F/A-18 Aircraft Sales to Canada, Australia, and Spain: A Case Study of Offsets

By

The Office of Management and Budget

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The primary focus of this analysis is on the short-term and potential long-term impacts of offset-related transactions on the industrial capabilities of the three purchasing countries [Canada, Australia, and Spain], and the implications for overall U.S. industrial competitiveness. Since each of these sales and their associated offsets were initiated nearly 10 years ago, some preliminary conclusions can be reached about their impacts. In addition, by reviewing sales of similar equipment to three different countries, comparisons of foreign government offset policies and implementation efforts can be made.

Information for this analysis was obtained through an extensive review of public and private literature, field visits to MDC [McDonnell Douglas Corporation] and General Electric (GE) corporation facilities, consultations with major system subcontractors, and the Naval Air Systems Command. In the interest of determining what subcontractor production was included in each sale, we examined all government-to-government contracts, from the Naval Air Systems Command relating to the Spanish, Australian, and Canadian sales of the F/A-18 aircraft as well as company-to-government agreements related to these programs. In addition, data was reviewed from the 1988 offsets survey conducted by the BEA [Bureau of Economic Analysis of the Department of Commerce].

BACKGROUND

The F/A-18 Hornet is a single seat, twin-engine, fighter/attack aircraft designed to replace the A-7 light attack jet and the F-4 Phantom fighter. In Navy and Marine Corps service, the Hornet is now the front-line aircraft in 21 U.S. squadrons. F/A-18s have been sold to Canada, Australia, and Spain. In addition, Kuwait recently contracted to purchase the F/A-18, Switzerland selected it in October 1988 subject to parliamentary funding, and the ROK [Republic of Korea] chose it in December 1989 to meet its fighter/attack aircraft requirements.

McDonnell Aircraft Company (McAir), a component of MDC, is the prime contractor for the F/A-18. The main subcontractors include GE, which produces the Hornet's smokeless F404 low bypass, turbofan engines; Hughes Aircraft Company, which provides the APG-65 radar; and Northrop Corporation, the principal airframe subcontractor. Supporting this group are hundreds of other companies.

The first Hornet flew in November 1978. Today, there are over 600 Hornets in service in the United States (Navy and Marines). The Navy intends to procure a total of 1,157 F/A-18s. Canada received its first CF-18 in October 1982; the last was delivered in late 1988. The Canadians currently have 138 CF-18s operating out of Cold Lakes, Alberta; Bagotville, Quebec; and Baden Srellingen in West Germany. The first Australian F/A-18 arrived in 1985 to the Operational Conversion Unit, Williamstown, Australia. Most Hornets delivered to the Royal Australian Air Force are assembled and flight tested in Australia. As of April 16, 1990, MDC reports that 74 Hornets have been delivered out of the total 75 on order. Deliveries will be completed in mid-1990. The first EF-18s arrived in Spain in early 1986. Sixty-eight EF-18s have been ferried from St Louis to Zaragoza, Spain. An additional 4 are on order and will be delivered by mid-1990.

CANADA

In March 1977 the Canadian Cabinet approved acquisition of a new fighter aircraft to replace Canada's aging F-101s, CF-104s, and CF-5s. The Canadians were looking for 130-150 aircraft to serve long-range, high-altitude intercept missions in Canada as well as low-level air-to-air and air-to-ground missions in Europe, as part of Canadian NATO forces. Estimated at over $2 billion dollars, the fighter procurement program (known as NFP—New Fighter Program) was the largest in Canadian history.

In September 1977, the Canadian Government issued a RFP with bids due by February, 1978. Bids were submitted by the Grumman Corporation for the F-14, MDC for the F-15, GD for the F-16, Panavia for the Tornado, and MDC/Northrop for the FA-18. Dassault-Brequet, the French manufacturer of the Mirage, unexpectedly did not submit a bid. All of the competitors appeared to meet general Canadian requirements.

In late 1978, the McDonnell Douglas F/A-18 and the General Dynamics F-16 were chosen as finalists. Although a favorite of the Canadian military, the McDonnell Douglas F-15 was ruled out because it was too expensive. Similarly, the Grumman F-14 and the Panavia Tornado were not selected as finalists because of their high costs.

At that time, the Canadian defense budget would allow procurement of 127 F/A-18s at $17.7 million per aircraft, or 142 F-16s at $10.8 million per aircraft. In addition to lower per unit costs, the F-16 had the advantage of being common with NATO forces, which purchased the F-16 in 1975. However, some in Canada believed that the F-16 was not suitable for Canadian air defense due to a limited range and radar capability. Moreover, the F/A18 was expected to have a lower attrition rate because of its dual engines, partially compensating for its high per unit price.

In April 1980, the Canadian government selected the F/A-18 over the F-16, contracting for 138 aircraft (113 single seat, 25 two-seat trainers). The planes, designated the CF-18, cost the Canadians approximately $2.8 billion dollars (1989 US$). The U.S. Government agreed to waive the Research and Development (R&D) recoupment charges, a total of $880,000 per aircraft. In explaining their choice, the Canadians cited the importance of two engines for safety reasons, and the belief that the F/A-18s spacious airframe would allow room for future systems growth. The sale of F/A-18s to Canada constituted the first major export sale for this aircraft, and established it as a major contender in the international fighter aircraft market.

For years, Canada and the U.S. have shared special arrangements concerning defense cooperation. The Defense Development and Production Sharing Agreements (DD/PSA), signed by the U.S. and Canada in 1956 and 1963, essentially pooled the economic resources of the two countries to form a common North American defense industrial base. At the root of these

arrangements was Canada's decision not to pursue development of its own weapons systems, but to rely on the U.S. and its vastly larger defense base.

The Canadian Department of Industry, Science, and Technology is responsible for pursuing industrial development opportunities which arise in the course of major government purchases (those over C$2 million). The request is usually for 100 percent offset. Depending on the intensity of the competition among the various bidders, this figure can be higher or lower. Major Crown Projects (those in excess of C$100 million) are subject to strict management procedures and must endure more intensive and formalized processes of review, including regular industrial benefit achievement reports to the Canadian Government.

Like some other nations that require offsets, Canada places much of its emphasis on obtaining high technology. Provisions on technology transfer are not formally published, but rather implied by the types of offsets authorized by the Canadian government. Much of the government's offset goals related to industrial and regional development including technology development, investment in research and development, development of Canadian design capability, promotion of competitive second source suppliers, and a regionally equitable distribution of benefits. To provide opportunities for Canadian industry, the government pursues contracts that stress coproduction or licensed production rather than "off-the-shelf" purchases.

Even at the early stages of the NFP [New Fighter Program], offset proposals played an important role in the bidding process, and offsets were sought in the RFP [Request for Proposal]. The extremely competitive nature of the procurement put Canada in an excellent position to obtain substantial industrial benefit proposals. As stated in the Canadian RFP for the CF-18, the basic objective of the Canadian Government was to achieve a mix of offsets through the NFP that would benefit a broad section of the Canadian economy. Specifically, the Canadians sought to:

(1) Minimize the economic cost of the program to Canada;

(2) Establish a Canadian industrial capability, including engineering cognizance for life-cycle support of the aircraft weapons system procured.

(3) Improve the capabilities of Canadian industry by stimulating technological advancement through transfer of technology;

(4) Improve the competitiveness of Canadian industry and its access to world markets;

(5) Provide work to stabilize employment and regional distribution of industrial activity in Canada;

(6) Stimulate Canadian exports; and

(7) Reverse or reduce Canadian imports (especially aerospace and related products).

The Canadian Government was willing to pay a premium for Canadian content in the aircraft in order to accomplish these objectives. The two finalists, MDC and GD, both produced planes which were capable of performing Canadian missions and roles within the specified budget allowances. Therefore, offsets became a major factor in the Government's decision on which plane to purchase.

In April 1990, the Canadian Government completed a complex analysis of the two firms' offset proposals, rating each according to a wide variety of macro and micro factors. For example, the two offset bids were assessed according to their likely benefits in aircraft and aerospace,

electronics, other industrial sectors, advanced technology transfer potential, and overall risk. The offset proposals were also analyzed according to their likely benefits to specific regions in Canada (Ontario, Quebec, and the rest of Canada). Final assembly and test of each aircraft was offered, but was rejected by the Canadian Government as too costly for the limited benefit to Canadian industry. On this basis, an overall score was assigned to each bid. MDC's composite score was higher. Thus, there is evidence that offsets played a major role in the Canadian decision to purchase the F/A-18 over the F-16.

MDC's winning offset proposal was valued at $2.7 billion Canadian dollars, or about 110 percent of the value of the CF-18 aircraft production received by McAir, and is worth an estimated 24,000 jobs for Canadian industry. The offsets are to be provided over a 15-year period, which began in April, 1980. According to the offset agreement, 60 percent of the offsets are to be in the aerospace and electronics sectors, at least 10 percent of which must be in "high technology and advanced programs." Tourism is included, but cannot exceed 10 percent of the offsets.

Since Canada chose not to coproduce the plane, or to produce it under license, the majority of these offsets are indirect. However, Canadian industry will carry out subcontractor production for some components of the CF-18s and also for F/A-18s purchased by the U.S. Navy.

MDC is not alone in carrying out the offsets. Its major subcontractors are also responsible for a significant portion, including GE, Cleveland Pneumatic, National Water Lift, Hughes, Garrett AiResearch, and Litton. These subcontractors agreed to take on an offset burden which is approximately equal to their percentage contribution to the value of the aircraft. MDC and its subcontractors had fulfilled over 90 percent of their offset commitment to the Government of Canada by the end of 1987. Since then, the offsets have surpassed the total required. We estimate that the ongoing business activity could reach 150 percent of the value of the original sale by the end of the period.

According to the BEA 1988 offset survey, MDC itself was responsible for about 55 percent of the offsets, while its subcontractors accounted for 36 percent. The remainder was carried out by MDC's foreign subsidiaries. About 85 percent of the offsets are indirect; however, all but 10 percent of those were in the form of indirect subcontractor production by Canadian industry.

Industry Sector	SIC Code*	Percentage of Offset
Aircraft parts	3728	54 %
Detection and Navigation	3812	5%
Aircraft Engines	3724	15%
Durable Goods NEC	5099	4%
Plastics Materials	2821	4%
Electronic Components	3679	3%
Other	- -	15%

A major percentage of the offsets is accounted for by Canadian participation in the production of MDC's commercial and defense aircraft products. Canadian firms, most significantly McDonnell Douglas Canada, produce components for CF-18, F/A-18, MD-80, DC-10, KC-10, and MD-11 aircraft. F/A-18 components produced in Canada for use in U.S. aircraft as well as Canadian include: forward fuselage nose barrels (Canadair); graphite epoxy avionics access and gun loader doors (Fleet Industries); forward fuselage side panels and wing pylons (MDC Canada); wire bundles (IMP Group Ltd.); and heads-up and multipurpose displays (Litton Systems Canada). Canadian components for other aircraft programs include forgings, castings, engine

* Standard Industrial Classification

components, lighting panels, and plastic parts. Other direct offsets include Canadian production of the CF-18 Stores Management Set and Communications Systems Control Set (Leigh); landing gear components (West Heights Mfg.); AMAD castings (Haley); Harris ATS Building Blocks (Sperry Rockland); and investment castings (Cercast and Shellcast).

Another major element of the CF-18 offset package was the establishment of an aircraft engine component manufacturing facility in Canada in 1982. GE Aircraft Engine Company established a state-of-the-art compressor blade and vane manufacturing facility in Bromont, Quebec. The plant, valued at more than $100 million, supplies forged airfoils for the F110 engine used in F-16 aircraft, as well as components for GE's commercial engines (CFM56). Today, the plant has more than 400 employees, with plans to increase size in the near future due to increasing commercial demand. GE also purchases F404 and other engine components from other Canadian firms, including Bristol Aerospace (exhaust frame) and Aviation Electric (main fuel control components).

MDC assisted in arranging financing of a Numerically Controlled Machining Centre at UDT Industries of Montreal to provide access to five-axis machine tools. Other indirect offsets include credit for the Canadian content of MDC and others' purchases of such items as motor vehicles and computers. Since Canada is an industrially and technologically diverse country with close defense and trade ties to the U.S., it offers many opportunities for contractors to fulfill offset requirements. This may explain why the offset commitment of over 100 percent of the value of the sale has already been surpassed, with six years remaining on the agreement.

Canada accounts for our second largest merchandise trade deficit (after Japan) at $11 billion in 1988. Even in the aerospace sector in which the U.S. maintains a substantial trade surplus overall, Canada has achieved a positive trade balance with the U.S. every year since 1980. The Canadian exports to the U.S. are particularly strong in aircraft parts and engine parts, sectors in which offsets were fulfilled.

The Canadian F/A-18 offsets in some cases represent business for Canadian firms that would have transpired with or without offset demands. However, in other cases, the offset obligation introduced another factor into the decision making of U.S. firms. The F/A-18 prime and major subcontractors emphasized that they attempted to fulfill the offset obligation with transactions that "made good business sense," but also met the strict Canadian criteria for what is an "acceptable" offset.

For example, GE's decision to established a blade and vane manufacturing facility in Canada was based on a genuine need for additional capacity in this area. Moreover, the site selected for the plant has a good, skilled labor base, and is relatively close to a sister operation in Rutland, Vermont. However, the fact than an offset obligation existed may have given Canada an edge over similar communities in New Hampshire or Massachusetts. In other words, although Canada may be a competitive producer of certain F/A-18 and other aircraft parts and subsystems, the fact that an offset obligation existed produced a preference toward Canadian industry.

In conclusion, the Canadian industrial goals to obtain technology, to improve competitiveness, and to stimulate exports were all advanced by the CF-18 offset implementation. It is impossible to quantify the magnitude of this advancement since the offset effects cannot be isolated for other factors. However, it is clear that offsets have benefitted Canadian industry.

AUSTRALIA

In October 1981, the Government of Australia selected the F/A-18 to fulfill the prescribed mission of the Royal Australian Air Force (RAAF). A fleet of 75 aircraft was commissioned with

employment. Specific offset activities requested by Australia to accomplish these broad objectives included orders for Australian manufactured goods or services; part production or assembly; joint or collaborative ventures; software development; research and development; design and development; technology transfer; and certain types of technical training by the overseas suppliers.

The F/A-18 offset agreement provides for three distinct types of offsets. The first is called Defence Designated and Assisted Work. Under this program, elements of the F/A-18 are required to be manufactured, assembled, and/or tested in Australia. As a result, Australia is the only country outside the United States where a production and assembly facility exists for F/A-18s. This portion of the F/A-18 offsets is valued at approximately $200 million dollars. Work for this portion of the offset will be completed when the last Australian aircraft is finished in 1990.

The second element of the F/A-18 offset package is usually called Eligible Offsets. This is a firm commitment, with liquidated damages for non-fulfillment. Some of the eligible offsets are directly related to the F/A-18s (such as the production of parts for use in F/A-18s in the United States), while others are indirect. However, in order to meet the Australian criteria for satisfying the requirements, the transaction must have technological significance and contribute to the self-reliance of the Australian defense industry through the establishment, enhancement, or maintenance of defense capabilities. The period of fulfillment for these offsets is 1981-1999.

The final aspect of the Australian F/A-18 industrial compensation package is "Best Efforts" offsets which are in addition to the firm Eligible Offsets commitment. This includes such indirect offsets as the promotion of Australian exports and tourism. This portion of the offset package was primarily a marketing tool used by MDC to make its overall offset proposal more desirable.

Defence Designated and Assisted Work. As part of this portion of the offset commitment, Australian industry produces a variety of parts, components, and subsystems for the F/A-18. In order to accomplish this, the Australian Government invested tens of millions of dollars in facilities and equipment for Australian industry to be able to take on some of the new technologies involved in coproduction, assembly, and support of the F/A-18. In addition to these up-front additional costs, the Australian Department of Defence is also paying a premium for this designated work. The total premium is estimated to be about $3 million per aircraft, or 15 percent, in return for about 2,000 jobs over the life of the project.

The final assembly and test of the RAAF F/A-18 is being carried out by ASTA, a 100 percent Government-owned company which until 1987 was know as the Government Air Factory. ATSA is also producing forward fuselage installations, trailing edge flaps and shrouds, windscreen and canopy transparencies and assemblies, and the radome assembly. Specific components of the F/A-18 being produced in Australia in addition to those being produced by ASTA, as well as the name of the Australian and U.S. producers are:

Normalair-Garrett Australia: Auxiliary Power Unit (Garrett Engine); air conditioning system components (AiResearch); Electronic Countermeasure System components.

Hawker de Havilland Ltd: wing pylons (McAir); engine access door assembly, aft nozzle fairings (Northrop); F404 engine components (GE); stabilator actuator, leading edge flap servo valve, aileron actuator (Textron); electrohydraulic rudder actuator (HYD Units); trailing edge flap (National Water Lift); trailing edge flap actuators, hydraulic reservoir (Parker-Hannifan); mounted accessory gear box (Western Gear).

Thorn EMI Electronics Australia: Inertial Navigation System (Litton); fire direction control units, Stores Management System, air data computer power supply, Communications Systems Control Set (SLI); fire and bleed air detection system (Systron Donner).

a value of $2.36 billion, to replace the aging French Mirage IIIs procured in 1960. Of the 75 aircraft, 57 will be strike fighter versions, while 18 will be two-seated trainer/attack aircraft. Aerospace Technologies of Australia (ASTA), as part of the negotiated contract, will assemble 73 of the aircraft in Australia. The sales, with flyaway costs of about $20 million per unit, is a direct government-to-government buy managed by the U.S. Navy. Aircraft assembly began in Australia in 1984, with completion slated for 1990.

The decision to purchase F/A-18s in 1981 followed several years of consideration by the Government of Australia. Desire for a new aircraft to replace Australia's Mirage IIIs dates back to 1972. Rivals to the F/A-18 at that time included Northrop's P530 lightweight fighter, the Swedish Viggen, the MDC F-15, GD F-16, Panavia's Tornado, and the Dassault-Breguet Mirage 2000. In 1975, the RAAF dropped the Panavia Tornado and the MDC F-15 from the list because of cost and lack of assurances that production of both aircraft would continue through the year 2000.

The final contenders were the F-16, F/A-18, and the Mirage 2000. These finalists were analyzed for their suitability by an Australian Evaluation Group made up of operational, technical, and industrial specialists. An evaluation group determined that of the contenders, none was able to match the F/A-18 in all-weather avionics and twin engine safety, both important considerations for missions in and around harsh Australian territory.

As part of the sale, MDC agreed to provide Australian industry with industrial benefits with about $800 million, about one third of the estimated value of the sale. According to Australian officials, GD's and MDC's offset proposals were "near equal." Neither contractor, however, was offering sufficient work to please the Australian cabinet. Offset fulfillment began in 1981 and will continue until the end of this century.

Australia's offset requirements are publicly available and clearly defined. The offset policy (known as the Australian Industrial Participation Program) dates from 1979, when it was announced by the Australian Department of Defence Support as a means for Australian industry to achieve self-reliance in defense production, support, and maintenance through local industrial involvement. Since that time, the policy has been reviewed and refined several times. While the primary focus continues to be defense support capabilities, it is also used to bring advanced technologies to Australia; to establish internationally competitive activities; to increase sales of Australian-built equipment and components to American and other overseas customers; and to encourage cooperative R&D projects between Australia and overseas industry.

The policy now applies to Government purchases for defense or civil purposes in excess of 2.5 million Australian dollars (about U.S.$2 million), and is administered jointly by the Australian Department of Defence and the Ministry for Industry, Technology, and Commerce. Overall, offsets must equal thirty percent of the imported content value of the item being purchased. In addition, offsets in Australia are generally firm commitments rather than "best efforts" agreements. The Australian offset program is becoming increasingly sophisticated as an instrument of industrial policy—to restructure the Australian economy toward more desirable industrial sectors.

Today there are 84 foreign defense suppliers (40 of which are American) who participate in Australian defense offsets. Other major past and present programs in Australia include those associated with the sales of Lockheed C-130 transports, GD F-111 strike/reconnaissance aircraft, Bell Iroquois, Boeing Chinook, and Sikorsky Blackhawk and Seahawk helicopters, Swiss Pilatus trainers, and Canadian de Havilland Caribou transports.

MDC and the Government of Australia signed an agreement on offsets associated with the sale of the F/A-18 aircraft in 1983. The stated purpose for the F/A-18 offsets was to bring new technologies to Australia from the U.S. and to promote Australian industry and domestic

Godfrey Howden: hydraulic filter and valve manifolds (A/C Porous Media).

Dunlop Australia: main wheel and brake assemblies, nose wheel assembly (Bendix); speed brake actuator, compression ring (Northrop).

Phillips Defense Systems AN/APG 65 radar, radar data processor (Hughes).

Aircraft Equipment Overhauls and Sales: hydraulic pump assemblies (Abex). vent tank fuel cell (American Fuel Cell).

Lucas Industries Australia: afterburner fuel control units, variable speed constant frequency generators; main fuel control unit (GE).

British Aerospace Australia: avionics fault tree analyzer, up front control panel (McDonnell Douglas Electric Corp.); heads up display, multipurpose display group (Kaiser); flight control computer (GE).

Standard Telephones & Cables: flight control computer power supply (GE).

There are approximately 44 F/A-18 components which are produced in Australia under the designated work provision. These components are administered either by MDC or Northrop, directly or through their subcontractors. In addition, GE entered into a coproduction agreement with the Government of Australia, and Australian industry is producing 29 separate parts of the F404 engines.

Another element of the coproduction program relates to the Forward-Looking Infrared (FLIR) system. The FLIR system provides a day, night, and adverse weather attack capability by presenting the pilot with passive thermal imagery in a TV formulated display. In May, 1989, MDC and the Government of Australia signed a $21.1 million deal establishing the offset obligation associated with the RAAF acquisition of 29 F/A-18 FLIR pods. The program includes 1) Laser Relay Optics Assembly and Laser Beam Expander (Ford Aerospace); 2) Laser Target Designator/Ranger (Ferranti Defense Systems); and 3) FLIR Relay Optics Assembly (Texas Instruments). All coproduction programs include the manufacture, assembly, and testing of components, as well as the training of Australian industry personnel, required tooling for the projects, drawings, alignment procedures, and manufacturing instructions.

Eligible Offsets. The requirement for eligible offsets (subject to liquidated damages) makes up approximately 67 percent of the value of the overall offset obligations. Through the third quarter of 1989, MDC has achieved approximately 65 percent of the requirement for eligible offsets. Approximately one half of the eligible offsets were F/A-18 related, and the large majority of the eligible offset achievements were in the aerospace sector.

A major portion of this part of the offset package is made up of purchases by MDC and its subcontractors of Australian products. For example, MDC and GE are buying back Australian components for use in U.S. F/A-18 and F404 production. Such "buyback" components include flaps and shrouds, engine access doors, aft nozzle fairings, hydraulic pumps, actuators, auxiliary power units, gear boxes, nose landing gear, power supplies, radar data processors, and 19 various engine components, including blades, vanes and airfoils. In addition, MDC is using Australian producers for some parts of its civilian aircraft, such as elevators for DC-9s and pressure relief ducts and evacuation slide containers for DC-10s.

Another element of the eligible offsets is the establishment of Centres for Industrial Technology in Perth and Sydney. These are technology transfer centres designed to bring CAD/CAM [computer aided design/computer aided manufacturing] methods and the use of four- and five-axis numerically controlled machine tools to Australian industry. MDC has also placed production control and non-destructive testing specialists in Australian plants to instruct Australian employees in these advanced techniques.

Moreover, Hawker de Havilland has been selected as a 20 percent risk-sharing partner in a new helicopter venture currently under design at MDC called the MDX. The MDX will not have a tail rotor and will use an all composite rotor and other composite structures. Under the terms of the agreement, Hawker de Havilland will have responsibility for the final design and production of MDX's airframe, including composite components. The airframes will be shipped from Australia to Arizona where MDC will complete final assembly and installation of engine transmissions and other systems. The MDX's first flight is scheduled for 1992; orders of 200 have already been placed, and account for nearly 2 years of production.

Best Efforts. With regard to this portion of the offsets, information was not as easy to acquire. Export assistance was provided by MDC for certain products manufactured in Australia. In addition, the FLIR coproduction deal includes some non-project related agreements benefiting a wide-range of Australian industries, from tourism to aerospace.

For example, Ford Aerospace is responsible for offset credits for increased business related travel to and from Australia on Qantas Airways. Additionally, Ford will support continued demonstration and evaluation of an Orbital Engine two-stroke engine project. Ford Motor Company may invest in subsequent phases of the Orbital Engine Project which could ultimately lead to a decision to fund the full production of Orbital's two-stroke engine. Other Australian products which are listed on MDC's 1988 offset survey response (but account for only a small portion of the total value of the offsets) include industrial sand, gaskets, cutting tools, pipe, and steel.

This section addressed the implications of the offsets associated with the F/A-18 sales to Australia for both Australian and U.S. industries. Perhaps the most obvious impact is coproduction. Production of a variety of F/A-18 airframe, radar, engine, and avionics components by Australian manufacturers means that the historical suppliers of these items did not participate in this sale, or did so in reduced ways.

Australian industrial participation was mandated by the Australian Government rather than driven by cost considerations. In fact, cost and time differentials for Australian production were acceptable because they were justified as militarily necessary by the Australian government. This report does not dispute that judgement. However, the coproduction offset introduced additional costs to Australia and redirected opportunities from U.S. business; MDC itself lost potential business as a result of coproduction; however, for this company and the major subcontractors, the benefits of the sale far outweighed the losses. The systems being produced in Australia involve the support of lower tier subcontractors, displacing MDC's historical supplier chain.

In most cases, coproduction involved technology transfer to Australia in order to bring Australian industry up to a level to produce sophisticated fighter aircraft components. The coproduction and eligible offsets programs are considered very important for the Australian aerospace industry, which is a fraction of the size of the U.S. industry. For example, the F/A-18 coproduction represents 60 percent of the workload of ASTA, a 100 percent Government-owned company run on a commercial basis. F/A-18 and other offset programs comprise the bulk of business for other Australian firms, as well.

Coproduction provided the inducement and guaranteed workload for the Australian Government and industry to invest in modern equipment and technologies. In addition, many technologies not formerly available in Australia were introduced through the F/A-18 offsets. For example, the GE engine offset programs have significantly increased Australia's capabilities with regard to jet engine parts production and repair. Production for the Australian F404s, as well as export of components back to the U.S. involves such techniques as numerically controlled turning and milling, high temperature vacuum braying, precision broaching of advanced materials, vacuum heat treating, titanium tube formation, and precision blade forming.

A major benefit of ASTA's participation in coproducing F/A-18s was learning composite manufacturing techniques. A new facility was established to carry out this work. Hawker de Havilland, already the most sophisticated aerospace firm in Australia, was similarly advanced in the area of composite manufacturing through its production of composite wing pylons and engine access doors. Likewise, the establishment of Centres for Industrial Technology in Perth and Sydney brings additional CAD/CAM and numerically controlled machine tool technology to Australian firms.

As stated in *The Defence of Australia, 1987* document, the Australian:

> Government has implemented a wide range of policy changes to make Australian industry more internationally competitive and export oriented. The new policies are designed to enable industry to adapt to changing market conditions and to take advantage of opportunities presented by technological developments. To meet these objectives, industry needs to be able to design world class products, manufacture and market them competitively, and be less reliant on Government assistance. Changes have included economic policies, such as deregulation of the exchange rate and of the financial sector; general industry policies, for example those applying to research and development, technology development, and exports; and industry specific policies for many areas important to defence such as aerospace, telecommunications, electronics, machine tools, steel, heavy engineering, shipbuilding, and ship repair.
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> Participation in defence projects can . . . bring to industry important technology, introduce new equipment and skills, and develop expertise in aspects of project management and quality control. This can lead to ongoing work in repair, maintenance, and adaptation, as well as to participation in other defence projects, and to work on related civil production or for export. The offsets obligations generated by overseas suppliers can be exploited by Australian industry to supplement [the] Australian defence production base, and [to gain] access to new technology and markets.
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> Defence projects can foster the development of managerial and other expertise in Australian industry which can then facilitate growth in related civil or export markets. When defence equipment is purchased overseas, or where there is substantial import content in a local product, high strategic priority is given independent local repair, maintenance, and adaptation capabilities. To assist Australian industry to acquire the necessary technology, equipment, and expertise, Defence procurements have a requirement for Australian Industry Involvement [including offsets]. [It is important for] Australian industry to use the linkages established in achieving higher local content to build longer term relationships with overseas principals. These will be essential if opportunities for competitive subcontracting and exports, previously provided under the Defence Offsets program, are to continue.

> The export of defence and defence-related products can foster skills and capacity in Australian industry and reduce the costs of indigenous supply and support for the ADF [Australian Defence Forces]. Successful competition in overseas defence markets benefits [Australia's] overall trade interest as well as the firms involved. Opposition is growing to the traditional Offsets mechanism used by Australia Hence, collaborative projects are likely to become increasingly important for Australia. The Government has used the offsets program and the leverage afforded by major Defence procurements to provide opportunities for Australian industry to collaborate in future developments with major overseas defence equipment manufacturers.

SPAIN

In 1982, after four years of intense review of the future requirements of Spain's military forces, the Spanish Defense Commission (composed of representatives of the armed forces, the Government, and private and public aircraft companies) announced its decision to procure 72 MDC F/A-18 fighter planes. At more than $2.4 billion, the program was marked as the biggest procurement package in the history of the Spanish military. The aircraft, designated as EF-18, was first delivered to Spain in February 1986 and will continue until July 1990.

The competition which led to this decision included bids from Dassault-Breguet (Mirage 2000), Panavia (Tornado), and GD (F-16). The Mirage 2000, selected as the primary combat aircraft of the French Air Force for the mid-1990s and beyond, was not chosen because Spain sought to add diversity to its fleet by procuring another type of aircraft to supplement the older Mirage aircraft already in its inventory.

As in many major defense procurement decisions, politics played a large role in the process, causing much debate in the Spanish press, government, and community. Spain withstood much pressure from the European community, which saw Spain's purchase as a chance for the nation to strengthen ties with West Germany in return for its support of Spain's entry into the European Economic Community. Moreover, many Europeans felt that Spain's choice of an American producer signaled a malevolence toward European manufacturers.

The strongest competitor to the F/A-18 was the F-16. The F-16 was unable to beat out the F/A-18, despite its cost advantage. One of the reasons it may have lost the competition was that the most lucrative offset possibilities had already been distributed in Western Europe through the sale of the F-16 to the EPG [European Participating Group] in 1975. Also, because of a large number of purchase orders pending for F-16s at that time, the Spanish Air Force, whose F-4 Phantoms and F-5 Tigers were 20 years old, would receive F-16s at a much later date than F/A-18s.

As part of the sales agreement, MDC and its major subcontractors agreed to complete offset transactions having a value of $1.5 billion in January 1981 dollars between 1983 and 1996. Offsets have been a part of Spanish defense procurements since the creation of a unified Spanish Defense Ministry in 1977. Major goals of the Ministry are to develop Spanish technology to the highest level, to become as self-sufficient as possible and to increase exports in order to improve the balance of payments. This policy is accomplished by the promotion of advanced research and development for weapons systems, participation in major multinational projects, and negotiation to obtain industrial and technological offsets from foreign suppliers.

For the procurement of new equipment, the Ministry of Defense first attempts to design and manufacture in Spain. If it is not possible to develop the equipment locally, then the participation

of technologically more advanced countries is sought, particularly in Europe, in a way that will help Spain to produce the equipment and improve its technological capabilities. If it proves absolutely necessary to purchase the equipment or spare parts abroad, then suitable offset arrangements are required.

The objectives of Spain's offset policy are to equalize the balance of payments with the supplier country; to obtain a transfer of technology to enhance the capabilities of the local defense industry; to ensure that maintenance will be carried out locally; to provide work for under-employed sections of the economy; and to stimulate other sectors of the economy. The level of offsets demanded depends primarily on the amount of competition between the foreign suppliers involved in a proposed transaction.

Obtaining direct offsets is the top priority. Also desirable are indirect offsets that include Spanish defense goods sold to the supplier country, "Technology offsets" (licenses to make commercial or defense products in Spain that involve technology transfer), and "economic offsets"—purchases of civilian products or services such as tourism. Currently, there are approximately 40 offset agreement is various stages of implementation in Spain.

As an adjunct to the sales agreement for 72 EF-18 fighter aircraft, MDC committed itself and its subcontractors to supply industrial and technological benefits to Spanish industry valued at $1.5 billion (1981 U.S. dollars), which was equivalent to 100 percent of the value of the sale in 1981. The offset agreement, signed in July, 1984, specifies that at least 40 percent of the value of the offsets must involve technology characteristic of a developed country, 10 percent of which must involve technology transfer. Finally, no more than 10 percent of the offset may be in tourism. The offset commitment is scheduled to be completed by December, 1993, with a "grace" period of three additional years in which to achieve the balance of any outstanding commitment. Liquidated damages may be accessed if the offset commitment is not achieved by 1996.

As of October, 1989, MDC and its subcontractors had fulfilled approximately 50 percent of the offset obligation. According to the 1988 offset survey, direct offsets make up only about one-quarter of the total Spanish offsets. The indirect offsets are scattered across a wide range of industries from chemicals to plumbing fixtures to citrus fruits. The following industries accounted for significant offsets:

Industry Sector	SIC Code*	Percentage of Offset
Aircraft parts	3728	32 %
Shipbuilding	3731	10%
Navigation/Detection	3812	9%
Engineering Services	8711	8%
Organic Dyes & Pigments	2865	5%
Steel	3312	4%
Nonferrous Medals	3339	3%

MDC has passed nearly 50 percent of the offsets on to its subcontractors. GE, which operates its own trading company, is fulfilling its offset commitments ahead of schedule. With regard to direct offsets, Spanish industry is involved in producing a variety of EF-18 parts and components. The most significant are shown below.

* Standard Industrial Classification

Item	Spanish Producer	U.S. Producer
Leading Edge Extensions	CASA	MDC
Inboard Leading Edge Flap	CASA	MDC
Outboard Leading Edge Flap	CASA	MDC
Horizontal Stabilizer	CASA	MDC
Speed Brakes	CASA	Northrop
Stores Management Set	Inisel	Smith Industries
Rudders	CASA	Northrop
AFT side Panel	CASA	Northrop
Radar Low Voltage Power Supply	Marconi Espanola	Hughes
Multipurpose Display Indicator	Inisel	Kaiser

(72 ship sets of each—for the Spanish EF-18s)

All direct Spanish EF-18 work was completed as of September, 1988. MDC continues to import some of these items from Spain for use in F/A18 manufacture for the U.S. Navy. For example, Hughes has contracted with Marconi Espanola to supply power supply and linear regulator modules for the APG-65 radar as an EF-18 offset. The 1989 contract has a value of $1.7 million with opportunities for additional procurement.

With regard to indirect transactions that make up the bulk of EF-18 offsets, established programs include an internship program for Spanish graduates, a wood burning facility, and an investment castings operation. These complex yet creative ventures are excellent examples of the diverse types of transactions that are possible to satisfy offset obligations.

- The Spanish Internship program was created by MDC in support of the EF-18 indirect offset program. MDC organized a consortium of U.S. businesses to provide temporary job opportunities for Spanish graduate students that would furnish them with experience in working for a U.S. company involved in international business.

- The Fort Fairfield Power Energy Venture is a wood-fired power plant in Fort Fairfield, Maine. Two Spanish companies, ENSA and Initec, won a contract to design, engineer, and procure this facility. MDC specifically assisted them in obtaining the necessary insurance and bonding, and made the initial contact with the contractors in the United States. Over 20 additional Spanish companies supplied various equipment and services valued in excess of $20 million. Moreover, a five-year fuel supply contract was signed with a Canadian paper company, and MDC was able to get offset credit for this as well under the CF-18 program.

- MDC was also involved in an agreement to establish a joint venture in Spain for the purpose of manufacturing aluminum investment castings for aerospace, electronics, and defense-related industries. MDC facilitated the joining of a Spanish company with a Canadian company in this undertaking, which included guaranteed buybacks of investment castings.

Other indirect offsets include the countertrade of diverse Spanish products, including steel coils, cord and reinforced bars, butadiene, phenol, acetone, CNC controls, sunflower seed oil, sailboats, paper products, zinc, marble, and even slime. Many of these products were transferred to third countries and never entered the United States; others were sold here. MDC also facilitated the establishment of a Dominos [pizza] franchise in Barcelona, and the publishing and distribution of a picture book on Spanish lifestyles.

As in the case of Canada and Australia, the eleven F/A-18 components license-produced in Spain represent subcontractor work that was awarded to Spanish companies. The direct offset benefitted Spanish industry by increasing its strength and knowledge in the manufacture and testing of these components, while decreasing its dependence on the U.S. aerospace market to support and maintain the Spanish EF-18 fleet. The offset work also triggered investment in production machinery, quality assurance, and systems maintenance at technology levels not previously available.

CASA, for example, is moving into automated production and robotics, including automated composite material cutting, CAD/CAM. CASA, Inisel, and Marconi Espanola all have had personnel trained in the U.S. in using new manufacturing techniques. For many Spanish companies, offset work from the EF-18 and other military and civilian programs make up the majority of business.

As in the other F/A-18 overseas sales, the direct offsets resulted in increased competition in U.S. and foreign aerospace markets, particularly at the subcontractor level. An example of this increased competition is the success of Marconi Espanola, which under an offset agreement was trained to make low-voltage power supplies and linear regulator modules for the APG-65 radar. In 1987, this company beat out Hughes in a competition for a contract to supply similar modules directly to the U.S. Navy.

CONCLUSIONS

The three preceding sections illustrate the role that offsets play in U.S. defense exports. In each case, offsets were one of several factors in the choice of an aircraft to meet each Government's defense needs. The competition between the two companies drove up both the level and the quality of the offsets. In every case, the final competition was narrowed down to two aircraft—the GD F-16 and the MDC F/A-18, both made in the United States.

Each of the three countries had similar objectives in requiring offsets when purchasing the F/A-18—to obtain advanced technology, to increase the capabilities and competitiveness of defense and commercial industrial sectors, and to politically and economically lessen the impact of a major foreign purchase. The three countries differed in the implementation of offsets, however. Australia's offsets are largely direct, including coproduction of the plane. Much of the Canadian offset is indirect, but is still in aerospace and other high technology sectors. Canada's substantial technology and industrial base allowed offsets to be fulfilled in these sectors with relative ease. Spain, on the other hand, has a higher percentage of offsets outside the aerospace and defense sectors.

The extent to which the three Governments achieved their industrial, economic, and technological objects is impossible to quantify. Certainly, a substantial short term gain in business was achieved through direct offsets. In some cases, especially in Australia, the offset work comprised the bulk of business for the foreign firms. Often, a cost and time premium was paid by the F/A-18 purchasers in order to support domestic industries and incorporate domestic components in the aircraft. Beyond these gains, many foreign firms hoped and have achieved in limited circumstances, to become suppliers to the U.S. Navy and other F/A18 operators for spare

and replacement parts (e.g., Marconi Espanola's contract to supply radar modules to the U.S. Navy). Canadian firms were particularly successful in turning what was originally offset work into long term business opportunities.

More generally, foreign offset recipients benefitted from access and training in new manufacturing technologies, establishment or enhancement of their production base and skilled work-force, and experience in testing and quality control techniques. Although in many cases the technologies transfered were only moderately sophisticated by U.S. standards, they still represent a gain over what was previously available. For some the F-18 and other offset programs have been a driving force for modernization and technology infusion. The capital improvements and skills acquired through the F/A-18 offsets are transferable to other aerospace projects.

In addition, the foreign firms received the benefits of large U.S. firms' international marketing expertise and global networks as part of the offsets. In effect, the offsets allowed the three countries to promote the growth and development of high technology industries. The success or failure of these industrial sectors remains to be seen, but both Australia and Spain are attempting to break into the international aerospace market as a partner with the larger aerospace firms in Europe and the United States. This is evidenced by Spanish involvement in Airbus, EFA, and ESA, and Australian participation in the MDX helicopter project.

From the U.S. perspective, the benefits of the sale of U.S. aircraft would not have been possible without provision of offsets to the foreign buyers. However, without offsets which were required for the sale, MDC would have had the opportunity to compete for more of the subcontract work associated with these programs. Finally, offsets may result in establishment or enhancement of competitors abroad for U.S. defense industry.

Offsets affected the U.S. industrial base in other ways as well. Decisions to invest, purchase materials and components, etc., were made not only on the basis of price and quality, but also on outstanding offset obligations.

The total impact that offset have on U.S. industry is complex and intertwined with our economic factors. However, it appear that offsets have contributed to the strengthening of foreign competitors in Australia, Canada, and Spain.