

Spring 2009
Industry Study

Final Report
Aircraft Industry



The Industrial College of the Armed Forces
National Defense University
Fort McNair, Washington, D.C. 20319-5062

Aircraft Industry 2009

ABSTRACT: As a provider of technologically advanced aircraft for national defense and an influential contributor to the national and global economies through its commercial sectors, the aircraft industry is a critical strategic industry for the United States. The aircraft industry is currently healthy and capable of meeting the strategic needs of the country despite multiple challenges. The civil aircraft sectors are currently experiencing stagnated growth as a direct result of the current economic recession; however, long-term growth is projected. In the defense aircraft sectors for which maintenance of U.S. technology advantage is desired, the Department of Defense faces a critical decision point regarding the shrinking number of aircraft manufacturers that will shape future market competition. Also on the defense side of the market, future non-discretionary budget pressure will likely reduce funding profiles for defense aircraft programs. Additional long-term challenges exist for the overall aircraft industry in the form of barriers to trade, engineering workforce replenishment, infrastructure modernization, and environmental impact.

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INTRODUCTION

The United States aircraft industry is a critical contributor to America's economic well-being and national security. The commercial side of the aircraft industry, although capable and currently stable, faces major near-term challenges due to decreasing demand from the airline industry and customer difficulties with financing. The outlook improves in direct proportion to the speed of recovery from the current economic recession. The defense side of the aircraft industry is currently more stable due to steady demand from the U.S. government and foreign military sales, however, challenges exist. Over the past year, the environment in which the industry operates has changed. The single most important development affecting the industry is the ongoing global economic recession.

The economy has negatively affected the airline industry, and as a result, the civil aircraft sector in the near term. Although backlogs are often purported as a health indicator by the large commercial aircraft firms, increasingly lower passenger volume on airlines is causing many airlines to defer or cancel their orders. The outlook for 2008 end-of-the-year profit figures was bright due to the significant decrease in aviation fuel costs over the past year, but this forecast profit was eroded by the economic downturn. Aside from this relatively temporary reduction in backlog, long-term projection beyond 2013 is positive for the civil aircraft sector.

On the defense side of the industry, pending non-discretionary budget pressure is the greatest impediment to continued growth. Although ongoing overseas contingency operations in Iraq and Afghanistan, as well as a global surge of recapitalization efforts, keep the demand for defense related aircraft industry products high, the ushering in of President Obama's administration is shifting the priorities of the defense aircraft market. Couple the current economic recession with the predicted growth of non-discretionary spending and the gloomy forecast of the economic challenge for defense aircraft procurement only deepens. The cumulative side effect of these upcoming fiscal realities on defense is a more fiscally constrained approach to defense procurement. Considering Secretary of Defense Robert Gates' emphasis on increasingly manpower-intensive capabilities (e.g. counterinsurgency operations focus and increases in Army and Marine Corps end-strength), the bill-payer will likely take the form of more expensive conventional warfare acquisition programs, especially aircraft programs. Balancing these potential defense budget cuts with maintaining the major combat capabilities in our air forces will prove an extremely challenging endeavor. Additionally, some defense sectors face a reduction in the number of prime aircraft manufacturers to the point that less than efficient market competition will occur in the future, specifically in the fighter/attack sector.

The 2009 Aircraft Industry Study (AIS) seminar conducted an in-depth analysis of the industry for the purpose of assessing the health of the industry and its ability to meet the strategic needs of the nation. After defining the industry, the structure, conduct, and performance of the overall aircraft market are assessed. Selected sectors of the aircraft industry and their primary markets are analyzed. The sector analysis focuses on the current condition of the industry, outlook for the industry, challenges to the industry, and the role of government. In addition, selected essays on topics pertinent to the industry are presented. These essays assess the surge capacity of the aircraft industry, airline bankruptcy impact on the aircraft industry, NextGen air traffic management (ATM), and the outlook for unmanned aircraft systems (UAS). The cumulative research herein forms the basis for public policy and industry recommendations that will provide the aircraft industry the best opportunity for continued viability and success.

THE INDUSTRY DEFINED

The aircraft industry is an advanced technology sector of U.S. manufacturing capability in terms of both products and production processes. While the United States has an overall trade deficit, the aircraft industry contributes a trade surplus to the U.S. economy.¹ This industrial capacity represents a strategic asset for the United States with its unique ability to provide the equipment necessary for national defense, protection of strategic interests, and a major source of employment. The scope of this report includes civil (large and regional commercial, business and general aviation, and rotary wing) aircraft and defense (fighter/attack, transport/tanker, and rotary wing) aircraft. Engines, spacecraft, and the armament industry related to aircraft weaponry are beyond the scope of this document. Unmanned Aircraft Systems are discussed in the Essays on Major Issues section.

Structure. The overall market is an oligopoly characterized by imperfect competition due primarily to barriers to entry. Notwithstanding these impediments to market efficiency, both the civil and military sectors are globally competitive. Although specific factors impact the effectiveness of the defense market, such as export regulations like the International Traffic in Arms Regulations (ITAR), all sector supplier bases and production processes are spread around the world, allowing competitive access to materials and practices.² Currently, in the fighter/attack aircraft sector, as program length and cost increase while the number of programs decreases, potential exists for erosion of true market competition as manufacturers exit the market or merge with other firms.

Conduct. In terms of behavioral attributes, the extensive merger and acquisition (M&A) strategies that occurred in the late 1990s have continued pace for the last three years. The size and quantity of M&A activity is a significant factor in the evaluation of the conduct of this industrial segment.³ This signifies a wealthy and dynamic market that is pursuing efficiencies through economies of scale. The economic recession may also cause a general decrease in M&A activity in the near term. Furthermore, capital investment as well as research and development (R&D) investment have decreased slightly since the economic downturn began. The DOD R&D expenditures are decreasing and forecast to continue this trend. While domestic aircraft manufacturers closely monitor the health of their global supply chain, international aircraft manufacturers have a more active level of control over their supply chain as the parent firm owns many of the sub-tier companies. Both domestic and international parent firms are also diversifying their business models into other sectors (e.g. homeland security and non-defense related businesses) and increasing their focus on life-cycle support as a hedge against a cyclical economy and fickle defense portfolios.

Performance. The aircraft industry has continued to enjoy healthy performance, although less pronounced than previous years.⁴ As mentioned earlier, the industry supports both civil and defense consumers. Despite the relatively few numbers of suppliers, the industry is competitive. Civil aircraft manufacturers offer multiple classes of aircraft designed to enable their customers to execute their business strategies effectively and efficiently. Consumers have also benefitted from the expansion of service support offered by most aircraft companies. In this case, the customer can specify an operating tempo and the manufacturer uses its expertise to determine the optimal maintenance schedule. While it is difficult to quantify the value created by defense products, U.S. aircraft manufacturers have consistently delivered capabilities that meet national

security requirements in all sectors. In addition, the level of innovation that complex defense aircraft, such as fifth generation fighter/attack aircraft, bring to the market sets the standard for international competitors and often provides pertinent technology to civil aircraft design. Structural factors that have impeded a more sustained growth profile in the first half of 2008, such as oil prices, had a less dramatic effect than expected during the first half of 2009. Although the current economic recession has reduced large commercial aircraft backlogs, positive long-term growth is projected. Customer difficulty obtaining financing is one reason that domestic and international civil aircraft manufacturer backlogs are diminishing. Some analysts maintain that a return to a sustained growth may be as far away as 2013.⁵

CURRENT CONDITION AND OUTLOOK

Civil Aircraft

The commercial aircraft industry is composed of the following sectors ordered by market share: Large Commercial Aircraft, Business Jets/General Aviation, Regional Jet Aircraft, and Rotary Wing Aircraft. Although the current condition of this market is healthy with modest growth in overall production value, the industry is currently experiencing declines in new orders as well as order deferrals and cancellations of existing orders because of the economic downturn and its effects on the demand side of the market, especially the airline industry.⁶ The recession, which began in late 2007, has resulted in major impacts to the financial system and significant tightening of the credit market.⁷ As such, the availability of financing for the purchase of new aircraft has become a significant market factor.⁸ Additionally, the airline industry, “strongly correlated with economic conditions,” has seen decreased demand globally.⁹ Given these challenging market conditions, over 25 airlines filed for bankruptcy in 2008 while other airlines have begun postponing new orders, extending deliveries, or, in some cases, cancelling orders.¹⁰ Notwithstanding the current challenges, the commercial aircraft industry appears prepared to weather the economic recession, at least in the short term, given some combination of revenue and operating margin growth, adequate cash positions, cost reduction initiatives, and considerable backlogs in key commercial aircraft companies (Airbus, Boeing, Bombardier, and Embraer).¹¹

The overall outlook for the aircraft manufacturing market is strong. In the near-term, the economic downturn will impact the sectors differently; however, the forces that were expanding the market as a whole prior to the recession, such as increasing demand in other countries, will continue to spur growth following recovery. Concern exists over available purchasing capital due to the potential demise of the International Lease Finance Corporation (ILFC). If ILFC becomes insolvent, the future of \$25 billion in outstanding orders from Boeing and Airbus will be in jeopardy and further the near-term decline of aircraft manufacturing orders.¹² In the long-term, Teal Group analysis predicts an overall growth rate of 37% aggregated for all production sectors from 2008-2017.¹³ Approximately 60% of the new market will be for commercial aircraft with Boeing predicting a demand for over 2,600 airliners (large & regional jets) over the next two decades.¹⁴ The exception could be the regional jet market, but even that segment provides room for growth on the upper end of the seat capacity scale, and the most potential for change in market share. Globally, all market sectors are expected to maintain strong barriers to entry and no new entrants are projected with the exception of the regional jet market, which China, Russia, and Japan are now entering.

Large Commercial Aircraft Sector. The large commercial aircraft sector (defined as gas-turbine-powered airliners of 150 seats or greater) functions as a duopoly with two highly competitive firms: Boeing and Airbus.¹⁵ These two firms' newest aircraft reflect different market strategies.¹⁶ Boeing's mid-size, fuel-efficient 787 Dreamliner is looking to capitalize on trends in the number and frequency of point-to-point flights over 3000 miles.¹⁷ With 878 orders as of April 2009, Boeing is scheduled to begin delivery of 787s in 2010, vice 2009.¹⁸ In contrast, Airbus' A380 is targeting the jumbo jet niche to take advantage of what it sees as a continuing trend toward utilization of the traditional airline hub-and-spoke model.¹⁹ Airbus began deliveries of the A380 in October 2007, a two-year delay from original plans.²⁰

The effects of the recession became apparent in 2008 with both Boeing and Airbus seeing large declines in new orders accompanied by deferrals and some cancellations, especially for Airbus.²¹ Additionally, Boeing saw a major downturn in aircraft deliveries (66 units), associated revenue (15 percent), and profit margin (6.5 points) due primarily to the effects of a 57-day machinists' strike.²² In contrast, 2008 Airbus deliveries (30 units), revenues (9 percent), and associated profit margin (10 points) increased from 2007.²³ Airbus' positive financial performance can be attributed to increased A320/330/340 and A380 revenues, positive currency contributions from favorable foreign exchange rates, and the continued success of Airbus' efficiency initiatives.²⁴ Airbus has garnered a 57 percent revenue share compared to 43 percent for Boeing.²⁵ Despite these positive indications, Airbus has a backlog of only 187 orders for A380, five of which have been placed in the past fifteen months.²⁶

Looking forward, large aggregate backlogs of 7,400 aircraft and trimmed finance portfolios should allow the companies to provide some financial assistance to customers, however, both Airbus and Boeing could end up having to cut production or increase "white tail" production (manufactured aircraft without contracted buyers) if economic and financial conditions worsen in 2009.²⁷ Accordingly, to be in a better position to weather these economic uncertainties, Boeing initially planned to decrease personnel by 4,500 in 2009 and the number is growing.²⁸ Industry analysts expect interrupted growth between 2010 and 2013.²⁹ The large commercial aircraft sector is the largest sector with respect to expected future value at more than five times the size of the next largest sector (business jets/general aviation's \$109.2 billion).³⁰ The profitability of this sector is drawing China as a new entrant. Despite China's aspiration to enter this market, analysts predict they will not produce a competitive product until the mid-2020s. Even then, China will have to convince the global market buyers that the product is on par with Boeing and Airbus in terms of quality, capability, and safety.

Regional Commercial Aircraft Sector. This sector, defined as gas-turbine jet and turboprop-powered aircraft up to 145 seats, operates as a competitive "near-duopoly."³¹ The market is divided between Embraer (51%) and Bombardier (37%) as the principal regional jet manufacturers and Avions de Transport Regional a distant third in terms of 2009 market share.³² The current economic downturn has decreased passenger demand, forcing regional airlines to cut capacity along with the mainline airlines, leading to fleet reductions and "making the operating economics of the regional jets problematic."³³ There has also been an increasing trend away from small regional jets to turboprops since 2004 due to "air traffic trends, high fuel prices and the need for regional airlines to cut costs and reduce fares."³⁴ The industry has seen a transition from smaller regional jets to 70-plus and 90-125 seat models.³⁵ Consequently, both Embraer's ERJ 170/190/195 models and Bombardier's CRJ 700/900 models are positioned effectively to exploit this market segment while Bombardier with its new CS-series seating up to 145, is

determined to compete with both Embraer and the smaller single-aisle of the higher segment (i.e., A319 and B 737).³⁶

Long-term growth in this sector is expected to be weak with the vacated small regional jet market and U.S. airline industry de-emphasis of large regional networks.³⁷ As such, sector value is expected to increase through 2010 then drop and ultimately plateau beyond 2013.³⁸ Despite this projection, three new players are poised to enter the market. Russia's United Aircraft Corporation is building the Sukhoi SuperJet 100, China's AVIC looks to build an ARJ-21, and Japan's Mitsubishi Industries is leveraging its partnership experience with Boeing to produce its MRJ. All three aircraft are in the 70-100 seat range. Commercial Aircraft Corporation of China (COMAC) estimates that China will need about 900 mid-sized regional jets over the next two decades.³⁹ Embraer, the leader in the Regional Jet market, foresees global demand for 6,750 aircraft (30-120 seat capacity) over the next 20 years. Tendencies will be toward the upper end of the capacity scale, as regional jets can continue to help airlines match capacity to demand by right-sizing the aircraft occupancy ratio.⁴⁰

Business Jet and General Aviation Aircraft Sector. The business jet/general aviation aircraft market is shared between the following five companies with respect to forecasted market share in 2009: Gulfstream (25.5 percent), Dassault Aviation (22.4 percent), Bombardier (20.8 percent), Cessna (17.7 percent), and Embraer (13.5 percent).⁴¹ This sector has experienced double-digit production growth in the competitive business jet segment over the last four years.⁴² However, this was the first aircraft sector impacted by the economic recession with declines in orders, delivery deferrals, and potential cancellations, all in direct response to weakened corporate demand.⁴³ The tightening of credit reduced capital available for the purchase of aircraft and drove potential customers to select more economic modes of travel. Also, the message from consumers to corporations was that business jet travel is an unnecessary luxury in hard times.⁴⁴ As a result, this sector became the first to implement personnel reductions with Cessna and Hawker Beechcraft planning to lay off 665 and 490 personnel, respectively.⁴⁵ Industry analysts predict a decline in production rates over the next two years.⁴⁶

As the global economy comes out of recession, this sector will likely continue its strong growth trajectory beginning in 2013, led by the introduction of a number of all new business jets (Gulfstream 650, Cessna Columbus, and Bombardier's Learjet-85).⁴⁷ The future of this market appears sufficiently bright to lure new entrants as evidenced by Honda Motor's plan to mass-produce its new light business jet in North Carolina.

Rotary Wing Commercial Aircraft Sector. Four principal companies share this market: Eurocopter, Agusta-Westland, Bell, and Sikorsky.⁴⁸ Eurocopter remains the sector leader with its large EC series portfolio providing the "most aggressive market presence."⁴⁹ Agusta-Westland is in second place with its winning A109 family as well as the heavier AW139 introduced in 2005.⁵⁰ Bell remains in third place with its new Model 429 due for delivery beginning in 2009.⁵¹ Sikorsky comes in fourth with its S-76 family and the S-92.⁵² Four demand drivers have fueled large growth in the competitive civil rotary wing sector over the last three years: increased energy exploration, homeland/civil security and disaster management, corporate aircraft demand, and global emerging markets (principally China, India, and Russia).⁵³

The long-term outlook for rotary wing aircraft is very bright. Built on the backs of the defense industry and increased corporate sales, the rotorcraft market boasted an impressive 14.6% compound annual growth rate from 2003-2008.⁵⁴ With high barriers to entry, this established industry, the smallest of the four commercial aircraft sectors, will continue to grow

with normal perturbations due to economic cycles.⁵⁵ Indeed, the forecast from the Teal Group is for more than 15,000 aircraft from 2008-2017.⁵⁶ A significant part of market growth is due to emerging economies in China and Russia.⁵⁷ Agusta Westland, Bell, Sikorsky, and Eurocopter will likely continue their hold on 98 percent of the global market. Further consolidation is unlikely. Russian, Chinese, and Japanese designs will largely service these domestic requirements.⁵⁸

Defense Aircraft

The current condition of the defense sector of the aircraft industry, which includes fighter/attack, transport/tanker, and rotary wing aircraft, is strong and stable. The defense aircraft sector is less affected by economic conditions than its commercial brother is because the former answers to the needs (and funding levels) of governments rather than volatile consumer-driven airline demand. Although public administration business can provide some insulation from highly volatile consumer economic conditions, other risks exist. Dealing with government subjects defense aircraft vendors to the annual defense budget appropriations process that can change based on shifting national security priorities. Decisions about specific program budgets are subject to change from one year to the next based on political support or opposition. In the Fiscal Year (FY) 2009 budget, eleven of the top 25 DOD procurement programs are aviation systems with total estimated FY 2008 and FY2009 values of \$14.80 billion and \$15.85 billion, respectively.⁵⁹ With Secretary of Defense Robert Gates' recommendation to cancel the VH-71 program and cease procurement of F-22 and C-17 aircraft, the FY 2010 President's Budget submission reflects a funding priority shift away from the defense aircraft industry toward manpower-related funding requirements.

The long-term outlook for the defense aircraft market is positive, however, the fiscal reality of non-discretionary budget pressure (Social Security, Medicare) on the overall budget will place major defense program funding at risk. As defense aircraft are some of the most technical and expensive programs, they may become the most obvious targets for funding cuts. DOD's ability to make its case for continued procurement of advanced defense aircraft systems as a key contributor to national security will become more and more critical as this pending budget pressure comes to fruition.

As a result of years of defense industry manufacturer consolidation, an additional concern exists for the defense aircraft market. DOD is at a decision crossroads regarding competition in the defense aircraft market, especially in the fighter/attack aircraft sector. DOD must choose between three possible outcomes: (1) accepting a monopolistic U.S. market environment, (2) allowing global competition, or (3) maintaining design teams to keep a minimum of two U.S. fighter/attack aircraft producers competitive in the industry. In the first case, a monopolistic market is an inefficient market and value is difficult to maximize. In the second case, while global competition may be acceptable for a less technically advanced transport or tanker aircraft, it is not necessarily acceptable to some parties for political or technology advantage reasons in the fighter/attack aircraft sector. Finally, if DOD chooses to plan for future U.S. only competition in the fighter/attack aircraft sector, they must devise a way to keep competitive bidders for future contracts actively engaged in fighter/attack aircraft and system design until the next major competition occurs. Regardless of which approach is used, the government will bear increased costs to either maintain competition artificially or deal directly with a single vendor. As such, any approach will put increasing pressure on a potentially shrinking DOD budget. For situations wherein maintenance of U.S. technical advantage is highly desired, maintaining design capability in multiple firms through methods such as Joint Concept Technology Demonstrations

(JCTD) or technology development efforts could maintain the most efficient competition in these highly competitive markets.

Fighter/Attack Aircraft Sector. The largest sub-sector of the defense aircraft industry is fighter/attack aircraft with 2009-2010 values of production of about \$28 billion for 518 aircraft.⁶⁰ For customers desiring innovative fifth generation fighter technology (defined by Lockheed Martin as “advanced stealth, extreme fighter performance, information fusion, and advanced sustainment”) only two options exist: the F-22 Raptor, and the F-35 Lightning II.⁶¹ Full-capability F-22s are not exportable due to technology transfer restrictions and foreign customers are unwilling to pay the high price for a reduced-capability export grade F-22.⁶² On the other hand, the F-35 incorporates fifth generation capability in an aircraft that, from the beginning, was developed with, and for, international partners. F-35 partners are keen on unit costs staying within targets and much of the responsibility for doing so falls on the shoulders of the largest F-35 partner, the United States.⁶³ The FY 2010 President’s budget submission recommends increasing F-35 orders to 30 while cancelling the F-22.⁶⁴ The United States has clearly staked its fighter/attack future on the F-35.

Regardless of the apparent strong showing for F-35, current fourth generation fighters are still fiercely competitive in the global market with offerings from around the world such as the F/A-18E/F, F-16, Gripen NG, Typhoon, Rafale, Su-30, and MiG-29. Several of these fighters are already in competition now for India’s \$10 billion Medium Multi-Role Combat Aircraft.⁶⁵

U.S. fighter aircraft production is on the verge of substantial change. Domestic production for the F-35 is ramping up to full rate production by 2014 and this rate will far exceed production rates for recent fourth generation fighter/attack aircraft. Absent any further orders above 187 for the F-22, production will cease in 2011. Production lines for F-16, F-15, and F/A-18 will close by the middle of the next decade. Unless the F/A-18 gains more domestic (unlikely) or international (more likely) customers, Boeing’s capability to compete meaningfully for the next major fighter/attack aircraft contract could be in jeopardy.⁶⁶ Although a considerable global market for fighter aircraft exists, a similar dilemma now faces Europe’s fighter industry. Rather than maintain viable competition between two or more private firms in the fighter/attack sector, Europe has approached this dilemma by allowing the government and the single fighter/attack manufacturer to become partners. According to Forecast International, “production of new fighter aircraft is set to rise during the next decade, and the landscape of this market overall is about to undergo a drastic change.” The F-35 will dominate the field and drive several competitors out of the market.⁶⁷

Transport and Tanker Military Aircraft Sector. The military transport market has a potential production value of \$15.4 billion for 156 aircraft in 2009-2010.⁶⁸ As with other categories of military aircraft, transports are in need of recapitalization around the globe although the United States is in a better position than most with its C-17 and C-130J cargo aircraft. The Boeing C-17 stands alone in the large strategic airlift category as the only aircraft in this class currently in production. Production is planned to ramp down beyond 2010 when final deliveries to the U.S. Air Force (205 total) are complete. The C-130J currently dominates the large tactical transport category and is the latest iteration of the venerable C-130 that has served the tactical airlift needs of numerous countries for decades. The United States is looking to buy at least 115 and other countries see it as a logical replacement for their aging C-130 fleets (Canada has ordered 17 and India has ordered 6).⁶⁹

The Airbus A400M, the nearest possible competitor to the C-130J, is experiencing delays. Airbus is currently working a restructure plan with the joint organization representing the seven partner countries to keep the A400M moving forward.⁷⁰

The U.S. Air Force's \$35 billion KC-X aerial tanker program continues to face challenges. After several false starts, the Air Force looked poised to get its first lot of aircraft on order in 2008 when it awarded the contract to EADS/Northrop Grumman. However, Secretary Gates cancelled the initial \$12.1 billion contract following GAO's upholding of Boeing's protest.⁷¹ DOD will likely re-compete the initial procurement with a possible Request for Proposal (RFP) expected by summer 2009.⁷² In March, a bipartisan effort began in Congress to place language in the FY 2009 supplemental spending bill that would require the tanker competition to occur in 2009. Included in the effort is a proposal to make the procurement a mixed buy, which would have both companies build aircraft to fulfill the tanker requirement.⁷³

In the long-term, military transport and tanker aircraft will continue to capture a profitable share of the aerospace market. Although DOD demand for the C-17 has waned over the past several budget cycles, political pressures have kept procurement alive. International orders have been sporadic, but uncertainty surrounding the Airbus A400M has generated renewed interest. The Lockheed C-130J continues to fill tactical aircraft needs, extending production of this prolific global exports program. Other smaller efforts exist in Japan, Brazil, India, and Russia, but do not appear to be contenders for substantial market share. When the U.S. Air Force Tanker Replacement program is re-launched, either Boeing or EADS, or perhaps both, will produce wide body tanker aircraft for the U.S. Air Force. Global competition in the defense tanker and transport sector is appropriate and the possibility of a mixed buy, although possibly not easily acceptable by a single manufacturer, still provides value to the United States and ensures national security objectives are attainable.

Rotary Wing Military Aircraft Sector. Military rotary wing (helicopters and tilt rotor) have an estimated 2009-2010 market value of \$13.1 billion for 1,169 aircraft.⁷⁴ The United States is by far the largest customer for military rotorcraft with a large fleet across all four services that is rapidly wearing out due to age and high operational tempos in combat. Current major recapitalization efforts are underway with numerous modifications, upgrades and new-build programs of mature aircraft systems (e.g., Sikorsky's UH-60M Blackhawk, and Boeing's CH-47F Chinook and AH-64D Apache helicopters).⁷⁵ The lucrative U.S. helicopter market is drawing foreign competitors. In particular, the void left by the 2004 cancellation of the Comanche program offered huge opportunities. One highly successful example is the UH-72A Lakota light utility helicopter. The UH-72A is a modified version of Eurocopter's EC145 commercial helicopter and is built in Mississippi by American Eurocopter (a subsidiary of EADS North America).⁷⁶ The Army took delivery of the 58th UH-72A Lakota in March 2009 out of an initial order of 128 aircraft and is planning to buy 345 aircraft through 2016.⁷⁷ However, not all foreign entrants to the U.S. market are enjoying success. Cost overruns have plagued the controversial VH-71 Presidential Helicopter program nearly doubling the program to \$11 billion for 28 aircraft.⁷⁸ The VH-71 is under development by a Lockheed Martin-led team providing a modified version of the AgustaWestland EH101 helicopter. The FY 2010 President's budget recommends cancellation of the VH-71.⁷⁹

CHALLENGES

The Economy. The strong correlation between the health of the global economy and the aircraft industry presents a considerable challenge. With little ability to control or reliably predict economic swings, the aircraft industry is a victim in a reactive role. The significant capital investment required to produce aircraft and the long lead times for raw materials and components limit the industry's ability to respond quickly to shifts in the economy. The question becomes how to maintain a steady flow of work that supports both the company and its suppliers. Consequently, aircraft manufacturers have adopted a conservative strategy that foregoes the ability to capitalize on rapid increases in demand in order to guard against downturns. Almost universally, the aircraft industry has constrained their capacity; developing massive backlogs of work that represent several years' worth of production. Now that demand has dropped, companies can draw work forward to maintain their production pace and keep their supplier network consistently employed. However, when the global market is receding, additional measures are required.

The manner in which U.S. and European aircraft industries respond to the global market downturn reveals a subtle difference in management style. All manufacturers use cash reserves to the best of their ability to assist both their customers and suppliers. However, some firms entered the recession cash-poor because of rigorous M&A activity, limiting their options for response. Companies also differ in their management of suppliers. European firms enjoy more direct control of and insight into their supplier base. This is a by-product of their industry consolidation and acquisition strategy. Conversely, U.S. firms tend to contract with a changing list of second and third tier suppliers to provide the parts they need. While this does allow them the flexibility to select the most responsive companies, some firms have incurred unexpected delays when the suppliers were unable to deliver. In historical perspective, the current downturn may not happen again for decades, but the aircraft industry would do well to increase its liquidity to respond to weaknesses in its supply chain. U.S. firms must also review their own understanding of the risk in their supply chains to determine if their cash reserves are sufficient.

Non-Discretionary Budget Growth. The defense aircraft industry faces a significant long-term funding challenge due to the expanding percentage of the government budget consumed by non-discretionary items such as Social Security and Medicare.

In a nutshell: The U.S. population is aging, health-care costs are spiraling upward and neither program has the money to cover promised benefits. In addition, politicians have known this for many years, and yet no progress has been made in fixing the programs. The deteriorating economy has made things worse. The date when the Social Security trust fund will start running deficits has moved closer by a year, to 2016, and the date of trust fund depletion has advanced by four years, to 2037.⁸⁰

- The Trustee's Report, The Washington Post, 14 May 2009

Likely fallout of the situation will be constrained defense budgets, and as defense aircraft programs are among the most expensive, they become prime targets for discretionary budget cuts. DOD and defense aircraft manufacturers will face challenging times and must be prepared to meet national security requirements within these constraints. In light of the forthcoming reduced percentage of the overall budget available for defense aircraft programs, DOD should emulate the F-35's joint approach to common aircraft platform procurement. While interoperability is a valid objective between systems and allies, a more fiscally responsible

approach to aircraft procurement in the coming fiscally restrained environment is to seek every opportunity for the procurement of common, not just interoperable, systems. The time of different aircraft platforms performing common missions among the services, or even among allies, has passed. Although some individualized, mission-specific aircraft platforms will always be needed (aerial refueling aircraft, for example), DOD must perpetuate the common platform approach to aircraft procurement to the maximum extent possible.

Barriers to Trade:

International Traffic in Arms Regulation. As more countries look to the global market to meet their defense needs, ITAR presents a significant hurdle to U.S. aircraft manufacturers when competing for business. In some cases, foreign manufacturers purposefully avoid including U.S. parts to advertise their systems as hassle-free “no ITAR” products.⁸¹ Dating back to 1976, the Arms Export Control Act (AECA) provides the President the authority to control defense-related exports.⁸² Within AECA, the International Traffic in Arms Regulation (ITAR) governs exports identified on the U.S. Munitions List (USML). In January 2008, President Bush signed directives to improve the efficiency of the cumbersome export licensing process.⁸³ These directives modernized export controls for Department of Commerce’s (DOC) dual-use process for commercial and defense items, clarified the USML and reduced the Department of State’s (DOS) export license timeline to 60 days.⁸⁴ President Bush also signed export treaties with the UK and Australia; however, Congress still has not ratified these treaties.⁸⁵ Doing so would further reduce the cumbersome ITAR licensing process for arms exports to these countries. Despite some progress, export licensing remains a highly specific approval process in which any change in overall aircraft configuration requires re-submission for approval. Revision of the ITAR licensing approach to enable umbrella of approval for a class of technologies rather than specific pieces of hardware is required. U.S. firms could then quickly tailor their aircraft to meet foreign requirements without fear of administrative backlash from the U.S. Government (USG). Ratification of the existing proposed export treaties with the UK and Australia and the creation of similar treaties with our NATO allies would benefit the aircraft industry by reducing the export burden to our partner nations with no added risk to national security.

Buy America Act. While foreign manufacturers are making inroads into the U.S. market, protectionist practices still limit the ultimate competitiveness and efficiency of the aircraft industry. European firms like BAE and Agusta Westland have become successful partners with U.S. companies like Northrop Grumman and Lockheed Martin, expanding their access from commercial into defense sectors. However, the Buy America Act remains firmly in place, requiring a blanket 50 percent U.S. stake in government purchases. The Obama Administration Stimulus Plan for the recession focuses domestically and contains provisions that restrict sourcing in accordance with Buy America direction. Despite the inefficiencies caused by protectionist policies, manufacturers remain competitive. International firms have come to view these provisions as a part of the business landscape, similar to the offsets demanded by other nations for work share in their country. While the overall industry could benefit from increased access to the global supply chain, it is unlikely that political interests would allow jobs to disappear. Although repealing the act may not be feasible, the USG should structure the act to preserve the high value strategic capabilities, such as the design and manufacture of fighter aircraft radar, while allowing firms to outsource low-end work competitively. By moving beyond the crude 50 percent line of the Buy America Act, the government may play a more

progressive role in balancing the ability of the industry to support national security against the competitiveness of those companies in the market.

Open Skies Treaty. The second stage of the European Union’s (EU) Open Skies agreement exposes U.S. Airlines to more competition for revenue traffic within U.S. borders and allows foreign companies to own U.S. airlines. The previous liberalization of global airline markets in North America, the EU, and now, even China, has proven a boon to U.S. airlines because of the bilateral agreements in place allowing them to carry revenue traffic within EU countries, but the time has come for reciprocity. Failure to respond with openness by signing the second phase Open Skies Treaty may ultimately result in the loss of the freedom of operation in these participating countries. Therefore, the benefit of maintaining U.S. participation in the expanding global airline market exceeds the shortsighted benefit of maintaining a protectionist approach to the domestic airline market. True globalization of the airline market will result in competition that is more open. This will directly benefit the consumer, the airline passenger, and as airline companies see the subsequent increase in travel, demand for commercial aircraft will increase as well. The United States should sign the second stage of the Open Skies Treaty in order to maintain participation in the expanding global marketplace and to increase demand for commercial aircraft.

Engineering Workforce Replenishment. The aircraft industry workforce faces the dual challenge of an aging workforce and a forthcoming shortage of science, technology, engineering, and math (STEM) degreed personnel entering the industry. Regarding the aging workforce, “fifty-eight percent of employees in the U.S. based aerospace and defense industry are over 50.”⁸⁶ The Aerospace Industries Association has quantified the concern over the STEM shortage:

*In a survey conducted by the Aerospace Industries Association, 30 member companies estimated that they will need to hire approximately 58,000 scientists and engineers over the next five years. Lockheed Martin conservatively estimates it will need to hire 140,000 people in the next 10 years, but that figure could be as high as 190,000.*⁸⁷

- Aerospace Industries Association, December 2008

The “declining supply of new engineers in the U.S. and Western Europe” is driving the aerospace industry to seek offshore engineering talent.⁸⁸

This changing of the guard portends a significant shortfall in engineering talent for aircraft industry firms. Consider that the shortfall of STEM talented graduates is a national problem, not just specific to the aircraft industry, and it becomes readily apparent that the aircraft industry simply must offer a more attractive alternative to engineering graduates than competing industries if they hope to maintain a level of expertise in this highly technical engineering design field. Many of the member companies of the Aerospace Industries Association spend eight to ten million dollars annually on STEM education programs, but these programs do not necessarily steer the prospective STEM students toward the aircraft industry.⁸⁹ While this is a noble endeavor, the effort and associated funds are misplaced. Individual firms must shift at least a portion of those resources into the funding of attractive starting salaries for new engineering graduates and compensation of their current workforce if they hope to recruit and retain STEM graduates. Industry must encourage increased government focus on the K-12/college-level STEM effort. In other words, while attacking the core problem of engineering student supply is important and virtuous, aerospace firms need to shift focus and resources to recruiting programs that incentivize engineering talent to come to and stay with their firms specifically. Co-ops,

internships, and scholarships that require an employment payback are excellent recruitment tools, especially when followed by attractive post-graduation compensation packages. Specifically, an extremely competitive salary offer and extremely competitive long-term earning growth potential will attract and retain the best new engineering talent in the country to the aircraft industry.

Infrastructure Modernization. Continued growth of air traffic presents a challenge to aging ATM system infrastructure and a bottleneck that will limit demand in the aircraft industry. Over the past 20 years, air travel grew by an average of 4.8 percent per year. Over the next twenty years, passenger travel is anticipated to grow at a rate of 5.0 percent per year, with cargo traffic increasing by 5.8 percent per year.⁹⁰ The effect of this explosive growth in the airline industry is congestion, both in the air and on the ground. The Federal Aviation Administration (FAA) estimates that failure to implement NextGen ATM will cost the U.S. economy \$22 billion by 2022 and \$40 billion by 2033 in lost economic activity.⁹¹ Although the current economic recession has slowed the growth in demand for airline flights, and thus commercial aircraft demand, temporarily, the growth will return as the economy recovers. To address this impending recession, the FAA is leading the effort to field modernized hardware and traffic management procedures to increase the capacity of the national airspace. Without the improvements planned for in the NextGen ATM, the vision of robust growth in air travel will likely wither.

While the air traffic infrastructure is the focus of the FAA's modernization program, ground support also presents a potential bottleneck. Aircraft can be more efficiently routed between airports and stacked even more closely along the airways, but the increase in throughput is all for naught if the network of airports cannot turnaround the increased number and rate of aircraft arriving. The current modernization program does not synchronize the increased capacity of the airways with an increase in ground handling capability. The FAA should develop a more comprehensive plan to include needed improvements in ground support to match the modernization of the air traffic system.

Environmental Impact. While the global aircraft fleet is not a major source of greenhouse gas emissions, the industry unfortunately continues to have high visibility on this issue and must respond to political pressures to reduce noise and environmental pollution. Aircraft emissions constitute only around 2% of the world's man-made emissions of carbon dioxide (CORR₂).⁹² However, considering the potential global growth of the airline market, manufacturers, airports, airlines, and air traffic management have joined to work towards the reduction of a growing carbon footprint.⁹³ Key recommendations for the reduction of environmental impact are the implementation of aircraft and ATM Required Navigation Performance (RNP) technology and the performance of constant descent approach procedures. Implementing these recommendations will reduce fuel burn and approach-related noise pollution. These recommendations go hand-in-hand with infrastructure modernization recommendations.

GOVERNMENT GOALS AND ROLES

Goals. The USG works as a close partner with the aircraft industry in pursuit of three strategic goals: national security, economic growth, and protection of the environment. Maintaining this segment of the U.S. industrial base also boosts national security of our allies via the export of interoperable U.S. equipment. The USG also seeks sustained economic growth by fostering

success of the aircraft industry along with its significant exports. To encourage exports, it promotes trade agreements and helps resolve trade disputes. The USG promotes industry competitiveness with improvements in efficiency, like inculcating lean/six-sigma principles and offering innovation awards. Furthermore, it advances research and development efforts through organizations like the Defense Advanced Research Projects Agency (DARPA). Lastly, the USG provides assistance in financing aircraft sales through the U.S. Export-Import (Ex-Im) Bank. The third goal the USG pursues is protection of the environment, and, as such, provides research funding for improvements in fuel efficiency and reduction in carbon footprint. USG is also developing new efficient airspace management infrastructure to reduce emissions and fuel consumption. Overall, the USG seeks national security, economic prosperity and protection of the environment working with aircraft industry partners.

Roles. The USG directly and indirectly serves four roles for the aircraft industry: a controller, a champion, a consumer, and a service provider.

The USG controls the aircraft industry via regulations on manufacturing, exports and domestic production preferences. These regulations expose a delicate balance, as they may protect American jobs, yet may create trade retaliations that could threaten U.S. exports. Furthermore, by creating trade barriers, the government may diminish aircraft industry efficiency and innovation since protectionism decreases competition across the global aircraft industry. However, DOS export controls are necessary to prevent the transfer of U.S. technology that could threaten national security. Like export controls, domestic content preference creates foreign trade concerns and can decrease industry efficiency, even if American jobs are protected in the short term. The Buy America Act and the Specialty Metals Provision are two domestic preference laws affecting the aircraft industry.⁹⁴ Domestic material preference laws may protect the industrial base, but they can also drive costs higher. For example, the Specialty Metals Provision can force aircraft firms to maintain two separate material supply lines, one for compliant material supporting DOD procurements, and one for commercial-only applications. Regarding the legal arena, the Department of Justice (DOJ) reviews aircraft industry mergers and acquisitions with respect to anti-trust. Particular to aircraft production, the FAA specifies aircraft safety, communications and navigation equipment and ensures safety criteria are satisfied with aircraft design approvals and airworthiness certificates. A final area of USG control on the aircraft industry is through regulation of foreign military sales.

As a champion for the aircraft industry, the USG advocates for aircraft firms due to their huge contribution to the U.S. economy and jobs. The government also offers industrial research and development incentives to promote technical progress. Moreover, the USG fosters innovation through organizations like the National Aeronautics and Space Administration that provides “spin-offs” to other industries. USG sponsors global trade through the Office of the U.S. Trade Representative (USTR) and the DOC. For example, the USTR is currently supporting a World Trade Organization (WTO) case against the European Union and aircraft development “launch aid” subsidies.⁹⁵ Finally, the USG is an advocate for the aircraft industry. For example, it represents the U.S. airline industry in Open Skies negotiations to increase global competition.

From a consumption viewpoint, USG and aircraft industry co-dependence is evident by the USG being the largest consumer for the U.S. aircraft industry. In fact, DOD budgeted over \$45 billion in Fiscal Year 2009 for aircraft modernization alone.⁹⁶ Along with significant DOD procurements, other agencies like the Department of Homeland Security (DHS) and DOJ’s Drug Enforcement Agency also purchase aircraft, rotorcraft, and unmanned air vehicles.

The final USG role is an indirect service provider. For example, the FAA supplies air traffic management and aviation licenses. The Transportation Security Administration is responsible for passenger security at airports. Also, USG provides financing of aircraft purchases through the U.S. Ex-Im Bank. In 2006, the Ex-Im Bank supported over \$5 billion in financing for U.S. large commercial aircraft sales.⁹⁷

RECOMMENDATIONS

Public Policy Recommendations:

- Maintain a minimum of two viable and competitive prime aircraft manufacturers in those defense sectors for which maintenance of United States technical advantage is vital to national security (e.g. fighter/attack aircraft and systems) and ensure continued innovation in aircraft design by preserving design teams with timely Joint Capability Technology Demonstrations (JCTD) or similar methods. Based on historical precedent, approximately \$40 million per annum should be budgeted for this effort (estimate based on actual amounts allotted for Next Generation Bomber development in previous budgets).⁹⁸
- Accept the opening of aircraft markets to global competition and/or mixed buy scenarios when critical technology is not an issue (e.g. tanker aircraft).
- Expand and improve the ITAR licensing approach to enable umbrella approval for overarching classes of technologies rather than specific hardware, allowing U.S. aircraft firms the capability to tailor their aircraft to meet foreign requirements more efficiently.
- Ratify existing proposed export treaties with the UK and Australia and create similar treaties with our NATO allies to benefit the aircraft industry by reducing the export burden on our partner nations.
- Amend Buy America Act procedures to shift from a flat 50% U.S. dollar value requirement toward the ability to focus strategically on those capabilities and resources that maintain key U.S. technical capabilities.
- Sign the second stage of the Open Skies Treaty in order to maintain participation in the expanding global marketplace and to provide for increased demand for commercial aircraft.
- Perpetuate the common platform approach to defense aircraft procurement, as demonstrated by the F-35 program, as a means of maximizing the value to the warfighter during expected future budget constraints.
- Relieve industry of the burden to focus private resources on the development of increased STEM capabilities in K-12 and college level students. Industry members currently allocate private resources to this effort and need to focus on recruitment and retention of this talent, not its development. Steering the country's education focus is an inherently government focus that has yet to be sufficiently addressed beyond rhetoric. National security demands maintenance of these technical abilities of U.S. students. Shifting available tuition resources toward students entering STEM degree programs is an initial step in this process.
- Develop a comprehensive FAA approach to upgrade ground support infrastructure that complements and enables the ongoing ATM system infrastructure modernization.
- Reduce environmental impact and the perception of environmental impact of the aircraft industry by mandating full implementation of RNP technology at earliest opportunity in

aircraft and ATM facilities.

- Increase the frequency of constant descent approach procedures as part of the effort to reduce fuel burn and approach-related noise pollution.

Industry Recommendations:

- Increase cash reserve and liquidity of prime aircraft firms to enhance capability to respond to weaknesses in sub-tier supply chain networks.
- Review and, if necessary, improve prime aircraft manufacturer capability and processes to assess the health of their sub-tier suppliers in order to determine if cash reserves are sufficient and when intervention to maintain sub-tier supplier health is necessary.
- Shift resources currently allocated to promotion of K-12 and collegiate-level STEM capabilities to the recruitment and retention of these technical degreed personnel. Maintain the technical advantage currently enjoyed in the United States in the aircraft industry by providing co-op, internship, scholarship opportunities, and more attractive starting salaries that will increase recruitment of talented engineering students. Long-term advancement of STEM personnel within the aircraft industry is a key enabler to retention of these engineers.

ESSAYS ON MAJOR ISSUES

ESSAY #1 - Surge Capacity of the United States Defense Aircraft Industry

Preparation for a surge is a low priority across the military aircraft industry because a sustained conflict that requires a surge is considered unlikely. Moreover, aircraft have significant lead times that are not easily compressed. As defense strategy analyst, Pierre Chao says, “we don’t surge aircraft, we go to war with what we have.”⁹⁹ The unlikelihood and difficulty do not relieve DoD of the responsibility for preparedness for a surge. DoD should take low cost measures to facilitate a surge in the event it becomes necessary.

Production Line Acceleration. According to industry and government sources, accelerating aircraft production lines is readily feasible and the limiting factor is funding.¹⁰⁰ The trend has been the antithesis of surge, namely slowing production.

Beyond funding, the constraints are complex and vary by company. The contractor or government program office for each aircraft type performs its own assessment, but OUSD should collect these data in a repository. This is an inexpensive way to be poised to accelerate the right components should a surge become necessary.

Although the specific item on the critical path varies from aircraft to aircraft, in general they are not in the prime contractor’s assembly process. The limiters tend to be raw materials including, but not limited to, cobalt, steel, aluminum, and especially titanium. An Office of the Secretary of Defense (OSD) recent initiative, a strategic metals buffer pilot project within the war stopper program holds promise as a way to facilitate a surge with a limited investment.¹⁰¹ A small amount of strategic materials will enter production and held as work-in-progress prior to assuming a specific part identity. For example, steel 300M grade would be forged to the ingot stage. These semi-finished ingots will be available in a national emergency to shrink lead times.

Rapid Modification. In the era of asymmetric war, the most likely scenario for a surge is that the enemy will surprise us with an innovation that makes our aircraft less effective. In Iraq, the insurgents continuously improved the improvised explosive devices (IED) by adding penetration

aids and increasing explosive size.¹⁰² The U.S. defense of lightly armored vehicles became ineffective.

The Mine Resistant Ambush Protected Vehicle (MRAP) provides lessons for rapid acquisition. Some enablers were indefinite delivery, indefinite quantity contracts, concurrency, and government furnished mission equipment.¹⁰³ The MRAP's start was slowed by evaluating multiple designs from nine companies.¹⁰⁴ If an aircraft surge is required, it is probably best to contract sole source to the original manufacturer. In a surge, the schedule dominates cost concerns. Another modest cost option is to retain contracts with primes that can be quickly activated to modify systems in response to enemy innovation.

A refinement to workforce policy would facilitate surge readiness. Government engineers in aircraft program offices should attend one technology event during each Defense Acquisition Workforce Improvement Act certification cycle.¹⁰⁵ They are already required to maintain certification through continuing education, so this would piggyback on an existing administrative system. The goal would be for government engineers to perform environmental scanning to reduce the risk from an adversary's technology leap.

Conclusion. The defense portion of the aircraft industry supports national security by providing the world's most advanced weapon systems. While a surge is not foremost on the national agenda, it remains a possibility to defeat an enemy innovation or to overcome attrition from a protracted war. Therefore, DoD planners must take leveraged measures to prepare for a potential surge to guarantee air dominance.

- Ms. Janet Miller, DAF

ESSAY #2 – Airline Bankruptcy Impact on the Aircraft Industry

Airline Bankruptcy Causes

The health of the aircraft industry is obviously dependent upon the financial health of its customers, which includes as a large segment the airline industry with sales of commercial jetliners at \$55.7 billion in 2008, more than twice the dollar value of the next market segment.¹⁰⁶ Therefore, anything that adversely affects the airline industry will consequently adversely and directly impact the aircraft industry per se. Such is the case with the increasing bankruptcies. The Government Accountability Office reported in 2006 that there had been 162 airline bankruptcy filings since de-regulation in 1978 “owing to the fundamental financial weaknesses of the airline industry.”¹⁰⁷

Bankruptcies are caused by costs exceeding revenues, leading to large debt balances held by the airline. The major factors include: 1) excessive labor costs, which can be as much as 40% of the airlines, total cost;¹⁰⁸ 2) fuel prices; and, 3) general economic conditions. All of these have recently acted to impact the airline industry adversely. This has led a number of airline companies to file Chapter 11 bankruptcies to restructure labor agreements and/or terminate pension plans in an effort to reduce the labor cost burden. Further, with the current economic recession, “airlines are having to cut fares to attract passengers. Airlines in recent weeks have cut ticket prices as much as 50 percent from a year ago...as American companies scale back business travel and skittish consumers put off vacation plans.”¹⁰⁹ The International Air Transport Association reports in February 2009 “the financial markets signal a further deterioration in the outlook for airline profits with the Bloomberg airlines index down 42% since the start of the year.”¹¹⁰ So further bankruptcy filings can be anticipated which would cause a further and continuing detrimental impact on the aircraft industry.

Effect of Airline Bankruptcies on the Aircraft Industry

As noted above, any change in the airline industry will have a direct and measurable impact on the aircraft industry. Chapter 7 (liquidation) bankruptcies can have a severe impact in removing a customer from the aircraft manufacturers' sales book should another airline not be in a position to pick up the demand and, therefore, require additional aircraft to fulfill that demand. Chapter 11 (restructuring) bankruptcies can lead to delays in orders or delivery of new aircraft. Under Chapter 11 bankruptcy, an airline can restructure its labor contracts and debt holdings to enable it to emerge from bankruptcy protection as a healthier firm. However, lack of travel from business and vacation passengers due to uncertainty in the economy could force these same firms to enter Chapter 11 once again, resort to a Chapter 7 filing and fully liquidate the firm, or be acquired by another firm further consolidating the industry.

Given the current state of the airline industry and in an effort to maintain health and avoid bankruptcy or acquisition, airlines will not be as eager to trade in their current aircraft for more fuel-efficient models, especially when they are having trouble filling seats on their existing aircraft. A better alternative seems to be retiring older aircraft and not replacing them but instead using these "retired" aircraft as spare parts for in-service airplanes. According to Ascend, a global aerospace information provider, "more than 11% of the global aircraft fleet [almost 2,300 jet aircraft] is now in storage."¹¹¹ Further, North American carriers announced 800 aircraft idled since mid-2008.¹¹² It is possible that the figure could exceed 13% which was the number recorded at the end of 2001, following the 9/11 terrorist attacks.¹¹³ This means that the U.S. airlines are delaying orders and delivery from the aircraft manufacturers. Boeing and Airbus have reported more cancellations than new orders since the beginning of the year, with Boeing reporting 22 orders and 32 cancellations and Airbus reporting 6 orders and 14 cancellations.¹¹⁴

Recommendations

There are a number of options available to increase the profitability of the airline industry and thereby positively impact the aircraft industry, e.g., through an increase in orders and/or a decrease in cancellations. Of the available policy options designed to improve the health of the airline industry – which will therefore affect the aircraft industry, whether intended or not – Government financial assistance and tax relief provided directly to the airline industry on a temporary basis would be highly appropriate policy instruments to provide the greatest short run impact. This is because, alternative policies, such as, further de-regulation, re-regulation and a pure free market approach are longer-term initiatives that require further study to determine potential adverse impacts. Since any Government policy can have intentional and unintentional consequences, it is recommended that policy makers, prior to enacting legislation aimed at the airline industry, fully consider the implications on the nation's largest exporter of goods: the aircraft industry.

- Ms. Susan Kroetch, NCIS

ESSAY #3 – Next Generation Air Traffic Management

The National Airspace System (NAS) services and encompasses myriad stakeholders, each having their own, often conflicting, goals. It is a rigidly structured network of navigation aids, airways, six classes of airspace divided into sectors, and special-use airspace. Today's air transportation system in the United States is an extremely large, complex, and loosely integrated network of systems, procedures, and infrastructure with the primary goal of safe expeditious movement of people and goods. The goals and objectives of our NAS range from air transport carrier desire to make a profit, the FAA requirement to ensure a safe and secure system, local

governments (airports) desire to generate local economic activity and tax revenue, to the traveling public whom desire safe, inexpensive and expeditious travel including the leisure pilot's desire to fly freely. The primary daily control is executed through the actions of the "triad" of airline operations centers (dispatchers), aircraft operators (pilots), and the FAA (air traffic service provider).

In a Committee hearing on Transportation and Infrastructure, Mr. Robert Sturgell, Deputy Administrator of the FAA, testified that a MITRE study done for the FAA concluded that the current system, within its limitations, cannot handle the increase in air traffic by 2015 absent modernization.¹¹⁵ Currently, the U.S. air transportation system handles about 50,000 flights over a 24-hour period. By 2025, air traffic is projected to increase about 150 percent, equating to about 100,000 to 150,000 flights every day.¹¹⁶

In response to this challenge, the Commission on the Future of Aerospace in the United States has recommended the transformation of the U.S. air transportation system as a national priority. This recommendation was shortly followed by Congress and the President signing into law the Vision 100 – Century of Aviation Reauthorization Act that led to the formation of the Interagency Joint Planning and Development Office (JPDO). The JPDO is charged with developing the vision for the 2025 Next Generation Air Transportation System (NGATS) and defining the research required to achieve that vision.¹¹⁷

Next Generation Air Transportation System. The Next Generation Air Transportation System (NGATS) is the transformation of the current ground-based air traffic control system to a satellite-based system. This transformation is essential in order to accommodate the increasing number of people who fly in the United States safely. The already astronomical cost of delays, approximately \$9.4 billion each year, will increase if nothing is done.¹¹⁸ The list of associated technologies includes satellite-based technology, communications and physical infrastructure, automation, and procedural changes based on four-dimensional (4D) trajectory analyses. Implementation will substantially increase capacity while improving safety and efficiency of the NAS.¹¹⁹ An added benefit of implementation is reduced environmental impact due to decreased fuel burn and less noise pollution in terminal areas.

Impact on the Aircraft Industry. Aside from the obvious increases in efficiency and safety in the conduct of air passenger and cargo transport, the overarching benefit provided by NGATS implementation to the aircraft industry is ultimately manifested in increased demand for commercial aircraft to support an expanding capacity for air travel within the NAS.

- COL Fernando Torrent, USA

ESSAY #4 – Unmanned Aircraft Systems Outlook

In January 2009, the Teal Group viewed UASs as the most dynamic sector in the aerospace market.¹²⁰ However, this assessment does not match the future projections. The once rapid onset of modern UASs has mellowed to a more modest trajectory. At the heart of this change is a reduction in innovation and an incremental mindset toward programs in the future.

The drop in UAS innovation is characterized by incremental improvements and designs that do not maximize their unmanned advantages. While unmanned drones have been employed since the Vietnam War, the arrival of the Predator and Global Hawk were a significant change to the military's intelligence, surveillance and reconnaissance (ISR) capabilities. UASs could provide ISR support in ways that were more flexible than overhead satellites and more tactically accessible than the manned U-2 aircraft. However, new programs since then have only reproduced the same basic capabilities with slight variations. The Navy's Broad Area Maritime

Surveillance (BAMS) program simply retrofits the existing Global Hawk with multi-function radars and ground stations compatible with Navy facilities.¹²¹ General Atomics extended the wingspan and swapped out the payload of its Predator B UAS to meet NASA's high altitude scientific research needs.¹²² While more companies may be working on UASs, they have not achieved the same level of innovation that the early efforts reached.

By eliminating the on-board pilot, UASs can have an advantage over manned platforms in endurance, complex controls, and price. However, not all designs exploit these aspects. For example, the RQ-4 Global Hawk UAS has nearly three times the endurance of the manned U-2 aircraft.¹²³ But after that, most systems provide an unmanned version of manned capability. This manned mindset also carries over into air vehicle control concepts. UASs can leverage automation to make it possible for a single operator to control multiple air vehicles. While "multi-vehicle control" is part of its strategic vision for UASs, the USAF also recognized that many of the necessary technologies have not been developed.¹²⁴ Perhaps the most concerning issues for the UAS business case is their stubbornly high prices. For example, in 2005 a single Predator cost \$16.6 million with command and control stations included.¹²⁵ However, in response to a surge in demand for ISR platforms in Iraq, the USAF opted for a lower cost, manned solution. They created Project Liberty, which modifies a \$7.5 million Beechcraft King Air 350 passenger aircraft.¹²⁶

Earlier, the market was described as leveling out. This modest view of the future stems from the incremental mindset of the users. It is interesting to note that after a drop off in production ending in 2012, the future demand appears to climb and quickly level off. In its overview of the market, the Teal Group explained that the demand for UASs should drop off as the conflict in Iraq draws down, but then increase again as replacement aircraft are required.¹²⁷ In short, the order book for the next ten years is dominated by the existing UAS platforms. New programs, like the Navy's BAMS, which modify current designs, do not significantly increase the volume or value of the market in the future. With demand only coming from the need for replacements, the flat UAS market does not inspire revolutionary growth.

The Defense Advanced Research Projects Agency (DARPA) and Lockheed Martin's Skunk Works present the only bright spots in UAS innovation. DARPA's initial work on the Joint Unmanned Air Combat System (J-UCAS), although abruptly cancelled, fueled the Navy and Air Force work in carrier landing, stealth, and air refueling capabilities for UASs. DARPA also provided steady support for the Vertical Take-off and landing Unmanned Air Vehicle (VTUAV). The VTUAV experienced wavering support from the Army's Future Combat Systems and the Navy's Littoral Combat Ships program before finally becoming the MQ-8B Fire Scout program for the Navy. Finally, DARPA initiated Micro Air Vehicle program to work with universities on tiny UASs that fly as 'swarms'.¹²⁸ On the industry side, Lockheed Martin Advanced Development Programs (better known as the Skunk Works) is pursuing radical new designs such as the submarine launched Cormorant UAS. Not surprisingly, DARPA and the Skunk Works have recently announced a new program to develop a prototype unmanned airship designed to fly at altitudes of up to 70,000 feet for a staggering 10 years.¹²⁹ Overall, DARPA and the Skunk Works are the leading organizations in pumping innovation into the UAS defense market.

- LtCol Hunter Hobson, USMC and LtCol William Bailey, USAF

CONCLUSION

The U.S. aircraft industry plays a critical role in the economic health and national security of the country. With significant trade surpluses in both the commercial and defense

sectors, the industry represents a strategic national asset. On the commercial side, U.S. companies compete effectively for large shares of the airline and rotorcraft market. In defense, U.S. firms produce the most advanced aircraft in the world, dominating nearly every category of fixed and rotary wing product. In looking to the future of the industry, the commercial and defense sectors each operate in a set of circumstances that challenge their long-term growth.

While the current economic recession has impacted previous predictions of robust growth, the commercial aircraft manufacturers entered the downturn on solid footing and only a protracted or uneven recovery could prevent a return to profitability. As the industry looks to expand into the emerging markets in China, Russia and India, those countries may not recover at the same rate as the U.S. Although all the firms had established large backlogs of work, widespread deferrals and cancellations have left them juggling the lists to maintain a steady flow of work. The greater concern in that case would be for the second and third tier suppliers who operate under much lower margins and may face a more desperate future in the event of delayed recovery.

Conversely, the defense sector has been spared the impact of the recession, but the long-term concerns over defense budgetary pressures and industrial design base temper the outlook. With the exponential growth of entitlements spending and weak political will to reverse course, the defense budget will undoubtedly come under increasing scrutiny. As aircraft programs like the F-35 represent large ripe targets for cuts, the ability to field new systems or recapitalize old ones will be constrained. The services may find the political pressure to combine requirements muscling out desires for unique capabilities. The effect of this pressure is already threatening the industrial capacity to design and build fighter/attack aircraft. The USG is at a decision point on whether to preserve the design teams at different firms or allow the expertise and technological edge to disperse.

Finally, the aircraft industry faces a common set of challenges that inject inefficiency and friction into its operation. Barriers to trade prioritize protectionism and national security over competitiveness. In some cases, as with the Buy America Act and the Open Skies Agreement, the government can balance the requirement to preserve American jobs with the need to keep American companies cost competitive. The economic downturn may provide the political incentive to make changes regarding these long lasting issues. As the demand for air traffic increases, the need for modernization of the ATM system becomes more important for continued growth. As the FAA races to field their NextGen solution, the current recession may have actually bought them some more time to bring it on line. Lastly, the technical workforce is suffering from the double effects of low recruiting and a high average age. While grass-roots efforts have delivered only meager results, companies may find that increases in salaries and better long term earning potential are more direct methods of reversing the trend.

ENDNOTES

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