
SUMMARY & HIGHLIGHTS

The U.S. Aerospace Industry in the 1990s A Global Perspective

The United States is the world leader in aerospace design and manufacturing but other countries are strong competitors. In a new report, "The U.S. Aerospace Industry in the 1990s: A Global Perspective" the Aerospace Industries Association takes a hard look at where it stands and how it can maintain or increase its market position.

The aerospace industry of the 1990s is global, dynamic, and complex—driven by fast-paced technological change and heavily influenced by national government support. The aerospace market is also characterized by numerous international partnerships of every sort. In this environment, the traditional "modus operandi" of many U.S. firms and the U.S. Government may be inappropriate for continuing success.

The U.S. Aerospace Industry in 1991

Since AIA published its 1988 report on *The U.S. Aerospace Industry and the Trend Toward Internationalization*, the U.S. industry has increased its international activities. As a result, both exports and imports continue to rise, but export growth has been considerable enough to ensure a continuing string of record trade surpluses. Aerospace has the largest positive trade balance of any U.S. manufacturing sector. Still, the U.S. world market share in aerospace is declining. Despite growing demand for aerospace products, there are an increasing number of market competitors.

In a changing world, where market access is often on a *quid pro quo* basis, U.S. companies cannot depend only on direct sales abroad of U.S. products manufactured in the United States. Other avenues of trade must be pursued. Consequently, the number of U.S./foreign partnerships is rising and U.S. companies are exploring new roles in these relationships.

U.S. aerospace manufacturers are producing for two very different markets,

although strong foreign competition and international cooperation—to one degree or another—are characteristic of both.

Defense Aerospace Market With the end of the Cold War, and despite lingering concern over a Soviet threat, the United States and its allies are more concentrated on regional threats to global peace. A lesson of the Persian Gulf War is that a strong defense is still necessary; at the same time, that lesson will not prevent the decline of the defense budgets of the United States and its allies. Instead, there will be increased emphasis on tactical systems, and on force mobility and deployment.

The U.S. defense industry is entering this new era from a weakened financial position resulting from government policies that limited profits and reduced the cash flow needed to meet increased operating capital requirements. Defense exports can offset some of the lost sales as the U.S. Government cuts defense spending. However, any number of sales are politically problematic for the United

States, and with enormous excess defense production capacity in the world, American companies can easily be supplanted as suppliers. The loss of key defense markets could mean loss of national influence in certain regions of the world.

The issue of economic competitiveness has grown in importance relative to purely defense-related concerns in the United States. Worries about the industrial/technology base have heightened discussion over foreign sourcing for defense system components, foreign investment in the United States, offset sales arrangements, and technology export through international defense cooperation. While many would have the United States pull back from cooperative relationships, other countries, particularly in Europe, are forging closer ties; this could limit U.S. participation in those markets. European countries are also strong competitors for defense sales around the globe.

Civil Aerospace Market The market for civil aerospace products is more promising than the defense market. Commercial production is the growing share of total U.S. industry output and

commercial products have long dominated U.S. aerospace exports. With world airline capacity expected to double by 2005, prospects for the commercial transport sector are particularly bright.

Problems confronting U.S. producers include economic recession and airport congestion, which could limit expected expansion of this market. Another concern is the need to harmonize airworthiness requirements to prevent additional costs to U.S. manufacturers, and to preclude these requirements becoming technical barriers to trade between nations. Probably the most serious threat to all U.S. civil aircraft and space vehicle manufacturers is foreign government support of their aerospace companies.

The U.S. civil helicopter industry is not faring as well as the commercial transport sector. Strong foreign competition, often subsidized, has made substantial market inroads. Rotorcraft manufacturers have suffered from recession in the oil industry. Today, they are pinning hopes on the need to replace aging fleets, a rebound in energy markets and the economy, and new technology models under development. Long-term, expansion of this market depends on development of an infrastructure to support regularly scheduled rotorcraft operations.

American general aviation manufacturers have experienced serious decline in the piston-powered aircraft market, due to excessive product liability claims and the resulting high cost of insurance. Higher-value commuter and business turboprops and business jets are selling well and exports are rising. New technology aircraft and sizable military contracts should lead to stronger sales.

The space vehicles and launch services sector is expanding steadily. Military requirements for space systems will continue to grow. The commercial space market will develop more slowly and require substantial government support and encouragement.

Two regional markets are particularly important to the U.S. aerospace industry in the 1990s — Western Europe and the Asia-Pacific Rim.

Western European Aerospace Market

The market landscape is being altered for U.S. manufacturers by the emergence of a unified Western European economy, parallel efforts to integrate the European defense market (which already has significant cross-border relationships), the unification of East and West Germany, and the opening of other Eastern European countries. The U.S. relationship with Europe through NATO has been a cornerstone of the American defense market. Events in Eastern Europe and the Soviet Union may mean that the NATO alliance will take on a more political than military cast — with considerable effect on European defense purchases and U.S./European manufacturing arrangements.

Western countries will continue to need defense equipment such as deep strike, theater ballistic missile defense, air defense, chemical/biological warfare protection, command and control, surveillance and verification, early warning and reconnaissance, and long-range targeting systems. These needs should provide opportunities for joint U.S.-European cooperation. However, joint programs have not occurred on any significant scale. Instead, European countries are cooperating among themselves—as are American companies—to a greater degree.

Cross-border relationships have been central to European strategic planning for years, and they have been a key element in keeping the European aerospace sector viable. Meanwhile, U.S. defense manufacturers were able to be successful by concentrating on the large U.S. domestic market, and competing against each other.

Exports have been extremely important to European aerospace manufacturers for years, and—as the U.S. defense market shrinks—their importance to U.S. companies is growing. Both U.S. and

European aerospace companies lean heavily on direct exports and on licensing to achieve foreign sales objectives. In addition, European manufacturers are pursuing international joint ventures and mergers at a pace unparalleled in the industry. While most of these efforts are aimed at consolidating their regional position, European manufacturers are also making inroads in the U.S. and Asian markets. The emergence of these larger corporate entities and interfirm alliances is spearheading a global change in the industry.

Factors that figure prominently in the European embrace of a transnational strategy, and the development of larger companies, include: the rising price of advanced technology, the increasing risk of undertaking aerospace programs, regional overcapacity, and the need to balance the United States' competitive advantages in terms of a greater sales base and strong R&D funding.

European governments have fostered international aerospace alliances by:

- Allowing companies to participate in transnational partnerships—particularly those involving defense contracts and nationalized firms. European governments have not overburdened partnerships with oversight and technology-transfer restrictions.

- Continuing to fund joint venture projects which, in many cases, would have been impossible without government assistance.

- Supporting European economic unification, joint aeronautical R&D, and the efforts of the Independent European Program Group, which has called for cooperative R&D and greater regional competition to strengthen Europe's defense industrial base.

Nine of the 12 European Community members can produce some form of aircraft and several have the capability to design and assemble state-of-the-art products. Depending on the extent of their

current capabilities, these countries use international collaboration to supplement their domestic programs, build their credentials in the world aerospace market or, in the case of new market entrants—Greece, Portugal and Turkey—to build their industrial base.

Japan and the Asia-Pacific Rim Aerospace Market

Twenty-three countries comprise the Asia-Pacific Rim region and the robust economic growth of this region will continue to create demand for aerospace products. Commercial air traffic is in a growth mode. Defense spending is also on the increase, with annual regional increases of 6 percent. The region is an important market for U.S. aerospace manufacturers and commercial sales, particularly, have shown growth. European manufacturers have also gained a share of this market—once totally dominated by U.S. industry. European firms are currently engineering a more aggressive marketing campaign in the region.

Many nations in the Asia-Pacific Rim are launching their own aerospace programs. Japan has ambitions to be a major player in the world aerospace market. While its efforts have not always met with success, Japan continues to move forward and is currently involved in several important aerospace projects. China is another active regional aerospace market participant, although with more limited capabilities. Taiwan and South Korea both have programs underway, which they hope will provide the start necessary to build at least some aerospace capacity within their countries. While these nations will not be able to challenge U.S. "big-ticket" programs such as the manufacture of commercial transports, they will increase competition in other segments of the market—e.g., in the production of components and parts. Because a large national commitment will be needed for success, government support of aerospace programs in the Asia-Pacific Rim will be substantial and long-term.

Japan is the economic power in the region and its actions may be a guide to its neighbors. In the defense sector, the Japanese aerospace industry has used its strong position as a buyer to obtain technology and manufacturing skills from foreign companies, particularly those in the United States. The Japanese domestic market alone is not of sufficient size to allow Japan to sustain a large commercial aircraft manufacturing effort. Instead, the Japanese have concentrated on niche markets, such as parts and subassembly production, and have targeted export demand.

The Japanese government has been strongly behind the development of its aerospace industry. It has identified projects, solicited foreign collaboration, set up and coordinated domestic consortia, and arranged financing and R&D funding. Japan considers cooperation between government and industry in developing market capabilities not only desirable, but necessary. The government sees aerospace as a strategic industry, and the key to advancing high-technology development generally.

Japan is pursuing an aerospace development strategy centered on:

- Continuing R&D aimed at enabling Japanese manufacturers to shoulder a larger role in development and production of future or next-generation technology (e.g., high speed civil transport). Japan will seek an equal partner role in such an effort.
- Attempting to launch a regional aircraft program with foreign partners.
- Improving design and production processes by remaining a high-quality reliable supplier of aircraft parts and sections, particularly fuselage subassemblies and wing parts.
- Becoming a world leader in aerospace systems and components production. Japanese industry is looking for joint development opportunities in this area.

- Developing high technology space systems, including unmanned launch vehicles and manned space systems.

At the subcontractor level, Japanese firms compete against each other and foreign companies for business. For large projects, which require high levels of R&D funding, national competition is limited; major Japanese aerospace firms form domestic consortia and negotiate workshares. Consortia enable Japan to present a stronger position on the international market.

Changing U.S. Role in International Space Activities

For years, the United States dominated free world space efforts, cooperating with other nations to establish worldwide satellite communications capabilities, but continuing to develop guidance systems, electronics, computer software, new materials, propulsion equipment, and so forth, in the United States—and almost solely for government needs. Today many nations have space capabilities and any nation with the ability to pay for a launch can have access to space. At least seven nations offer launch facilities and vehicles. Space is on the way to becoming a business, not simply a function of national prestige or dominance driven by political and military considerations.

Worldwide, it is estimated, nearly \$80 billion a year is being spent on space-related activities. Of that \$80 billion, the United States accounts for about 42 percent, the Soviet Union 45 percent, and the rest of the world 13 percent. Of that 13 percent, Europe predominates followed by China and Japan. Many newcomers to space have piggybacked on American technology.

In a world of tighter space transportation and R&D budgets, the United States must make decisions about its investment. Billions of dollars have been spent to support a serious space program. However, large near-term outlays for long-range, visionary programs may be in doubt in light of program setbacks and budget

deficits. The United States will maintain a broad capability in space—in part, for national security reasons. But it must better position itself to capture the benefits of space in the commercial sector.

Over the next few years, it will be important to maintain confidence in the U.S. space program, and to sustain an appropriate level of funding. In addition, space programs need stronger coordination and focus within the government. With a spotty history of success in international cooperative programs, the nation also needs to recognize that international partnerships will be necessary for many new space endeavors—and operate accordingly. Finally, there are some tough trade issues to be faced including how to ensure that U.S. private companies can compete against the space products and services of nonmarket economies.

Aerospace Technology - Trends and Strategies

Technology development and technology export are priority concerns for the aerospace industry. Technology is a key issue in either creating or impeding international partnerships. The high cost and risk of new technology, access to technology advantages of partners, and market entry are reasons favoring cooperation. But technology leaders such as the United States also face the possible loss of a key element of business advantage. It is important to ask: What must be held back to protect future competitive advantage? What can be shared to achieve today's sales, today's market access, today's mutual benefit?

Nations are collaborating more to develop and apply new aerospace technology, and the capabilities of U.S. competitors are growing. An additional complication is that some technology being applied in aerospace is "dual-use," with both military and civil applications. This has led to a situation where some U.S. products are—or may be—restricted from export, while similar products of competitors are not.

The issue of technology transfer was at the heart of the controversy over the FSX fighter project with Japan. The issue has also caused problems between Europe and the United States. If the United States is not willing, or U.S. companies not allowed, to pursue cooperative efforts—sometimes from initial R&D on—companies from other nations will not hesitate to fill the void. The agreement between Germany's Daimler-Benz and Mitsubishi of Japan to discuss a range of collaborative efforts is a striking example.

What can be lost in discussions about cooperation between the United States and other countries is the fact that technology flows both ways. Other countries have made advances from which the United States can benefit. Agreements can be structured to protect critical, proprietary information while taking advantage of the market potential cooperative arrangements provide.

The United States has no strategy to foster technology development and satisfactorily address technology-sharing questions. Its approach is an *ad hoc* blend of government and private industry initiatives, offensive and defensive. Defensive initiatives include Buy American legislation, offset restrictions, anti-foreign direct investment measures, and export controls. Unfortunately, export controls are not coordinated, delays in issuing export licenses can be extreme and American manufacturers are often prevented from making, or must report at length, special arrangements needed to secure foreign sales.

Strategies that place the United States on the offensive include research and development incentives, teaming domestically for research and development, and targeted spending on critical technologies. The Aerospace Industries Association has launched a Key Technologies initiative to keep the United States aerospace industry in the forefront. AIA identified important enabling technologies, and is developing technology roadmaps and development plans, and working co-

operatively with the government and universities to focus funding and research.

Government policy makers and industry continue to debate what a national technology strategy should be, and the issue is often contentious. Technology strategy is frequently cast, and negatively, in terms of "industrial policy"—the choosing of winners and losers. The question is: what middle ground can be found between a government-directed and supported approach to business and leaving things as they are? Meanwhile, U.S. companies compete in a marketplace where other nations' resolve to subsidize and otherwise assist their industries is influencing the outcome of sales.

Conclusions

The World Aerospace Market

The aerospace market is a global market that will strongly challenge U.S. aerospace firms in the 1990s.

The aerospace market is characterized by numerous international business partnerships—from joint ventures through subcontracting relationships. In this environment, the traditional *modus operandi* of many U.S. firms and the U.S. Government may be inappropriate for achieving success.

The U.S. aerospace industry will continue as the world leader in aerospace for the foreseeable future—given the right balance of policy and programs. It will not maintain as dominant a position as in the past in all segments of the market.

The prescription for market success calls for maintaining the industry's scientific and technical strengths and enhancing them with greater manufacturing capability. Success depends upon the industry's ability to export, its access to affordable investment capital—and to well-educated workers.

New market opportunities are available for U.S. aerospace firms.

With sales and exports at record levels, the U.S. aerospace industry is in a strong position to capitalize on the market opportunities of the next decade. The world's defense market will continue to be an important source of sales.

However, the commercial sector is now the area of market growth.

U.S. aerospace producers face greater competition.

Every national market will be more competitive. Manufacturers from the Soviet Union and Eastern Europe will be moving into Western markets for the first time. Aerospace firms in Western Europe will be stronger and more capable than ever. Countries in the Asia-Pacific Rim are intent on developing their own aerospace industries.

Trends In International Aerospace Cooperation

Foreign firms will continue to seek out U.S. companies for collaborative efforts, particularly on commercial projects.

Aerospace companies are cooperating internationally in order to compete. The size of the U.S. military and commercial markets makes U.S. companies attractive partners. At the same time, foreign companies—particularly European firms—are competing with the United States for key roles in international partnerships

Defense cooperation between the United States and other nations will not live up to recent expectations.

The decline in defense funding and the changing threat will reduce defense cooperation between the United States and other countries from expectations of several years ago. Paradoxically, these same trends and events will highlight the usefulness of cooperation as a means of spreading costs, sharing risk, and increasing market access.

In Western Europe and Japan, cooperation is viewed as a fundamental part of the defense industrial strategy. In general, in the United States, cooperation is not seen as essential to building an effective defense.

Cooperation among U.S. defense contractors is increasing.

American companies are beginning to work together, as are the Europeans, to rationalize their defense technology resources.

International collaboration will often take different forms than in the past.

The competitive pressure on the United States for more genuine collaboration is resulting in new types of partnerships and new, sometimes subordinate, roles for U.S. manufacturers. But critical U.S. technologies will be more closely guarded by both companies and the government for competitive reasons.

The Space Market

The United States will continue to be a leader in space but will face increasing competition in commercial markets.

U.S. space leadership will continue thanks to the large investment in space-related research and the significant space infrastructure the United States has created. However, the trend is towards sharing of a larger space market and away from the dominance of the United States and the Soviet Union.

In the years just ahead, it will be difficult for NASA to do ambitious "big ticket" projects.

Political consensus is necessary to fund ambitious large-scale space projects and, at a time of budget restraints, that will be difficult for the United States to achieve. A new attitude of long-term commitment by the government is necessary in order to accomplish the goals of large-scale programs. It will be necessary to establish discrete short-term goals, concentrated on enabling technologies.

U.S. commercial space business prospects could be enhanced by more centralized decision-making.

Programs that could lead to competitive products and services suffer from a lack of focused, business-oriented management. The diffusion of responsibility and lack of focus make funding decisions difficult for Congress.

U.S. government help will be needed to get the commercial space sector established.

The U.S. Government should support space-oriented commercial business—as other governments are doing.

International space consortia are proceeding without U.S. participation.

The United States will be excluded from some international arrangements because of its reputation as an unreliable partner and its restrictive technology transfer policies.

Technology Trends and Strategies

The United States needs a national technology strategy and commitment to a strong industrial/technology base.

The United States does not yet have a coherent strategy to support industry on high technology issues. A strong case is building for a strategy of nurturing generic, enabling technologies—technologies that encompass both civil and military applications and are vital to worldwide competitiveness.

The United States needs to step up its investment in manufacturing capability.

While maintaining the vitality of science and technology, the United States cannot afford to underinvest in manufacturing technology. The true cutting edge in world competition is how fast, how well and how cost-effectively products are manufactured.

The prospects of the U.S. aerospace industry will be affected by tighter R&D budgets and the debate over how technology dollars should be spent.

Technology demonstration will become more important than ever in order to shorten the time from concept to application and to learn how various advanced technologies work together.

Validation of generic technology—to reduce the risk of application for manufacturers—is as important in the civil as in the military sector. Over the long term, lack of validation funding will inhibit technological preeminence in civil aeronautics.

More codevelopment and coproduction among American companies will strengthen the competitive position of the United States.

Coproduction ventures among U.S. firms will help companies build upon joint research, and create profits they can reinvest in the technology base.

Trying to stop the international flow of advanced technology through excessive restrictions on products or on cooperative programs is nonproductive.

Company proprietary know-how and technologies critical for national security must be protected. Beyond that, restrictions on technology are less productive than working to continually advance the state-of-the-art, improve manufacturing technology, and speed up the cycle of concept to application.

An educated, motivated work force is one of the most important components of competitive success for aerospace.

The aerospace industry will be challenged to meet its future work force needs. Other countries are doing a better job of preparing workers who can meet the requirements of high technology industries.

Recommendations

Create Better, Lower-cost Products Faster Than Competitors

Industry

- Give technology planning and development as much priority in business planning as profits.
- Expand the use of concurrent engineering whereby engineering designers and manufacturing planners work hand in hand from the first stages of product development.
- Pursue the aerospace industry's Key Technologies for the Year 2000 program.
- Commit to a strong, continuing investment in manufacturing capability.
- Emphasize use of Total Quality programs to motivate employees and improve the productivity of the aerospace work force.
- Put more effort into building better working teams, both in domestic partnerships, and with foreign companies.

Government

- Support industry-led Key Technologies program and work with industry to develop consensus technology development plans.
- Provide sustained, strong, balanced funding of the technology base and technology demonstration/validation.
- Provide incentives for private R&D investment.
- Enact legislation supporting formation of U.S. production-based consortia.

- Support major space initiatives such as Space Station Freedom, the Missions to and from Planet Earth, and the Space Exploration Initiative within the context of a strong overall U.S. space program and the incremental development of technology.
- Pursue bilateral or multilateral cooperative efforts in space.
- Support a competitive commercial space industry in the United States through a strong public-private partnership.
- Increase IMIP funding within the DoD budget, set unified policy for management of programs across services, and streamline IMIP contract implementation.
- Support development of the National Defense Manufacturing Technology Plan.
- Foster use of management concepts for continuous productivity improvement.

Establish An Investment Climate That Supports A Strong Industrial/Technology Base

Industry

- Build partnerships with U.S. suppliers and promote productivity through assistance with employee training, R&D, manufacturing investment.
- Develop international partnerships that provide a strong flowback of financial and technology resources.

Government

- Pursue fiscal and spending policies that will make capital available and affordable for business investment.
- Place greater effort into improving the dialogue between government and industry, and involving industry in the development of program requirements.
- Encourage industry's investment in technology and innovation by allowing full recovery of the costs of IR&D/B&P.
- Increase progress payments to defense contractors.
- Reorient the defense budget cycle to allow more multi-year procurements.
- Rescind the current DoD policy on recoupment of RDT&E costs and apply recoupment surcharges only to major defense equipment sold to foreign countries.

Educate, Attract, And Develop A High-calibre Work Force

Industry

- Continue and strengthen support of the public education system, particularly science, math and language programs from K-12 through university level.
- Expand enhanced in-house education programs for those with specialized and critical skills, and to increase productivity and competitiveness of the work force as a whole.
- Expand in-house remedial education for workers, stressing fundamentals such as English, communications, and computations.

- Expand recruitment and training of women and minorities.

- Continue to pursue and develop ties with the university community in support of research objectives and development of an educated work force.

- Continue to provide Key Technologies information to universities to help guide curriculum changes.

Government

- Provide strong support nationwide for the study of science, math and languages.

- Provide financial incentives to develop university-industry partnerships.

Academia

- Work with industry to develop and integrate curricula that respond to the needs of knowledge-intensive production.

- Work with industry and government to develop sound Key Technology development plans, coordinate with them on university-based research efforts and relate curriculum where possible to important generic technologies.

Remove Barriers To Trade

Government

- Work toward a free and open climate for international trade and investment including greater harmonization of country practices on R&D and production subsidies, and elimination of non-tariff barriers and technical barriers such as some standards, testing and certification requirements.

- Take aggressive action against violators of international trade agreements.

- Continue to support the Uruguay Round of the GATT and work to strengthen the multilateral trading system.

- Effectively regulate the entry of space launch systems developed in

nonmarket economies into the limited commercial market.

Establish Pro-trade Policies

Government

- Seek active FAA role in promotion of U. S. aviation interests worldwide, including strong efforts to maintain the integrity of U.S. federal airworthiness regulations (FARs).

- Work toward speedy harmonization of product liability laws in the international arena, and reform present U.S. product liability law and penalties.

- Affirm an Administration policy on defense exports and international cooperative programs.

- Work toward a multilateral framework on offset understandings and take no unilateral action to limit offsets.

- Ensure adequate financing for all exports.

Implement Technology Export Policies That Make National Security And Market Sense

Industry

- Foster discussion of industrial/technology base issues from a global perspective.

- Focus internal activities on key company strengths—critical product and process technology—while cooperating internationally to enhance U.S. market opportunities.

- Structure cooperative agreements for strategic acquisition—as well as sharing—of technology.

Government

- More clearly define products and technologies to be controlled rather than imposing broad, generalized prohibitions.

- Provide a single DoD policy guidance on defense exports, technology transfer, the industrial base, and arms cooperation.

- Clarify jurisdiction between Departments of State and Commerce with respect to “dual-use” commodities, with final appeal to the President.

- Conform U.S. Munitions List to COCOM International List to put U.S. suppliers on equal footing with foreign competitors.

- More narrowly define “defense articles and services.”

- Streamline export controls administration.

- Pursue technology developed abroad through government to government efforts.

The Aerospace Industries Association (AIA) is the non-profit trade association representing the nation's manufacturers of commercial, military, and business aircraft, helicopters, aircraft engines, missiles, spacecraft, and related components and equipment.

The full report on *The U.S. Aerospace Industry: A Global Perspective* is available to AIA nonmembers for \$20. Contact AIA at 202/371-8561.



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