INDUSTRY STUDIES 2000

Aircraft

ABSTRACT:

The U.S. aircraft industry has long been a critical enabler of U.S. political and military power and remains one of the most pervasive industries within the U.S. economy. However, continued U.S. dominance in the global aircraft market is uncertain. After a decade of mergers and downsizing, the industry's four main sectors—commercial fixed-wing aircraft, military fixed-wing aircraft, rotary-wing aircraft, and jet engines—are entering a head-to-head competition with Europe from a strategically weakened position. To ensure profitability and maintain market dominance, aerospace manufacturing companies are striving to improve profit margins by streamlining production processes, reducing overhead costs, and entering into strategic partnerships to stimulate revenue-generating opportunities. Many of these innovations are indeed yielding new profit centers. Nevertheless, U.S. dominance of the global aircraft market has eroded to the point that vigorous action is required by industry and government to preserve this vital element of national power.

CONTRIBUTERS:

Col William F. Andrews, USAF

CDR Stephen W. Bartlett, USN

Ms. Janie B. Benton, Dept. of Energy

LTC Richard W. Brooks, USA

Lt Col Stephen R. Cooper, USAF

Col John D. DeWitt, USMC

COL Joseph A. Durso, USA

LtCol George E. Fleming, USMC

Lt Col James W. Hyatt, USAF

Col Athanasios Kotoulas, Hellenic Air Force

LCol Mark Matheson, Canadian Air Force

Mr. Edward H. Offerman, Defense Logistics Agency

LTC Vincent P. Oppenheim, USA

Lt Col Russell E. Sackett, USAF

Lt Col Michael P. Zepf, USAF

Dr. Rolf H. Clark, faculty

Dr. Nicole Crain, faculty

Col Larry C. Franks, USAF, faculty

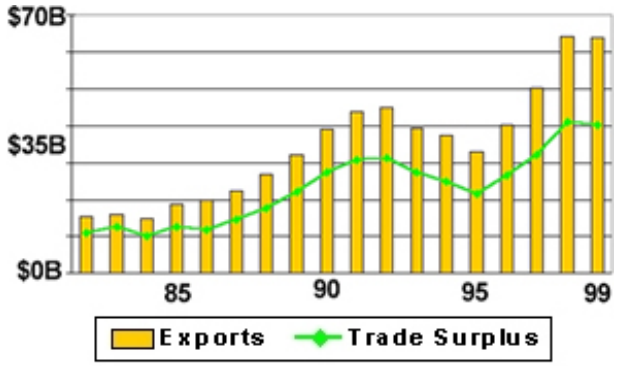
COL Michael J. Miller, USA, faculty

INTRODUCTION

The U.S. aircraft industry has long been a critical enabler of U.S. economic, political, and military power and a pervasive catalyst of U.S. trade. It remains the country's number one export industry (Figure 1), having in 1999 realized nearly $140 billion in sales, including $62 billion in exports.

However, continued U.S. dominance in the global aircraft market is uncertain. After a decade of mergers and downsizing, the industry's four main sectors—commercial fixed-wing aircraft, military fixed-wing aircraft, rotary-wing aircraft, and jet engines—are entering a head-to-head competition with Europe from a strategically weak position. The health of the U.S. aircraft industry has eroded due to constraints of the civil and military market, ineffective U.S. industrial policy, and an increasing preference among traditional foreign customers for aircraft and engines produced by indigenous aircraft industries.

Figure 1 - Aerospace Exports 1982-1999



Throughout this study, we focused on the efforts of all major aircraft assembly and engine manufacturers to remain profitable. We examined how the continuing improvement of manufacturing and assembly processes, vertical integration with suppliers and increasing reliance upon strategic partnerships enables companies to maintain market share and reduce development risks and costs. We also examined how current U.S. trade and defense acquisition policies affect future competitiveness.

Next Page

Page 2 | 3 | 4 | 5

Aircraft

THE AIRCRAFT INDUSTRY DEFINED

Commercial Fixed-Wing Aircraft

For purposes of this report, commercial fixed-wing aircraft include medium and large passenger aircraft (more than 100 passengers) and large cargo aircraft. The global commercial aircraft sector now consists of only two major competitors—Boeing in the United States and Airbus Industrie in Europe. Together, the two companies are expected to deliver 797 commercial transport aircraft in 2000, 117 less than the 914 planes delivered in 1999.,

Current Condition. As indicated in Figure 2, commercial aircraft orders and deliveries are cyclical, and they are just past their peak for the current cycle. Boeing enjoys a 3-year production backlog, but orders and production rates are declining. Profitability remains an elusive goal. Boeing expects to remain competitive and increase its profitability in the years ahead by employing fewer people and using more efficient equipment and processes.

Figure 2

Although Airbus faces many of the same challenges as Boeing, it is forecasting production of 307 aircraft in 2000, 13 more than it produced in 1999. This increase will complement successive annual production increases over the last 5 years. These increases are attributable to streamlined production, cost and design innovations, increased outsourcing, and capacity expansion. Furthermore, the inclination of most European airlines to "buy European" continues to provide a competitive advantage for Airbus.

Competition in the commercial aircraft industry is particularly intense with regard to price, operating costs, and production schedules. Increasingly, major manufacturers are teaming with global suppliers to reduce their risks, cut costs, and boost profitability. With its subcontractors performing more manufacturing tasks, Boeing is achieving its corporate vision to become a final assembler and integrator of aircraft and systems.

The wave of restructuring that dominated the U.S. aircraft industry in the late 1990s is now moving to Europe and will culminate in formation of the European Aeronautic, Defense and Space (EADS) Company. This will be Europe's largest aerospace company and the third largest in the world, just behind Lockheed

Martin. The new EADS Company will be a challenge to manage, as it will employ 96,000 workers speaking four languages and have major operation centers in three countries (i.e., France, Germany, and Spain). Despite this challenge, EADS should prove a formidable global competitor, for it will consolidate individually strong companies, more than 80 percent of which have a history of success in partnerships and joint ventures.

Concurrently, the Airbus consortium will reorganize into a single corporate entity to be known as the Airbus Integrated Company. EADS will own 80 percent of the Airbus Integrated Company; British Aerospace Systems, the remaining 20 percent. This new company will have a more conventional corporate structure with greater financial transparency and obligations. The new structure, emphasizing profitability and responsibility to stockholders, should boost Airbus' overall efficiency and make it an even stronger competitor to Boeing.

Challenges

The principal challenge to the commercial aircraft industry is creating profits. Despite lower anticipated revenues, Boeing is striving to create larger operating margins and greater profits. It continues to increase productivity by reducing square footage, overhead costs, and its supplier base. Furthermore, the company is streamlining operations and containing costs by divesting itself of excess facilities and unprofitable, non-core business activities.

The acquisition of McDonnell-Douglas was an important diversification step for Boeing, for it provides the company with an established military product line to dampen the cyclical impacts of commercial sales and shore up competitiveness for the Joint Strike Fighter (JSF). As a result of such diversification, commercial aircraft now account for only 59 percent of Boeing's business, instead of the pre-merger business split of 80 percent. By diversifying and seeking product support and service business, Boeing has reduced its exposure to the cyclical nature of the commercial market, added stability, and enhanced its profitability.13

As it searches for greater profits, Airbus should also move in this direction. Like Boeing, it reduces overhead costs by minimizing inventories through a combination of just-in-time delivery and conservative ordering of parts and supplies. Also on the Boeing model, the new Airbus Integrated Company is entering the military airlifter market in an effort to dampen overall market cycles.

The ability to offer innovative financing and create international offsets to stimulate sales is essential to corporate profitability. For many commercial aircraft buyers, the financing package, not the aircraft itself, is the determining factor in a decision to buy aircraft. In the past, Airbus enjoyed a great competitive advantage in this area because of its unique, semiprivate consortium structure and government support. As a single corporate entity, Airbus will face additional pressures from stockholders to achieve profits with reduced government support.

As with any industry, large-scale strikes can be a serious threat to aircraft industry stability. This year's strike against Boeing by the Society of Professional Engineering Employees in Aerospace (SPEEA) may have a lasting impact on the industry. The 40-day walkout by 18,000 SPEEA members in February and March slowed aircraft production and vital defense programs. It also significantly reduced Boeing's first-quarter commercial deliveries and will probably affect its total annual production figures. Such strikes simply enhance the competitive advantage of aircraft and engine companies in Europe, where national labor and employment policies are conducive to more stable labor relations.

European protectionist policies also weaken U.S. competitiveness. The contentious cross-Atlantic dispute over environmental noise restrictions on older U.S. jet aircraft is a case in point. The European Union has in fact banned aircraft produced in the United States and equipped with U.S. engine hush-kits from European skies after 2002. This action has weakened the resolve of European carriers to upgrade aging fleets with newer U.S. aircraft because airlines tend to purchase a family of aircraft from one manufacturer. To avoid the risk of future profit loss through national sanctions on the operation of U.S. aircraft, European airlines may elect to buy Airbus rather than to continue buying U.S. aircraft. The U.S. government must press supranational organizations such as the World Trade Organization and the International Civil Aviation Organization to act against national policies that bar access to the global aircraft market.

Finally, increasing fuel costs and inadequate infrastructure development are serious obstacles to continued growth, a necessity for industry survival. World markets will be critical to both Boeing and Airbus, and whichever company is quickest to penetrate these markets will gain the lion's share. Accordingly, both companies will continue to pursue emerging technologies that provide cost savings and greater operational efficiency. They will also continue to lobby for increased infrastructure investment globally, to strive to increase profits by controlling manufacturing costs, and to pursue opportunities for such diversification as is

consistent with healthy growth.

Outlook

Industry forecasts call for sales of nearly 9,000 new aircraft over the next 10 years, and sales of more than 15,000 commercial transports valued at $1.3 trillion over the next 20.14,15 These trends are based on annual airline ridership increases of almost 5 percent per year. Future ridership increases could be jeopardized, however, by higher energy prices. If recent increases in oil prices were to continue, consequent fare increases could adversely affect ridership and thus the demand for aircraft.

The growth forecasts also include a growth in infrastructure. However, current infrastructure investment, foreign and domestic, may not support the projected sales increases of jet transports. An overloaded infrastructure could increase travel delays and adversely affect ridership. Despite the urging of many domestic and foreign carriers for increased infrastructure investment, many foreign governments do not have the free capital necessary to invest. Ultimately, the aircraft industry will have to team with other interested parties to lobby for international investment in infrastructure development.

Although Boeing predicts overall market growth of 4.7 percent over the next 10 years,16 this market will be shared with Airbus. In 1999, Airbus achieved a 57 percent share of the world's new aircraft orders—the first time Airbus orders have exceeded 50 percent of the world market in which it competes. Its previous high of 46 percent was achieved in 1998.17 These recent gains suggest that Airbus and Boeing will split the world market for commercial aircraft over the next 5 years.

Airbus, however, is stepping up the competitive intensity by challenging Boeing's dominance of the jumbo jet market. Airbus Industrie believes sufficient demand exists for, and is developing, a new super-jumbo jet, the A3XX, with more than 550 seats. The A3XX will enable Airbus to compete directly in the large-capacity aircraft market now cornered by the Boeing 747.18 Boeing does not believe the market demand warrants the $12.5 billion development cost of a new aircraft, but it is countering the Airbus A3XX strategy with a stretched 747X. Airbus is likely to successfully launch the A3XX in the 2001–2002 time period.

As the world's economies become increasingly globalized, the delivery of goods and material will fuel increased demand for cargo/freighter aircraft. The freighter fleet is expected to grow by more than 3,000 aircraft by 2018, primarily through the conversion of passenger aircraft to freighters. These conversions are a practical means of extending the useful life of commercial aircraft that would otherwise be retired. Nevertheless, approximately 700 freighters will be new B747Fs, B757Fs, and A300-600Fs. Stretched cargo versions of the B747 and the A3XX are also generating attention among the high-volume, long-range carriers. While growth in the freighter market is promising, new freighters will constitute less than 5 percent of total annual production for either Boeing or Airbus.

Previous Page **Next Page**

Page 1 | 2 | 3 | 4 | 5

Aircraft

Military Fixed-Wing Aircraft

The military fixed-wing sector of the U.S. aircraft industry consists of strategic, tactical, and support aircraft designed and built for military missions. The current market for these U.S.-produced military aircraft is stagnant. Consequently, market viability of the three major military aircraft manufacturing and assembly companies—Boeing, Lockheed Martin, and Northrop Grumman—depends on the acquisition of F-22 Raptors, JSFs, and C-130J Hercules aircraft at current rates, supplemented by foreign sales. Historically, congressional budget priorities have resulted in cuts of planned acquisitions that, while costly in terms of money, time, and operational capabilities, were not life-threatening to a corporation. This is no longer the case.

Significant cuts in major acquisition programs such as the JSF, F-22, F/A-18E/F Super Hornet, or the C-17 Globemaster III would not only weaken corporate competitiveness and the ability to support national security objectives, but also would likely cause one of these three remaining major defense contractors to quit designing and building military aircraft. In that light, as political "non-discretionary" items (e.g., Social Security, health care) continue to come due, the nation must resolve its commitment to industry (particularly military aircraft production) as a strategic element of national power. A variety of industrial-base strategies, ranging from low-rate production options to an expanded market share of depot-level modifications and aircraft system maintenance, must be considered. In some cases, federal law and regulatory policies would have to be changed. For example, increasing the split of depot-level maintenance awarded to the commercial sector would require a statutory change to Title 10 of the United States Code. Specifically, the requirement to maintain a minimum of 50 percent of all depot-level maintenance within the public sector would have to be lifted and market forces allowed to determine the public–private workload mix.

Current Condition

Flat defense spending in the United States and Western Europe following the Cold War, combined with disproportionately high operations and support costs for aging aircraft, has contributed to a decline in acquisition funding needed to modernize tactical aviation. Department of Defense (DOD) efforts to restore procurement funding to desired levels of about $60 billion annually have been slow to materialize. In addition, the conflicting modernization priorities of Congress and the military services have destabilized acquisition strategies, increased costs, and threatened the stability of various programs, including those for the F-22, JSF, F/A-18E/F, and C-17. Finally, reduced funding has prompted a shift in U.S. research and development (R&D) priorities from basic research aimed at expanding the technological state of the art to applied research for shorter term aircraft acquisitions and modifications. At the same time, European nations remain committed to the production of aircraft (e.g., Eurofighter Typhoon, Dassault Rafale, A400M), thereby reducing U.S. opportunities for military sales to NATO allies.

The future U.S. military market is heavily leveraged and relies for survival on DOD intentions to replace many of its tactical aircraft over the next decade. The F-14 Tomcat, F-15 Eagle, F-16 Fighting Falcon and F/A-18 Hornet aircraft fleets are scheduled to be replaced by the F/A-18E/F, F-22, and JSF. Low-rate production of trainer and cargo aircraft, such as Boeing's T-45 and C-17, will also continue for the next several years.

The three remaining major aircraft companies have a tenuous hold on the military fixed-wing market. Boeing's military sector is a McDonnell-Douglas legacy of F/A-18s and T-45s for the Navy, AV-8B Harriers for the Marine Corps, and F-15s and C-17s for the Air Force. Of those programs, only the F/A-18E/F and, to a lesser degree, the C-17 promise significant long-term profitability. The F/A-18E/F has completed developmental and operational evaluation and testing. Congress has approved procurement of 222 Super Hornets over the next 5 years, with follow-on acquisition scheduled to increase that total to 548 aircraft by

2010. AV-8B remanufacture is ongoing, but long-term prospects are limited given the scheduled replacement of the Harrier with the JSF. The Boeing F-15 production line is idle, and future orders are unlikely.

Lockheed Martin, traditionally the U.S. leader in tactical fighter/attack aircraft, is in no better shape. Foreign military sales, such as the recent United Arab Emirates purchase of 80 Block 60 model F-16s, and congressionally mandated sales to the U.S. Air Force are keeping Lockheed Martin's F-16 production line open. The F-22 remains a prime congressional target for military funding cuts. Increasing congressional scrutiny of cost and developmental test results has delayed the low-rate-initial-production decision. Six pre-production aircraft are funded for the year 2000. A third potential competitor, Northrop Grumman, no longer produces aircraft. However, it does maintain a B-2 modification capability and is following the industry trend toward a more lucrative system integration and component assembly market.

The JSF program is the program that will determine which of these companies remains in the fighter/attack aircraft market. That program calls for production of nearly 3,000 short-takeoff-and-vertical-landing (STOVL), carrier-suitable, and conventional-takeoff-and-landing aircraft. Accordingly, both companies have adopted a "must win all" competitive strategy for the JSF.

Affordability remains a critical factor for the JSF. Boeing and Lockheed Martin are staying within the government's time and cost requirements, with first demonstrator flights scheduled for mid-2000. The JSF procurement signals a major shift in military procurements by setting cost as an independent variable. Judicious trade-offs will ensure that performance requirements are met while remaining within aggressive cost goals. Flyaway costs for current conventional-takeoff-and-landing variants are estimated at $28 million per aircraft (fiscal year 1994 dollars). Costs of the carrier-based and STOVL variants have yet to be determined.

Squaring off against the weakened U.S. military aircraft companies is a strong group of international military aircraft manufacturers with the potential to successfully undermine JSF sales to allies and other foreign countries. These competitors include the British-led Eurofighter Consortium with Germany, Italy, and Spain; Dassault; and Saab. Among them, they offer a potent mix of aircraft, including the multinational Eurofighter Typhoon, Dassault's Mirage 2000 and Rafale, and Saab's Gripen. Producers of the former Soviet Union are not considered major competitors, as they remain insufficiently capitalized to participate seriously in the military market.

The U.S. airlifter market share is equally tenuous. The recent Kosovo conflict underscored the need for "blended" airlifters capable of performing both strategic and tactical airlift roles. Boeing builds the only U.S. airlifter with strategic and tactical airlift capability, the C-17. Lockheed's C-130J is the latest model of this venerable tactical airlifter, but the reluctance of the U.S. Air Force to buy it has reduced production to sporadic foreign military and congressionally mandated sales. Airbus has unveiled plans for a new large military transport aircraft, the A400M. This Future Large Aircraft would accommodate anticipated European airlift requirements and would satisfy an emerging market niche between Lockheed Martin's C-130 and Boeing's C-17. The C-17, while an ideal solution to the blended strategic/tactical airlift problem, is too expensive for many countries. Consequently, while there will be a demand for C-130Js, the high cost of the C-17, combined with European nationalism, will result in the A400M's securing a major portion of the global market for "blended" airlifters.

The U.S. aircraft industry has a strategic opportunity. A number of large multipurpose aircraft are reaching the end of their life expectancy within the next 10-–15 years. These include, among others, the KC-135, the KC-10, various 707 derivatives, the C-130, and the P-3. Adoption of a common airframe would allow for service to a large domestic and international market. It would also reduce acquisition costs through economy of scale, expedite much needed modernization, and decrease operating costs.

Challenges

Military aircraft manufacturers increasingly are turning to other markets such as post-production support and foreign military sales to remain profitable. Manufacturers must balance overhead expenditures for idle capacity against retention of production capability to meet surge requirements. This capacity could be maintained by open market competition for depot maintenance on military aircraft, which would require lifting the Cold War policy establishing a work share quota for public/private depot-level maintenance.

Competition for international military aircraft sales is fierce. Sales to international customers decrease unit costs and enable the United States to maintain a production line for mobilization spares and the repair of domestic units. Additionally, foreign military sales enhance military-to-military diplomatic contacts and

interoperability for coalition activities. The expense of military aircraft is forcing foreign buyers to pass up state-of-the-art technology in order to meet budget constraints, however, making the Typhoon, the Rafale, and the A400M more attractive to some global customers.19

Outlook

Frugal defense budgets will limit U.S. military aircraft procurement over the next 10 years. Despite budget constraints, however, the F/A-18E/F, F-22, and JSF programs will remain funded, albeit at reduced levels, and undergo major restructuring. For example, recent direction from the Under Secretary for Defense, Acquisition Technology and Logistics, to study options for a split JSF production strategy suggests that Boeing and Lockheed Martin will share JSF production in an effort to preserve a competitive military aircraft industrial base. Results of the competition will determine whether the two companies produce distinct models or whether they co-produce the same aircraft. While controversy continues regarding the final numbers of JSFs that will be funded, a single design will probably be selected, with production shared by Boeing and Lockheed Martin under a "leader–follower" relationship. Given competing priorities and continuing budgetary pressures, further program slippage and a reduction in overall numbers for all three fighter programs are likely. Even for the JSF, which will dominate the future U.S. fighter market, exports will be reduced and limited to traditional customers.

The Typhoon and the Rafale will provide potent competition for JSF sales. In Europe, development and acquisition costs should lead to increased consolidation in the military aircraft market. Although the French government continues to underwrite the cost of the Rafale, future fighter projects are likely to involve multinational consortiums as the Eurofighter Typhoon does. Despite continuing European consolidation and the growing allied preference for indigenously produced aircraft, foreign military sales will remain a major market for the U.S. aircraft industry. However, technology transfer concerns will limit export of new U.S. military aircraft such as the F/A-18E/F, F-22, and JSF. Additionally, time delays attributable to these technology transfer issues will reinforce the European desire to procure European fighter aircraft (Typhoon and Rafale), further eroding U.S. foreign market share.

Likewise, the A400M is well situated to capture a significant portion of the military airlift market. Sized between the C-130J and the C-17, and priced competitively, the A400M will present a severe challenge to Boeing and Lockheed Martin not only in Europe, but also throughout the world.

Finally, post-production support and management will be a growth area for aircraft manufacturers worldwide. Within the United States, there is an opportunity for an increased share of depot-level maintenance to offset reduced procurements. Operations and maintenance costs of military aircraft represent a significant portion of the DOD budget. The requirement to maintain no more than 50 percent of the depot-level maintenance in the private sector precludes open market competition for that budget and must be re-considered in light of its potentially stabilizing effect on profitability and sustainment of the industrial base.

Previous Page Next Page

Page 1 | 2 | 3 | 4 | 5

Aircraft

Rotary-Wing Aircraft

Helicopter and tilt-rotor aircraft provide a multitude of capabilities for the civilian and military markets. Currently, there are three major U.S. competitors in the rotorcraft sector: Bell Helicopter Textron, Boeing Aircraft, and Sikorsky Helicopter (United Technology Corporation). Foreign producers of state-of-the-art rotorcraft include Eurocopter (Germany-France), GKN Westland (United Kingdom), and Agusta (Italy). Other countries such as Russia, Japan, Malaysia, India, South Africa, and China produce rotorcraft, but are not significant global competitors.

Current Condition

Decreased demand for rotorcraft has resulted in the reduction and consolidation of rotorcraft manufacturers as they seek profitability in specific market niches. The world rotorcraft market of $7–$8 billion per year reflects a drop in demand similar to that of the commercial and military fixed-wing sectors.20 The three major U.S. rotorcraft companies remain profitable, with a market share of roughly $1.5 billion each.21 However, reduced procurement budgets continue to change acquisition strategies, reducing industry's ability to establish efficient, steady production lines. Additionally, civil rotorcraft production remains flat—although stable—due to the low demand. Market predictions for this year call for a split of 60 percent to 40 percent between the civil and military sectors.

Challenges

The rotorcraft industries lack sufficient demand to maintain their current capacity. Demand is weakened by reduced defense budgets, the high cost of capital ownership, and costly operation and support outlays. Today, there are only 4 models of military and civilian rotorcraft in production and 1 in development, as opposed to 11 models in 1990.

Overcapacity raises costs and makes manufacturers less competitive. The 2002 forecast for worldwide capacity use is 53 percent, with Sikorsky projected at 41 percent, Boeing at 68 percent, Bell at 96 percent, and Eurocopter at 86 percent.22 Teaming arrangements and joint ventures are becoming increasingly more important in maintaining a stable industrial capability. Sikorsky, Boeing, Bell, and several international competitors will continue to reduce their cost of capital ownership while seeking opportunities for international partnerships. The Bell-Boeing V-22 Osprey and the Boeing-Sikorsky RAH-66 Comanche programs reflect this strategy.23 Additional characteristics of the civil sector, including reduced cost of ownership and multinational partnerships, are apparent in the development of Sikorsky's new S-92 Helibus. Partners in the venture include Japan's Mitsubishi, China's Jingdezhen Helicopter Group/CATIC, Spain's Gamesa, Brazil's Embraer, and Taiwan's Aerospace Industrial Development Corporation.24

To remain solvent, companies are pursuing more military upgrade and modification business. After-market sales and remanufacturing provide good revenue for aircraft companies to help compensate for low production rates. Helicopter upgrades provide a cost-effective alternative to new production. By 2007, remanufacturing is expected to be about 21 percent of the total military rotorcraft market value, up from 8 percent in 1998.25 Companies are working with the DOD to increase their share of prime vendor support at aviation depots and maintenance units.

Finally, although employment in the U.S. rotorcraft industry has not decreased significantly, retention of skilled technicians and aerospace engineers is increasingly difficult within today's robust economy.

Outlook

Cautious optimism describes the outlook for the rotorcraft industry during the next 10 years. Domestically

and abroad, the industry appears ripe for further consolidation in order to reduce risk and improve competitive advantage. Joint ventures with industry competitors must continue if profits are to be maintained. In Europe, there is a strong business case for only one manufacturer to survive. Because of national interests, however, both GKN Westland and Eurocopter will likely continue manufacturing rotorcraft at lower than desirable production rates.

Accordingly, expectations are that GKN Westland and Agusta will complete the merger announced last year, leaving two European manufacturers. It is also likely that U.S. rotorcraft industries will continue to consolidate, also leaving two rotorcraft manufacturers. In the end, only modest sales gains are projected in an environment of overcapacity and intense foreign competition. To ensure future survival, the remaining rotorcraft manufacturers will have to size their capacity to match reduced demand, expand their modification and remanufacturing capabilities, and pursue rotorcraft logistics services.

In the civil sector, competition will remain fierce. The total commercial helicopter market for the period 2000–2009 is projected to be 7,943 civil rotorcraft valued at approximately $20.6 billion (fiscal year 2000 dollars).26 Within this market, fractional ownership of rotary-wing aircraft is becoming increasingly important to manufacturers, the hope being that such arrangements will spur increased sales similar to those of the business jet market. Fractional ownership involves the corporate or private purchase of an aircraft share based on total annual flight hours. Although it appears to be a promising venture, the limited range of conventional helicopters in comparison with that of business jets could inhibit the potential benefits.

Military production through 2009 will total about 3,639 new military rotorcraft worth approximately $49.5 billion (fiscal year 2000 dollars). The Bell-Boeing V-22 is the only major military aircraft currently in production, but the Boeing-Sikorsky RAH-66 remains a top Army priority and should enter full-scale production in 2006.

Tilt-rotor technology will likely transform the rotorcraft market. Industry analysts estimate that tilt-rotors could provide a $5–$7 billion benefit to U.S. civil rotorcraft manufacturers. Bell-Boeing and Bell-Agusta are leading the way with the military V-22 and the civil BA 609, respectively. It is projected that the V-22 program will be worth $7.5 billion, excluding upgrades and support, to the contractors through 2009.27 Bell Helicopter has partnered with Agusta to develop the BA 609 civil tilt-rotor aircraft and has already received more than 100 orders. Bell recently introduced its quadruple tilt-rotor design, which is intended to compete with C-130–class fixed- and rotary-wing aircraft.

Sikorsky and Eurocopter are also pursuing tilt-rotor technology. Sikorsky is developing a variable diameter tilt-rotor aircraft in which large rotors are used for lift during vertical flight and are retracted in forward flight for improved performance and efficiency. Eurocopter has plans for a Eurotilt aircraft in the 19-seat, 300-knot range, in which rotation is limited to the nacelle with the rotor rather than the entire engine as in the V-22. Eurocopter feels that this technique will make their entry lighter and more cost-effective.

Aircraft Engines

Four companies—General Electric (GE), Pratt & Whitney, SNECMA, and Rolls Royce—dominate the military engine market. Robust competition is driving all four to pursue continuous improvement of engine performance, industrial processes, and services, and to collaborate frequently on specific engine projects through limited partnerships. Partnering enables companies to reduce risks, gain access to international markets, and share expertise.

Current Condition

Three important factors stimulate the continuous improvement of aircraft engines. First, stringent environmental restrictions require, and are yielding, quieter and cleaner commercial engines. Earlier generation engines must be replaced or modified to ensure continued access to environmentally restricted markets. Second, rising energy costs demand improved fuel efficiency. Third, the new generation of fighters, the F-22 and JSF, will require significantly greater engine performance—supersonic cruise without afterburner for the F-22 and STOVL capability for the JSF—within tight cost constraints.

Defense-funded R&D is slowly pushing the fighter engine performance envelope. Aircraft-specific programs such as those for the PW119, F-22, and JSF engines produce near-term improvements for specific applications, while broader interagency programs such as the Integrated High Performance Turbine Engine Technology program fuels broader, long-term development. Improvements in fighter engine materials, nozzle design, and shaft technology, as well as reduced numbers of moving parts, are yielding the weight and performance improvements needed by the next generation of fighters.

Commercial improvements are progressing along more conservative, incremental lines. Uncertain sales of new engine designs coupled with the billion-dollar-plus cost of developing a new engine have prompted a shift in emphasis to small improvements on proven engine cores rather than dramatic, high-risk changes. This approach has yielded steady improvements in efficiency, emissions, noise reduction, reliability, and weight.

Challenges
Tight, competitive engine markets pose the greatest challenge to engine manufacturers and have mandated lean production methods, reduced stockpiles, and rapid inventory turnover. Moreover, continual industrial process improvements have driven down costs, allowing manufacturers to remain competitive.

Partnerships now serve to distribute the risks and high costs of new engine development. International partnerships expand access to the global engine market. All major engine manufacturers have international partners: GE (United States) is partnered with SNECMA (France), Rolls Royce (United Kingdom) has acquired Allison (United States), and Pratt & Whitney (United States) is partnering with MTU (Germany) and Fiat (Italy). Significantly, GE and Pratt & Whitney have formed a potentially important domestic partnership, the "Engine Alliance," to develop a cutting-edge power plant for the Boeing 747X and Airbus 3XX super-jumbo jets.

The higher thrust and better reliability of the current generation of commercial engines are leading to greater use of two-engine aircraft on international routes. This shift reduces future engine production. Today's engines of the 100,000-pound-thrust class will allow the two-engine 777 to carry comparable numbers of passengers as far as the four-engine 747. Furthermore, today's engines are considerably more reliable than those previous generations. Operators report that engines have gone 25,000 hours with only routine maintenance and have logged more than 20,000 takeoff and landing cycles without shop visits. This improved reliability, however, is increasing the life spans of engines and, ironically, further depressing the potential for engine sales.

Engine customers have two to three comparable engines to select from when procuring new aircraft, and this selectivity exerts considerable price pressure on new engine sales. Profits on new engine sales are thus driven to very low levels, and in some cases engines may be sold at a loss in the hope of realizing profits from life-cycle service contracting.

Low sales profits underscore manufacturer emphasis on product support, spares, and service. Innovative service schemes such as Rolls Royce's "power by the hour" (where the manufacturer guarantees engine performance and spares availability) reduce operator ownership costs, relieve operator workloads, and encourage continuous improvement in engine reliability. Although DOD service-related business has been limited by laws mandating the use of military depots, ongoing efforts to reduce costs are driving more military programs—the V-22 program, for example—to "power-by-the-hour" concepts.

Outlook
The highly competitive engine market will continue to deliver very high quality products in the future, but will mandate lean, efficient production and be unforgiving of inefficiencies. Risk mitigation will dominate new-product development, because a billion dollar development program that does not capture a large market can jeopardize a corporation's financial health and viability. Risk mitigation as a basic strategy, however, can have certain undesirable consequences. It tends to promote partnering, which can blur traditional company and national boundaries, thereby complicating defense industrial base and mobilization strategies. Moreover, partnering itself is subject to complications deriving from statutory and regulatory constraints on U.S. technology transfer. Risk mitigation also justifies incremental changes, lessening the prospect of technological breakthroughs unrelated to defense projects or government-backed research.

GOVERNMENT GOALS AND ROLE

Current Condition
Historically, the U.S. government approach to shaping and sustaining the U.S. aircraft industry has been laissez faire. Relying on free market competition, the U.S. government has limited its involvement to the sustenance of R&D and defense procurement. Within this "free market" model, the U.S. aircraft industry continues to generate the largest trade surplus of all U.S. export industry sectors and remains one of the most vibrant industries within the U.S. economy. This industry, however, is at a global crossroads. The current laissez faire strategy not only jeopardizes future U.S. competitiveness in the global aircraft market, but also threatens the very existence of a viable U.S. aircraft industrial base.

Challenges
The global aircraft market is clearly moving toward "head-to-head" competition between the United States and Europe. Boeing and Lockheed Martin will square off against EADS in competition for a flattening global commercial and military aircraft market. After a turbulent decade of domestic mergers and declining government procurement, both U.S. companies have strategic competitive weaknesses. Boeing dominates the commercial aircraft sector, but has only a tenuous grip on the military aircraft sector. Lockheed Martin is not competitive in the commercial aircraft sector and is struggling to remain competitive in the military aircraft sector. Concurrently, European aircraft and aerospace companies are entering a period of strategic consolidation and merger. Strengthened by enabling national trade and defense acquisition policies, as well as substantial government subsidies, EADS will emerge as a formidable competitor in the global aircraft market. Potentially, only one U.S. competitor will survive as the remaining major U.S. producer of both commercial and military aircraft.

Despite its strategic corporate weaknesses, Boeing enters this competition in a stronger position than Lockheed Martin. Boeing's experience in strike/fighter aircraft design and production is limited to those programs acquired in the merger with McDonnell Douglas. None of these legacy fighter programs provides Boeing with a solid military aircraft production base. However, Lockheed's experience in strike/fighter aircraft design is not enough to overcome the significant facts that it does not produce commercial aircraft and has lost most, if not all, of its government space launch business. Given these weaknesses for both companies, if the JSF remains "winner take all," the losing company may not remain in the military aircraft production business.

This end result does not serve U.S. national security interests and must be avoided. The U.S. government must recognize the legitimate role of government in sustaining a national aircraft industry that is a critical enabler of national power. Cumbersome and contradictory policies of the Departments of State, Commerce, and Defense constrain access to the global aircraft market. Declining R&D spending erodes advanced technology maturation. The engineering and skilled craft workforce is aging, and the industry is having significant difficulty attracting and retaining the talent to remain world class.

Outlook
The current U.S. aircraft industry will not sustain a global competitive advantage in a head-to-head competition with the European industry. The President and Congress must recognize that the U.S. aircraft industrial base is a critical enabler of economic, political, and military elements of national power. To that end, the President's National Security Strategy should articulate the U.S. role in, and objectives for, the global aircraft market. The Departments of State, Commerce, and Defense must reformulate supporting policies to be complementary and enabling rather than contradictory and constraining. The State Department should quantify U.S. objectives and roles in global sales of commercial and military aircraft; the Commerce Department, review regulatory, licensing, and statutory constraints to ensure full U.S. access to the global markets; and the Defense Department, stabilize procurement across all sectors of the domestic military market to strengthen global competitiveness. The President should restore declining R&D funding. Finally, Congress should take a longer, strategic view when appropriating money for aerospace R&D, as well as military procurement. Funding decisions based on short-term political priorities will continue to undermine the aircraft industry's long-term domestic and global competitiveness.

CONCLUSION

The U.S. aircraft industry has long been a hallmark of U.S. ingenuity and a vital element of its national power. In the wake of downsizing and consolidation, however, other global competitors have emerged to erode the worldwide market dominance of the United States. If the aircraft industry is to be "right-sized" to meet market demand, a renewed emphasis on competitiveness and national security is imperative.

All available evidence compels a simple conclusion: U.S. aircraft industry dominance has eroded to the point that necessitates vigorous action by industry and government to preserve this vital element of national power.

Previous Page **Next Page**

Page 1 | 2 | 3 | 4 | 5

Aircraft

ESSAYS ON MAJOR ISSUES:

PROFITABILITY

Joseph A. Durso

Corporate profitability is paramount within the aerospace industry. Industry-wide profit margins remain flat compared with the profitability and return on investment enjoyed by traditional blue-chip companies, especially "new economy" information technology firms. The legislatively imposed caps on fees and profits tend to impede military aerospace profitability. Furthermore, arcane government policies and procedures tend to constrain corporate initiative.

In order to implement more streamlined manufacturing processes while compensating for reduced production requirements, the Lean Aerospace Initiative (LAI), instituted by the Under Secretary of Defense for Acquisition, Technology, and Logistics, is a pervasive influence in the aircraft industry. The LAI permits the industry to manufacture aircraft and perform services more efficiently and with greater profit margin in a manufacturing environment typified by a pronounced lack of demand for new aircraft. Positive improvements in profitability have been observed. These benefits, however, should prove marginal unless industry exploits potential savings from a simultaneous reduction in capacity.

The best method for improving the aerospace industry's bottom-line profitability (and its standing on Wall Street) is to increase markedly the overall military and commercial demand for aircraft. However, flat defense budgets reflecting post–Cold War national priorities have resulted in low levels of production and closed production lines. To compensate for reduced demand for new aircraft (especially military aircraft), the industry continues to become more service-oriented and vertically integrated; that is, it seeks more after-market business in the repair, maintenance, and overhaul sectors, as well as opportunities to absorb more suppliers.

RESEARCH AND DEVELOPMENT

Stephen R. Cooper

A chronic decline in national aerospace R&D funding over the last decade reflects the underlying strategic shift away from national priorities that once emphasized and stimulated basic aircraft R&D. Research and development funding has fallen by more than 50 percent from a 25-year peak in 1987.28 Expectations that private R&D funding would increase to offset federal investment cuts have not been realized. Hampered by increasing demands for returns on investment, the industry R&D focal point has shortened to less than 10 years. Some reports indicate that as much as 80–90 percent of R&D resources are now committed to short-term development and process improvement.29

The lack of basic aircraft R&D has eroded the industry's ability to advance the state of the art, create new market opportunities, and support national security objectives. Basic and applied research are self-sustaining and must remain balanced to achieve all three of these interdependent goals. Basic research advances the science; applied R&D transform this new knowledge into advanced technologies and new application opportunities. New application opportunities generate profits while advancing the state of the art. The profits provide stable funding for continued basic research, while new applications point to future

technology needs.

Diminishing basic research slows the advancement of science and reduces applied R&D to seeking marginal profit opportunities for the application of current science. Beyond this first-order effect on technology advancement and profitability, there are significant second-order effects on the aircraft industry's scientific and engineering workforce. For example, the lack of basic research undermines the industry's ability to attract the next generation of scientists and engineers needed to advance aviation science and technology.

Aircraft R&D is always a risk venture; there is no guarantee of useful discovery or profitable product. Committing funding to mitigate that risk allows basic research to continue in parallel with the more immediately profitable applied research. Recent efforts to return federal R&D funding to levels that restore the emphasis on, and balance between, basic and applied aircraft R&D are encouraging. It is hoped that these efforts presage movement toward an appropriate national security objective: restoration of aircraft R&D investment to pre-1990 levels.

AIRCRAFT INDUSTRY WORKFORCE

Michael P. Zepf

An essential concern of the U.S. aircraft industry is the ability to recruit and sustain its workforce. Company spokespersons say the average worker's age has increased dramatically over the last decade. In one company in particular, 75 percent of the workforce are older than 45 and have at least 20 years' tenure. Fewer than 5 percent of the workforce are under 35 or have been with the company fewer than 10 years. The cyclical nature of the industry and the interactions of the labor unions are in part responsible for this problem. Faced with production slowdowns, companies first lay off the newest, and usually youngest, workers. The implications of such an action are catastrophic. Within the next 10 years, many companies will have almost two-thirds of their workforces retirement-eligible. Absent some creative personnel decisions, these companies may have work, but no workers.

Two other factors shape the workforce problem: recruitment and retention. Today's young white-collar workers are not looking to the aircraft industry for jobs. Moreover, many workers in the industry are looking outward to the computer and electronics industries, the "dot-coms," for higher paying, more competitive jobs, with stock options and the opportunity for instant riches. Also disturbing are trends relative to retention of the blue-collar workforce. Recruiting young people has become an uphill battle. Jobs are scarcer as a result of downsizing pressures, layoffs, and union policies. Thus, merely finding work is a problem for many high school graduates. Even those who get jobs at a good entry wage do not find the work interesting. In effect, then, an industry once regarded as one of the most glamorous, designing and building aircraft, appears to be losing its allure.

Developing and providing incentives for the "future" workforce is a challenge, but three alternatives offer promise. First, industry can go further in terms of teaming with schools (high school and college levels) and nearby high-technology employers to mold tomorrow's workforce. Teaming could involve tuition assistance or "free" training and summer work, both with the lure of a "guaranteed job" following school. Teaming, however, must not stop at the school level; unions must also be part of the process. Union help is required to keep a sector of the labor force "young." Financial pressures will continue to keep production low, but unions will only be hurting themselves if they allow their current policies to continue. Second, increased funding is necessary for research and design work. Informal interviews with some of the engineering workforce reveal "nothing new" on the horizon. Quite often engineers are still working on decades-old designs. Government action could include federally sponsored programs (e.g., The National Aeronautics and Space Administration's blended-wing research) and tax incentives offered to companies for research. Finally, companies have to reduce their need for touch labor as much as possible. Modernizing processes and production lines is an expensive up-front alternative, but prospects for substantial long-term payoff are excellent. Combining the existing LAI with a reduction in the external pressure to hire.

Previous Page
Page 1 | 2 | 3 | 4 | 5