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AEROSPACE

The multibillion-dollar global industry that develops and produces commercial and military aircraft and spacecraft. The aerospace industry is of great importance in contemporary foreign affairs. Aerospace technology has vital military applications in military aviation, rocketry, space satellites, and space weaponry. In addition, large industrialized nations feel a need to have a presence in the civilian aerospace industry because of its high-wage jobs, revenues, profits, and export receipts; the aerospace industry generated $40 billion in annual export revenues in the United States in the early 1990s (one aerospace firm, Boeing, is the largest single earner of export revenues). Some underlying technologies in aerospace are generic technologies that have applications outside of the aerospace complex, including, for example, the development of Plexiglas for aircraft cockpits, charge-coupled devices (CCDs) for digital imaging, solar cells and solar arrays. advanced radars, and new composite materials. The use of satellites for earth observation and broadcasting of data and video images makes the satellite and launcher industries important for an increasingly wide range of economic activities. The next generation of low-orbiting satellites promises to turn the earth into a single cellular telephone market.

The aircraft industry accounts for a large part of the aerospace industry's total revenues and employment. It is particularly vulnerable to strategic trade policies because of the high research and development (R&D) costs required for the invention of new aircraft and because of the steep learning curves in their subsequent production. A commercial aircraft company developing a new wide-body jet, for example, may have to sell seventy aircraft or more at a loss before breaking even. But once the break-even point has been attained, profits are typically quite high. There is substantial risk, however, that a particular new aircraft will not meet the needs of purchasers and that the company will never make a profit on its substantial investment, sometimes reaching billions of dollars. Military aircraft manufacturers face similar economic requirements. It has been estimated that from 1972 to 1988, General Dynamics spent somewhere between $5 and $7 billion to develop and improve the F46, at least half of which went into the electronics (called "avionics" in the aircraft industry) for the plane. Such large and risky investments are not likely to be made without assurances that there will be, in the end, a big customer like the U.S. government.

One reason the commercial aircraft industry is of considerable interest to governments is that many aircraft, with the exception of supersonic fighters and the like, are dual-use products utilizing dual-use technologies. (The term "dual-use" means that the product or technology can have either military or civilian applications.) A jet engine, for example, can be used in either a military or a civilian aircraft. A missile can be used to carry either civilian communications satellites or nuclear warheads into space. In the past, there has been considerable "spin-off" from military technologies to civilian ones because there were many military technologies that could be applied to commercial products. The early commercial airline industry was made possible because of investments by the military and the U.S. Postal Service in aircraft technology for the military and other govern-mental uses, and the turbofan engine that is used for commercial wide-body jet aircraft was developed initially for military transports.

Spin-off may be limited, however, by the exotic and highly expensive nature of new military technologies—it is not likely that a commercial aircraft needs to have "stealth" radar profiles or special radar-absorbing coatings. As a result, attention has increasingly been paid to the opportunities for "spin-on" applications from civilian to military technologies. A good example of spin-on is the current ability of military products to take advantage of greatly improved performance and lower unit costs of

microelectronic circuits built mainly for civilian applications. Because of increased concern about spin-on, many members of the defense community no longer consider it sufficient simply to maintain defense-oriented industries by subsidizing R&D and products for military weapons systems. Increasingly, these individuals are willing to provide governmental support to civilian industries where dual-use products and technologies are created, arguing that the United States would otherwise be less able to afford needed high-technology weapons systems. This issue was a topic of rather heated debates during the 1992 presidential election campaign, in which the administration of President George Bush defended its policies of supporting only military-use technologies, while Bill Clinton's forces argued for stronger support of dual-use technologies.

Global Aerospace Production

World sales of aircraft totaled $220 billion in 1990. Military aircraft accounted for 70 percent of global sales in that year, civilian aircraft for only 30 percent. U.S. shipments of aerospace products peaked at over $133.6 billion in 1992 but were projected to decline to $101.9 billion in 1994. Shipments of complete aircraft totaled $41.8 billion in 1992: $30.3 billion in civilian large trans-ports, $1.8 billion in civilian general aviation, $0.1 billion in civilian rotocraft, and $9.6 billion in military aircraft. In 1992, shipments of aircraft engines totaled $24.1 billion, aircraft parts and equipment shipments were $23.3 billion, guided missiles and space vehicle shipments were $22.1 billion, space propulsion units and parts were $3.5 billion, and space vehicle equipment shipments were $1.8 billion. Demand for large transports and military aircraft, a substantial chunk of the total demand for aerospace products, was projected to drop sharply in 1993 and 1994, while demand for other aerospace products were projected to be flat or increasing.

The ten largest companies in aerospace by revenue in 1992 were Boeing, McDonnell-Douglas, General Electric, Rockwell, United Technologies, British Aerospace, General Dynamics, Lockheed, Deutsche Aerospace, and Airbus Industrie. Of these, only British Aerospace, Deutsche Aerospace and Airbus Industrie were not U.S. firms. The U.S. aerospace industry has traditionally had strong competitive advantages over its overseas competitors (in 1992, for example, U.S. exports of aerospace vehicles and equipment totaled $45 billion and imports were $14.5 billion, producing a trade surplus of $30.5 billion). The U.S. aerospace trade surplus declined during the 1990s, mainly as a result of the increasing competitiveness of the European commercial aircraft industry.

One reason for the stiffer foreign aerospace competition was the formation in 1969 of Airbus Industrie, a European consortium which eventually had four principal members, British Aerospace, Deutsche Aerospace, Aerospatiale of France, and CASA of Spain. The attempt to establish a European consortium for civilian aircraft had begun in the 1960s. By the end of 1991, the governments of Western Europe had spent at least $5.6 billion and possibly as much as $26 billion in support of the efforts of the Airbus consortium to challenge successfully the two other major producers of wide-body jet aircraft, Boeing and McDonnell-Douglas.

Aside from the threat from Europe, the U.S. commercial aircraft industry has suffered from the long-term effects of governmental deregulation. Beginning in 1978, deregulation has had the effect of increasing the number of passenger miles and carriers but at the expense of the profit margins and hence the investment capability of the major airlines. When there is a round of price competition, the airlines tend to cancel or defer orders for new aircraft. Hence, one source of competitive advantage of the period before 1978, strong and steady domestic demand for new aircraft, has been weakened. U.S. air-craft producers are increasingly dependent, as are the Europeans, on demand for aircraft in third markets.

The production of aircraft outside the major industrialized regions has been increasing since the 1970s. This is partly driven by increased domestic demand for air-craft in those countries and the desire to limit foreign imports. Through tariff protections or state-run enterprises, some newly industrializing countries in the Third World have built local commuter aircraft businesses and have even been able to export some of their domestic production of aircraft in order to earn hard currencies. For example, the Brazilian state-owned aerospace firm, Embraer, was quite successful in selling turboprop air-craft both for military uses and for commuter airlines.

As a result of the rapid drop in demand for military aircraft worldwide, U.S. military aircraft manufacturers shipped **only** $8.4 billion in complete aircraft in 1993. Historically, the U.S. government has accounted for 80 percent **of** U.S. military aircraft purchases. The rest is sold through direct exports and the Department of Defense's Foreign Military Sales program.

International Cooperation in Aerospace

U.S. dominance in the aerospace industry has created some tensions with its major allies. The U.S. government has tried to deal with these tensions by promoting international cooperative ventures. For example, the U.S. position in NATO has been to favor cooperation in defense matters. During the 1970s, U.S. policy recognized the desire and the necessity for European countries to build up their own defense production capabilities by adopting the idea of a "two-way street" in defense contracting and procurement. The United States supported the creation of the Independent European Pro-

gram (group (IEPG) in 1976, which was a forum for meetings by European defense ministers to harmonize national policies toward promoting defense industries. In addition, the United States favored within NATO a policy of Rationalization, Standardization, and Interoperabilitv (RSI) which would redress the unwillingness of NATO member countries to standardize production of major weapons systems. The lack of standards in military production not only reduced the combat readiness of NATO troops but also may have added $10–15 billion to annual defense procurement costs. The U.S. government encouraged coproduction of military aircraft by firms in major allied countries. Coproduction agreements took the form of memoranda of understanding (MOUs) negotiated among governments and firms. Examples include a U.S.-European agreement to coproduce F-16 fighters; a U.S.-German agreement to coproduce AIM 9L air-to-air missiles; and a U.S.-U.K. agreement to coproduce Harrier "jump-jet" fighters.

The response of the European governments to these U.S. initiatives was somewhat disappointing in that the United States expected to be a partner in a much wider variety of agreements than were actually obtained. The U.S. government remains concerned that a "fortress Europe" mentality is developing in this sector, with a pronounced tendency to favor intra-European cooperation over cooperation between the United States and Europe. It has been U.S. government policy not to allow key aerospace technologies to be transferred to foreign countries. One example is the great effort made by the U.S. government to prevent foreign firms or governments from acquiring the capability to use high-definition satellite imaging technologies for "spy-in-the-sky" satellites. Another is the policy of not revealing the source code for the software controlling avionics computers in advanced fighter aircraft (even to allies in coproduction agreements).

Aerospace issues rose to the top of the policy agenda of U.S. presidential administrations in the 1980s and 1990s. The "Strike Force" of President Ronald Reagan's administration wrote a report on the threat to the U.S. civilian aerospace industry posed by European subsidies for Airbus a decade earlier. There was insufficient consensus at that time for the recommendations of the report to be carried out. President Reagan and his advisers pushed hard for new efforts in aerospace technology through their advocacy of the Strategic Defense Initiative (SDI or Star Wars). They tried to win support for SDI in Europe by allowing European firms to bid for SDI contracts.

The administration of George Bush focused its attention on both military and civilian aerospace issues after the Department of Defense announced, and the U.S. Senate attacked the agreement with Japan to build a modified F-16 fighter plane called the FSX (Fighter Support Experimental). Critics of the deal claimed that it represented a precedent for the transfer of avionics source code and other vital technologies. The FSX conflict was an embarrassment for both governments and may have done great long-term damage to U.S.-Japanese relations. The Bush administration was responsible for negotiating the U.S.-E.C. Commercial Aircraft Subsidy Agreement (1992), which was designed to end the dispute between the United States and the European Community over Airbus. This agreement helped to dampen what was becoming a very serious trade dispute.

At an appearance at a Boeing Aircraft plant in February 1993, just after taking office, President Bill Clinton presented his ideas for promoting high technology in the United States, but in a highly publicized aside he commented that Boeing's current financial difficulties were due to "the $26 billion that the U.S. sat by and let Europe plow into Airbus..." and promised to "change the rules of the game" so that this would not continue. Shortly after this, President Clinton reaffirmed his sup-port of the 1992 Aircraft Subsidy Agreement, but the underlying tensions created by the efforts of Europe, Japan, and even some Third World nations like the Republic of China (Taiwan) to challenge the United States in commercial aircraft markets did not appear likely to go away.

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See ***also*** North Atlantic Treaty Organization; Strategic Defense Initiative

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