APPENDIX E

Case Studies in Defense Industrial Cooperation

This chart outlines specific cases in transatlantic defense industrial cooperation, organized around the generic categories of cooperation listed in appendix D. Within each category, programs are described chronologically. The survey and program descriptions are not intended to be exhaustive but rather to illustrate the range and intensity of factors that contributed to the success or failure of representative cases in transatlantic defense cooperation, many of which derive from the direct input of the Commission's corporate members.

[Annotation: ✓Indicates favorable conditions for success; ✗ Indicates unfavorable/ missing conditions.]

Case Studies in Defense Industrial Cooperation

	Main Features	Evaluation
Science & Technology Exchanges		
	• Project-specific (individual scientists/ engineers) or structured programs (government scientists/ engineers). • Longevity; large number of exchange agreements; relatively low profile. • Continuing support across the Atlantic.	Multiple, ongoing successful arrangements. ✓ Decade-long practice; funding ensured. ✓ Little criticism due to small scale and low profile. ✓ Accommodation mostly reached over export controls.
Government-sponsored Codevelopment Programs		
NATO Seasparrow Missile	• 30 years in operation, involving 12 active members and spawning a new (10-country) development program (Evolved Seasparrow). Begun with U.S. company responsible for actual missile and others producing various components. • Stable funding pattern. Each member country had a say in how program was run; each benefited from industrial participation. Participating companies formed coherent unit. • Program produced system that performed as advertised.	A resounding success by any objective measure. ✓ Firm military requirement. ✓ Quality program management. ✓ Stable and predictable support from participating navies. ✓ Industrial arrangement perceived as fair by all partners.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
Rolling Airframe Missile (RAM)	• Launched 1976; in service as self-defense system on German and U.S. navy ships. • Unlike NATO Seasparrow, often endangered by numerous technical problems, cost overruns, schedule slippages, and technology transfer issues. • Flagging support by U.S. Navy. Survived several attempts each year by navy to terminate funding. OSD served as the "product champion." • Flagging congressional support heightened German concerns about U.S. reliability/commitment to program. Saved through direct intervention by U.S. and German senior officials and German industry support following agreement on 50-50 shared production. • Program's long duration necessitated modification to MOUs to adapt to changing procurement laws. True stability achieved in mid-1990s, with codevelopment of a block I upgrade.	An ongoing, successful codevelopment program. ✓ Firm and jointly agreed military requirement. ✓ Quality program management (instituted in mid-1980s). ✓ Strong commitment on part of partner gov'ts. ✓ Bold initiative by industry partner to maintain program. ✗ Disagreement over tech transfer/third-country exports. ✗ Initially lacking agreement on production shares. ✗ Continued funding uncertainties (esp. from U.S. Navy).
Multiple Launch Rocket System (MLRS) & Terminal Guidance Warhead (TGW)	• Mandated 1978 by Under Secretary Perry to coordinate planning of similar rocket system development programs by France, Germany, UK, and United States. U.S. Army agreed to modify preliminary design to accommodate German-designed warhead and to codevelop TGW. • All four participants assigned substantive roles within basic MLRS program, with substantial say about how the program was run. • Initial design later subjected to review to lower costs and facilitate production. • U.S. Army would periodically neglect funding TGW, only to be countered by OSD. • Eventually, U.S. Army canceled TGW in favor of BAT, a once "black" program in its early stages.	Partially successful codevelopment program. ✓ Firm military requirement for MLRS and TGW. ✓ Threat to "either cooperate or do without." ✓ Collegiality among participants. ✗ Interoperability of MLRS eroded over time. Unites States favored updates more often than European partners. ✗ U.S. "black" solution prevailed over TGW, though subsequently found to be inadequate and possibly outdated.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
NATO Identification System	• Started in early 1970s; after long disputes within NATO, breakthrough reached in mid-1980s when German defense minister Wörner agreed to politically sensitive compromise solution. • U.S. Air Force consistently hostile to program; eventually prevailed in 1991 over OSD counter-attempts. • OSD served as the "product champion."	Failed codevelopment program. ✗ Firm and consistent mandate over 15-year period from senior political level inadequate to overcome strong resistance from military department managing the program. ✗ Presence of competing domestic "black" program.
Family of air-to-air missiles	• "Family of weapons" offered by DOD under Carter administration as an alternative to legal restrictions to cooperative transatlantic agreements. United States and Europe would each develop a missile independently and allow other to coproduce. • Program intended to fulfill high-priority military requirement for short-range (ASRAAM) and medium-range (AMRAAM) missiles common to all initial participants (Germany, UK, United States). • Continued resistance by U.S. military services led to program termination in early 1990s.	Failed codevelopment program. ✓ Firm military requirement ✗ … but no strong commitment to cooperate, including sharing requirements information. ✗ U.S. military services rejected European help to acquire new, capable short-range missile. ✗ No single, visible "product champion." Long resistance to OSD initiative by senior/mid-level officials.
NATO Frigate replacement (of the 1990s)	• Program proceeded collegially with each of the eight participating navies, who willingly provided substantial insights into their ship design philosophy and preferred approaches. • In attempting to meet the needs of all eight members, program eventually bifurcated into antiair warfare and antisubmarine variants, with additional subsets tailored for each member. Many of the promised benefits of commonality were consequently lost. Members began to drop out, until the remaining three (the Netherlands, Spain, and United States) agreed to terminate it.	Failed codevelopment program. ✓ Collegially run and willingness to share insights ✗ … but program suffered from fundamentally different views in Europe and United States about ship size, complexity, and price.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
Modular Standoff Weapon (MSOW)	• Begun with three partners (United States, Italy, Germany), with United States actively coaxing Germany into abandoning participa-tion in French-German APACHE program in favor of MSOW. Senior U.S. Air Force officers gave Germans assurances that MSOW would proceed to production regardless of the existence of a domestic "black" program. In the end, funding limitations prevented air force from continuing both programs, at the expense of MSOW.	Failed codevelopment program. ✓ Firm military requirement. ✗ Funding constraints. ✗ Tepid military support. ✗ Competition from domestic "black" program.
Multifunction Information Distribution System (MIDS)	• Structured around agreed set of standards that can be implemented differently on both sides. • Critical to program's success to date: equipment produced is functionally identical (a given signal input will generate an identical signal output regardless of whether the equipment is produced in United States or Europe). • Initially, the lead service for the program, U.S. Air Force gradually grew hostile; OSD transferred responsibility to U.S. Navy. • To allow for transfer delay in the program, later delivery date was decided, lending the program greater stability.	System past development, now entering production. ✓ Firm military requirement. ✓ Flexibility in structuring the program (i.e., separate European and U.S. design teams, enabling both sides to work in parallel and produce separately). ✓ Decision to assign program to a willing sponsor. Presence of several willing and capable program managers acting as effective "product champions."
Medium Extended-range Air Defense System (MEADS)	• Structured as a joint venture between Lockheed Martin (U.S.), DaimlerChrysler Aerospace AG (Germany), and Alenia Marconi (Italy). Following initial fears that program was becoming too expensive, United States proposed alternative approach built upon U.S. PAC 3 program, although new solution would fall short of desired German capability as had been agreed originally with United States. • Continued budgetary constraints, Germany subsequently reluctant to provide needed funds.	Currently in a three-year risk reduction phase. ✓ High-level political intervention often saved program from funding crises and discord over technology release. ✓ A firm military requirement ✗ … but changing military requirements in United States and Europe. ✗ Frequent lack of a truly committed U.S. sponsor. Flagging congressional support; tepid U.S. Army and MDA support. ✗ Slow implementation; constant funding uncertainty.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
	• Despite high-level intervention during 1990s to save it, program continues to be challenged by lack of a traditional sponsor. In United States, gap separating Missile Defense Agency (more requirements than funding) and army (many funding priorities related to transformation).	
Joint Strike Fighter(F-35)	• Project moved in October 2001 to contract award for the systems acquisition phase. Bush administration awarded contract to team headed by Lockheed Martin (incl. Northrop Grumman, BAE Systems, propulsion system suppliers). MOUs signed with several European gov'ts, with partners opting for different levels of participation. UK will be closest partner ("level 1"). Other partners: Italy, the Netherlands, Canada, Denmark, Norway. • Project to meet requirements of U.S. Air Force/Navy/Marine Corps and of U.S. allies for next-generation, cost-effective strike aircraft weapon system. A key objective is better system affordability through a cooperative structure that reduces development, production, and ownership costs. Project offers DOD promise of better-quality system at lower price, enhanced interoperability with allies, and political benefits from cooperation; for competing teams, opportunity to expand beyond domestic market and facilitate technology transfer via teaming arrangements. • Tiered structure allows varying levels of participation, each involving different financial commitments/benefits (e.g. information access, influence on requirements), allowing the program to meet the partners' diverse needs. Participating gov'ts are offered a seat at (or near) the table in exchange for relatively modest downpayment and a commitment to acquire JSF.	Ongoing codevelopment project; still in early stages. ✓ Firm military requirement, accepted by incoming U.S. gov't. ✓ Harmony among key stakeholders contributed to successful completion of competition phase/contract award. ✓ Strong incentives for both gov't and industry. ✓ Structure accommodates conflicting demands of national security in each participating country, achieving value for money within the program and creating domestic jobs. ✓ Flexible partnership structure designed to accommodate different levels of commitment and available resources. ✓ Fewer inefficiencies from production allocation decisions based on geography rather than performance and price. ✓ JSF also attracting new participants, who may bring added stability to the program. ✗ Allied partners unlikely to contribute more than 15 percent of funding, thus scaling their role and influence in the program proportionally.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
	• International partners brought in early on to resolve issues of timeliness and military requirements. Market allowed to determine teaming arrangements. • Despite existing export control-related impediments, State Department likely to make JSF first program to receive a "Global Project Authorization" under DTSI.	
Industry-sponsored Codevelopment Programs		
Kestrel AntiArmor System	• A derivative of the Predator AntiArmor system developed and produced by Lockheed Martin for U.S. Marine Corps. Modification accomplished by Lockheed Martin and MBDA. An unsuccessful competitor for the UK's NLAW program. • A UK-U.S. government MOU supports technical data exchange between the two companies.	Failed effort. ✓ Firm military requirement. ✓ Both team partners saw benefits and greater chances of winning NLAW contract through teaming with the other. ✗ U.S. government was a reluctant supporter in facilitating the flow of technical data, inhibiting ability to operate as an effective team.
Gripen aircraft	• A Swedish design drawing heavily on subsystems from United States and Europe. • Swedish MOD decided to acquire world-class aircraft designed specifically to operate within Sweden's operational doctrine but realized that aircraft would be unaffordable if all or most of its major subsystems were developed domestically. • Gov't-to-gov't talks begun late 1970s. MOD secured advance assurances from U.S. and various European capitals that Sweden would be allowed to import what was needed for production.	A continuing success. ✓ Pragmatic approach from the very beginning. ✓ Successful preliminary gov't-to-gov't discussions. ✓ Reliability of foreign sources of supply.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
AV-8B Harrier aircraft	• Started as a French concept for a vertical takeoff and landing capability, receiving most of its initial funding from the U.S. Mutual Weapons Development Program. Two UK companies performed early work and provided remainder of funding. UK MOD subsequently became interested, as did German MOD. • 1962 three-nation program begun; years later UK MOD authorized production. 1957 U.S. Marine Corps expressed interest in close air support vertical/short takeoff and landing aircraft; 1960s acquired more than 100 aircraft. 1975 McDonnell Douglas took over Harrier development, with Hawker as subcontractor. 1981 McDonnell Douglas and BAe entered into teaming and licensing agreement to develop Harrier II AV-8B. • UK and U.S. gov'ts concluded parallel MOU on programmatic and other issues, such as third-country transfer. Both gov'ts acquired new aircraft, with U.S. and UK partners dividing production tasks (UK-produced engines and rear fuselages, U.S.-produced front fuselages). • United States, Italy, and Spain entered into MOU on developing variant of the aircraft equipped with advanced radar to improve aircraft's ground attack performance.	Project marked by long and varied, but largely successful, history. ✓ Throughout several stages, support provided variously from U.S. gov't, UK industry, UK gov't, German gov't, and UK and U.S. industry. ✓ Each transition successful largely because effort led to an aircraft capable of meeting the unique priority military requirements of all four MODs (UK, United States, Italy, and Spain). ✓ Industry showed flexibility in allocating production tasks and sensitivity to program cost.
Norwegian Advanced Surface-to-air Missile	• Derivative of U.S. AMRAAM. • Modification for ground launch accomplished by industry responding to a Norwegian MOD requirement. Industry first brought possibility to MOD's attention as a relatively straightforward, affordable solution.	A successful, ongoing project. ✓ Industry initiative instrumental in satisfying needs of Norwegian MOD. ✓ Industry solution required and received support from U.S. government.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
Government-sponsored Coproduction Programs		
F-16 aircraft	• 1976 U.S. offer of F-16 to Belgium, Denmark, Norway, and the Netherlands; among the largest gov't-sponsored coproduction arrangements at the time. • Offer brought in substantial industrial participation, backed by long-term industrial relationships. Strong links forged between U.S. F-16 contractor (General Dynamics at first, now Lockheed Martin) and its four European partners (the European Production Group). • Creation of a formal steering group brought EPG Air Force officials together with U.S. counterparts on periodic basis, enhancing program management and interoperability. • EPG countires also earned place in U.S. F-16 program office. • Four-nation EPG constituted role model for other countries that later acquired F-16.	A successful, ongoing program. ✓ Focused and timely U.S. approach to program (EPG countries were in the market for a new fighter aircraft). ✓ Strong incentives for both industry and gov't to participate in the program. ✓ Solid program management assisted in keeping the program on track.
Stinger man-portable air defense system	• Offered by United States to NATO Europe, as a candidate for "dual production." • Germany seized initiative and formed a consortium with Greece, the Netherlands, and Turkey, which provided the volume needed to achieve economies of scale in production. Negative first U.S. reaction to German initiative despite advance approval by both the DOD and State Department. Two years lost while release issues were debated within DOD. • Favorable decision eventually delivered but only after considerable debate over whether to honor previous U.S. offer. U.S. delay sent mixed signals to allies, raising doubts about U.S commitment and reliability.	Past successful coproduction program. ✓ Effort guided by a German-U.S. MOU and supported by industry agreements. ✓ Support within DOD critical to overcoming objections of DOD technology transfer community. ✓ U.S. gov't support instrumental in Stinger gaining acceptance in Europe.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
Industry-sponsored Licensed Production		
Mobile Subscriber Equipment (MSE)	• Cooperative arrangement with origins in competition between French RITA and British Ptarmigan systems. French and UK companies knew of U.S. Army's requirement and made their products known to the army secretariat. • U.S. acquisition decision driven largely by army under secretary's awareness of existence of foreign systems and his desire to purchase "off-the-shelf" system for purposes of speed and relatively low risk. • French and UK suppliers each teamed with a U.S. company to strengthen their competitive position. French (Thomson-CSF and GTE) solution ultimately selected and MSE system produced in United States. • Demonstrated that foreign capabilities were decisive to the success of MSE.	Past successful licensed production. ✓ Firm military requirement; U.S. Army prepared to initiate domestic development program, but foreign competitors had already demonstrated capabilities that approximated the army's requirement. ✓ Senior army official functioned as "product champion" and was personally involved. ✓ Environment especially favorable for a foreign competitor with available product and a U.S. partner. ✓ Efficiency, delivery time, and an existing system capable of meeting military requirement prevailed.
AT-4 AntiArmor missile	• AT-4 offered to U.S. Army after recognition that Viper missile program was on the verge of failing. Sweden actively marketed its AT-4. Missile subsequently tested against and prevailed over three available alternatives (two U.S., one Norwegian). • Bofors of Sweden signed licensed production arrangement with Honeywell, allowing missiles' production in United States for DOD and for export sales.	Past successful licensed production. ✓ A firm, funded program was in place. ✓ Superior foreign program. ✓ Innovative production arrangement. ✓ Ensuring "made in America" label through production of a Swedish solution produced under license to a U.S. firm.
AV-8 aircraft	• U.S. Marine Corps acquired British-made AV-8 to meet immediate need for ground-attack aircraft capable of operating from temporary bases near front lines. • Though major shortcomings regarding payload, range, and stability, UK aircraft viewed as close approximation to requirement; acquired in modest quantities. • AV-8 demonstrated sufficient promise to warrant development effort that led to the AV-8B.	Successful acquisition for ongoing enhanced program. ✓ Firm military requirement; no domestic option available. ✗ Marines expected to experiment operationally with aircraft, determine required improvements, and then encourage industry to upgrade aircraft's capabilities.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
120mm smoothbore tank gun	• Firm military requirement; project encountered difficulties when technical disagreements surfaced but recovered and survived. • Gun selected by Secretary Rumsfeld in mid-1970s to be mounted on M-1 tank and provide firepower substantially in excess of then-standard 105mm gun. Decision motivated, in part, by need to persuade Germany to join NATO AW&C program (see below). Political decision welcomed by U.S. Air Force (as AW&C program sponsor) but resisted for years by U.S. Army insisting that 105mm gun was fully adequate for its needs. New gun ultimately installed upon DOD persistence. • Later British, French, Germans, and Americans team up to jointly consider feasibility of a 140mm tank gun.	Successful acquisition for ongoing program. ✓ Firm military requirement. ✗ Initially, very strong technical disagreement over adequacy of 105mm gun. ✓ Sustained political leadership over eight-year period in pushing program ahead before that persistence was ultimately applauded by the army itself.
Hawk aircraft	• Selected to meet U.S. T-46 requirement. Variations of same British aircraft offered by a McDonnell Douglas-BAe and a BAe-McDonnell Douglas team. McDonnell Douglas-led team selected as the winner. • Aircraft modified substantially after contract award to meet the operational requirement.	Successful acquisition for ongoing program. ✓ Firm military requirement; no suitable domestic competitor. Foreign supplier met requirement, with modification, at lower risk and price. ✓ U.S. company familiar with DOD acquisition practices managed modification and production of aircraft.
Small Utility Support Vehicle	• Acquired by U.S. Army for use in Arctic operations. • No viable U.S. competitor. • Quantities required insufficient to warrant U.S. development program or U.S. production; more cost effective to acquire from Swedish producer. • Additional vehicles required in subsequent years.	Ongoing successful acquisition. ✓ Firm military requirement and no suitable domestic competitor for production or modification. ✓ Army received needed product in a timely manner, with very little risk, at a predictable price.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
Roland short-range air defense system	• Selected in 1970s to meet U.S. Army requirement. Army later decided on substantial modification. Changes performed to allow "black boxes" in European and U.S. systems to be functionally interchangeable, even if different inside. Boeing and Hughes performed modifications with license-based production. • Program cancelled in early 1980s after army under secretary determined system to be too costly and not significantly more effective than systems already fielded by U.S. Army. (28 Roland fire units subsequently produced were transferred to the New Mexico National Guard.)	Failed acquisition. ✓ Firm military requirement and proven European solution ✗ … but decision to redesign negated much of the benefit of buying "off the shelf." ✗ Loss of faith in and commitment to new system. ✗ While production ongoing, political decision brought program to an abrupt halt.
Chobham Armor	• A British discovery, made available to United States by UK gov't in late 1970s for use on U.S. M1 tank. • Technology viewed as especially sensitive at the time; highly classified agreement signed by two gov'ts.	Past successful acquisition. ✓ Dialog between UK and U.S. anti-armor technical communities paved way for technology transfer that was initially beneficial to United States. ✓ Sensitivity of armor technology required involvement of two heads of state to bring agreement to closure.
Government/Industry Incentives		
NATO Airborne Early Warning & Control (AW&C)	• Major undertaking involving gov't and industry incentives to strengthen NATO's ability to confront Soviet air power. • Despite clear military requirement, difficult to convince all NATO capitals to contribute to program cost. Separate U.S. negotiations with each NATO member with offers of benefits, but France, Germany, and UK remained ambivalent. • Germany later convinced, but France and UK declined to join program (although they acquired aircraft several years later for their own forces).	Benefited from political leadership. ✓ Very compelling military requirement ✗ … but insufficient to motivate senior officials and their legislatures in European countries to appropriate funding for offshore programs. ✓ Negotiations between U.S. defense secretary and European counterparts resulted in acceptable package of political and industrial incentives.

Case Studies in Defense Industrial Cooperation *(continued)*

	Main Features	Evaluation
NATO Central Region air defense	• Launched in early 1980s to replace Nike with Patriot. NATO multinational study group, charged with exploring how NATO European capitals might proceed. German MOD in full agreement with modernization need but unable to convince German Bundestag to provide needed funds. MOD officials met later with U.S. counterparts and agreed to explore innovative approaches to address the military requirement aspect, the need for flexibility, and the industrial dimension. • Final solution allowed Germany to pay for new Patriot fire units partially with money and partially with services (manning U.S. Patriots in southern Germany, protecting four U.S. air bases in Germany with Roland air defense units, exploring future programs in discussions that later led to the MEADS requirement). • Similar bilateral discussions between United States and the Netherlands, Italy, and Belgium. The Netherlands accepted variation of German-U.S. agreement; Italy about to follow but reconsidered after fall of Berlin Wall.	Partially successful gov't-led incentives. ✓ Firm military requirement ✗ … but lacked senior gov't support due to high financial investment. ✓ Innovative financial solutions and creation of "package" that included military, political, economic, and industrial components helpful in winning support of some allied gov'ts ✗ … but ran afoul of political changes and was only marginally effective.