

# AIRCRAFT

## ABSTRACT

The domestic aircraft industry is one of the US strongest strategic assets that underpins our national defense and economic power. The strength of US national security strategy rests on America's unmatched heavy lift and combat airpower. Aircraft production is a crucial component of the economy, generating 1.2% of GDP and 6.5% of US export sales. The global industry is coping with significant restructuring, shrinking supplier base, increased international competition, and divergent market trends for commercial and military aircraft, and changing government roles. The industry restructuring is occurring as companies merge and shed noncore business activities to reduce costs and become more competitive in the global market. Some countries are undergoing increased privatization of their industries, while others are dealing with an expanded government role in protecting key industrial capabilities. This analysis focuses on these challenges and their impact on the fixed wing, rotary wing, and engine sectors of the industry.

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## **INTRODUCTION**

The US aircraft industry is a strategic industry that serves as a foundation for our nation's security and economic strength. The fixed-wing aircraft, rotary-wing aircraft, and aircraft engine sectors of the aircraft industry provide unique capabilities, however, there are many issues that are common to all sectors of the industry. This study includes an analysis of each sector within the aircraft industry and its cross-cutting issues.

## **THE AIRCRAFT INDUSTRY DEFINED**

### ***Commercial Fixed-Wing Aircraft***

The commercial fixed wing aircraft industry includes small general aviation aircraft, medium capacity passenger aircraft, large passenger aircraft, and large cargo aircraft. This report focuses primarily on large jet aircraft that carry 100 passengers or more and cargo versions of those airframes. This sector consists of two major competitors: Boeing in the US and Airbus Industries in Europe. The two companies are expected to deliver close to 800 commercial transport aircraft in 1998.

*Current Condition.* The commercial aircraft industry currently benefits from the largest commercial aviation boom in history. In 1997, the US aerospace industry increased civil aircraft sales by 15% to \$69 billion, marking the first time since World War II that commercial orders have exceeded military orders. However, the aircraft industry backlog is significant, equating to 2 years of production. To meet production demand, Boeing had to contend with production challenges related to lack of skilled workers, raw material shortages, internal and supplier parts shortages, productivity problems, and management focus on restructuring activities. Airbus has faced many of the same challenges but has still managed to increase production over 60% in 1997 with streamlined production, cost and design innovations, and capacity expansion.

Competition is particularly intense regarding price, operating costs, and production schedule. To manage costs and to meet customer demands, a closer relationship has been developed among customers, manufacturers, and suppliers. Major manufacturers are teaming with suppliers, pushing responsibility for quality and product capability to the vendor base. Additionally, component manufacturers have been asked to assume greater risk in the design and production of new aircraft. Manufacturers have been able to minimize inventories with just-in-time delivery and conservative ordering of parts and supplies.

The prevalent trend in the aircraft industry is restructuring. The consolidation of Boeing, McDonnell Douglas, and Rockwell International forced the integration of three separate corporate cultures and \$20 billion worth of operations. This strategy entailed the divestiture of excess facilities and noncore business activities to contain costs and focus on core competencies. Similar consolidations in Europe, such as the impending conversion of the Airbus consortium into Airbus SCE (Single Corporation Entity), present the potential for eliminating inefficient business practices supported by national subsidies.

*Challenges.* The principal challenge facing the US commercial aircraft industry is increasing production while containing costs. Production delays by Boeing in 1997 resulted in the company's first net financial loss in 50 years. The second significant challenge facing the industry is meeting setbacks created by the Asian economic crisis. The Asian market constitutes one third of the backlogs and one third of aircraft orders. To a limited extent, the Asian downturn will relieve backlog and associated delays in delivery schedules.

*Outlook.* Projected production trends over the next 10 years reveal sales of approximately 5,294 commercial jet transports valued at \$358.2 billion. This appears to be sufficient market demand to support two global commercial aircraft producers. The overseas markets are critical to US manufacturers because they will be the major source of future growth. Industry restructure, closer relationships among customer, manufacturer and suppliers, and innovations in technology and manufacturing processes have the potential to increase the competitiveness of US manufacturers.

### ***Military Fixed-Wing***

The Military Fixed-Wing sector consists of strategic, tactical, and support aircraft designed and built for military purposes. Unlike commercial aircraft, mission effectiveness drives the design, acquisition and maintenance costs of military systems.

For those countries committed to military aircraft as a strategic industry, acquisition and support costs are less important than the overriding security objectives that underlie force size and modernization decisions. Security requirements often drive countries to design and build aircraft within their domestic industry even if similar capabilities exist in the international market.

*Current Condition.* The military fixed-wing sector continues to face lean times. Defense spending in the US and Western Europe seems to have stabilized, but planned increases in acquisition funding needed to

recapitalize tactical aviation have not materialized because disproportionately high operations and support costs continue to drain modernization accounts. Reduced defense budgets only support low domestic buys, which pressures producers to look to export sales as a way of increasing quantities and profitability. The result is stiff international competition and a push to reduce life cycle costs of acquisition and support of military aircraft.

The US market is dominated by the Defense Department's plan to modernize its tactical aircraft inventory over the next 10-15 years, replacing the F-14 and F-15 with F/A-18E/F and F-22 and the F/A-18A/B/C/D and F-16 with the Joint Strike Fighter. Trainer and cargo aircraft (Boeing's T-45 and C-17) will continue production at low rates.

The merger of Boeing and McDonnell Douglas leaves Boeing and Lockheed Martin as the prime contractors producing fixed-wing military aircraft within the US. Lockheed Martin's F-22 (with substantial Boeing subcontract content) is conducting initial developmental flight testing for the Air Force. Boeing's F/A-18E/F is completing developmental testing and has entered low rate initial production for the Navy. Both companies have foreign military sales of earlier products (F-15, F-16, and F/A-18C/D) in production at low rates. In addition, both are contenders for the Joint Strike Fighter (JSF) early in its development. The low production rates planned for the F/A-18E/F and F-22 will keep unit prices high.

Overseas manufacturers include the Eurofighter Consortium, Dassault, and Saab. Offerings include the multinational Eurofighter, Dassault's Mirage 2000 and the newly launched Rafale, and Saab's Gripen.

*Challenges.* There is weak political and popular support for investment in modernizing existing tactical aircraft inventories. With no clear threat, the need to allocate a larger portion of national resources to military systems modernization loses its imperative. Lean manufacturing initiatives and increased emphasis on controlling total ownership costs are required in order to finance modernization within existing budget constraints.

Although international competition for military aircraft is fierce, foreign sales are important to the US for two reasons. First, international sales decrease unit costs and enable the US to maintain a warm (up and running) production line for spares and repairs of domestic systems after domestic production has ended. Second, foreign military sales increase military-to-military diplomatic contacts and interoperability.

Military aircraft available for sale in the international market include Boeing's F/A-18C/D, Lockheed Martin's F-16, Dassault's Mirage 2000 and Rafale and Saab's Gripen. These aircraft incorporate modern weapons systems; selection will generally be based on a combination of technical evaluation, cost, financing, and industrial participation (offsets).

The need to reduce the cost of operating and maintaining aircraft promotes innovative approaches to logistics support. These support approaches offer low cost technology insertion, just-in-time style inventory reductions and rely on premium transportation and original equipment manufacturer depot support in lieu of traditional military organic depots and a just-in-case infrastructure. Successfully adopting these new approaches requires trust and teaming with prime contractors and contractor acceptance of commercial levels of financial risks.

*Outlook.* The fixed-wing military aircraft sector is poised to begin slow growth at low to moderate production rates. Current acquisition plans, if executed, will create an upswing in the tactical aircraft market over the next 10 years. The European Union's "Future Large Aircraft" requirement for transport modernization is the only nontactical program start envisioned. Development of advanced Uninhabited Air Vehicles (UAVs) continues as the future of the air war is debated. Success in the export market will lead to lower unit costs for domestic purchases and will maintain the support infrastructure for aircraft that will remain in domestic inventories through the first decade of the next century. National security considerations will ensure continued military aircraft production and continued competition for export sales in the global marketplace. The market will reward the manufacturers who can best adopt lean manufacturing practices and leverage flexible sustainment to reduce life cycle costs.

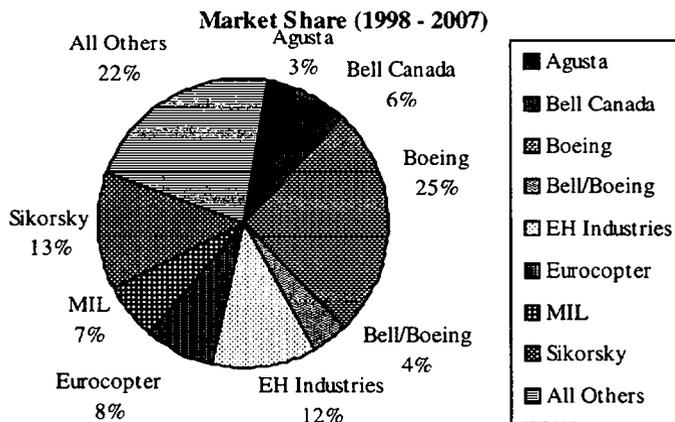
### ***Rotary-Wing Aircraft***

The rotary wing sector consists of military and civilian helicopters and tilt rotor aircraft. These categories can be subdivided by gross weight. The major US producers are Bell Helicopter Textron, Inc., Boeing Defense and Space Group and Sikorsky Aircraft, and United Technologies Inc. Foreign producers include Eurocopter (a French and German consortium), Agusta (Italy), GKN Westland (Great Britain), MIL and Kamov (Russia), and Hindustan (India). Japan and South Korea primarily coproduce American helicopters in their countries.

Each producer has pursued niche markets defined by weight and mission to ensure survival and profitability.

*Current Condition.* The worldwide market for helicopters and tilt rotor aircraft was \$5.27 billion in 1997. The market is predicted to remain stable in terms of numbers produced, however the dollar value of production will increase as customers demand larger, multiengine turbine helicopters with advanced integrated avionics, visionics, and automated flight control systems. The civilian market for helicopter purchases exceeds the military market in number of aircraft produced (714 civilian versus 449 military), but the value of military production and retrofit exceeds the civilian value by a factor of three (\$3.96 billion military versus \$1.31 billion civilian). Growth and profitability in the rotary wing sector is, therefore, highly dependant on the military market.

**Figure 1: Rotary-Wing Aircraft Market Share**



Source: 1998 American Helicopter Society Annual

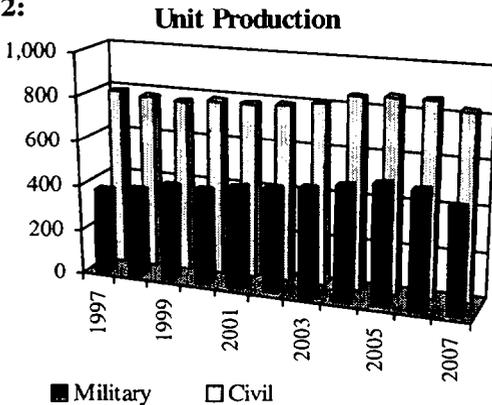
*Challenges.* Decreasing procurement of helicopters by DoD has forced the US industry to concentrate on military remanufacturing and retrofit programs, maintenance and depot support to the military customer, and commercial sales. In the commercial market, the ultimate challenge is to produce helicopters and tilt rotor aircraft that are cost competitive by driving down sustainment costs. A further challenge for the commercial sector is to expand internationally in undeveloped markets, while the military sector assumes more responsibility for research, development, and production of mission systems that can be leveraged for commercial use. Addition of the MD 500 and 600 series helicopters to the Bell line strengthens their commercial position against

Eurocopter. Boeing has chosen to pursue military-only production after consolidating the former McDonnell Douglas helicopters under Boeing Defense and Space Systems. Sikorsky is attempting to further diversify between military and commercial lines with the introduction of the commercial S-92 Helibus.

*Outlook.* The rotorcraft industry’s long-term outlook is for a slightly improving market. The value of military rotorcraft production for 2006 is forecasted to be \$6.23 billion, compared to the 1997 value of \$3.96 billion. The production of military aircraft through the turn of the century will remain flat. In 1990, 11 rotorcraft models were in development or in production for the US military - by 2000 only four rotorcraft will be in production and only one new helicopter in development. The commercial market will drive the industry as defense budgets continue to shrink and new developmental programs are stretched out.

Figure 2 illustrates the outlook on unit production for military and commercial rotorcraft.

**Figure 2:**



Source: 1998 American Helicopter Society Annual

The industry remains marginally profitable and overcapacity remains an issue. All three US rotorcraft producers and GKN Westland are small components of larger corporations. Failure to produce consistently reasonable profit margins may force parent corporations to divest, requiring further mergers or liquidation. The merger of Boeing and McDonnell Douglas will help the US market address over-capacity and further define the niche markets of each major manufacturer. Further merging of US manufacturers is unlikely but success in the joint production of the EH101 could logically lead to merger of Agusta and

Westland. Still to be decided is possible alignment or teaming of Russian manufactures with US or European counterparts.

Joint ventures in producing the V-22 Osprey tilt rotor, RAH-66 Comanche armed reconnaissance helicopter, EH-101, and NH-90 medium utility helicopters mark the trend of the future in military development and production. Joint ventures allow for sharing information, engineering, and expertise while lowering the risk to each venture member. Joint ventures also ensure two lines of production and a source should one member leave the venture.

Bell Helicopter's future success is dependent upon the success of the joint venture V-22 and the civilian counterpart Model 609 tiltrotor while maintaining dominance in the commercial light single and multiengine market. Boeing's future success is dependent on the joint venture V-22 and RAH-66 and the continued production/remanufacture of the AH-64D and the CH-47 Improved Cargo Helicopter. Sikorsky remains the US producer at greatest risk dependent upon UH-60 and CH-60 production in the short term and the joint venture RAH-66 and remanufacture of the UH-60 and SH-60 over the longer term. Sikorsky's S-92 Helibus is the unknown that could make up for the company's lack of commercial market share.

### *Aircraft Engines*

The top four engine makers are Pratt & Whitney and General Electric in the US, Rolls Royce in the United Kingdom, and SNECMA in France.

*Current Condition.* Spurred by the growth of commercial aircraft sales worldwide, the commercial engine market is driving overall sales. Backlogs in foreign and domestic aircraft production will guarantee substantial opportunities in the commercial market. The military engine market – impacted by the contraction of defense budgets worldwide – has fared less well. The F-22, F/A-18, Grippen, Eurofighter, Rafale, and Joint Strike Fighter present limited opportunities for military engine development and production.

The engine market is characterized by high development costs and low profit margins. Consequently, engine manufacturers are looking to the following initiatives to reduce costs and enhance profitability.

- Joint ventures among engine manufacturers (domestic and/or overseas) in order to spread risk and development costs. European manufacturers are aggressively seeking ventures to maintain their share of the critical commercial market.

- Development of derivative engines from a common core to reduce initial development costs. Design modifications include greater thrust and capabilities to improve range, weight and noise reduction.
- Innovative life cycle support and financing options (including lease and “power by the hour” agreements) to expand business base and improve profitability. The manufacturer (domestic or overseas) assumes responsibility for maintenance and for integrating improvements throughout the life of the engine.
- Foreign military sales (FMS) to increase quantities, to reduce unit cost, and to keep military engine programs profitable.
- Quality and statistical process control initiatives in both prime contractor and subcontractor facilities to improve reliability, increase time between overhaul, and decrease support costs.

*Challenges.* The greatest challenge for engine manufacturers is profitability in an environment of fierce competition. Extremely high development costs (up to \$2 billion), competition, and the long period to realize return on investment (15-20 years) means low profit margin on engine sales and makes the pursuit of new engines a strategic corporate decision. These conditions will demand manufacturing innovation and the development of life cycle support programs.

While US industry maintains a competitive technological advantage in the global marketplace, international competitors are closing the gap. European companies are striving to achieve number one or two in their respective core competencies to keep their niche in the market. Of particular concern is the vigorous competition that is building in the emerging markets worldwide.

*Outlook.* A growing commercial sector and early retirement of commercial aircraft and engines (for age and future noise/emission standards) will fuel a growing engine market. Dual-use technology should continue to establish a workable system to keep defense contractors viable. Extremely high development costs and the long period to return on investment will force collaboration through joint ventures. Profitability will be found in innovation and total engine support for the foreseeable future. The future for aircraft engines is joint ventures between the major producers and expanding profitability in total life cycle engine support.

## **OTHER IMPACTS ON THE AIRCRAFT INDUSTRY**

### ***Trends in Design, Integration, and Manufacturing***

Information technology within the aircraft industry has attained a new level of maturity that is now capitalizing on information technology investments. Today, Computer-Aided-Design/Computer-Aided-Manufacturing (CAD/CAM) software and other information technology solutions are incorporating standard data interfaces that provide for the total integration of design, engineering, analysis, manufacturing, product data management and life cycle support processes—as well as integration across software product lines. This movement towards systems integration is leading to dramatic enhancements in concurrent engineering design processes, consortia approaches in development of new aircraft, engineering design analysis modeling and simulation, tooling and manufacturing processes, and final production. Single CAD/CAM systems are now supporting the total design and development of new systems' integration engineering efforts.

Integrating engineering analysis with product design is becoming extremely important as design problems become more and more complex, and require increasingly sophisticated analysis techniques. Corporations now aim at information technology solutions to develop analysis and simulation models through integration with original 3D CAD design data. The objective is to determine design problems and product design performance earlier in the development phase. Integration of visualization products and digital prototyping software is also leading to the restructuring of design and development processes into large-scale, interactive virtual environments. Prototyping, physical mockups, and certain aerodynamic design testing are now being eliminated in the development process and performed digitally through “virtual design” applications made possible by these innovative, collaborative technology solutions.

The major benefits of advanced information technology solutions are increased corporate productivity, efficiency and competitiveness, and reduced design/manufacturing costs and product cycle times. Further movement toward integration of virtual design applications and leveraging of information technology solutions, as well as restructuring of design, manufacturing and production processes, will continue to be significant in the future. Corporations seeking to maintain their competitive edge will need to continue to focus on integrating design

automation and information technology solutions into their business processes.

### *Advanced Materials*

The vocabulary of the aerospace world includes such terms as super alloys, composites, ceramics, carbon-carbon, memory metals, intermetallic, and metal-matrix composites. Many of these materials are already in use; however, significant advances still lie ahead. While the lure of a promise of greater strength, reduced weight, and increased heat resistance is strong, challenges remain in manufacturing technology and cost.

Metal, most notably aluminum, has been the mainstay of the aircraft industry. New aluminum alloys offer engineers specific improvements over previous materials. The best candidate is aluminum-scandium; a material investigated more in Russia but recently supplied by US producers. It is both strong and corrosion resistant. Another advance in the metals arena includes the use of powdered metal technology. Molten metal droplets are cooled at rapid rates to produce uniformly distributed crystals resulting in alloys which are stronger and have higher melting points. Powder metallurgy offers cost savings due to net shape design and little scrap loss.

The greatest challenge for composites has been to get a better balance between cost and performance. Recent advancements offer progress on both fronts. Improvements in fiber development could lower the price of conventional carbon fiber from the current \$20 per pound to \$3 per pound. Resin transfer molding (where resin is injected into fiber preforms enclosed in heated mold cavities) has emerged as a viable method for producing composite parts. One manufacturer used this process to develop a fan inlet case for an aircraft engine, saving both weight and cost. Another new process involves the use of an advanced stitching machine to join large composite sections together to form an all-composite wing which should lower production costs by 20% and weight by 25% when compared with conventional aluminum construction.

For years ceramics have held great promise for advancement in engine technology because of their ability to withstand high temperatures, but progress has been slow because of problems with brittleness and lack of ductility. Development of ceramics with ultrafine grains shows promise for creating ceramics with metal-like properties. Recently, researchers discovered that hollow ceramic beads originally

made for heat insulation also make a good noise-dampening candidate, offering a way of abating engine noise.

Two promising areas for continued research and development efforts include smart materials and memory metals. Smart materials could improve aircraft monitoring systems, for example through a network of optical fibers or electrical sensors, and warn of cracks or defects as they occur.

### ***The Shrinking Supplier Base***

In the last 10 years, there has been a reduction of US aerospace prime contractors and their suppliers due to the downturn of the civil aviation markets in the late 1980s and an overcapacity condition in the defense aerospace business due to the end of the cold war. While the civil aviation markets are currently booming, the military has seen considerable reductions in budgets for procurement, and operations and maintenance. The initial impact, especially on second and third tier suppliers in the early 1990s, was that many went out of business, were bought out by larger companies, or changed to nonaviation product lines. As civil and defense prime contractors restructured and consolidated to become more cost competitive (and reduce overcapacity in the defense sector) more emphasis was placed on the lower tier suppliers to produce higher quality products, on time and at low cost. Since the late 1980s, it is estimated that the supplier base fell from 120,000 firms to around 30,000 firms in 1993. This number could be reduced another 20-25% by 2002 due to defense consolidation and lean manufacturing initiatives. Similar reductions in the European aerospace supplier base have, and are currently taking place.

A recent Deloitte & Touche Consulting Group survey of 67 leading North American aerospace and defense prime contractors and suppliers offers some insight into future trends in the aerospace and defense industry. Most primes plan to continue concentrating purchases and rationalizing their supplier base at an accelerated pace -- particularly defense primes. Both primes and suppliers agree that suppliers who can offer broader integration and more comprehensive systems and solutions will increase their business. Willingness to partner, sharing the investment/risk and build to pre-specified costs are becoming key discriminators by primes when choosing suppliers.

While defense primes continue to rationalize excess capacity acquired through mergers and acquisitions, commercial primes and suppliers surveyed are generally planning to increase manufacturing

capability. Most suppliers surveyed plan to pursue new lines of business, develop strategic relations or merger/acquire in response to recent changes in the aerospace and defense industry.

Suppliers, more than ever, need to partner with customers to remain viable. To support this, suppliers must consider developing the infrastructure to facilitate seamless integration with their prime partner(s) by developing capabilities required to deliver more broadly integrated and more comprehensive systems/solutions. They must also consider proactively pursuing alliances, joint ventures or mergers and acquisitions necessary to develop these capabilities. Those suppliers who survive the industry stakeout will have greater financial strength through enhanced volume, fewer competitors, increased stability, and a more level workload. Based on the Deloitte & Touche survey, the total number of suppliers will continue to shrink, though those who remain will realize a greater share of the total workload and have a more stable relationship with prime contractors.

From a DoD perspective on downsizing and consolidation, there is minimal impact on essential capabilities required for unique military requirements. However, DoD has taken action to sustain key subtier industrial capabilities required to meet current or projected defense requirements. The 1997 Annual Industrial Capabilities Report has identified no vulnerabilities from foreign suppliers in cases where foreign industry is the preferred or economically viable source for suppliers. However, militarized flat panel displays, (Japan has cornered the commercial market on displays) are nonexistent within the US. Government involvement is required in helping the next generation flat panel display industry in the US become economically viable and competitive in the world market place.

With the worldwide consolidation of the aerospace industry, and the use of an international aerospace supplier base for the prime aerospace contractors, the US must ensure suppliers of critical components and materials are not eliminated or fall behind in production capability (surge) due to over commitment. Without a quantifiable, robust, lower-tier supply base, our ability to bring about a surge in supply during mobilization or contingency operations could be at risk.

### ***International Competition***

Competition in the aircraft industry is and will remain fierce. Extremely high program development costs and slim profit margins over extended periods make each sale crucial to the business strategies of the

major corporations. Currently, the key to successful sales of aircraft, helicopters and engines involves innovative funding and leasing packages and life cycle support offered at the time of sale. Product reliability and maintenance and operating costs play a significant role in customer decisions but the real driver is price.

Competition between the two major commercial fixed wing aircraft companies will likely intensify as Airbus challenges Boeing's market lead. As late as 1997, Boeing had 55% of the market compared to 45% for Airbus. Although Airbus is still restricted by a cumbersome four-nation consortium, it already has a significant share of the global market and has publicly announced its corporate goal to become the number one commercial aircraft builder in the world. Until recently, Airbus aircraft design and production work share has been split among four nations based on a politically expedient distribution of the workload rather than on best price and efficiency. Should the Airbus consortium be privatized as expected, it will be in a better position to obtain the best prices from available vendors, and its competitive position could improve.

Bell, Sikorsky, Boeing, Eurocopter, Westland and Agusta are the major helicopter manufacturers with no significant shift in market shares anticipated. For commercial products, each company has its own niche market on which it depends. High development costs coupled with relatively low production numbers prevent most of the firms from breaking into the core competency areas of the other industry leaders.

Although competition continues to increase in the aircraft engine industry, there has been no significant shift in the industry make up of General Electric (GE), Pratt & Whitney, Rolls-Royce and SNECMA Engines continue to be sold at extremely small profit margins, if any, with both American and European engine manufacturers focusing on life cycle support to increase business profits. However, increasing engine reliability has resulted in a declining market for parts and repairs. With narrow profit margins and intense competition, industry analysts believe that three large engine makers is one too many and they expect to see continued emphasis on partnerships between the leading firms. Engine manufacturers themselves agree that the fierce competition hurts them all and that there will likely be an increase in joint ventures and alliances.

### ***Industry Restructure***

Within the US aircraft industry, viable consolidation is almost complete while internal restructuring is still underway. Overseas,

neither consolidation nor restructuring has been pursued to their optimal ends. European industry in general is making slow but steady progress toward restructuring and consolidation of both national and transnational corporations as they seek to decrease costs. Governments in Europe still pursue policies intended to prevent the migration of industry out of their countries regardless of the inefficiencies of such policies. The European industrial block is trying to ensure that European firms remain key players in the global economy. When European industry does rationalize its structure, its competitive edge may increase. With an increasingly global economy, international corporations are buying firms in other countries to address issues of reciprocity and to ensure market access.

Consolidation of the European defense industry lags behind the commercial sector. Cooperative efforts like the Eurofighter 2000 have succeeded in rationalizing some manufacturing facilities at the sub-component level. However, national security priorities have prevented shutdown of military aircraft production lines. Despite aggregate defense spending levels less than the US, Europe is currently supporting six separate fighter aircraft assembly lines. In the near-term, it's unlikely this overcapacity will be significantly trimmed. Until then, the US will enjoy a substantial production cost advantage in the military aircraft market.

Extreme competition in the international aircraft industry will continue. Virtually all of the competitors are introducing business strategies intended to incrementally reduce the cost of production while investing heavily in research and development to push their technological edge.

## **GOVERNMENT GOALS AND ROLE**

As the defense budget declines, a strong market focus will be needed to retain world leadership in the military market and to sustain a warm industrial base for potential mobilization. In the aggregate, it is essential to national security and economic prosperity that the government ensures the health of the aircraft industry.

In contrast to booming commercial sales since the mid-1990s, US military aircraft purchases have fallen dramatically over the past 10 years. Many production lines have been closed and remaining programs have been repeatedly cut and stretched out. Plans over the last few years to boost total military procurement from \$40 billion to \$60 billion a year failed to materialize during budget execution. In short, military aircraft

procurement funding has been unstable relative to plans. Research funding for defense-related programs has also declined. The technological preeminence of US industry will erode unless government continues to support research initiatives. Furthermore, government restrictions, sanctions, regulations, and trade laws impact the industry's ability to compete with international manufacturers.

Overall the government's most important aviation industry role is to develop sound defense procurement policies and foster fair trade policies like those that have driven recent record commercial aircraft sales. To pursue these ends further, the government should do the following.

- *Clearly define military aircraft mission requirements and develop a stable, joint, best-fit procurement strategy.* Absent this crucial first step, resulting procurement decisions and industrial consolidation sacrifice rationality.
- *Consolidate military infrastructure to reduce operations and support costs.* The administration faces little congressional support for another round of base closings due to the potential impact on local constituencies and disagreements over past closure actions. These issues need to be resolved so that DoD can reduce excess infrastructure that is driving operations and support costs and draining resources from modernization accounts.
- *Compete depot level maintenance of military aircraft systems, regardless of the parochial objections of government depots and industry.* Benefits include increased depot efficiency, potential new work for industry to offset declining aircraft production, and savings that can be applied to modernization.
- *Promote acquisition reform and dual use technology.* Acquisition reform eliminates government-unique burdens and moves defense managers to commercial standards and practices. This is essential for the integration of the defense industrial base within the civilian economy. With dual-use technology, defense goods benefit from economies of scale in commercial production and domestic manufacturers reap the advantages of military funded R&D.
- *Utilize the contested Lockheed-Martin/Northrop-Grumman merger to define the legal (antitrust) standards for corporate consolidation.*
- *Support foreign military and commercial sales of domestic aerospace products.* US foreign policy initiatives and global diplomatic efforts are needed to sustain and enhance the aircraft industry through offshore sales.

## CONCLUSION

The aircraft industry is a mature but evolving industry. Intense international competition and high development costs have driven the industry to consolidate and divest business activities that are not part of its core mission. As a result, the industry has transformed from numerous competitors with a wide range of products to a more concentrated industry with fewer product lines. This concentration has rippled through the subtier levels as suppliers seek to establish preferred supply agreements with the prime contractors, reducing the overall number of suppliers. This process has allowed companies to specialize and focus on their core competencies, thereby achieving economies of scale and reducing production costs. However, there may be hidden costs to customers associated with reduced competition. A narrower supply base also introduces vulnerabilities to commercial contractors, who cannot expand supply quickly in reaction to increases in demand for aircraft. In addition, it may create a vulnerability for DoD, which will have fewer suppliers to rely on to meet mobilization surge requirements. In order to mitigate these vulnerabilities, the government should monitor the industry rationalization process closely to ensure that the resulting structure will meet the Nation's economic and national security interests.

Not only is the aircraft industry becoming increasingly global, the market is becoming increasingly sensitive to international influences such as the east-Asian financial crises. In addition, domestic companies are looking to overseas suppliers and competitors for partnerships and joint ventures to obtain critical capabilities and share risk.

Competition has forced the industry to focus on total life cycle cost of their product. Aircraft customers (i.e. airline companies, leasing companies, and transport companies) must actively contain costs in order to survive. They are sensitive not only to the purchase price of the aircraft, but the cost to operate and maintain it. Manufacturers are offering customers total life cycle support their products as a means of lowering overall costs and risk of ownership. This also provides the manufacturers an opportunity to increase profits while providing incentives for product improvements.

Overall, the aircraft and engine manufacturers know their markets and are responsive to customer requirements. This market awareness should help aircraft manufacturers predict and adapt to changes in customer requirements more accurately in the future.

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