain a constant and critical link to our allies long after the sale of a major weapons system such as a fighter aircraft. "In order to sustain the operation of [its] weapon system for the years ahead, the foreign country must enter the USAF supply system" (Mohammed, 1986:13).

The U.S. capability to provide adequate logistics support is more important than ever. Further research is necessary to answer the question "Is the United States providing adequate follow-on logistics support for F-16 aircraft owned by foreign countries?"

#### Research Objective/Investigative Questions

The objective of the research is to offer practical insights into the special logistics requirements of foreign customers. This thesis will consider the following research questions.

1. Is the logistics support for the F-16 responsive to foreign customer requirements?
2. What major logistics support problems exist for the F-16 aircraft owned by foreign countries? How were these problems solved?

#### Scope of The Research

The research will be restricted to logistics support provided in the 1980 - 1990 time frame. The research will also be restricted to the F-16 aircraft. These restrictions are necessary to allow the research to be completed within the allotted time period.

Although applicable classified information is available, none was integrated in this report due to the difficulty involved in obtaining, storing, and using classified material. It is likely that classified material

would have enhanced portions of the report, but the effort has not suffered for lack of classified material.

### Methodology

Method. This thesis was accomplished through an extensive review of the literature. A literature search is an obvious first step and can provide excellent background on the areas of interest (Emory, 1985:62). Literature was obtained from Defense Logistics Studies Industry Exchange (DLSIE) and Defense Technical Information Center (DTIC) searches. Government and business indexes were searched under the topics of logistics, foreign military sales, and F-16. Interest items, point papers, and briefings were obtained from both the International Logistics Center (ILC) and the Systems Program Office (SPO).

The research uses a combination of the historical and descriptive methodology to answer the investigative questions. Historical methodology involves defining the problem, collecting data, and evaluating and merging the data into a realistic portrayal of the topic (Borg, 1971:261). Historical methodology may be thought of as an integrated narrative about some aspect of the past based on critical analysis and synthesis of the past (Lang, 1984:58-64). In research using descriptive methodology, the objective is to learn who, what, when, where, and how of a topic (Emory, 1985:69).

Since the research is restricted to a weapons system program (F-16) and a specific time frame (1980-1989), the thesis perspective was that of a case study, i.e., the analysis of a specific case. The case study approach emphasizes the detailed analysis of a limited number of events or conditions and their interrelationships (Emory, 1985:61). A case study is problem oriented (Lang, 1984:84-86).

Personal interviews were used to identify specific areas of concern and interest from personnel close to the F-16 program. A personal interview is "a two way conversation initiated by an interviewer to obtain information from a respondent" (Emory, 1985:160), and provides an opportunity to collect data from primary sources. Only the mind of the observer stands between the interviewer and the original event (Lang, 1984:72).

Personal interviews were conducted with program managers at the USAF F-16 Systems Program Office (SPO) and the International Logistics Center (ILC), both of which are located at Wright-Patterson Air Force Base (AFB). F-16 support personnel from the Ogden Air Logistics Center (OO-ALC) located at Hill AFB, Utah were also interviewed.

Organization. Chapter II consists of a detailed explanation of the types of logistics systems used to support foreign aid and foreign military sales. This phase of the research discussed the impact these foreign aid and

sales programs have on the U.S. economy and balance of payments, as well as current topics such as codevelopment, offsets, coproduction, and competition. The chapter also includes a discussion of the role played by the Department of Defense (DOD) and USAF to support foreign military sales in general, and the F-16 aircraft in particular.

Chapter III begins with a discussion of the changes which have occurred in fighter aircraft since 1945. The chapter traces the history of the jet engine, and the evolution of fighter aircraft into a delivery system for nuclear weapons. The chapter also examines the history of the lightweight fighter aircraft, and the so-called fighter mafia. The chapter concludes with a discussion of the F-16 as a multinational fighter aircraft, and, also, as big business for the U.S.

Chapter IV discusses the major logistics support problems for the F-16 aircraft owned by foreign countries. The problems were identified and chosen as a result of personal interviews with logistics personnel assigned to the F-16 SPO, OO-ALC, and the ILC. The interviews included a discussion of the current status of each problem, as well as any solutions implemented.

Chapter V consists of lessons to be learned from the F-16 aircraft foreign aid and foreign military sales program as well as recommendations for the future.

## Definitions of Commonly Used Terms

Case. A contractual sales agreement between the U.S. and an eligible foreign country or international organization documented by DD Form 1513 (Samelson, 1990:B-2).

Commercial Sale. A sale made by U.S. industry directly to a foreign buyer which is not administered by the Department of Defense through FMS procedures (Samelson, 1990:B-3).

### Cooperative Logistics Supply Support Arrangement (CLSSA).

The combining term for procedural arrangements (cooperative logistics arrangements) and implementing procedures (supplementary procedures) which together support, define, or implement cooperative logistics understandings between the United States and a friendly foreign government under peacetime conditions (Joint Chiefs, 1984:91).

Coproduction. Method by which items intended for military application are produced and/or assembled under the provisions of a cooperative agreement that requires the transfer of technical information and know-how from one nation to another (Samelson, 1990:B-5).

Economic Support Fund (ESF). The Economic Support Fund provides economic assistance to allies and developing countries of strategic importance to the United States.

The fund is administered by the Agency for International Development and is used primarily to provide direct financial assistance (cash transfer) or the financing of commodity imports (loan) to ensure the acquisition of critical raw materials. By fostering economic development and reform, ESF helps to avert or alleviate the economic and political disruptions that can threaten the security and independence of key allies and friends (Congressional Presentation, 1991:24)

Gramm-Rudman-Hollings. The Balanced Budget and Emergency Deficit Control Act of 1985, Public Law 99-177. This legislation was enacted to address the growing federal deficit, and set maximum deficit amounts for the federal budget (Collender, 1991:9-18).

Grant Aid. Military assistance to foreign countries for which the United States receives no financial reimbursement (Samelson, 1991:B-11).

Foreign Military Sales (FMS). That portion of United States security assistance authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act, as amended. This assistance differs from the Military Assistance Program (MAP) and the International Military Education and Training (IMET) Program in that the recipient provides reimbursement for the articles and services transferred (Samelson, 1990:B-10).



Foreign Military Sales Financing Program (FMFP). This program enables U.S. allies and friends to improve their self defense capabilities through the acquisition of U.S. military articles, services, and training. Acquisitions are financed by FMS grants (sometimes referred to as non-repayable loans) and FMS loans which are repayable at concessional rates of interest (Samelson, 1990:B-10).

International Logistics. The negotiating, planning, and implementation of supporting logistics arrangements between nations, their forces and agencies. It includes furnishing logistics support (major end items, material, and/or services) to, or receiving logistics support from, one or more friendly foreign governments, international organizations, or military forces, with or without reimbursement. It also includes planning and actions related to the intermeshing of a significant element, activity, or component of the military logistics systems or procedures of the United States with those of one or more foreign governments, international organizations, or military forces on a temporary or permanent basis. It also includes planning and actions related to the utilization of United States logistics, policies, systems, and/or procedures to meet requirements of one or more foreign governments, international organizations, or forces (Joint Chiefs, 1984:193).

International Military Education and Training (IMET).

That portion of the U.S. security assistance program which provides formal or informal instruction to foreign military students, units, and forces on a nonreimbursable (grant) basis by offices or employees of the United States, contract technicians, and contractors (Joint Chiefs, 1984:193-4).

Interoperability. The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together (Joint Chiefs, 1984:194).

Letter of Offer and Acceptance (LOA). The U.S. Department of Defense (DD) Form 1513 Offer and Acceptance by which the U.S. government offers to sell to a foreign government or international organization defense articles and defense services pursuant to the Arms Control Export Act, as amended (Samelson, 1990:B13).

Letter of Request (LOR). The term used to identify a request from eligible FMS participants for the purchase of defense articles and services. The request may be in message or letter format (Samelson, 1990:B14).

Logistics. The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, logistics refers to those aspects of military operations that deal with design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of material (Joint Chiefs, 1984:214).

Military Assistance Program (MAP). That portion of the United States security assistance authorized by the Foreign Assistance Act of 1961, as amended, which provides defense articles and services to recipients on a nonreimbursable (grant) basis (Joint Chiefs, 1984:229).

Military Standard Requisitioning and Issue Procedures (MILSTRIP). A uniform procedure established by the Department of Defense to govern requisition and issue of material within standardized priorities (Samelson, 1990:B-16).

Offsets. Refers to the usage of industrial and commercial compensation practices required as a condition for sale of military related exports (Marr, 1987:7-1,2).

Security Assistance. A group of programs authorized by the Foreign Assistance Act of 1961, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense

related services, by grant, credit, or cash sales, in furtherance of national policies and objectives (Joint Chiefs, 1984:327).

Special Defense Acquisition Fund (SDAF). A revolving fund established in FY 1982 to finance the acquisition of defense items and services in anticipation of authorized Foreign Military Sales (Congressional Presentation, 1991:34).

Technology Transfer. The process of transferring, from the industry in one country to another or between countries, technical information related to the design, engineering, manufacturing and production techniques for hardware systems using recorded or documented information of a scientific or technical nature (Samelson, 1990:7-18).

## II. Literature Review

### Chapter Overview

This chapter presents information obtained through a search of the literature. The chapter begins with a description of Foreign Military Sales (FMS) and grant aid, and their impact on the U.S. economy. Economic issues such as cooperative research and development, technology transfer, coproduction, increased competition, and offsets are examined. The chapter concludes with a discussion of government support of FMS.

### FMS

Under FMS, eligible countries purchase defense articles, services, and training directly from the U.S. government. The U.S. government acts as a middleman between the foreign buyer and the U.S. defense contractor. FMS programs are non-appropriated which means the purchasing government pays all costs associated with a sale: no monies are appropriated for this service by the U.S. Congress.

A sale consists of a signed agreement, normally referred to as a case and documented on a DD Form 1513, between the U.S. government and a foreign government (Samelson, 1990:2-8).

FMS Process. The process for FMS follows a logical sequence of steps over a prescribed timeline. The following

description of the FMS process is summarized from The Management of Security Assistance, chapters 3 and 8.

The FMS process officially begins when the foreign country submits a Letter of Request (LOR). If the FMS request is for significant military equipment (SME) such as the F-16 fighter aircraft, the request is routed through the U.S. Embassy to the appropriate military department for review and action. SME items are those designated in Section 121.01 of the International Traffic in Arms Regulation (ITAR). Information copies of the LOR are routed through the U.S. Embassy to the Defense Security Assistance Agency (DSAA) and the Bureau of Military Political Affairs in the State Department (Samelson 1990:Chapter 8).

The appropriate military department, for example the United States Air Force (USAF) program office in the case of the F-16 fighter aircraft, is responsible for preparing the U.S. response or the Letter of Offer and Acceptance (LOA), DD Form 1513.

The Arms Control and Disarmament Agency (ACDA) has statutory authority for evaluating arms sales proposals. Even though the ACDA is independent and separate from the Department of State, the ACDA Director receives policy guidance from the Secretary of State (Samelson, 1990:5-9). ACDA prepares an evaluation (in consultation with the Secretaries of State and Defense) which describes the proposed sale and, as required by the Arms Export Control

Act, determines if the sale or export might contribute to the arms race, or violate existing arms control arrangements (Congressional Presentation, 1991:40-42).

Congressional Approval. The sale or transfer of military equipment to foreign countries is subject to Congressional approval. The President must submit a numbered certification to the Congress before issuing a Letter of Offer and Acceptance (LOA) to sell defense articles and services for \$50 million or more, design and construction services for \$200 million or more, or major defense equipment of \$14 million or more. The LOA can not be issued if the Congress adopts a joint resolution stating it objects to the proposed sale (Samelson, 1990:3-13).

Both Jordan and Saudi Arabia have experienced Congressional disapprovals. In March of 1985, the House Committee on Europe and the Middle East voted to ban sales of F-16 fighters to Jordan until Jordan openly and clearly committed itself to recognizing Israel and had initiated negotiations with Israel. In 1987, the Reagan administration submitted a \$1.46 billion sales package for Saudi Arabia which included 1,600 Maverick missiles and 12 F-15 fighters. Immediate uproar occurred in the Congress because the arms package was perceived to be a possible threat to Israel. The Reagan administration was forced to withdraw the LOA package (Bajusz and Louscher, 1988:64).

Under the "Second Shanghai Communiqué," a 1982 accord with the Peoples Republic of China (PRC), the United States pledged itself to reduce arms sales to Taiwan. Since 1982, the U.S. has refused to sell Taiwan F-16 fighter aircraft because such a sale would violate the 1982 agreement (Peking, 1986:8C).

Total Package Approach (TPA). DOD policy calls for the offer of a major system or item to be complete with regard to repair parts, publications, etc. This policy, as described in the Security Assistance Management Manual, is called a Total Package Approach (Security Assistance, 1988: Chapter 8, Section 800). TPA is a means of insuring FMS customers are aware of and afforded the opportunity to plan for obtaining all the necessary support items and services to efficiently introduce and operationally sustain major items of equipment/systems considered for purchase. Under TPA, four major logistics categories must be considered: training, technical assistance, initial support, and follow-on support. Also under TPA, all supporting material should be on the initial LOA (Samelson, 1990:Chapter 8).

### Commercial Exports

Commercial exports are those arms sold directly to a foreign country by U.S. industry. All expenses are paid by the purchasing country. The Office of Munitions Control (OMC), Bureau of Politico-Military Affairs, Department of State administers the commercial export of arms. Rules and



procedures for these sales are contained in the International Traffic In Arms Regulation (ITAR). All OMC licenses are approved for two calendar years (Congressional Presentation, 1991:45).

Even though commercial export sales do not involve the use of U.S. funds, they must be approved by the Congress. Thirty days before the issuance of any export license for Major Defense Equipment in excess of \$14 million, or other defense articles/services in excess of \$50 million, the President must submit a numbered certification to the Congress. The export license cannot be issued if the Congress adopts a joint resolution stating it objects to the proposed sale (Samelson, 1990:3-13).

Commercial export deliveries for FY 90 are estimated to total 16.7 billion dollars (Congressional Presentation, 1991:48).

#### Grant Aid Programs

Grant aid programs differ from FMS programs in one very important respect--grant aid programs are paid for by the U.S. government. Since the grant aid programs are paid for by the U.S., funding must be obtained via the budgetary process. Congressional authorizations as well as appropriated funding levels must be assessed and formulated into a single budget request. Budget requests for grant aid programs are submitted by the President to the Congress for approval and funding appropriations on an annual basis. The

budget request is formally titled the Congressional Presentation Document (CPD) for Security Assistance Programs. The CPD is the President's budget request for the various grant aid programs and is in three sections (Samelson, 1991:6-11,12).

Section I of the CPD provides a general perspective of and rationale for the President's request. This section also provides a synopsis of the global and domestic conditions which influenced the formulation of the request. Section II lists the types of assistance and provides a recap of how much each country gets from each program. This section also provides estimates of FMS and commercial export sales. Section III contains a description of each country's program including the type and amount of equipment requested (Congressional Presentation, 1991:1-73).

Foreign Military Financing (FMF). This program has been known under several different names such as Foreign Military Sales Financing, Foreign Military Sales Credits, and Military Assistance Program (MAP). FMF was initiated in its previous form in the Mutual Defense Security Act of 1954 and was continued in the Foreign Assistance Act of 1961, as amended. MAP originally provided for the granting of military equipment, services, and materials to allied and friendly nations. Beginning in 1982, MAP funds were merged with recipient countries' funds and/or FMS credits and financing (Congressional Presentation, 1991:10).

The FMF program acknowledges that the high costs of modern weapons systems make it difficult for financially constrained countries to purchase U.S. defense equipment on a cash basis. FMF, in the form of direct or guaranteed loans, enables countries to buy equipment by providing necessary financing, or by guaranteeing the loan (Congressional Presentation, 1991:9).

Initially this program consisted of both grant aid and loans. In the early 1980s, the Congress became concerned that earlier loans were contributing to these countries' debt problems. In other words, the countries were having problems repaying earlier loans (Congressional Presentation, 1991:11).

The overwhelming majority of the FMF grant aid money, 4.18 billion dollars, goes to just two countries, Israel and Egypt. The FMF program has enabled Israel to meet cash flow requirements associated with procurements such as the Apache helicopter and the F-16 aircraft (Congressional Presentation, 1991: 170).

Today, most of the FMF money is in the form of "forgiven loans" or grants. The estimated FY 1990 FMF expenditures under this program is 4.82 billion dollars of which 4.44 billion dollars is for grant aid. The Administration is requesting a 5.01 billion dollar all-grant FMF program for FY 1991 (Congressional Presentation, 1991:10-12).

Economic Support Fund (ESF). ESF is a grant program aimed at encouraging economic reform and development in recipient nations. The program provides assistance in the form of cash transfers (grant aid) or through the financing of commodity imports such as oil. ESF is managed by the Agency for International Development (AID). FY 90 funding for this program was 3.98 billion dollars with 2.0 billion of this total going to just two countries, Israel and Egypt (Congressional Presentation, 1991:24-27).

Israel's FY 90 ESF funds were used to support its economic reform and stability by paying debt owed to the U.S. (Congressional Presentation, 1991:170). Egypt's FY 90 ESF funds were oriented toward revitalizing Egypt's private sector and introducing policy reforms to promote economic growth. Egypt's FY 90 funding also financed commodity imports as well as major improvements in power generation (Congressional Presentation, 1991:130).

International Military Education and Training (IMET). IMET is a grant program which provides military education and training to students from allied and friendly nations. Under this program, foreign students are brought to the U.S. for formal training and exposure to the American way of life (Manolas and Samelson, 1990).

IMET also funds Military Training Teams (MTT) which travel to foreign countries to accomplish training. For example, in FY 90 Chile requested MTT support for in-country

naval mine warfare training (Congressional Presentation, 1991:107). The estimated FY 1990 IMET funding was about 4.71 billion dollars for an estimated 5,922 students (Congressional Presentation, 1991:17).

Peacekeeping Operations (PKO). The Foreign Assistance Act of 1961 authorizes assistance to friendly countries and international organizations for peacekeeping operations which further U.S. security interests. PKO funds U.S. contributions to the United Nations Peacekeeping Forces in Cyprus (UNFICYP) and the Multinational Force and Observers (MFO) in the Sinai. The estimated FY 1990 expenditures for MFO totals 23.9 million dollars. The estimated FY 1990 expenditures for UNFICYP are 8.8 million dollars (Congressional Presentation, 1991:32-33).

#### Economic Impact of FMS and Grant Aid

Even though grant aid programs are paid for by the U.S. government, the cost of these programs is offset somewhat by their positive impact on the U.S. economy. In a prepared statement presented in testimony before the Subcommittee on Foreign Operations of the House Appropriation Committee, Lieutenant General Charles W. Brown, U.S. Army, Director, Defense Security Assistance Agency, noted that military assistance programs confer substantial economic benefits on the U.S., and that almost all of the assistance monies are spent in the U.S. (Brown, 1989:47).

Regarding FMS, Lieutenant General Brown stated,

Defense sales make a significant contribution to U.S. economic activity and international trade. Military assistance and sales create or preserve hundreds of thousands of American jobs and generate significant amounts of revenue for the U.S. Defense is one of the relatively few areas where the U.S. has consistently enjoyed an export advantage, although this advantage has eroded over the last several years. Sales also contribute to the preservation of the U.S. defense industrial base, and enable the Department of Defense to realize economies of scale savings for our own forces. (Brown, 1989:47)

Since the early 1970s the trend has been to rely on sales to foreign markets to help sustain the U.S. defense industrial base capacity. FMS has also resulted in stronger economic ties with foreign markets (Gansler, 1980:203-208).

FMS may also help to lower unit costs on individual weapon systems. For example, the production of arms for FMS helps American manufacturers achieve economies of scale through longer production runs. All other things being equal, longer production runs reduce the unit costs of weapons systems of continued interest to the U. S. Armed Forces (Congressional Presentation, 1991:3).

#### Declining Defense Budgets

The Congressional Presentation Document (CPD) for 1991 noted that grant aid accounts "have suffered progressive deep cuts in aggregate program levels from FY 85 through FY 90." The CPD further stated that "the cuts reflect budget conditions and the impact of Gramm-Rudman-Hollings,

rather than any lessening of U.S. commitments to the defense of friends and allies" (Congressional Presentation, 1991:4).

The Balanced Budget and Emergency Deficit Control Act of 1985, commonly known as Gramm-Rudman-Hollings, set specific deficit targets for the federal budget and provided enforcement mechanisms to reduce spending when deficit targets were exceeded. The Budget Enforcement Act (BEA) of 1990 was signed by President Bush on November 5, 1990. Under new procedures established by BEA, reducing the deficit was no longer the goal. The goal now became limiting spending (Collender, 1991:17-18).

Declining defense budgets meant smaller purchases by the U.S. military which raised the relative importance of the sale of arms, i.e., Foreign Military Sales (FMS). In addition to the political benefits of FMS, the economic benefits became at least equally important (Rowen, 1990:19).

#### Cooperative Research and Development

Weapons systems have become increasingly complex and their research and development costs have increased proportionately. Sharing these research and development costs among several nations has often been proposed as a method to reduce the cost to any one nation. In the U.S., the Nunn-Roth-Warner Amendment to the FY 86 Defense Authorization Bill, commonly known as the Nunn Amendment, set aside \$200 million per year for five years strictly for cooperative development projects between the U.S. and its

allies. The Nunn Amendment was an unequivocal endorsement of armaments cooperation as the method of equipment modernization between the U.S. and its NATO allies (Brandt and Bleakley, 1989:106).

Proponents of cooperative programs emphasized the cost savings involved and cited cooperation as a means to enter new markets, increase business, and share in development expenses (Marr & Fischer, 1990:87). Despite these apparent advantages and the endorsement of the Nunn Amendment, codevelopment has proven difficult to implement.

Cooperative programs between the U.S. and Europe have usually taken the form of coproduction, most notably in programs such as the F-16, Sea Sparrow, and the AIM-9L missile (Brandt and Bleakley, 1989:107).

One of the principal difficulties in the codevelopment of weapon systems is that foreign countries not only gain jobs and revenue, but they also gain technological expertise which ultimately threatens the entire U.S. defense industrial base. American manufacturers are understandably reluctant to give up their lead in emerging technologies, and they are supported by Congressmen who fear the loss of jobs to foreign competitors (Brandt and Bleakley, 1989:108).

#### Technology Transfer

Transfer of technology can take many forms. Research and development conducted in the buyer country or technical



assistance provided to the subsidiary or joint venture are all types of technology transfer (Samelson, 1990:7-8).

In 1990 testimony before the Congress, Joseph Kelly, Director, Security and International Relations Issues, National Security and International Affairs Division, General Accounting Office, discussed the U.S.-Korea Fighter Coproduction Program. The GAO had been asked by the Congress to review the negotiating history of the Korean program and to discuss Korea's aerospace goals and plans.

Kelly stated that the program does not involve "... transfer of design and technology know-how. Rather this program involves the transfer of manufacturing and assembly know-how" (Kelly, 1990:35).

Kelly stated,

... although Korea has a military need for the fighters, based on our review of the negotiating history, the Koreans' desire for a coproduction program has been driven by their industrial development goals and interests. These goals are reflected in Korea's position on a number of issues. (Kelly, 1990:35)

### Offsets

In a 1988 paper presented at a European Arms Collaboration Workshop at Harvard University, Robert H. Trice, Director, Business Development, General Dynamics, defined offset as

a term used to describe a range of commercial practices, usually required as a condition of purchase, through which some portion of the purchase value is 'offset' by some form of economic activity by the supplier in the purchasing country. (Trice, 1989)

Trice described three types of offset programs:

Indirect Offset. Any business activity that does not relate to the products or services sold.

Direct Offset. Any reciprocal business activity that relates specifically to the products or services sold to a foreign country.

Coproduction. Overseas production based on a government to government or an industry to government agreement that permits a foreign government, or selected contractor, to acquire the technical information needed to manufacture all or part of a U.S. origin defense article. (Trice, 1989)

Indirect Offsets. Indirect offsets do not directly involve the production of the weapon system. Indirect offsets take the form of purchasing other products or services from the foreign country. Most potential arms customers insist on some offset to soften the economic impact of arms imports.

In 1984, for example, General Dynamics announced the sale of forty F-16 fighter aircraft to the government of Greece. The sales agreement included a 100 percent offset package to be fulfilled by General Dynamics and its partners. The sales agreement required the seller's best efforts to

achieve a distribution of 50 percent purchases, 15 percent direct investment, 15 percent enhancement of Greek participation in construction projects and studies in third countries, 10 percent technology transfer, and 10 percent tourism. (F-16 Aircraft Sales, 1989:73,77)

Direct Offsets. Direct offset arrangements are those in which the foreign country takes a direct part or share of

the production of the weapons system and, as a result, the nation gains technological expertise (Klare, 1984:176).

For example, the Korean Airlines learned a great deal about manufacturing military aircraft from its licensed production of Northrop's F-5E fighters (Sanders, 1990:97). In the case of the Korean Fighter Program, Kelly noted Korea's written policy was to require a "minimum of 50 percent offsets for major purchases of foreign weapons and systems" (Kelly, 1990:37).

Coproduction. The most celebrated coproduction venture is the F-16 coproduction venture between the U.S., Belgium, the Netherlands, Denmark, and Norway, for manufacturing the F-16 fighter aircraft. The four countries signed a memorandum of understanding (MOU) with the U.S. government in June 1975 that outlined the conditions for the sale as well as an extensive coproduction program to be implemented between the four European countries and the U.S. The coproduction program cost the European partners 34 percent more than buying the aircraft off the shelf from General Dynamics--more than 2 million dollars per aircraft in 1975 prices (Dorfer: 1983:206).

Even though offsets take many forms, the purpose is the same in every instance. The intent is to allow the purchasing country to participate in the project. The purchasing country views offsets as a means of improving the economy,

strengthening the industrial base, and improving its balance of payment position.

A 1988 General Accounting Office (GAO) study noted, "Foreign countries can use these agreements to counter competitive advantages of some U.S. industries," and the "transfer of technology abroad diminishes U.S. ability to compete for future business" (General Accounting Office, 1988:17).

What does the U.S. gain from offsets and coproduction? Captain Samuel Arroyo, in his thesis entitled Contracting and Purchasing Management In the International Marketplace, argues that "cooperation and international teaming arrangements allow the U.S. defense industry access to bigger markets," and that "armaments cooperation, particularly coproduction and licensed production, has the added benefit of increasing employments to both participants" (Arroyo, 1989:42-46).

Since production of the F-16 began in 1978, General Dynamics has delivered 2,454 aircraft to the U.S. and 15 other nations around the world (Trice, 1989:69). International cooperative ventures have played a vital role in the F-16 program with 87 percent of the foreign customers involved in some form of participation as coproducers, suppliers, or indirect offset partners (Trice, 1989:69).

## U.S. and Japan

In many ways, the US-Japanese Fighter Support-Experimental (FS-X) aircraft program is an example of the opportunities and risks associated with cooperative projects. The FS-X program refers to Japan's plans to acquire a next generation fighter aircraft. On 28 April 1989, President Bush announced the U.S. and Japan had agreed to the "joint development of the FS-X fighter aircraft" (U.S. and Japan, 1989:3).

As Robert Trice of General Dynamics notes, the FS-X program is unique in that General Dynamics will be acting as a subcontractor to foreign industry for the first time in a cooperative program. Under the terms of the agreement, General Dynamics and Mitsubishi Heavy Industries (MHI) will codevelop and coproduce a new aircraft based on substantial modifications to the F-16. General Dynamics and other U.S. companies will receive the 40 percent U.S. share of both development and production work. Under the licensed development and production program, General Dynamics will become a subcontractor on a derivative of its own product (Trice, 1989).

Critics of the FS-X program argued Japan was getting off cheap and the U.S. was simply giving technology away. Clyde Prestowitz, former acting Secretary of Commerce for International Economic Policy, claimed that the FS-X will be virtually a new airplane and that interoperability is not a

realistic goal. Mr Prestowitz also pointed out that Japan's Ministry of International Trade and Industry has targeted development of a domestic aerospace industry (Prestowitz, 1989:112).

Proponents of the FS-X pointed out that a straight purchase of F-16 aircraft by Japan was never a real possibility. Even a simple direct offset program would not have satisfied the Japanese goal of further developing its aerospace industry (Trice, 1989). The only realistic alternatives to the FS-X deal were either codevelopment and coproduction, or indigenous production of the aircraft by Japan. From the U.S. point of view, indigenous production by Japan would not contribute anything to the U.S. economy (Trice, 1989).

Japan clearly has the financial resources and technological base to develop the aircraft. The FS-X will cost much more to develop than would a similar purchase of F-16 aircraft. The Japanese justify this as "the cost of education" (Fight Over Fighters, 1987:302).

#### Government Support of Defense Sales

As U.S. defense budgets have declined, sale of defense products to foreign governments has become increasingly important. The problem of smaller defense budgets has been compounded by increased competition in the arms business. This has occurred partly because of the globalization of industry as a whole and also because of the increasing

technical capabilities in other developed countries (Defense Policy, 1990:82).

In its 1989 year-end review, the Defense Policy Advisory Committee on Trade (DPACT) noted,

The financial condition of many prime U.S. contractors as well as that of subcontractors is of continuing concern and has been the subject of several studies over the past few years. Technical leadership, the cornerstone of strength for the U.S. defense industry, is narrowing vis-a-vis the rest of the world--in part due to certain U. S. government policies. (Defense Policy, 1990:83)

Economically Motivated Suppliers. The U.S. is not alone in recognizing the economic benefits of the arms trade. Countries such as the United Kingdom, France, and the Soviet Union provide active government support to their defense industries (Turner, 1986:97).

In the United Kingdom an extensive Defense Sales Organization (DSO) operates directly within the Ministry of Defense. The stated purpose of the DSO is to help British firms market and sell defense products and services overseas (Turner, 1986:97).

In France the Office General de l'Air (OGA) provides a comprehensive commercial presence in more than 40 countries throughout the world. A sister organization, the Office Francais d' Exportation de Material Aeronautique, presents and sells French products from the French aerospace, weapons, and allied industries. Both agencies operate under the sponsorship of the French government and are wholly

concerned with international marketing and promotion of the French aerospace industry (Turner, 1986:97).

After the Soviet Union and the U.S., France is the world's third largest arms seller. France's arms industry is mostly state-owned, but the French arms industry could not survive without foreign sales (Arms for Sale: 1991:25).

In the Soviet Union, arm sales are driven by a desperate need for hard currency (Bajusz, 1988:25). Says Igor Belousev, chairman of the Cabinet of Ministers' Military Industrial Commission: "We will be selling as much military hardware as we can against increasingly tough competition on the world market" (Arms For Sale, 1991:24).

#### Conflicting Goals

The U.S. must be concerned about its defense industrial base and the threat of foreign competition. Increasingly, foreign governments want offset agreements to protect and enhance their own economies.

In his 1986 testimony before the Congress, Dr James P. Wade, Jr., Assistant Secretary of Defense, stated,

The Europeans will not tolerate, and rightly so, a two-way street that is in reality a one-way super-highway where the United States does not purchase its share of European-developed systems. We cannot tolerate a one-way super-highway in the other direction either. (Wade, 1986:63)

C.D. Vollmer, a vice president of General Dynamics, commented on these conflicting goals of international collaboration:



If you favor allied cooperation, a common mobilization base, and a way to reduce the cost of U.S. weapon systems, then it is good. If you are worried about the erosion of U.S. competitiveness, technology transfer, and the loss of a significant part of the U.S. export market, then it is not so good. (Roos, 1989:32)

### Chapter Summary

This chapter presented information obtained through a search of the literature. The chapter began with a description of Foreign Military Sales (FMS) and grant aid. Economic issues such as cooperative research and development, technology transfer, coproduction, increased competition, and offsets were examined. The chapter concluded with a discussion of government support of FMS. Chapter III will examine the F-16 program as well as a brief review of the history of fighter aircraft in general.

### III. History Of The F-16 Fighter Aircraft

#### Chapter Overview

This chapter traces the history of the F-16 fighter aircraft manufactured for the U.S. Air Force by General Dynamics, Fort Worth, Texas.

The chapter begins with a discussion of the changes which have occurred in fighter aircraft since 1945, the history of the jet engine, and the evolution of fighter aircraft into a delivery system for nuclear weapons. The chapter also reviews the history of the lightweight fighter aircraft, and the so-called fighter mafia. The chapter concludes with a discussion of the F-16 as a multinational fighter aircraft, and also as big business for the U.S.

#### History Of The F-16

Jet-Powered Aircraft. The history of the F-16 dates back to 1939, the birth of the first jet airplane. However, jet-powered aircraft did not take part in military action until 1945 in World War II (Whitehouse, 1971:311).

The German Heinkel 178 was the first true jet aircraft to be flown. This plane made its maiden flight on August 27, 1939. By early 1943, the German Messerschmidt ME262 twin jet prototype was being flown by high ranking German pilots, all of whom were delighted with its performance. Years after World War II had ended, the Allies realized that, by 1944, the Germans had at least an 18 month lead in the development of jet powered military aircraft. The

Germans did not benefit from this lead since the German high command did not fully appreciate the value of this new technology (Whitehouse, 1971:313,314).

Great Britain began experimenting with jet propulsion as early as 1926. In the early 1930s, Frank Whittle built an experimental model of a gas turbine engine. In 1937, the first test run was made on the Whittle engine and, in 1940, 160 Whittle engines were ordered to go into eighty Meteor aircraft (Whitehouse, 1971:311,312).

In 1946, the British were the first to use a jet-powered plane, a modified Gloster Meteor, in deck landings on aircraft carriers (Whitehouse, 1971:338).

American interest in the jet engine began in 1941 when U.S. Army General Henry H. Arnold went to England to study the research and development then being carried out by British manufacturers of aircraft engines. General Arnold found the British program far ahead of anything in America and recommended the U.S. institute a similar jet propulsion program (Whitehouse, 1971:320).

Development of a jet-powered fighter plane began in 1943 when the Lockheed company was asked to produce a military plane to be powered by an American-built version of the British de Havilland H-1 turbojet engine. General Electric built the American H-1 engine for the prototype aircraft which was known as the YP-80A (Shooting Star) (Whitehouse, 1971:322).

The first Shooting Star was delivered in October 1944. A final version of the Shooting Star was produced in 1948-49 and the designation was eventually changed from YP-80 to P-80 to F-80. Approximately 2,000 F-80s were produced and delivered. The Shooting Star became the first U.S. jet-powered aircraft to enter combat, fly the Atlantic, and shoot down an enemy airplane although that did not occur until the Korean War (Whitehouse, 1971:323).

The speed of military aircraft took a revolutionary turn with the introduction of the jet engine. Between 1939 and 1945, the speed of fighter aircraft rose from 350 to 550 miles per hour (mph). By 1958, the speed of fighter aircraft had almost tripled, from 550 mph to nearly 1500 mph (Hallion, 1990:5).

The Korean War, 1950-1952. The Republic Company's F-84 Thunderjet and the North American Aviation Company's F-86 Sabre were America's first line fighter aircraft in the Korean War. The first model of the F-84 Thunderjet was flown in August 1946. One month later, the Thunderjet established a U.S. national speed record of 611 miles per hour. The F-86 Sabre flew for the first time on October 1, 1947, and was the first U.S. jet to exceed the speed of sound, Mach I. The Sabre was used extensively in Korea and, in its final form, had a top speed of 707 miles per hour (Whitehouse, 1971:320-322).

The Sabre's main adversary in Korea was the subsonic Mikoyan-Gurevich MIG-15 Fagot produced by the Soviet Union. The air superiority of the F-86 enabled the U.S. Air Force to achieve remarkable success. The air battle exchange rate was 6.2, 941 enemy aircraft downed against 152 U.S. Air Force and Navy losses (Hallion, 1990:5).

The Century Series. The encounters with the MIG-15 in Korea caused the U.S. to realize it would only be a matter of time before a transonic or even supersonic Soviet-built fighter aircraft emerged. The air battles over the Yalu River in Korea led U.S. fighter pilots to believe a lightweight, maneuverable fighter aircraft would be needed to confront future Soviet fighters (Hallion, 1990:8).

In January 1951, while the first of its F-86s were fighting in Korea, the North American Aviation company submitted an unsolicited proposal for a supersonic "Sabre 45." The proposal was approved in a matter of months and designated the F-100. Named the SuperSabre, the F-100 was the first U.S. Air Force supersonic fighter. However, the F-100 weighed almost twice as much as an F-86 loaded for takeoff and some Air Force officials worried that the plane would be too complex and expensive for use as a basic day fighter (Richardson, 1990:6-7).

The incorporation of the atomic warhead into bombs that could easily be carried by a fighter-class airplane began to influence fighter aircraft design. The fighter aircraft

evolved into a delivery system for atomic weapons. The century series aircraft (F-100, F-101B, F-102, F-104, F-106) were primarily thought of as either nuclear strike airplanes, or as interceptors of nuclear strike airplanes. The Air Force acquired a total of 5,525 century series fighter aircraft (Hallion, 1990:9).

U.S. national defense strategy emphasized nuclear strike and deterrence capabilities. In large part because of this national strategy, the Air Force was dominated by the Strategic Air Command (SAC) and Tactical Air Command (TAC) was not much different than a mini-SAC (Hallion, 1990:9).

Between 1954 and 1962 the USAF had regarded tactical fighters primarily as a means for delivering nuclear ordnance (Hallion, 1990:15). Top-end speed predominated as the primary design consideration. Flight safety and nuclear operations dominated Air Force thinking at the expense of realistic training and air combat maneuvering (Dorfer, 1983:3).

Vietnam. The first dogfights of the Vietnam War took place in April 1965. The North Vietnamese pilots flew lightweight, agile, Soviet-built fighters such as the MiG-17 Fresco and the MiG-21 Fishbed. U.S. pilots flew the Republic F-105 Thunderchief and McDonnell Douglas F-4 Phantom II (Richardson, 1990:6).

The McDonnell Douglas F-4 Phantom started life as a U.S. Navy fighter aircraft but the Air Force began to place large orders to meet the needs of the air war in Vietnam. The F-4 was a large size, big budget airplane in the 50,000-pound class and could not match the agility and maneuverability of the MIGs (Richardson, 1990:6).

In Vietnam, the air battle exchange rate was 2.41, 184 victories against 75 Air Force and Navy losses (Hallion, 1990:15). The response to the exchange rate of 2.41 was twofold: an increase in combat flight training and a clamor for a better fighter aircraft (Hallion, 1990:14).

Navy and Air Force fighter pilot schools, which emphasized air combat in the tradition of World War II and Korea, were revitalized. After the Korean War and the increased emphasis on nuclear strike capability, the USAF training curriculum had included little air-to-air combat (Hallion, 1990:15).

The desire for a better fighter aircraft meant more emphasis on air-to-air and less emphasis on air-to-ground missions. U.S. strategy had not called for and fighter pilots had not had a pure fighter aircraft since the F-86 (Hallion, 1990:15).

F-15 Eagle. In September 1968, the Air Force and the Office of the Secretary of Defense reached agreement on a Development Concept Paper for a new fighter aircraft. Concept studies were begun for an F-X (Fighter Experimental)

and an Advanced Day Fighter (ADF). The F-X was visualized as a 60,000 pound fighter aircraft while the ADF was to be a lightweight design of around 25,000 pounds (Richardson, 1990:7).

In July of 1967, the Soviet Union revealed several frontline aircraft including a high performance interceptor far superior to any other Soviet fighter, the MiG 25 Foxbat. This led to increased emphasis on the development of an American alternative, the F-X (Richardson, 1990:7).

The F-X or, as it was later to be known, the F-15, was to be a single seat, fixed wing, twin engine fighter in the 40,000-pound weight class. The F-15 completed its maiden flight in July 1972 and entered squadron service in November 1974 (Hallion, 1990:19).

The Fighter Mafia. The ADF concept had been overshadowed by the development of the F-X, but the idea still had the support of several individuals who argued for a leaner, more austere version of the F-15, or F-X. These individuals were convinced a less expensive fighter plane was required for the U.S. to maintain parity with the Warsaw Pact tactical fighter force. These proponents of a leaner, cheaper F-15 were known as the fighter mafia (Dorfer, 1983:5).

The fighter mafia argued for a highly agile, single engine fighter with less than Mach 2 speed in the 20,000-pound weight class. The idea of an agile, lightweight



fighter lingered even though the ADF had been deemphasized in favor of the F-X. The fighter mafia eventually found support with ex-pilots who were moving into positions of command within the Air Force and, in January 1972, the U.S. Air Force issued a request for proposal for a lightweight fighter aircraft (Richardson, 1990:8).

Prototype Acquisition. In June 1970, a "Blue Ribbon Defense Panel" recommended ending the so-called total package procurement which had been used by DOD since the late 1950s. The total package approach was based on cost evaluations of paper proposals. The panel recommended a return to competitive prototyping of aircraft hardware. This meant the lightweight fighter aircraft award would be decided by competitive prototyping and, ultimately, a flyoff (Hallion, 1990:20).

General Dynamics, Northrop, Boeing, Lockheed, and LTV all issued proposals for the lightweight fighter aircraft. In April 1972, Lieutenant General James Stewart of the Aeronautical Systems Division recommended to the Secretary of the Air Force the selection of the General Dynamics design and the Northrop design as the two competing finalists. General Dynamics was provided \$37.9 million and Northrop \$39 million to accomplish the following tasks:

1. Design, develop, and fabricate two prototype aircraft.
2. Assess and certify aircraft safety of flight.
3. Conduct a joint contractor/Air Force flight test program.
4. Train Air Force test pilots.

5. Provide total contractor support during the flight test program.
6. Provide a data accessions list.
7. Prepare a final report. (Dorfer, 1983:9)

The program targeted the first flight of the prototypes to occur in January 1974, to be followed by one year of flight testing (Dorfer, 1983:8).

YF-16 Prototype. The emphasis on maneuverability was apparent in the General Dynamics prototype YF-16. Since the Wright brothers, aircraft designers had always tried to make aircraft inherently stable. In order to make the YF-16 as maneuverable as possible, the General Dynamics design team decided to make the F-16 inherently unstable. With conventional mechanical controls, the YF-16 would have been all but impossible to fly. Therefore, the General Dynamics design engineers installed a fly-by-wire (FBW) stability augmentation and flight-control system (FCS). The pilot's control inputs were passed to an on-board computer system which calculated how much the various control surfaces should move to achieve the desired response. The FBW system had to be at least as reliable as the traditional mechanical linkages. Therefore, General Dynamics installed a quadruplex (four channel) FBW system. Failure of one channel would leave the remaining three operating normally-- the equivalent of a triplex system (Richardson, 1990:11,12).

The first of the two YF-16 prototypes was rolled out of the General Dynamics Fort Worth plant in December 1973. The first official flight test took place in February 1974.

Europe. Eurogroup, formed in 1969, was a forum where the defense ministers of the European NATO countries met to discuss methods to plan and coordinate weapons procurement. In December 1973, at the annual meeting of European NATO countries, a resolution was passed urging the four member countries (Norway, Denmark, the Netherlands, and Belgium) to try to coordinate their selection and purchase of a new fighter aircraft (Dorfer, 1983:16).

The resolution did not go unnoticed in the United States. The U.S. aircraft industry had been eyeing the European market, and lobbied for U.S. government support. Henry Kissinger, then Secretary of State, took the unusual step of sending a message to the defense ministers of the four countries stating that if an American aircraft was selected the U.S. government would undertake to:

- Collaborate ... to expedite development of certain aircraft technologies;
- Support transfer ... of aircraft technologies ... evolved through collaborative research and development;
- Provide ... logistical support for those program components ... in the U.S. inventory ... assure that the DOD logistics system is available for support at a level equal to that which we give our own aircraft;
- DOD will also consider complementing and supporting U.S. industrial offset proposals under terms and arrangements to be mutually agreed. (Dorfer, 1983:16)

Source Selection Of The Lightweight Fighter. The source selection was conducted by a team at Wright-Patterson AFB, Ohio. The source selection was headed by Colonel Bill Thurman, the lightweight fighter program manager. The U.S. government invited each of the four European countries to send officers to observe the selection process (Dorfer, 1973:22).

On January 1, 1975, Colonel Thurman briefed General James Stewart, Aeronautical Systems Division commander, on the two prototypes. The engineering and flight test data had shown the General Dynamics YF-16 to have better acceleration, rate of turn, and endurance. Also, the cost proposals submitted by General Dynamics were rated as better than those of Northrop. General Stewart chose the General Dynamics F-16, and two days later, General Jones, the Air Force Chief of Staff, was briefed. On January 6, the Secretary of the Air Force, John McLucas, selected the General Dynamics F-16. The choice of the F-16 for full scale development meant the acceptance of the contract proposals submitted by General Dynamics and United Technologies (Dorfer, 1973:24,26).

The contract awarded General Dynamics was valued at \$417,904,738 for the full scale development of 15 preproduction F-16 aircraft. The contract also awarded United Aircraft corporation \$20,908,449 to provide engine flight test support for the 15 preproduction F-16 aircraft.

Both contracts contained future production options for 301 USAF aircraft and 141 European aircraft should the Europeans choose the F-16 (Dorfer, 1973:24,26).

In June 1975, the four European countries decided to purchase the F-16 aircraft. The Memorandum of Understanding (MOU) between the U.S. and the four European Participating Governments (EPGs) became the basic charter for implementing the F-16 multinational program. The EPG program objectives were:

- Acquire a low cost, easily maintained aircraft with advanced avionics and weapons capability.
- Standardize aircraft in the North Atlantic Treaty Organization (NATO).
- Acquire advanced technology.
- Make optimum use of EPG industrial, economic, and technical resources in the production of aircraft. (Comptroller General, 1979:1)

The European decision was formally announced at the 1975 Paris Air Show. The MOU between the Eurogroup countries and the Government of the United States called for the U.S. to purchase 650 F-16 aircraft. 348 of the 650 aircraft were to be purchased for subsequent sale to the Eurogroup countries: 116 for Belgium, 58 for Denmark, 102 for the Netherlands, and 72 for Norway (Richardson, 1990:13).

The MOU included a coproduction program which made the F-16 more attractive to the Europeans. The coproduction program allowed the Europeans to manufacture a large percentage of their own aircraft, and called for F-16

assembly lines to be established in both Holland and Belgium (Drendel, 1982:12).

Economic And Political Aspects. By 1975, U.S. arms procurement was down to \$17 billion from \$44 billion in 1968. Combat aircraft had dropped from \$17 billion to \$7 billion from 1971 to 1975. In 1955, the United States produced 3,000 combat aircraft. By 1965, U.S. annual production of combat aircraft had dropped to 1,000 and, by 1975, U.S. annual production of combat aircraft had dropped to 300 aircraft (Dorfer, 1983:xvii).

Traditionally, only aircraft obsolete for U.S. forces were sold abroad. The F-16 MOU represented a major change in U.S. arms policy. Declining U.S. sales encouraged Washington to rethink this policy (Dorfer, 1983:xviii).

After the European contract was signed, the F-16 salesmen went to work on other sales. The first customer to commit to the F-16 was the Shah of Iran. The Shah was expected to buy more than 350 F-16s, with deliveries to begin in 1980. Unfortunately, the revolution in Iran intervened to kill this deal (Drendel, 1982:12).

#### The Selling of the F-16

Even though the Iran deal was canceled, other countries soon began to express interest in the F-16. However, not all requests were viewed favorably by the Carter administration, 1976-80. For example, King Hussein of

Jordan wanted to buy F-16s, but was turned down by President Carter (Drendel, 1982:14).

The election of President Reagan in 1980 brought a new administration with a more favorable view of military sales to foreign governments. Sales of F-16s (See Table 1) meant big business for General Dynamics and jobs for U.S. workers.

Table 1  
Current F-16 Program Status

| Customer        | Delivered<br>Through<br>1990 | Total<br>Ordered as<br>of 12/31/90 |
|-----------------|------------------------------|------------------------------------|
| U.S. Air Force  | 1,783                        | 2,261                              |
| U.S. Navy       | 26                           | 26                                 |
| Belgium         | 151                          | 160                                |
| Denmark         | 70                           | 70                                 |
| The Netherlands | 200                          | 214                                |
| Norway          | 74                           | 74                                 |
| Israel          | 150                          | 210                                |
| Egypt           | 80                           | 127                                |
| Pakistan        | 40                           | 111                                |
| Venezuela       | 24                           | 24                                 |
| Korea           | 36                           | 40                                 |
| Turkey          | 66                           | 160                                |
| Greece          | 40                           | 40                                 |
| Thailand        | 13                           | 18                                 |
| Singapore       | 8                            | 8                                  |
| Indonesia       | 12                           | 12                                 |
| Bahrain         | 12                           | 12                                 |
| Portugal        | 0                            | 20                                 |
| Totals          | 2,785                        | 3,587                              |

Source: General Dynamics 1990 Shareholder Report

Bahrain (Peace Crown). The LOA was signed in March, 1987 for 12 F-16 C/D aircraft with the first production delivery scheduled for March 1990. The program was a \$385 million cash sale without any coproduction (Hocking, 1990).

Belgium (Harvest Partner I). Belgium was one of the four European Participating Governments in the 1975 Memorandum of Understanding (MOU) with the U.S. The MOU specified a 58% coproduction target. Two European production lines were established, one in Belgium and the other in the Netherlands. The Belgian airframe and assembly plant was the Societe Anonyme Belge de Constructions Aeronautiques (SABCA) facility in Gossellies. SABCA was targeted to produce 164 of the 350 European-built aircraft. Start-up of the Belgian production line at SABCA began in February 1978 (Richardson, 1990:14).

The 1977 LOA called for the purchase 116 F-16 aircraft at a cost of \$1.7 billion. Deliveries of these aircraft were completed in 1985. In February 1983, Belgium agreed to purchase an additional 44 F-16s. Delivery of these aircraft began in January 1988, and was scheduled to finish in August 1991. No FMS credits were involved in either sale (Badami, 1990).

Denmark. Denmark ordered the smallest number of F-16s of the four EPG countries, 46 F-16As and 12 F-16Bs. The 1977 LOA, Harvest Partner II, called for the purchase of 58 F-16 aircraft at a cost \$900 million. Deliveries of these aircraft were completed in 1983. In January 1985, Belgium ordered a follow-on batch of 12 F-16 aircraft, Harvest Partner VIII, at a cost of \$130 million. Delivery of these aircraft began in December 1987, and was completed in



October 1989. No FMS credits were involved in either sale (Alexander, 1991).

Egypt, Peace Vector. In the middle 1970s, the Egyptian Air Force (EAF) found itself in dire need of new equipment since the Soviet Union had cut off supplies of arms and spares to Egypt earlier in the decade as a result of the Camp David Accords. In 1979, Egypt received 35 F-4 Phantom II aircraft from the U.S. Peace Vector I began in June 1980, and provided 41 F-16A/B aircraft to the EAF with final delivery in 1983. Peace Vector II began in May 1982, and covered the supply of an additional 40 F-16C/D aircraft with final delivery in 1987 (Richardson, 1990:44).

The LOA for Peace Vector III was signed in October 1987, and called for the purchase 41 F-16 aircraft at a cost \$1.28 billion. Deliveries of these aircraft began in August 1991, with final delivery scheduled for October 1992. In June 1990, Peace Vector III was amended to include the purchase an additional six F-16s. Delivery of Peace Vector IIIA aircraft was scheduled to begin in September 1992. An LOA for 46 F-16 C/D aircraft, Peace Vector IV, was signed in April 1991. All Peace Vector IV aircraft will be assembled in Turkey with first production scheduled in 1993 and last delivery targeted for May 1995. Peace Vector funding was accomplished through FMS credits (Hofemanns and MacLeod, 1991).

Greece, Peace Xenia. The Hellenic Air Force (HAF) requirement for a fighter aircraft was eventually narrowed down to two candidates, the Dassault-Breguet Mirage 2000 and the General Dynamics F-16. Greece eventually decided to split the purchase and ordered 40 F-16s and 40 Mirage 2000s (Richardson, 1990:44).

Peace Xenia was unique in that the F-16s were ordered from General Dynamics directly as a commercial buy rather than through the U.S Air Force. The program value was \$659 million. Deliveries began in October 1988, and completed in January 1990. In September 1990, the HAF requested post-production follow-on support from the U.S. Government under FMS. The \$33.7 million follow-on support program began in January 1991, and goes through 31 December 1993 (Peppers, 1991).

Indonesia, Peace Bema Sina. In August 1986, Indonesia agreed to purchase 12 F-16A/B fighter aircraft. The program value was \$341 million with FMS credits of \$42 million. The program also provided for an offset target of 30% which was accomplished through the production of doors, pylons, and flaperons at Industri, Pesawat Terbang Nusgntara (IPTN) (Foster, 1990).

Israel, Peace Marble. Peace Marble I began in 1978 when a Letter of Acceptance (LOA) was issued by the U.S. Government authorizing the sale of 75 F-16A/B aircraft to the Israeli government. The Peace Marble I LOA was valued

at \$1.2 billion. Delivery of 75 Peace Marble F-16s began in January 1980, and was completed in October 1981. In August 1983, a second LOA, Peace Marble II, authorized the sale of 75 F-16C/D fighter aircraft to Israel. Delivery of Peace Marble II aircraft began in 1986, and was completed in October 1988. The Peace Marble II LOA was valued at \$1.84 billion. In May 1988, a third LOA, Peace Marble III, authorized the sale 60 F-16 C/D fighter aircraft to Israel. The Peace Marble III LOA was valued at \$1.327 billion. The industrial offset package is valued at \$640 million with a \$41 million coproduction support effort. Production deliveries of Peace Marble III F-16s began in 1991, and will continue through December 1992. Peace Marble III support equipment and technical orders are managed by OO-ALC and the F-16 SPO; training is managed by Air Training Command. Configuration control for all Peace Marble aircraft is maintained by General Dynamics. Overall management of the Peace Marble programs is through the team efforts of the F-16 SPO, AFLC/ILC, OO-ALC, General Dynamics Fort Worth, and the Israeli Air Force (Johnston, 1991).

Delivery of F-16 aircraft to Israel were suspended on three separate occasions for political reasons. Deliveries were halted twice during the summer of 1981, the first following Israel's attack of the Iraqi nuclear plant at Osarik, and the second time following Israel's air raids on Palestinian targets in Lebanon. The third interruption in

deliveries occurred in 1985 in protest against Israel's invasion of Lebanon (Richardson, 1990:42).

Korea, Peace Bridge. The LOA for Peace Bridge I was signed in December 1981. The program involved the sale of 36 F-16C/D aircraft at a total cost of \$931 million. The first aircraft was delivered in February 1986 with the final delivery in January 1989. The LOA did not address any coproduction, although General Dynamics did subcontract with several Korean industries to manufacture F-16 components (Ponti, 1991).

On March 28, 1991, the General Dynamics Corporation announced a new agreement with South Korea to supply 120 fighter aircraft. The \$5.2 billion order included extensive coproduction requirements, and called for South Korea's Samsung Aerospace Industries Corp. to manufacture 72 of the planes under license at a factory in Korea (Pearlstein, 1991:F1).

The selection of the General Dynamics F-16 dashed the hopes of the McDonnell Douglas Corp. McDonnell Douglas had proposed its F/A-18 aircraft to Korea (Hayes, 1991:D4).

The Netherlands, Harvest Partner. The Netherlands was one of the four European Participating Governments in the 1975 Memorandum of Understanding (MOU) with the U.S. The MOU specified a 58% coproduction target. Two European production lines were established, one in Belgium and the

other in the Netherlands at the Fokker plant at Schiphol-Ooost (Richardson, 1990:13).

The LOA signed in 1977, Harvest Partner III, called for the purchase of 102 F-16A/B aircraft at a costs of \$1.64 billion. Harvest Partner III deliveries began in July 1979, and were completed in June 1984. In January 1984, a second LOA, Harvest Partner V called for the sale of 111 F-16A/B aircraft at a cost of \$1.7 billion. Harvest Partner V deliveries began in July 1984 and are scheduled to be completed in February 1992 (Branam, 1991).

Norway, Harvest Partner. Norway was one of the four European Participating Governments in the 1975 Memorandum of Understanding (MOU) with the U.S. The MOU specified a 58% coproduction target (Richardson, 1990:13).

The LOA signed in 1977, Harvest Partner IV, called for the purchase of 72 F-16A/B aircraft at a costs of \$1.3 billion. Harvest Partner IV deliveries began in January 1980, and were completed in June 1984. In January 1984, a second LOA, Harvest Partner VII called for the sale of two F-16B aircraft at a cost of \$26.3 million. Harvest Partner VII aircraft were delivered in July 1989 (Skrodzki, 1991).

Pakistan, Peace Gate. The U.S. agreed to supply Pakistan with modern fighter aircraft as a direct result of the U.S. invasion of Afghanistan. Earlier Pakistani requests for fighter aircraft had been denied due to growing

evidence that Pakistan might be trying to develop nuclear weapons (Richardson, 1990:44).

To date four LOAs have been approved by the U.S. Peace Gate I and Peace Gate II, both signed in December 1981, called for the purchase of six F-16A/B aircraft, and 34 F-16A/B aircraft, respectively. Peace Gate I deliveries were complete in December 1982, and Peace Gate II deliveries were complete in January 1986. Peace Gate III, signed in December 1988 called for the sale of 11 F-16A/B aircraft with deliveries expected to begin in December 1991. Peace Gate IV, signed in September 1989, called for the sale of 60 F-16A/B aircraft with deliveries expected to begin in September 1992. Peace Gate I, II, and III were funded with FMS credits of \$114.14 million, \$614.562 million, and \$242.46 million, respectively. The Peace Gate program does not involve any coproduction (Wood, 1990).

Portugal, Peace Atlantis. The Peace Atlantis LOA, signed in December 1990 called for the sale of 20 F-16A/B aircraft at a cost of \$375 million. The first training aircraft is expected to be delivered in September, 1993. Peace Atlantis does not involve any coproduction (Dent, 1991).

Singapore, Peace Carvin. The Peace Carvin LOA, signed in April 1984, called for the sale of eight F-16A/B aircraft at a total cost of \$272 million. In-country delivery of the aircraft was completed in January 1990. Peace Carvin did

not involve any FMS credits. However, Singapore did negotiate a 20 percent offset arrangement with General Dynamics (Foster, 1991A).

Thailand, Peace Naresuan. The Peace Naresuan I LOA, signed June 1985, called for the sale of 12 F-16A/B aircraft. Peace Naresuan II, signed in December 1987, called for the sale of six F-16A aircraft. The cost of the 18 F-16 aircraft was 424.8 million. No FMS credits were involved. No coproduction was involved. Delivery of Peace Naresuan I aircraft was completed in October 1988. Delivery of Peace Naresuan II aircraft was completed in April 1991 (Foster, 1991B).

Turkey, Peace Onyx. The Peace Onyx LOA, signed in December 1983, called for the sale of 160 F-16C/D aircraft at a cost of \$4.2 billion. Funding for the program was 75% FMS credits. The remaining 25% funding, approximately \$1 billion, came from Turkish national funds. The 25% funding committed by Turkey was earmarked for coproduction work in Turkey. The first eight Peace Onyx aircraft were built by General Dynamics in Fort Worth and delivered to the Turkish Air Force in October 1987 and January 1988, respectively. The remaining 152 aircraft are being built in Turkey by a consortium of Turkish companies. Deliveries of the remaining 152 aircraft from the production line at Murted, Turkey are scheduled to be completed by December 1994 (Connor, 1991).

Venezuela, Peace Delta. The Peace Delta LOA, signed May 1982, called for the sale of 24 F-16A/B aircraft at a cost of \$615 million. No FMS credits were involved. No coproduction or offsets were involved. Delivery of Peace Delta aircraft was completed in December 1985 (Wood, 1990).

#### Enhancements To The F-16

Military aircraft, especially fighters, are progressively updated and upgraded in the course of their service lives to meet latest perceived threats. In the past, this often required extensive structural redesign as the shape of the aircraft changed to accommodate the improved equipment. For example, the systems within the F-4 were tightly packed, leaving little room for expansion or improvement. The General Dynamics design for the F-16 included space as well as the structural features required for planned future upgrades (Richardson, 1990:16).

The result is that although all versions of the F-16 look nearly identical, there have been nine separate production batches, each introducing changes and improvements. For example, the F-16 structure and wiring was modified to carry systems such as the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), the Low-Altitude Navigation and Targeting with Infra-Red at Night (LANTIRN) system, and the Maverick air-to-ground missile. The F-16 was also modified in 1986 to accept engine designs from



either General Electric or Pratt & Whitney (Richardson, 1990:17-19).

### Operations

The ultimate test for any fighter aircraft is combat. The first combat test for the F-16 came in 1981 when eight Israeli F-16s carried out a strike against an Iraq nuclear reactor. Unchallenged by Iraqi fighters, the F-16s scored two direct hits on the reactor. Israeli pilots were the first to use the F-16 in air-to-air combat in clashes with the Syrian Air Force in 1982. The air combat began in June 1982, and by the end of the summer, Israel claimed to have destroyed 84 Syrian-flown MIG-21s and Sukhoi SU-22s. Of the 84 downed Syrian planes, 44 fell to F-16s and 40 to F-15s (Richardson, 1990:35-38).

The first U.S. F-16 combat experience occurred in the 1990-91 war with Iraq--Operation Desert Storm. U.S. pilots flying F-16s soon established air superiority, flying up to 400 missions daily. F-16 squadrons also took part in a high percentage of bombing strikes against heavily defended ground targets. Through it all, the F-16 achieved a combat-readiness rate of 90 percent, and a reported turnaround time of 30-45 minutes between missions (General Dynamics, 1990:15).

According to A. Dwayne Mayfield, a General Dynamics vice president,

The allied forces employed 175 F-16s during the war; four were shot down. Pilots flew 30,000 sorties in the F-16, including 4,000 at night. (Hayes, 1991:D-4)

### Chapter Summary

The U.S. victory against Iraq was a long-awaited tonic for America's biggest defense contractors. As the United States, the Soviet Union, and Western Europe cut back on military purchases, arms manufacturers are stuck with excess capacity. They need foreign customers (Arms for Sale, 1991:22).

This chapter traced the changes which have occurred in fighter aircraft since 1945. The first major change was the jet engine. The next major change was the evolution of the fighter aircraft into a delivery system for nuclear weapons. Finally, the chapter discussed the history of the lightweight fighter aircraft and the development of the F-16 as a multinational fighter aircraft, and its growth as big business for the U.S. industrial base.

#### IV. Logistics Support F-16 FMS Customers

##### Chapter Overview

This chapter, in an effort to answer the following research questions, discusses the logistics support for the F-16 aircraft purchased by foreign countries:

1. Is the logistics support for the F-16 responsive to foreign customer requirements?
2. What major logistics support problems exist for the F-16 aircraft owned by foreign countries?

The system which provides the logistics support to foreign customers is extremely complex. This discussion is focused on systemic problems of the U.S. Air Force logistics support system rather than on problems peculiar to a particular country.

The issue of reliable logistics support affects not only defense, but also jobs and the American economy. For example, during FY 90, Warner Robins Air Logistics Center (WR-ALC) managed \$6.3 billion in resources. The largest portion of this \$6.3 billion funding, \$3.3 billion, was funding for all open FMS cases directly managed at WR-ALC-- a total of over 200 cases supporting more than 80 nations (Warner Robins, 1990:13). At General Dynamics, a March 1991 agreement to sell 120 F-16 aircraft to Korea meant 500-1000 workers who were to be laid off in 1994 can now keep their jobs (Hayes, 1991:D4).

The issue is also important because the U.S. Air Force is becoming smaller. The U.S. Air Force operating budget was cut by 18.6 percent in 1991. A 17.8 percent cut is projected in 1992 (Davis, 1991:1,6). The challenge is to insure that these cuts in U.S. Air Force funding do not adversely impact service and support to our allies and our FMS customers.

### FMS Cases

A case is the contractual sales agreement between the U.S. and a foreign country. The U.S. government, as directed in the Arms Export Control Act, agrees to procure and furnish the items on a nonprofit basis. The foreign country agrees to pay in advance for all goods and services provided by the U.S. government (Samelson, 1990:16-1). A case is documented on a DD Form 1513, United States Department of Defense Letter of Offer and Acceptance (Samelson, 1990:10-2).

The two basic types of cases are systems and support cases.

Systems Case. A systems case is established to initially purchase a weapons system plus all the major support equipment, technical data, and services required to maintain operational capability for an initial period of time (Foreign Military, 1990:45). A purchase of a major modification or upgrade is also considered a systems case.

FMS case management begins with the systems sales case, sometimes called the systems or the activation case.

Systems cases are defined orders. The items or services are specified and quantified by the purchaser in the Letter of Request. A complete price and availability study is normally required for each separately deliverable line item and is subsequently stated explicitly on the Letter of Offer and Acceptance (Samelson, 1990:9-3).

Under the total package approach, the systems case includes not only the weapons system but also the support items, training, and services required to introduce and sustain the operation of major weapons systems such as the F-16 for an initial period of time (Foreign Military, 1990:47).

Systems cases for the sale of F-16 aircraft are managed by the F-16 SPO which is located at Wright Patterson AFB. Even though the F-16 SPO has overall responsibility for the systems case, the acquisition of common spares and support items included in the systems case is managed by the International Logistics Center (ILC) located at Wright-Patterson AFB. The acquisition of spares and support items unique to the F-16 weapons system and specified in the systems case is managed by the F-16 SPO.

Support Cases. Support cases are FMS cases established to provide foreign governments with continuing support of a weapons system. Continuing support cases, sometimes called

follow-on support cases, are managed by the ILC. The ILC is the Air Force Logistics Command's (AFLC) focal point for FMS programs, and is responsible for developing logistics requirements and taskings, and for providing defense articles and services to support the FMS, MAP and IMET programs. The ILC negotiates and implements about 1000 new contracts per year (International Logistics, 1986:1).

Follow-on logistics support is designed to maintain the weapons system in an operable condition after delivery to the foreign country. It does not make much sense to produce a superb weapons system and then turn a cold shoulder to its support needs (Plane Parts, 1991:IV-2). Follow-on logistics support must consider areas such as technical orders, training, support equipment, modifications, and configuration control (Marr, 1987:16-14).

Support cases are typically either blanket order agreements or Cooperative Logistics Supply Support Arrangements.

Blanket Order. A blanket order agreement is an agreement for a specific category of items or services with no definitive listing of items or quantities. The DD Form 1513 LOA specifies a dollar ceiling against which orders may be placed. The agreement also specifies a validity period, typically one year. Blanket Order are also called pull cases, and are normally used to purchase spare parts, reparable, and support equipment (Samelson, 1990:9-8).

Cooperative Logistics Supply Support Agreement (CLSSA).

The DOD considers CLSSAs to be one of the most effective means to provide follow-on support and to allow foreign countries to replenish stocks of spares and repair parts (Samelson, 1990:19-3). CLSSAs are the primary method used to provide follow-on spares support to foreign customers. In January 1991, the Air Force had CLSSAs with 48 foreign countries (SAMIS, 1991) as shown in Table 2.

TABLE 2  
List of CLSSAs

---

|                    |             |
|--------------------|-------------|
| Argentina          | Australia   |
| Bahrain            | Belgium     |
| Brazil             | Canada      |
| Colombia           | Denmark     |
| Dominican Republic | Ecuador     |
| Egypt              | El Salvador |
| France             | Germany     |
| Greece             | Greek HAI   |
| Guatemala          | Honduras    |
| Indonesia          | Israel      |
| Japan              | Jordan      |
| Kenya              | Korea       |
| Malaysia           | Mexico      |
| Morocco            | NATO        |
| The Netherlands    | New Zealand |
| North Yemen        | Norway      |
| Oman               | Pakistan    |
| Peru               | Phillipines |
| Saudi Arabia       | Singapore   |
| Somalia            | Spain       |
| Taiwan             | Thailand    |
| Tunisia            | Turkey      |
| United Kingdom     | Uruguay     |
| Venezuela          | Zaire       |

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Source: Security Assistance Management Information System

The basic philosophy of the Cooperative Logistics Supply Support Arrangement is couched in the word "Cooperative." The CLSSA is an FMS agreement between the U.S. and a foreign government for the furnishing of items from the U.S. logistics system to the foreign country. The initial action requires the country to make a capital investment in the DOD logistics system. The investment is used by the U.S. to acquire more stocks in anticipation of the foreign country's future demands. The investment allows the U.S. and the foreign country to pool common resources (Farnell, 1988:69).

Under a CLSSA, the DOD purchases, stores, manages, and issues spare parts to the foreign customer using the DOD logistics system. The intent of CLSSA is to provide the customer peacetime, follow-on support similar to that given to the U.S. forces having the same priority. The CLSSA is not designed to support any surge requirements related to any wartime activity of the foreign country (Farnell, 1988-70).

Some of the advantages of a CLSSA to the U.S. and foreign governments are:

- Reduced unit costs through higher volume procurement;
- Increased equipment standardization; and,
- Reduced order ship time (Marr, 1987:16-31).



CLSSA support is obtained through FMS Letters of Offer and Acceptance (LOA), referred to as Foreign Military Sales Orders (FMSOs), FMSO I and FMSO II (Farnell, 1988:71).

FMSO I. The FMSO I case defines the value of stocks to be maintained in the DOD inventory for the country. The FMSO I represents the dollar amount which will be used by DOD to increase its own stocks (Marr, 1987:1633). The FMSO I case is more a financial document than a logistics document since the customer gets no property with the FMSO I (Farnell 1988:71). At the beginning of 1990, the Air Force had 56 stock level cases valued at \$1 billion (USAF Audit Agency, 1990:1).

FMSO II. The FMSO II case actualizes the supply arrangement. The FMSO II works generally the same as the Blanket Order Agreement in that the customer does the requisitioning. However, the difference is that a CLSSA requisition will be honored when stocks are below the reorder point whereas a requisition from a Blanket Order Agreement will be backordered when stocks are below the reorder point. FMSO II agreements are renegotiated annually (Farnell, 1988:71). In January 1990, the Air Force was managing 540 FMSO II cases valued at \$6 billion (USAF Audit Agency, 1990:2).

#### Logistics Support

Logistics support requirements for U.S. Air Force-owned weapons systems are determined during the weapons systems

acquisition process. Integrated Logistics Support (ILS) is part of the acquisition process. ILS insures support considerations are integrated into systems and equipment design, and provides a disciplined approach to acquire support for the acquisition. An Integrated Logistics Support Plan is required for all weapons system acquisition programs and is intended to be a general guide for logistics planners.

Logistics Support Analysis (LSA) is the data and information source for the ILS process. LSA provides a uniform approach to activities necessary to manage and integrate the development, delivery, and life cycle support of logistics resources. The LSA effort results in a data base of LSA records which identify the U.S. support requirements for the weapons system (Youther, 1987:2-10, 3-16). For example, the U.S. Air Force uses the LSA process to determine the range and depth (quantity) of spare and support items required to sustain the weapons system. These decisions are made when the U.S. Air Force initially brings a weapons system into its inventory (Foreign Military, 1991:25).

The process of acquiring initial spares and support equipment is referred to as provisioning. Budget considerations must be reconciled with technical factors such as reliability, level of repair, and ease of maintenance, or maintainability (Samelson, 1990:18-2,3).

Provisioning determinations are made early in the acquisition program to permit timely receipt of necessary spares and support equipment (Samelson, 1990:18-3).

It is inefficient, or even unreasonable, to assume provisioning decisions based on U.S. needs and support infrastructure will apply to foreign countries. For example, a customer may find it more economical to send an item back to the U.S. for repair rather than develop an in-country repair facility. In such cases the customer must purchase inventory sufficient to cover the time required to send the item back to the U.S., complete repair, and be returned to the customer. U.S. repair of foreign-owned assets is a common practice. The customer must pay the actual cost of repair incurred by the U.S. for repair of the asset (Samelson, 1990:18-3,4).

FMS customer support requirements are based on both the customer and the USAF support infrastructure. The process of adapting U.S. provisioning information to the individual foreign customer's unique situation is called definitization (Samelson, 1990:18-4,5).

Even though the FMS customers use the same logistics systems as the U.S. Air Force, the support infrastructures used by foreign countries are often quite different. Indonesia, for example, owns only 12 F-16 aircraft and could not possibly justify the same support infrastructure as the U.S. Air Force.

Maintenance Concept. One of the most important logistics support determinations is the maintenance concept. The maintenance concept determines the maintenance infrastructure--who performs what maintenance actions, when, how often, etc. The maintenance infrastructure is often described in terms of levels. For example, the U.S. Air Force maintenance infrastructure for F-16s consists of three levels of maintenance: organizational, intermediate, and depot.

Organizational-Level Maintenance. This is the most basic level of maintenance. Organization level maintenance normally consists of inspecting, servicing, lubricating, adjusting, and the replacing of parts, minor assemblies, and subassemblies (Joint Chiefs, 1984:192).

Intermediate-Level Maintenance. Intermediate-Level Maintenance is the next higher level maintenance activity and is done by designated maintenance activities in direct support of organization level activities. Its phases usually consist of calibration, repair, or replacement of damaged or unserviceable parts, components, or assemblies. This level also may include the emergency manufacture of nonavailable parts, and of providing technical assistance to using organizations (Joint Chiefs, 1984:266).

Depot Level Maintenance. Depot Level Maintenance is performed by designated maintenance activities to augment stocks of serviceable material, and to support

organizational and intermediate level maintenance activities. Depot Level maintenance consists of complex maintenance, repair and modification work that requires special skills, tools, equipment and facilities (Foreign Military, 1990:14).

#### Logistics Support of FMS

The U.S. Air Force does not have separate logistics systems to support FMS customers (Samelson, 1990:17-9). The logistics systems which provide initial and follow-on support to the U.S. Air Force are used to support FMS customers.

Initial Support. Initial support items and services are required for the successful operation of the system until follow-on support is available (Samelson, 1990:18-1). In most cases, the Air Force Logistics Command (AFLC) is assigned the responsibility for supplying initial spares. The goal is to plan arrival of initial spares to coincide with in-country delivery of the weapons system.

A 1984 report by the Rand Corporation, entitled Improving Initial Logistics Support To Foreign Military Sales, examined initial spares support for an accelerated sale of F-16 aircraft to Egypt. The report noted the F-16 prime contractor was able to begin delivery of aircraft within approximately two years after the Letter of Offer and Acceptance (LOA) was signed (Smith, 1984:2). Rand further noted,

Using routine planning and procurement procedures, it typically takes AFLC between three and four years to complete delivery of initial spares and support equipment in support of a foreign military sale. The United States could be more responsive to foreign buyers if AFLC could provide initial logistics support within the same two year time span required for delivery of basic flight vehicles. (Smith, 1984:2)

As a result of the study, Rand made five recommendations to improve initial spares support:

(1) Modify certain administrative and funding procedures so that some of the ALC Program Manager's work could be completed while the LOA was being negotiated, instead of waiting for LOA signature;

(2) Provide the ALC Program Manager with an automated system for assembling the parts lists, organizing them for the definitization conference, editing them during the conference, and issuing the subsequent requisitions; and

(3) Provide the ALC Program Manager with the ability to create status reports that would highlight any requisitions that were experiencing manual delays in the procurement phase.

(4) The formal policy for delivery of initial spares should be modified calling for all critical items to be delivered within two years but recognizing that some items might be delayed for a year or so. (Emphasis in the original)

(5) A process should be developed to rank-order the initial spares provided by AFLC in a typical FMS case. (Smith, 1984:46-50)

Update on Rand Study. The ILC, in conjunction with the ALCs, has been working to improve the processes which provide initial support. For example, the ALCs have an automated system for assembling the parts list. The ALCs have also developed a process to rank order spares to identify long lead time items (28 months and over). Also, the Security Assistance Management Information System

(SAMIS) provides the ALCs with a reporting system to highlight problem requisitions (Smith, 1991).

However, even with these improvements problems still exist. For example, in May 1988, the U.S. signed an LOA, Peace Marble III, authorizing the sale of 60 F-16s to Israel. Delivery of Peace Marble III aircraft from General Dynamics is scheduled to begin in 1992. Even with the improvements noted above, late-to-need spares and support equipment have not been eliminated (Johnston, 1991).

The research was unable to find any U.S. Air Force personnel at Ogden ALC, the ILC, or the F-16 SPO cognizant of the Rand report on initial spares.

Follow-on Support. Support problems occur for FMS customers when the U.S. Air Force maintenance concept changes after customer definitization has been completed. A recent example of this problem occurred in the Peace Onyx (Turkey) program (Spires, 1991).

Concept Changes. The Pressure Vessel, stock number 76SR487G01, is a major component of the AN/APG-68 Radar Dual Mode Transmitter, stock number 758R990G01. The Dual Mode Transmitter costs \$307,000 each, of which \$293,000 is the cost for the Pressure Vessel (Spires, 1991).

The Pressure Vessel was originally coded by USAF for replacement at the intermediate level. This meant that failed Dual Mode Transmitters would be disassembled at the intermediate level, and repaired with spare parts at hand--

such as the \$293,000 Pressure Vessel. However, subsequent U.S. Air Force experience proved that intermediate level maintenance was not a feasible approach because of the complex interface between the Dual Mode transmitter and the Pressure Vessel Assembly (Vaughn, 1991).

Therefore, USAF changed the Pressure Vessel to a depot level maintenance. This change meant that any Dual Mode Transmitter that failed would be sent to depot for repair, and that spare Dual Mode Transmitters--not spare Pressure Vessels--would be stocked at the Intermediate level. This also meant procedures would not be available to remove a failed Pressure Vessel and replace it with a spare. Unfortunately, the Turkish Air Force had already acquired 14 Pressure Vessel Assemblies at a cost of approximately \$4 million. Since the Pressure Vessels were bought on the recommendation of the U.S. Air Force, the Turkish Air Force applied to have the Pressure Vessels bought back by the U.S. Air Force under the FMS Excess Material Return process (Spires, 1991).

In a March 1991 memorandum to the Turkish Air Force Ministry of National Defense, U.S. Air Force Brigadier General Otto K. Habedank, Commander, International Logistics Center, advised the Turkish government that a buy-back was not feasible and urged the Turkish government to consider the following options in lieu of a buy-back:



1. Work with General Dynamics to develop a procedure to remove a failed Pressure Vessel from the Dual Mode Transmitter;
2. Work with General Dynamics to explore the possibility of using the spare Pressure Vessels in the Turkish production aircraft; or,
3. Build up the Pressure Vessels to the next higher assembly. (Habadank, 1991)

In the meantime, the ILC continued to work the problem with the Ogden ALC, and in July 1991, requested Ogden ALC provide Turkey with the repair procedures used by Greece and Israel for organic repair of the Dual Mode Transmitter. Ogden informed the ILC that repair procedures could be provided to Turkey, but that an organic repair capability would require \$10 million tooling and equipment-- some or all of which may already be owned by Turkey. The ILC is continuing its efforts to secure a better solution for the customer (Spires, 1991).

Configuration Changes. Changes in the configuration of an aircraft after definitization of the initial provisioning requirements also cause support problems and often excess parts for foreign countries. The spare parts acquired on the basis of the old configuration cannot be used and, therefore, represent wasted money (Combs, 1991).

Configuration changes are often the result of engineering design changes. As a result, inventory of long

lead time items is always threatened by design evolution (Smith, 1984:37,38).

Reparable Support. A reparable is an item which can be reconditioned or economically repaired for reuse when it becomes unserviceable (Samelson, 1990:19-7). The FMS reparable program provides foreign countries with a means of obtaining repair services without the necessity of establishing an in-country capability. An in-country repair program can be a long term and, possibly, an uneconomical investment if the number of F-16s purchased by a country is small. A country which has an in-country repair program, Israel for example, may use the FMS reparable program to supplement in-country capability (Samelson, 1990:19-7).

Typically, reparables sent back to the U.S. by foreign countries are depot level repairs, overhauls, or rebuilds beyond the local capability of the foreign country (Samelson, 1990:19-7).

FMS reparables are accomplished through either repair and replace programs or through repair and return programs.

Repair and Replace. This is the process used by the U.S. Air Force to support its own repair work. In its simplest form, a broken part is turned in for repair, and a replacement part is issued from inventory. The broken part then enters the repair cycle.

For foreign customers, the repair and replace program applies to customers with eligible CLSSAs, or Blanket Order

cases. The broken part is sent to the U.S. where a serviceable part is pulled from inventory. The customer does not have to wait until the normal repair cycle is complete in order to obtain a replacement part. The customer exchanges a broken part for a part from the U.S. government inventory. Customer CLSSAs must specify which parts are covered. The money is used to purchase parts to supplement U.S. Air Force inventory.

Of course the customer must pay the repair costs for the broken part. In CLSSA cases, the cost of repair is estimated with a final adjustment later when repair is complete and the actual cost is known (Foreign Military, 1991:41). For non-CLSSA cases, the country is charged the replacement cost of the item issued from U.S. stocks (Samelson, 1990:19-8).

The Security Assistance Management Information System (SAMIS) maintains statistics on the fill rates for repair and replace requisitions. In 1990, 77 percent of the repair and replace requisitions for CLSSA programmed items were filled within 180 days; 47 percent were filled within 30 days (SAMIS, 1991), transport time not included.

Repair and replace parts carcasses go into the repair cycle, and a replacement part is issued out of the spares pool. The parts are not tracked by original owner nor by serial number. The existing spares inventory is expected to be sufficient to accommodate demand.

However, when demand for a part exceeds the supply, spares are issued based on the Uniform Material Movement and Issue Priority System (UMMIPS) (Jeffs, 1991). UMMIPS is a DOD-established priority system used to establish the relative importance of competing requisitions. This is accomplished through the use of a two digit priority designator which is based on the mission of the requisitioning activity and the urgency of need (Samelson, 1990:17-5).

An FMS customer, who sends a part to the U.S. depot for repair, would lose that part if demand exceeds supply and other requisitions arrive with higher priority. For example, a U.S. Air Force requisition for the part would be filled with the foreign customer's part if no other parts were available. The problem is aggravated by reduced defense budgets which force reductions in the number of spare parts (Jeffs, 1991).

From the customer's point of view, the priority system enables the U.S. Air Force to usurp foreign assets to satisfy U.S. needs. From the U.S. point of view, the logistics system is simply identifying the highest priority requirement, and allocating spares accordingly (Jeffs, 1991).

Another concern FMS customers have is the perception that U.S. assets are more heavily used than their own assets. For example, customers note that foreign F-16s fly

less hours than U.S. Air Force F-16s. Therefore, a customer does not want to give up an engine with only 100 flying hours recorded and receive in return an engine that has 2000 flying hours recorded. Similarly, a foreign customer does not want to give up an engine which was just delivered, and get back an engine produced in 1978 (Jeffs, 1991).

Repair and Return. Repair and return programs allow eligible foreign countries to return unserviceable reparable items to the U.S. for repair. The serial number of the part is recorded so that upon completion of repairs, the original part is returned to the country. The country is billed for the cost of repair (Foreign Military, 1991:41).

Unsatisfactory response time is the major problem found with the repair and return process. It is common for items returned for nonorganic (contractor) repair to take a year or more before being repaired and returned to the country. Lengthy repair cycles mean FMS customers must purchase additional spare parts to compensate (International Logistics, 1991). In a memo to the attendees of the 1991 Repair and Return Problem Smashing Conference, U.S. Air Force Brigadier General Otto Habedink, Commander, International Logistics Center, stated the timely repair and return of customer assets is "one of the most persistent and important problems facing the Foreign Military Sales establishment" (Habedink, 1991A).

The extent of the repair and return problem is illustrated by the results of a recent audit by General Dynamics, Fort Worth. The audit, in May 1991, reviewed each reparable item stored in a holding area. Reparable items are put in the holding area if some problem is found with the repair action, and must stay there until the problem is resolved. The objective of the audit was to determine how long each item had been in the holding area, and also to identify the reason the part was held back (Ferris, 1991).

The audit was limited to F-16 repair actions for two countries, Egypt and Israel. Egypt had 199 reparable items in the holding area. Israel had 88 items in the holding area (Ferris, 1991).

For Egypt, the audit found 21 (11%) parts had been in the holding area for 400-500 days, and 151 (76%) parts had been in the holding area for more than 50 days. For Israel, the audit found 62 (74%) parts had been in the holding area for more than 50 days (Ferris, 1991).

For both countries, the major cause of parts remaining in the holding area (88% for Egypt, and 94% for Israel) was lack of repair authorization from the U.S. Air Force--in this case a purchase request and delivery order from the F-16 production manager at Ogden ALC.

The audit found Ogden production managers were not always notified by the foreign country that a part had been shipped to General Dynamics for repair. Therefore, repair

of the part had to wait until the ALC production manager was contacted by General Dynamics. Even then, repairs could not begin until the Ogden ALC production manager provided contractual repair authorization to General Dynamics. An additional delay occurred if the part was not listed on the original repair contract. This meant a contract modification had to be accomplished prior to any contractual repair authorization (Thomas, 1991).

In October 1990, the Ogden Air Logistics Center (OO-ALC) formed a process action team (PAT) to study the repair and return process. The PAT studied the time required by OO-ALC to prepare a repair contractual authorization--purchase request and delivery order. The PAT charter is to look at all aspects of the repair and return process, and identify impairments and areas of opportunity (Jeffs, 1991).

The team found OO-ALC required 49 days process time for a purchase request and 25 days process time for a delivery order--a total of 74 days to prepare the contractual authorization. Ultimately, the PAT was able to cut process time for purchase requests from 49 days to 21 days, and cut process time for delivery orders from 25 days to 5 days--a total of 26 days to prepare the contractual authorization (Jeffs, 1991).

The U.S. Air Force does not have a standard system to track the repair cycle for repair and return assets and, therefore, statistics for the length of the repair return

cycle are not readily available. An ILC PAT is currently studying the problem of tracking repair and return assets.

Historically, repairs have had to take a back seat to production at General Dynamics. The combination of decreasing FMS sales and increasing FMS repairs has convinced General Dynamics to take a new look at repairs, especially as a source of revenue and jobs. For example, General Dynamics increased the floor space allocated to repairs, and purchased computer equipment to improve the management of repairs (Ferris, 1991).

#### Chapter Summary

This chapter discussed the logistics support system used by foreign countries who purchase weapons systems from the United States. The system is extremely complex, and can be the source of considerable irritation to customers trying to buy spare parts, or have a broken part fixed. Progress has been made by efforts such as the PATs at Ogden and the ILC, but much more work must be done to improve U.S. Air Force responsiveness to its customers.



## V. Conclusions and Recommendations

### Introduction

This chapter provides concluding remarks. The objective of this research was to evaluate the logistics support provided by the U.S. Air Force to its FMS customers, and to identify major logistics support problems. The research consisted of an extensive literature review along with personal interviews.

The thesis began with a history of FMS, and a discussion of the types of FMS and security assistance programs which evolved over the past 50 years. The economic influence of FMS was next reviewed. The declining U.S. defense budget has increased the importance of FMS programs for the U.S. defense industry, and its workers. The offset and coproduction demands of purchasers was also discussed. The demand for offsets has caused considerable controversy in the U.S. where offset critics argue the U.S. is giving away its lead in technology and manufacturing.

Chapter III of the thesis traced the history of the F-16 fighter aircraft. The discussion began with the development of jet engines, and traced the experiences of the Korean and Vietnam Wars which influenced the development of fighter aircraft. The U.S. Air Force struggle for a lightweight fighter aircraft preceded a description of the selection and acquisition of the F-16 fighter aircraft. The importance of the F-16 program must not be overlooked not

only because of the size of the program, but also because of the program's influence on issues such as coproduction, codevelopment, and offsets. The chapter concluded with a brief look at each of the countries which has purchased F-16s.

Chapter IV looked at the logistics support the U.S. Air Force provides to its FMS customers. The chapter began with a review of the types of FMS cases, and a discussion of logistics support cases such as CLSSAs. The impact of the U.S. logistics systems and policies was examined in terms of initial support, provisioning, and definitization. The chapter concluded with a discussion of the effectiveness of U.S. follow-on support.

### Conclusions

The U.S. has been the world's unquestioned leader in military and economic issues since the end of World War II. That leadership however is not a foregone conclusion for the next 50 years. Pacific Rim countries such as Japan and Korea have strong, growing economies. The U.S. lead in the auto industry has diminished because of strong foreign competition, and there are no guarantees for continued U.S. leadership in military technology. It has become increasingly important for the U.S. to look on foreign countries as valued customers and friends rather than only as allies dependent on the U.S. for a handout.

Logistics support is a major contributor to customer satisfaction. Even though the F-16 aircraft represents leading edge technology, customer concerns over U.S. ability to provide timely logistic support diminishes U.S. prestige.

U.S. support policy often changes without prior consideration of the impact on foreign customers. An example of this occurred when the Turkish Air Force purchased Pressure Vessel Assemblies for the Dual Mode transmitter (Vaughn, 1991) for intermediate level maintenance action. The U.S. Air Force support posture changed this from intermediate to depot level without consideration of the impact on the Turkish Air Force, thereby costing the Turkish Air Force a large sum of money.

U.S. logistics policy on spares allows the U.S. to usurp a part returned by a foreign customer to a U.S. depot for repair (Jeffs, 1991). The foreign country loses the part originally sent in without any assurance of a replacement in the near future. This can cause foreign countries to lose faith in U.S. integrity--both as an ally, and as a business partner.

Foreign customers often rely on repair and return support agreements to avoid the problem of losing parts sent in to the U.S. Air Force for repair. Slow turnaround time is often common for items sent in for repair and return. Nonorganic (contractor) repair average turnaround time is a year (International Logistics, 1991). Thus the customer is

forced to bear the costs of purchasing additional spare parts to counteract the effects of the lengthy repair cycle.

Timely, efficient logistics support of FMS customers possessing F-16 aircraft does not appear to be a principal concern of the USAF logistics system. Complexity of processes, untimely responses, and failure to consider customer needs are common failings on the part of the USAF.

### Recommendations

The U.S. Air Force must improve the logistics support system. Because the logistics support system is extremely lengthy and complex, decisions to change the system, or parts of it, have been made without a complete understanding of the impacts, especially to foreign customers. However, this is changing. Process Action Teams (PATs) are part of a growing Total Quality Management movement within the Air Force. The Ogden ALC was responsible for a 48 day reduction in the time required to process a contractual authorization by eliminating steps which add little or no value. Knowledge of the process is a first step toward improving it.

The U.S. Air Force must provide customers assurances of reasonable turnaround times. Turnaround times of 1 year or more must not be acceptable at any time.

Finally, the U.S. Air Force priority system for spare parts must recognize foreign ownership rights. The U.S. must not be allowed to usurp foreign assets simply to solve a U.S. problem.

## Bibliography

- Air Force Audit Agency. Cooperative Logistics Supply Support Arrangements (CLSSA)--Contract Administrative Services Surcharge. Project 0296214, Directorate of Acquisition and Logistics Audits, Wright-Patterson AFB OH, 30 August 1990.
- Alexander, Major Kelly, Program Manager, Denmark. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 16 May, 1991.
- "Arms for Sale," Newsweek, 24-28, 8 April 1991.
- Arroyo, Capt Samuel A. Contracting and Purchasing Management in the International Marketplace. MS Thesis, AFIT/GCM/LSY/89S-1. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1989 (AD-A216 356).
- Badami, Capt Ben, Program Manager, Belgium. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, September, 1990.
- Bajusz, William D. and David J. Louscher. Arms Sales and The U.S. Economy, The Impact of Restricting Military Exports. Boulder CO: Westview Press Inc., 1988.
- Bolstering Defense Industrial Competitiveness. Report to the Secretary of Defense by the Under Secretary of Defense (Acquisition). Washington DC: Government Printing Office, July 1988.
- Borg, Walter R. and Meredith D. Gall. Educational Research: An Introduction (Second Edition). New York: David McKay Company, 1971.
- Branam, Jean, Program Manager, The Netherlands. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 29 Jan, 1991.
- Brandt, Craig M. and G. A. Bleakley. "International Armaments Codevelopment: Nunn Amendment Spurs Interest in Collaboration on Weapons Development," The DISAM Journal of International Security Assistance Management, 11: 105-112 (Spring, 1989).

Brown, Lt General Charles W. "Military Assistance Requirements for FY 1990," The DISAM Journal of International Security Assistance Management, 11: 47-55 (Winter, 1989B).

Brown, Lt General Charles W. "Recent Trends and Current Objectives in Security Assistance," The DISAM Journal of International Security Assistance Management, 10: 41-44 (Winter, 1989A).

Collender, Stanley E. The Guide To The Federal Budget FISCAL 1992 (Tenth Edition). Washington DC: The Urban Institute Press, 1991.

Combs, Capt Nancy. Telephone Interview. OO-ALC/LAIL, Hill AFB UT, June 19, 1991.

Congressional Presentation for Security Assistance Programs, FY 91. Department of State, Washington DC: Government Printing Office, 1991.

Connors, Major Gary, Program Manager, Turkey. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 1 May, 1991.

Davis, Donna. "General talks about 'changes'," SKYWRITER: 1,6 (12 July 1991).

"Defense Policy Advisory Committee on Trade: 1989 Year End Review," The DISAM Journal of International Security Assistance Management, 12: 81-99 (Summer, 1990).

Dent, Program Manager, Portugal. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 7 Jan, 1991.

Department of Air Force. Weapon System Program Management, AFR 400-3. Washington DC: HQ USAF/LEYM, 1 June 1989.

Department of Defense. DODD 5132.3, DOD Policy and Responsibilities Relating to Security Assistance, DODD 5132.3, 1 October 1988.

Dorfer, Ingemar. Arms Deal The Selling of the F-16. Westport CT: Praeger Publishers, 1983.

Drendel, Lou. F-16 Fighting Falcon In Action. Carrollton TX: Squadron/Signal Publications, 1982.

Emory, William C. Business Research Methods (Third Edition). Harwood IL: Richard D. Irwin, Inc., 1985.

"F-16 Aircraft Sales to Greece: A Case Study of Offsets," The DISAM Journal of International Security Assistance Management 11: 73-83 (Spring, 1990).

Farnell, George M. "CLSSA: One of the Most Effective Means," The DISAM Journal of International Security Assistance Management 10: 69-73 (Winter, 1988).

Farr, C. Michael and William A. Fischer. "Managing International High-technology Cooperative Products," CMGT 523 Contracting & Acquisition Management. Wright-Patterson AFB OH, June 1990.

Ferris, Bill, Repair Management Chief, General Dynamics, Fort Worth TX. 18 July, 1991.

"Fight Over Fighters?" The Economist, 302: 72 (17 March 1987).

Foreign Military Sales Glossary of Terms. Prepared by AFLC ILC/XMXB. Wright-Patterson AFB OH, April 1990.

Foster, Kevin, Program Manager, Indonesia. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 4 May, 1990.

Foster, Kevin, Program Manager, Singapore. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 8 Mar, 1991A.

Foster, Kevin, Program Manager, Thailand. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 18 Jan, 1991B.

Gansler, Jacques S. The Defense Industry. Cambridge MA: MIT Press, 1980.

General Accounting Office. Industrial Base: Defense Critical Industries. GAO/NSIAD-88-192BR. Washington DC: Government Printing Office, August 1988.

General Dynamics 1990 Shareholder Report. Fort Worth TX: 1990.

Habedank, Otto K., Brigadier General, USAF, Commander, International Logistics Center. Memorandum to the Turkish Air Force Ministry of National Defense, Attn: Major General Remzi Utkon. Wright-Patterson AFB OH, 27 March, 1991.

- Habedank, Otto K., Brigadier General, USAF, Commander, International Logistics Center. Memorandum to the Conference Attendees, FMS Repair and Return Problem Smashing Conference. Wright-Patterson AFB OH, 11 July, 1991A.
- Hallion, Dr. Richard P. "A Troubling Past, Air Force Fighter Acquisition Since 1945," Airpower Journal 4: 2-22 (Winter, 1990).
- Hayes, Thomas C. "For F-16 Assembly Workers, Extended Life for the Line," New York Times: D-4 (29 March 1991).
- Hocking, Maj Steve, Program Manager, Bahrain. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 4 May, 1990.
- Hofemanns, Capt Paul, and Mr Fred MacLeod, Program Managers, Egypt. Unpublished Point Paper, ASD/YPXI, Wright-Patterson AFB OH, June, 1990.
- Hudson, Nancy, Chief of Policy and Analysis Branch. Personal Interview, ILC/XMXB, Wright-Patterson AFB OH, 18 July, 1991.
- International Logistics Center. Repair and Return Improvement Program, Brochure for Problem Smashing Conference, 16-18 July 1991.
- Jeffs, Bruce. Telephone Interview. OO-ALC/LAMRBD, Hill AFB UT, June 19, 1991.
- Johnston, Capt Gary, Program Manager, Peace Marble. Unpublished Point Paper. ASD/YPXI, Wright-Patterson AFB OH, June 13, 1991.
- Joint Chiefs of Staff. Dictionary of Military and Associated Terms, Washington DC: Government Printing Office, JCS Pub. 1, 1 April 1984.
- Kelly, Joseph E. "U.S. Korea Fighter Coproduction Program," The DISAM Journal of International Security Assistance Management 12: 35-41 (Summer, 1990).
- Klare, Michael T. American Arms Supermarket. Austin TX: University of Texas Press, 1984.
- Lang, Gerhard and George D. Heiss. A Practical Guide To Research Methods (Third Edition). Lanham MD: University Press of America, 1984.



- Manelos, Dr. Spiros and Dr. Lewis C. Samelson. "The United States International Military Education and Training Program: A Report To Congress," The DISAM Journal of International Security Assistance Management, 11: 12:20 (Spring, 1990)
- Marr, Francis C., et al. Guide for the Management of Multinational Programs, 7 January 1986 - 5 November 1987 (Second Edition). Contract MDA 903-86-C-0099. Fort Belvoir VA: Defense Systems Management College, May 1987 (AD-A1911433).
- Mohmamed, Afailal, Lt Col, Royal Morrocan Air Force. Foreign Military Sales: The Buyer's View or the "Fait Accompli". Research report for the Air War College, March 1986.
- Office of Management and Budget. Offsets in Military Exports. Fourth annual report to Section 309 of the Defense Production Act (50 U.S.C. 2099). Washington DC: Office of Management and Budget, December 1988.
- Pearlstein, Steven. "South Korea In Switch, Picks F-16," Washington Post: F-1 (29 March 1991).
- "Peking hits the sale of arms to Taiwan," Washington Times: 8-C (13 August 1986).
- Peppers, Ruth, Program Manager, Greece. Unpublished Point Paper, ASD/YPXB, Wright-Patterson AFB OH, April, 1991.
- Pierre, Andrew J. The Global Politics of Arms Transfers. Princeton University Press, 1982.
- "Plane parts shortage misrepresented," Chicago Tribune: IV-2 (9 December 1991).
- Ponti, Capt Mark, Program Manager, Korea. Unpublished Point Paper, ASD/YPXI, Wright-Patterson AFB OH, April, 1991.
- Prestowitz, Clyde V. "Giving Japan A Handout," Washington Post, 112: D-1, D4 (29 January 1989).
- Richardson, Doug. Classic Warplanes, General Dynamics F-16 Fighting Falcon. New York: W. H. Smith, 1990.
- Roos, John G. "U.S. Defense Contracting Changes Prompting International Teaming," Armed Forces Journal International, 32 (January, 1989).

- Rowen, Henry S. "U.S. Military Assistance in the 90's," The DISAM Journal of International Security Assistance Management, 12: 19-21 (Summer, 1990-91).
- Samelson, Louis J. The Management of Security Assistance. Defense Institute of Security Assistance Management. Wright-Patterson AFB OH, April 1990.
- Sanders, Ralph. "Arms industries: New Suppliers and Regional Security [National Security Implications]," The DISAM Journal of International Security Assistance Management, 13: 97-108 (Winter, 1990-91).
- Security Assistance Managment Manual. DOD 5105.38-M. Washington DC: DSAA, 1 October 1988.
- Skrodzki, Capt Miro, Program Manager, Norway. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 13 May, 1991.
- Smith, G., N. Y. Moore, and R. L. Petruschell. Improving Initial Logistics Support To Foreign Military Sales. Contract F49620-82-C-0018. Rand Corporation, Santa Monica CA, Sept 1984 (ADA-156-684).
- Smith, Myron. Telephone Interview. OO-ALC/LAIL, Hill AFB UT, June 19, 1991.
- Spires, Beverly. Telephone Interviews. HQ AFLC ILC/ECET, Wright-Patterson AFB OH, June 19, 1991 and August 8, 1991.
- "Theme Of The Quarter," The DISAM Journal of International Security Assistance, 4: 1-24 (Fall, 1981).
- Thomas, Major J. D., A. Moore, T. Kravos. "A Snapshot Look At Items At General Dynamics Awaiting Repair and Return." Briefing presented at the Repair and Return Improvement Program Problem Smashing Conference at the International Logistics Center. Wright-Patterson AFB OH, July 16-18, 1991.
- Trice, Robert H. "International Cooperation in Military Aircraft Programs." Paper presented at a European Arms Collaboration Workshop at Harvard University. Cambridge MA, 8 November 1989.

Turner, Derek. "Government Support of Defense Sales: Can More Be Done?" The DISAM Journal of International Security Assistance Management, 8: 96-100 (Summer, 1986).

"U.S. and Japan Settle Differences on FSX," Defense News: 3 (1 May 1989).

Vaughn, Roselinde. Memorandum to HQ AFLC ILC/ECET. OO-ALC/LAIM, Hill AFB UT, June 31, 1991.

Wade, Dr. James P. Jr. "Why DOD Procurement Dollars Are Being Spent Oversea," The DISAM Journal of International Security Assistance Management, 8: 63-69 Summer, 1986).

"Warner Robins Air Logistics Center," The DISAM Journal of International Security Assistance Management, 11: 1-13 (Winter, 1990).

Whitehouse, Arch. The Military Airplane, Its History and Development. Garden City, NY: Doubleday, 1971.

Wood, Capt George, Program Manager, Pakistan. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 13 May, 1991.

Wood, Capt George, Program Manager, Venezuela. Unpublished Point Paper, ASD/YPXC, Wright-Patterson AFB OH, 7 May, 1990.

### Vita

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