
International Cooperation in Military Aircraft Programs

By

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Abstract

General Dynamics Fort Worth has utilized several international cooperative arrangements in its F-16 military aircraft program. The initial cooperative program with the European participants provided General Dynamics the opportunity to expand the F-16 sales base, which increased the company's ability to accommodate unique customer requirements. The success of these efforts has created further incentives for foreign partners to support the program through follow-on buys, providing additional economic benefits and enhanced security. This paper outlines the evolution of cooperation in the F-16 program, from direct and indirect offset, to the establishment of a joint venture and on to licensed production and codevelopment with a foreign partner. This evolution is a result of changes in customer capabilities, the business environment, and programmatic realities.

Introduction

Since production of the F-16 Fighting Falcon began in 1978, General Dynamics Fort Worth Division has delivered 2454 aircraft to the U.S. Air Force, the U.S. Navy, and 15 nations around the world. Few of these international sales have been "off-the-shelf." International cooperative ventures have played a vital role in the production of these advanced aircraft, with 87 percent of foreign customers involved in some form of industrial participation as coproducers, suppliers, or indirect offset partners. The success of the F-16 program can be attributed not only to superior aircraft design and continual enhancements, but also to the innovative international business arrangements that have been developed to meet customer requirements in a highly competitive marketplace. Before discussing General Dynamics' international ventures in more detail, we will review the definitions that will be used throughout this discussion.

Offset

Offset is 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. The following are types of offset programs.

- *Direct Offset.* Any reciprocal business activity that relates specifically to the products or services sold to a foreign country. The most common form of direct offset is coproduction.

- *Coproduction*: Overseas production based on a government-to-government or 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. This can involve final assembly or more complex arrangements where components produced internationally are utilized in U.S. or foreign production.

- *Indirect Offset*: Any business activity that does not relate to the products or services sold. For example, in aircraft sales, the seller has purchased consumer items from the customer country for export and resale, invested in hotels or other businesses, and established unrelated manufacturing capability in the customer country.

General Dynamics' international cooperative ventures frequently involve a combination of offset arrangements. General Dynamics has established or is pursuing both uniquely innovative and conventional international agreements, including:

- European Participating Governments (EPG) program
- Joint venture with Government of Turkey
- Greek Indirect Offset program
- Japan FS-X program.

The European Participating Governments (EPG) Program

Specific circumstances existed during the development of the EPG program that provided for its success. Several nations identified a clear requirement for a new fighter aircraft. At the same time, there was also a push for standardization within NATO that provided an incentive for a common aircraft among these air forces. In addition, the United States expressed an interest in a low-cost fighter as a complement to the F-15 and intended to purchase a significant number. Thus, a definite requirement for a minimum number of aircraft was established among several nations that was sufficient to support the coproduction program.

Shortly after the U.S. Government selected the F-16 as the USAF's lightweight fighter aircraft in 1975, the European Participating Governments—Belgium, Denmark, the Netherlands, and Norway—reached a consensus to purchase the new American fighter. The four EPG countries signed a Memorandum of Understanding (MOU) with the U.S. Government in June 1975 that outlined the conditions of sale as well as an extensive F-16 coproduction program to be implemented in the four EPG countries and the United States. In addition to the benefits of enhanced national security and NATO interoperability, the EPG countries have seen a return of approximately \$7 billion (then-year dollars) to their respective economies since the program began. This agreement was a conceptual and political breakthrough in international cooperation in the defense arena and established perhaps the largest guaranteed business base ever for a modern aircraft program.

The principal conditions of this landmark cooperative venture, as outlined in the MOU, are as follows:

- The USAF would purchase a total of 650 F-16s, and the European governments would buy a total of 348 (these numbers exclude follow-on buys).
- The European countries would have access to F-16 advanced technology, with some exceptions.

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- Three assembly lines would be in operation—General Dynamics Fort Worth, Fokker in the Netherlands, and SABCA and SONACA in Belgium. All three lines would use parts and subassemblies produced on both sides of the Atlantic.
 - European industry would participate in the manufacture of the aircraft in the following percentage of value:
 - 10 percent of all F-16s bought by the USAF.
 - 40 percent of all F-16s for the European Air Forces.
 - 15 percent of all F-16s sold to non-consortium countries.
 - The consortium established a mechanism to fix the exchange rates of the participant's currencies at the rates prevailing in October 1974. European contractors would not realize gains or bear losses due to currency exchange fluctuations. The European companies were paid in their national currencies. The United States provided American currency for the 650-aircraft program. This mechanism was dismantled on completion of the initial 998-aircraft program.

The contractual arrangements for the 998-aircraft program placed enormous responsibility upon General Dynamics and its Brussels program office. Basically, EPG countries contracted with the U.S. Government to buy an initial quantity of 348 aircraft. The U.S. Government added this total to its own requirement for 650 aircraft, and placed a prime contract with General Dynamics for a grand total of 998 fighters. The ultimate responsibility for delivery of aircraft fell solely to General Dynamics. In turn, General Dynamics shared the production responsibilities by placing production contracts with firms in Europe and the United States. European governments did not place a single contract with participating companies, and the U.S. Government contacted with only one—General Dynamics.

One of the truly daunting challenges of the EPG program was to coordinate the production of parts and subassemblies from both sides of the Atlantic and supply them to three separate production lines with strict adherence to quality and delivery schedules. General Dynamics Fort Worth Division established contracts with U.S. suppliers. The U.S. suppliers established contracts with component suppliers and manufacturers in Europe. The size of the 998-aircraft program was sufficient to warrant the risks the contractors accepted to meet quality, cost, and delivery schedule requirements. The continuing success of the F-16 program has permitted the EPG countries to purchase additional F-16s and retain production lines, employment, and R&D capabilities. Almost 50 percent of all major F-16 airframe components (except the forward fuselage) have been manufactured in Europe.

For American firms, future cooperative arrangements in the European market are likely to involve less direct U.S. company management control, but more U.S. government oversight and requirements, more technology transfer, and greater offset requirements. Governmental commitment to transatlantic collaboration and rationalization appears strong, even though such cooperative efforts in aerospace demand a higher premium than those in other sectors. Accompanying the trend toward increased European competitiveness in the defense sector, U.S. firms should expect in the future to be required to share more product development tasks and management responsibilities with their European partners as a condition of doing business.

Indirect Offset Programs

The success of the EPG program established a solid foundation, which has allowed General Dynamics to pursue other types of cooperative ventures. In response to increasing competition in the global market, General Dynamics has become increasingly flexible in concluding coproduction and other offset agreements.

General Dynamics' approach has been to work with customers to devise a program and set of business arrangements that meet the customers' requirements and match their industries' needs and capabilities. Some of General Dynamics' suppliers, particularly Westinghouse (radar) and Pratt and Whitney and General Electric (engine), have also participated in these cooperative business arrangements.

Indirect offset is often a key element in establishing agreements that are satisfactory to customer governments. This is due to the fact that the finite range of components that can be coproduced and the cumulative effect of offset commitments can result in more direct offset obligations than requirements for the coproduced components. In 1985, General Dynamics established a corporate offset organization to facilitate making, and meeting, indirect offset commitments that are not part of the normal business activities of General Dynamics product divisions. Some examples of indirect offset include:

- *Belgium*, where General Dynamics donated a \$3 million advanced composite lay-up machine for SABCA to become capable of producing composite components and to provide jobs in the economically depressed region of Flanders.
- *Bahrain*, where General Dynamics manages and supports the Bahrain Amiri Air Force Technical Institute (BAASFTI) in which basic English, technical English, math and science, hand tools and test equipment safety, and aviation fundamentals are being taught.
- *Turkey*, where General Dynamics has set up and capitalized a business development investment holding company to assist local companies in generating new exports.
- *Greece*, where General Dynamics has established a business development company for the purpose of making investments in new ventures that will provide substantial benefits to the Greek economy.

Coproducers and Suppliers

In most direct offset programs, foreign companies bidding for subcontracts must be fully cost-competitive with other General Dynamics suppliers. When they are not, foreign governments may elect to pay their companies the difference between what a U.S. contractor is prepared to pay (the fully competitive price) and what it actually takes to perform the task. "Coproduction premiums" are the cost and price penalties associated with foreign coproduction. Foreign producers must also meet quality, schedule, and other requirements. Because coproduced components must meet the same standards wherever they are produced, all prospective manufacturers must be "qualified." This involves testing components and evaluating facilities and procedures. The cost of these tests and evaluations must be considered in determining cost-competitiveness.

General Dynamics is increasingly looking to countries like Egypt and Pakistan for the supply of competitively priced F-16 parts and components. For example, in Egypt General Dynamics is working to establish a long-term supplier relationship with the Arab Organization of Industrialization (AOI). AOI factories have successfully competed with other F-16 suppliers for the production of quality and price-competitive parts and components. Initial orders were placed in mid-1989 for production deliveries beginning in early 1990. These agreements between AOI and General Dynamics have assisted Egyptian industry in attaining compliance with USAF quality standards and specifications.

An additional coproduction program involves the production of F-16 alternate mission equipment (e.g., fuel tanks, batteries) by a depot facility of the Turkish Air Force (TAF). This

program is unique because the General Dynamics contract is with the TAF for work at its repair and maintenance center in Kayseri, Turkey, rather than with private industry.

Another form of industrial assistance has been the establishment of repair and overhaul facilities to help customer countries become more self-sufficient. For many EPG companies, this has brought the added benefit of being able to contract with other F-16 users (especially the USAF) for repair and overhaul business.

As General Dynamics has learned in many of its foreign markets, to be competitive U.S. defense firms must satisfy not only their own business objectives, but also the customer country's national industrial and economic objectives.

Turkey Joint Venture

In late 1983, the Government of Turkey announced its decision to purchase 160 F-16s. Recognizing the requirement for Turkish industrial participation and the Turkish Government's desire to establish an indigenous aerospace industry, General Dynamics entered into a joint venture agreement with the Turkish Government calling for creation of a modern aerospace company capable of producing the F-16 for the Turkish Air Force. The creation of the joint venture company, Turkish Aerospace Industries, Inc. (TAI), accommodates the transfer of aerospace management expertise and F-16 technology to one of America's major NATO allies. The \$137 million initial investment in TAI is shared 51 percent by the Turkish Government, 42 percent by General Dynamics, and 7 percent by General Electric (the engine manufacturer). This is not designed to be a single program business transaction, but rather a long-term commitment involving significant capital investment in aerospace technologies and human resources.

In November 1987, the first F-16 produced in Turkey was delivered to the Turkish Air Force two months ahead of the contract delivery schedule. The first of 152 aircraft produced at the Murted factory site was delivered to the Turkish Air Force under terms of a Foreign Military Sales (FMS) Agreement consummated between the American and Turkish Governments in December 1983.

The in-country coproduction program involves manufacturing, subassemblies and assembly of major components (aft fuselage, center fuselage, and wings), and mate-through-delivery of F-16s for the Turkish Air Force. The effort also includes a direct offset program involving production of major components for incorporation into USAF aircraft being produced at the Fort Worth Division.

The Turkish F-16 project not only expands General Dynamics' F-16 sales base, but at the same time provides Turkey with valuable technology, manufacturing capability, and management expertise. Although the initial objective of the venture company is to produce F-16s, its modern 1-million-square-foot factory complex can be utilized in the future to develop and advance other Turkish national industrial programs.

General Dynamics is providing key executive management personnel as part of its investment in the joint venture company. The executives include the General Manager, Director of Operations, Director of Quality Assurance, and Director of Finance, Contracts and Estimating. Other long-term specialists are overseeing construction of the facility and assisting TAI with new business and proposal development. In addition to creating a factory with trained personnel, the General Dynamics executives and specialists are assisting TAI in the pursuit of new business opportunities to supplement the F-16 project.

The Greek Indirect Offset Program

In 1984 the Government of Greece announced its decision to purchase 40 F-16s. General Dynamics and the Greek Government agreed on a two-part offset package. The first part is a direct offset coproduction program under which the state-owned aerospace corporation, Hellenic Aerospace Industries (HAI), will produce various components of the F-16 and its engine. The second offset agreement involved the establishment of a venture capital company dedicated solely to the identification, development, and implementation of profitable business transactions in Greece. In addition, this program is a direct sale; the General Dynamics contract is with the Greek Government. The U.S. government does not have a management or interface role, as it does in a standard FMS program. It does, however, provide certain contract administration and other services to the Greek Government.

The venture capital company established to satisfy the indirect offset obligation is a partnership between the Greek Government and the corporations of General Dynamics, General Electric (engine) and Westinghouse (radar). The joint venture company is called the Hellenic Business Development and Investment Company (HBDFIC) and is capitalized at \$50 million over a 10-year period.

The innovative international business arrangements contained in the General Dynamics-Greek Government F-16 program represent departures from traditional offset philosophy with some unique features.

- All parties share a common interest in successfully meeting the offset obligations due to the potential for profit.
- The venture capital company reduces the U.S. corporations' involvement with technology transfer issues outside those related to the coproduction program.
- The joint venture company is one of the few venture capital companies in Greece and could provide a valuable stimulus to an economy hungry for development capital.

Possible Future International Cooperative Ventures

In order to remain a leader in international sales, new business arrangements will be required to meet changing market and economic realities. Like other U.S. manufacturers, General Dynamics, is carefully monitoring global market developments that may affect the shape of future cooperative efforts. One such development is the increasing importance of the Pacific Rim in the global economy in general, and the aerospace sector in particular.

In the Pacific Rim region, General Dynamics has sold F-16 aircraft to Korea, Singapore, Indonesia, and Thailand under the FMS program. In the future the company will be required to construct new business arrangements and recognize the industrial sophistication and national economic objectives of these vibrant Asian nations. However, future cooperative aerospace ventures with Asian countries will also continue to be shaped by the prevailing U.S. Government attitude toward trade, technology transfer, and protection of the U.S. industrial base.

The Pacific Rim countries have shown great interest in using cooperative programs both to obtain technology and for economic development. There have been discussions regarding the establishment of joint spares/repair/overhaul depot facilities between the various Southeast Asian countries. Singapore has been particularly intent on obtaining the capability to be self-sufficient in support its aircraft fleet, both for purposes of maintenance and modification. These capabilities could be established by direct offset programs that would leave behind self-supporting activities when the General Dynamics contractual efforts are completed.

Also in East Asia, the U.S. Government, the Government of Japan, General Dynamics and Mitsubishi Heavy Industries (MHI) are negotiating the details of the FS-X fighter program in accordance with the U.S.-Japan Memorandum of Understanding (MOU) signed last year. It was clear that a simple direct offset program would not satisfy the Japanese goal of further developing its aerospace industry. Thus, the F-16 program has evolved to an even greater level of international cooperation through the establishment of a codevelopment program with MHI. Benefits will accrue to both sides of the partnership; most importantly, through the mutual sharing of technological developments resulting from the program. This program is also unique in that General Dynamics will be acting as a subcontractor to foreign industry for the first time in a cooperative program. Under the MOU, General Dynamics and MHI will codevelop and coproduce a new aircraft based on substantial modifications to the F-16. MHI will be the prime contractor. General Dynamics and other U.S. companies will receive 40 percent of the development work and 40 percent of the production work. Also, the United States will obtain some new Japanese technologies and the developments that result from the FS-X program.

In this program, General Dynamics will work directly with MHI, within the provisions of the government-to-government MOU, in two capacities: (1) licensor to MHI and (2) subcontractor to MHI. MHI is under contract to the Government of Japan and will let subcontracts to other Japanese and U.S. companies. Consequently, under this licensed development and production program General Dynamics will have become a subcontractor on a derivative of its own product. However, as the production of the currently planned 130 aircraft occurs (beginning in the late 1990s), the work performed by General Dynamics will still turn out to be as large as with some of the major programs for which General Dynamics was the prime contractor.

Lessons Learned

General Dynamics' experience in cooperative ventures has helped to identify a number of factors that are essential to a successful international program. A selection of the key elements include the following:

- At the outset, ensure that the program is identified as a high priority project among all the potential participating countries. An imbalance in the relative importance of the program among member nations could threaten the stability of long-term funding.
- Limit the number of participants. While it is impossible to set an ideal number of participants, be aware of the likelihood of increasing organizational complexity and costs associated with rising membership.
- Look for programs that have clear, undivided support among internal constituencies in their respective countries. Political clout can be one of the most significant factors in determining a program's future.
- Obtain a commitment from the participating countries for a minimum purchase sufficient to achieve "critical mass." Defense products, in particular, are viable only to the extent to which they are produced in economic quantities.
- Provide sufficient industrial incentives to overcome political obstacles. Cooperation by itself is not enough reason to either enter into or continue involvement in a program. Each participant needs to gain something substantial from its involvement.
- Be aware of potential conflict of interest among program participants. International cooperation has become so extensive that the potential for conflicts exists even for companies within the same country.

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- Clearly identify and define the goals of the program at the outset. Each participant should have a clear understanding of the goals of the program and the part they will play in achieving those objectives.
 - Understand the potential impact of the technology transfer issues on the marketability of the product. Participants with unduly restrictive export policies can negatively impact sales potential even in cooperative ventures.

Conclusion

As General Dynamics surveys the international marketplace of the 1990s and beyond, one lesson is clear: business as usual is not an appropriate strategy. Future cooperative business arrangements in aerospace may involve more creative means of reciprocity (in technology and funding for example), greater sharing of development responsibilities, and less program control for U.S. firms. The fostering of long-term industrial partnerships may be the key to maintaining and expanding market share in an increasingly competitive environment. The challenge for U.S. companies is to devise ways to establish these partnerships so as to facilitate

- Expanding the sales base.
- U.S. firms' profitably accommodating the foreign customer's needs.
- Providing incentives, through the expanded sales base, for a customer/partner relationship that support the benefits of cooperation.
- The combining of creative abilities, by U.S. firms and their partners, to maintain a competitive advantage in the world marketplace.