

AEROSPACE AND DEFENSE INDUSTRY RISK MANAGEMENT PERSPECTIVES

An Advisen Industry Analysis Report

Risk Management Series

January 2004

Industry Overview

The U.S. aerospace and defense (A&D) industry was significantly impacted by the events of 9/11 and all that grew out of them. While the “A” part of the industry entered a severe downturn due to the terrorist-induced fear of flying and resulting economic problems in the airline industry, the “D” part was boosted - at least temporarily - by the military response to those same events. The aerospace sector - consisting of large commercial and regional/corporate aircraft, aircraft engines and parts, and maintenance, repair, and overhaul (MRO) services - is just now slowly stabilizing and rebounding from one of the worst downturns in its history.¹ On the other hand, the defense and space sectors have seen a modest upturn in demand as a result of the Iraq and Afghanistan conflicts and other actions related to the global war on terrorism. In addition, the satellite sector is buoyed by the need for satellites and monitoring necessitated by the spread of peace and war-time technologies and equipment requiring such services.²

Even while in the midst of a slump, the U.S. A&D industry accounted for approximately 1% of the U.S. Gross Domestic Product (GDP), 0.5% of total U.S. employment, and \$148.2 billion in sales in 2002.² Globally, the A&D industry had sales of \$330 billion.⁴ Top companies in the industry include Boeing, Lockheed Martin, Northrop Grumman, Raytheon, BAE SYSTEMS, General Dynamics, EADS, Thales, and United Technologies. Among the largest regional aircraft makers are Bombardier, Gulfstream, and Cessna. GE Aircraft Engines, Pratt & Whitney, and Rolls-Royce are the three largest jet engine makers. The space market is made up of two primary segments: satellites and rocket manufacturing and launch services. The major players in that sector include Boeing, Lockheed Martin, Northrop Grumman, Alcatel Space, Astrium, Orbital Sciences, and Arianespace.

¹ “MRO Market Value Down in 2003 Despite Recovery Signs,” Overhaul & Maintenance, November 18, 2003.

² Ibid.

² “Fitch Comments on Aerospace & Defense Credit Outlook,” Business Wire, Dec. 19, 2002.

⁴ “Aerospace and Defense Industry Survey,” Standard & Poor’s, April 24, 2003.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

The hottest industry news as of the end of 2003 is that Boeing, the industry's largest company, is under new leadership. A&D industry heavyweight Harry Stonecipher was named the new CEO following the sudden resignation of Phil Condit. Stonecipher, the 67-year-old former president of the company, was asked to return by Boeing's board. He had served as a director since joining Boeing from McDonnell Douglas when the two companies merged in 1997. Condit's dismissal was announced after an internal company inquiry revealed that, during Condit's watch, CFO Mike Sears had negotiated to hire an Air Force procurement official at a time when she was in a position to influence military contracts involving the company. This favoritism, which may have induced nothing more than a ripple pre-Enron, created major waves in the era of Sarbanes-Oxley corporate cleansing. Also in the last weeks of 2003 it came to light that another industry participant - Halliburton - substantially overcharged the U.S. government (possibly inadvertently) for defense supplies, creating some embarrassment for Vice President Cheney, who formerly headed that company.

The A&D industry can be broken down into the following sectors: commercial aircraft manufacturing; business and regional aircraft manufacturing; maintenance, repair, and overhaul (MRO); jet engines; military defense; and space (including satellites). All sectors are characterized by long development and production cycles, large expenditures for research and development and retooling, and high entry barriers due to the enormous capital investment in facilities and equipment needed to start a company in this industry. In addition, the long-term established relationships that are common in this industry, such as between aircraft manufacturers and engine manufacturers, or between airlines and MRO firms, make entry even more difficult.⁵

Commercial Aircraft Manufacturing

The commercial aircraft sector is generally defined as companies that produce airplanes with 100 or more passenger seats. This sector had \$48.5 billion in 2002 sales.³ It consists of only two companies: Boeing and Airbus, which each have approximately half the market. Airbus is 80% owned by European Aeronautics Defence & Space Co., which is in turn owned 33% by DaimlerChrysler, 31% by public investors, 16% by the French government, 15% by Lagardere SCA, and 5% by the Spanish government. The U.K.'s BAE Systems owns the remaining 20% of Airbus. The end-user market for these aircraft is the world's airline market, of which there are about 500 operating approximately 11,500 aircraft, notes Avitas, an aircraft industry research firm. According to the Air Transport Association, U.S. airlines operate half of the total commercial aircraft fleet.

Experts predict an annual average growth rate of 3.4% for this mature and highly capital-intensive, highly cyclical, and difficult-to-enter sector, with the worldwide commercial aircraft fleet growing to 16,000 by 2012, from 11,500 as of 2002.⁴ This relatively modest growth is tied to the weakness of the airline industry in the wake of 9/11, the slumping economy, labor troubles, high fuel costs, and cut-throat competition that drives fare prices down. Compounding the problem is that airlines must project their need for new aircraft years in advance due to the long lead times involved in building large planes. Due to weak demand for new commercial aircraft, airlines have been obtaining discounts of up to 40% off of list price.⁵

Purchase contracts for large commercial aircraft, which take about 18 months to build, generally favor buyers. Buyers normally pay a third of the contract price up front, make several progress payments during the course of the

⁵ Ibid.

³ Ibid.

⁴ "2003 Global Outlook for Air Transportation," Avitas, 2003.

⁵ "Aerospace and Defense Industry Survey," Standard & Poor's, April 24, 2003.

building, and then make a balloon payment for the balance upon delivery. Contracts include price escalation clauses that are tied to a weighted average of labor and materials, and which use the producer price index and the employment cost index of industrial commodities, which might be expected to favor manufacturers in inflationary times. However, contracts also often contain prescribed delivery dates, which manufacturers are sometimes too optimistic about meeting, and stiff penalties payable to buyers for late delivery. Another disadvantage to manufacturers is that they cannot recognize any revenue or profits until aircrafts are delivered to buyers. On the other hand, buyers can choose to defer delivery under the contract, in effect shifting much of the economic risk onto manufacturers' shoulders.

Business and Regional Aircraft Manufacturing

Business and regional aircraft are generally defined as those with fewer than 100 passenger seats. This sector had 2002 revenues of \$17.5 billion.⁶ The world's largest maker of such aircraft is Bombardier, a Canadian company, which has about 40% of the market. Other participants include Gulfstream, Cessna, and Raytheon. The sector sells its aircraft mainly to small airlines and corporations that operate planes for use by executives and major clients. The success of some of the smaller and newer airlines, which are the preeminent buyers of under-100-seat airplanes, has helped this sector. Corporate belt-tightening in the slow economy of 2001 to 2003 has reduced the corporate market, although some unrelated corporations are now sharing aircraft usage and related expenses in order to reduce costs but still have the status and convenience of corporate jets. On the other hand, such status symbols are not necessarily a good thing in the post-Enron era of public distrust of corporations and intolerance for management excess.

Maintenance, Repair, and Overhaul (MRO)

The MRO sector consists of companies that service, fix, and provide replacement parts for aircraft. This sector had sales of \$37.8 billion in 2002, according to consulting firm BACK Aviation Solutions. It is divided into two kinds of companies: large diversified aerospace companies with MRO units, and smaller companies that specialize in MRO services. Among the former are General Electric, United Technologies, and Honeywell. Among the latter kind are AAR, Triumph Group, Mercury Air Group, and HEICO. Aging aircraft fleets are good news for the MRO sector, as older airplanes need more service and replacement parts. However, aviation consulting firm Avitas forecasts that there will in fact be more purchases of new planes than retirements in the next 10 years, and fleets will expand by about 3.4% a year during that period. Due to the trend to replace rather than repair old aircraft in light of the substantial discounts off of new planes offered by manufacturers, BACK predicts that the MRO sector is expected to grow by no more than about 2.9% per year from 2003 to 2013.

Jet Engines

⁶ Ibid.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

Jet engine manufacturing produced \$31.1 billion in global revenue in 2002.⁷ GE accounted for about a third of that total. Other participants include Pratt & Whitney and Rolls-Royce. The purchasers of these engines are for the most part the two commercial aircraft manufacturers—Boeing and Airbus, so the fate of companies in this sector are tied to the fate of these two industry behemoths. Jet engine manufacturers typically enter into exclusive arrangements with aircraft manufacturers to supply engines for certain models of airplanes. It is also common for engine manufacturers to heavily discount their products (especially in light of the 40% discounts offered by aircraft manufacturers to airlines) in return for acquiring long-term and profitable MRO contracts for the engines they sell. The MRO business provides a stable revenue stream to offset the more cyclical production part of the jet engine sector.

Military Defense

Worldwide, the military defense sector generates annual revenues of approximately \$180 billion.⁸ The major participants in this sector are Lockheed Martin, Boeing, Northrop Grumman, and Raytheon, all with over \$15 billion in yearly sales. There are dozens of other smaller players in various niches. Far and away the largest market for weapons, tanks, and other defense equipment is the U.S. military, which accounts for 40% of the global market, according to the Teal Group, an aerospace consulting firm. Recent U.S. military success in Afghanistan and Iraq demonstrated the utility of much of the state-of-the-art weaponry and equipment, but is not expected to greatly increase demand. The continuing global war on terror is expected to be fought more with intelligence data and technology than with conventional weapons. The previous Cold War defense build-up of conventional weaponry appears to be a thing of the past in this day of one global superpower. Standard & Poor's has predicted flat revenue growth for this sector during the next 10 years.⁹

Space and Satellites

The essence of the space sector is the production and launching of satellites. The Teal Group estimates annual revenues for this sector in the \$7.5 billion range. Boeing and Lockheed Martin have major satellite divisions, and there are also several European companies in this sector, the principal one being France's Ariospace. Satellite demand is tied to the need for communications services such as broadband Internet, telecommunications, broadcasting, and satellite television, which are generally on the upswing. The military is also a major user of satellites for weapons systems. In addition, some satellites are used for weather forecasting and scientific research. The Teal Group projects that satellite revenue will grow at a 5.8% annual clip from 2002 to 2012.

Two Broad Sectors Diverge

The industry's two broadest sectors as defined by Fitch Ratings - commercial aerospace and national defense - moved in opposite directions in 2002 and 2003, and Fitch expects the two sectors to continue this divergence,

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

according to a credit outlook report for the industry. Declining deliveries, continuing weakness in airline traffic and unit revenue, and the retirement of maintenance-heavy older aircraft are the basis for the negative credit outlook in commercial aerospace, said Craig Fraser, director of Fitch Ratings, in an announcement accompanying the report. He added that the defense sector's positive credit outlook continues to be based on the healthy U.S. defense budget. Solid defense results should continue to partially offset weakness in commercial aerospace, he noted.¹⁰ Key factors for the A&D industry in 2003 and 2004 include:

- Large commercial aircraft (LCA) units in operation were down more than 15% in 2003, and further declines are likely in 2004.
- LCA orders and deliveries may be helped in 2004 by the continuing expansion of non-U.S. carriers and low-cost airlines.
- Business jet deliveries were down at least 8% in 2003.
- Regional jet deliveries outperformed the rest of the industry, as they were up by 8% to 9% in 2003.
- Commercial aftermarket revenues were flat to up slightly in 2003 versus depressed 2002 levels.
- Fiscal Year 2004 budget modernization funding will continue to rise, but at much lower rate than in the FY2003 budget.
- Defense Department modernization outlays will be up in the high single digits in 2004.
- The commercial space industry is likely to address the overcapacity problem.
- Key uncertainties are the continued U.S. military involvement in Iraq, the United Air Lines restructuring, and the global economy.

Technology Drives the Industry

Rapid technology developments and improvements drive the A&D industry. Defense electronics is getting much of the credit for winning the war in Iraq and, partly as a result, technology spending will grow faster than the Pentagon's overall budget. In Iraq, soldiers can be seen on television checking their coordinates on a portable Global Positioning System (GPS), communicating through lightweight hands-free radios, and poring over computers with digital maps made from satellite photos. They have also been seen surveying enemy positions through helmet-mounted night-vision goggles, while precision-guided weapons drop from undetected stealth aircraft. It should come as no surprise, therefore, that about 19% of total defense spending in FY2004 is dedicated to electronics, and that figure will likely reach 19.6% in 2012.¹¹

Precision-guided weapons accounted for about 67% of the munitions dropped on Iraq, compared with only 9% in the Persian Gulf War 12 years ago, making precision target identification one of the most important development and procurement programs in the U.S. arsenal. Several programs are currently underway to improve precision targeting even further. One program, called Jigsaw, is aimed at building a laser radar sensor. It includes the development of video verification and identification (VIVID), a new concept that the Department of Defense's Defense Advanced Research Projects Agency (DARPA) is exploring for target identification in visible and infrared motion imagery.

¹⁰ "Fitch Comments on Aerospace & Defense Credit Outlook," Business Wire, Dec. 19, 2002.

¹¹ Government Electronics & Information Technology Association.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

Jigsaw's objective is to design and build an imaging laser radar device to produce very high resolution, three-dimensional, volumetric target data. This would enable the detection and identification of targets day or night, as well as through foliage, camouflage, and windows. For the first time, commanders in the field will be able to look beyond the target at the surrounding area.

Another critical element in DoD planning is the Global Positioning System (GPS), which has been around since the 1950s. It is estimated that 18 of the 28 GPS satellites now in orbit are overdue for replacement. The Air Force launched two new GPS satellites in January and April of 2003 and has another 13 in development, but it lacks the Delta rockets to put them into orbit. Also, the next generation of GPS satellites (known as GPS III), which are being designed to be even more accurate than current models, as well as virtually jam-proof, isn't expected to be in operation until at least 2012. In addition, the European Union is preparing to spend \$3.7 billion to orbit its own satellite-navigation system, called Galileo, beginning in 2008.

The Pentagon created another industry opportunity with the ongoing development of so-called next-generation communications. Most of the work is centered in DARPA's Advanced Technology Office. The XG Program, as DARPA calls it, focuses on a number of priorities. One is to embed low-power and compact spectrum sensing capability within highly mobile XG-enabled systems. At the same time, DARPA wants to characterize spectrum use by classifying the signals it senses to understand how to coexist with them - not only with military systems, but also with commercial television, cellular, and other wireless systems. On top of that, DARPA is coming up with a way to react to other spectrum users by selecting and coordinating frequencies, bandwidths, and spreading codes. The goal is to make the XG system operate without interference from other users.¹²

The collateral damage caused by carpet-bombing has compelled the U.S. military to develop more precise air-to-surface missiles. This technology is based on a combination of radar sensors, GPS, and inertial navigation systems. Improving accuracy of munitions will not only minimize civilian casualties and infrastructure wreckage, but also reduce the number of weapons that need to be fired. A tiny, silicon ring-based inertial measurement unit, using micro-electro mechanical system (MEMS) technology, can help guide projectiles to their targets accurately. Since some of these MEMS devices are rugged enough to withstand acceleration forces exceeding 20,000 times the force of gravity, they are being incorporated into next-generation, shoulder-launched, anti-armor rockets. The U.S. Army and Marines will incorporate these guidance systems in their helicopter rockets, while the U.S. Navy will use them to improve the accuracy of ground support fire. The U.S. military intends to simplify aeronautical communications by developing digital tactical systems that are compact and simple. For instance, the all-digital receiver directly digitizes incoming radio frequency signals to provide greater support to signal processing in diverse military applications. A promising tactical communications system is the light and small hetero-junction bipolar transistor, which can transmit information twice as fast as conventional transistors. The adaptability of the digital communications devices and clarity of audio are of immense use in military operations.¹³

¹²Ibid.

¹³ "Improved Guidance Systems for Missiles Will Reduce Collateral Damage," Business Wire, 12/10/03.

The largest worldwide defense companies are as follows:

Top-10 Worldwide Defense Companies by 2002 Defense-Related Revenue

Company	Country	Revenue. (\$mil)
Lockheed Martin Corp.	U.S.	23,337
Boeing Co.	U.S.	22,033
Raytheon Co.	U.S.	15,291
BAE SYSTEMS plc	U.K.	15,036
Northrop Grumman Corp.	U.S.	12,278
General Dynamics Corp.	U.S.	9,800
Thales	France	7,653
European Aeronautic	Netherlands	6,290
Finmeccanica SpA	Italy	3,984
Honeywell Inc.	U.S.	3,800

Source: Defense News Top 100

Business Environment

The aerospace sector was struggling to maintain profitability even before 9/11. Fears of further terrorism, the conflicts in Afghanistan and Iraq, along with the generally weak economy, combined to devastate the sector even further in the next two years. A vital factor in understanding the A&D industry in 2003 and beyond is geography: the U.S. compared to the rest of the world. In commercial aerospace, the U.S. mainline carriers continue to suffer significant traffic declines and financial losses that seep down to the manufacturers, while the rest of the industry appears to be making better progress toward recovery.

In the defense sector, the U.S. continues to increase its military-related budgets, while defense budgets in most other nations are under downward pressures. Sparked by heftier budgets to transform the military for the war on terrorism and for the Iraq conflict, the defense industry has been one of the few bright spots in the economy. But the terrorism factor won't be enough to offset the ongoing crisis in commercial aviation, so 2003 offered little prospect for net gains for aircraft manufacturers and their suppliers. When the Aerospace Industries Association calculated sales expected in 2003 from both military and civilian spending, it projected a 6.8% decline, to \$138 billion. That's double the size of 2002's 3.2% drop to \$148 billion. The outlook is actually bleaker for commercial aviation than the numbers suggest, because AIA projects that sales to the Pentagon will buck the downward trend and climb by \$5 billion. However, that modest boost on the defense side does not signal a long-term trend.¹⁴

The uncertainties in defense pale beside the woes of commercial aerospace. Nearly all airlines are bleeding red ink, tens of thousands of workers have lost their jobs, and the crisis shows no signs of letting up. While overseas sales of military aircraft remains relatively healthy, total aerospace exports dipped 5% in 2002 and will likely shrink another 10% when 2003's final numbers are in. Bottom line, AIA sees worldwide sales of commercial jetliners dropping by 33% in 2003, to about \$18 billion.¹⁷

Conflict is Good - Maybe

Global conflicts and domestic uncertainty gave defense stocks a boost in 2001 and 2002, but share prices came back to earth when the Bush Administration requested only a modest increase in defense procurement and research and development spending in 2003. It appears that the wars in Iraq and Afghanistan have convinced the Pentagon that asymmetrical warfare (where one side has vastly different capabilities than its adversary) doesn't necessarily require the stockpiling of military weapons and assets. A desire to be smart, fast, and mobile has replaced the "more and bigger" doctrine of the Cold War. To that end, several companies, including Lockheed Martin, Northrop Grumman, and General Dynamics, have invested in hardware and software companies that focus on government customers.

The fighting in Iraq isn't over, but the defense-stock boom appears to be as finished as the search for Saddam. Three major Wall Street firms have downgraded the defense industry amid the selling pressure that was already driving down the stocks of Pentagon contractors. These industry-wide revaluations were based on a top-down assessment of the political and economic factors that determine defense budgets and their implications for individual companies. The economic overview is that burgeoning budget deficits and other spending needs will force Congress and the White House to cut defense spending, or at least reduce its growth rate. Healthcare and the

¹⁷ "Surplus aircraft now account for a record 13% of the world's fleet," Business Week, 1/13/03.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

Social Security pension system top the list of needs that could challenge the Pentagon as the top government spending priority. Investment firms concluded that military spending is nearing its peak, and with it the prices of defense stocks. The business cycle is turning as well, they agreed, entering a period when investments in other industries will be as good as or better than defense stocks, which outperformed the Standard & Poor's 500-stock index for three years running in 2000, 2001, and 2002.¹⁸

Companies in the A&D industry will rely on their government customers to make up for shortfalls on the commercial side. And the tide isn't likely to turn anytime soon, as a recovery in commercial aerospace could be years in coming. Analysts tend to favor those companies that derive most of their revenue from government spending, such as Northrop Grumman, over those with heavy commercial exposure, like Boeing.¹⁹

Big Getting Bigger

Despite the downsizing on the commercial side, many of the biggest players in the industry are becoming even bigger. In all, A&D companies spent about \$30 billion on mergers and acquisitions in 2002, with Northrop Grumman making the most aggressive moves, purchasing both Litton Industries and Newport News Shipbuilding in 2001 and TRW in 2002. In 2001, Boeing and Airbus, the world's only large commercial aircraft makers, saw orders plummet by 45% and 28%, respectively. Airbus recently surpassed Boeing in orders, but the former's 2002 deliveries dropped 7% from 2001. Boeing meanwhile experienced in 2002 a staggering 28% decline in deliveries from 2001. As a result of the drastic fall-off in business, Boeing cut about 30,000 jobs or roughly 30% of its commercial aircraft workforce.²⁰

Expectations for the long-term profitability of the space market continue to outstrip the short-term realities, but companies continue to invest in this area. Even before the terrorist attacks, Boeing, for example, was placing more emphasis on this market in its strategic thinking, and proposed a sweeping overhaul of the world's air traffic control system.

Government Commission Issues Nine Recommendations

At the conclusion of the first-ever comprehensive examination of the U.S. aerospace and aviation industries, including assessment of air transportation, civil and military equipment manufacturing, and the outlook for expansion in space endeavors, the Commission on the Future of the U.S. Aerospace Industry issued in November 2002 its final report and a set of nine recommendations for government and industry action. The Commission recommended that:

1. The U.S. boldly pioneer new frontiers in aerospace technology, commerce, and exploration.
2. Transformation of the U.S. air transportation system be a national priority.
3. The U.S. create a space imperative.

¹⁸ "Defense Firms In U.S. Face Poor Prospects," The Wall Street Journal Europe, 9/30/03.

¹⁹ "US Aerospace Is All Defense In Second Quarter," Dow Jones News Service, 7/15/03.

²⁰ Ibid.

4. The nation adopt a policy that invigorates and sustains the aerospace industrial base.
5. The federal government establish a national aerospace policy and promote aerospace by creating a government-wide management structure.
6. U.S. and multilateral regulations and policies be reformed to enable the movement of products and capital across international borders on a fully competitive basis, and establish a level playing field for U.S. industry in the global marketplace.
7. A new business model be designed to promote a healthy and growing U.S. aerospace industry.
8. The nation immediately reverse the decline in, and promote the growth of, a scientifically and technologically trained U.S. aerospace workforce.
9. The federal government significantly increase its investment in basic aerospace research in order to enhance U.S. national security, enable breakthrough capabilities, and foster an efficient, secure, and safe aerospace transportation system.

MRO Market Suffering

The value of the worldwide commercial jet transport maintenance, repair, and overhaul (MRO) market has fallen \$1.5 billion since the beginning of 2003 as a result of economic malaise, SARS, the war in Iraq, and slower-than-expected airline capacity growth, according to BACK Aviation Solutions and Strand Associates, the consulting firms that produce the annual MRO Forecast. BACK and Strand now peg the value of the MRO market at \$34.6 billion, down from the \$36.1 billion used as the baseline for the 2003 MRO Forecast published in May of that year.²¹

According to BACK and Strand, the Spring 2003 forecast was based in part on expected worldwide capacity growth of just under 8%, but available seat miles have increased by only 3.6% over 2002 levels. A market value of \$34.6 billion represents a decline of nearly 8.5% from 2002's market value of \$37.8 billion, and a drop of 18% from 2001's value of \$42.2 billion. Despite the downward revision in the baseline market value, BACK and Strand believe their growth projections - 2.95% annually in a slow-growth scenario, 4.19% in a moderate-growth scenario, and 4.82% per year in a fast-growth scenario - will hold true over the decade. In fact, Strand and BACK both now believe the MRO market will shift up into a moderate-growth scenario sooner than either previously believed.²²

BACK estimates there were 1,600 aircraft in storage at the height of "desert parking" (temporary storage in slow economic times) in February 2002 and that about 100 of those planes had been put back into service by August 2003. The BACK aircraft storage estimate is somewhat lower than the often-cited 2,000-plane number, but that may be because BACK only counts those planes it considers to be "financially viable" to return to service.

When airlines have added aircraft to their fleets, they generally have resisted bringing older, maintenance-intensive planes out of the desert, opting instead, where possible, to go with new aircraft that are several years away from heavy maintenance visits. This smaller than expected increase in capacity and the grounding of older, maintenance-intensive aircraft in favor of new equipment that doesn't require heavy maintenance for several years is a "double-hit" for MRO providers, according to BACK and Strand. Ironically, the savings in maintenance costs on older, parked aircraft is helping subsidize the acquisition of newer, more efficient aircraft. But the outlook for

²¹ "MRO Market Value Down in 2003 Despite Recovery Signs," Overhaul & Maintenance, November 18, 2003.

²² Ibid.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

this sector is not all bad. BACK and Strand expect to see a surge in heavy maintenance demand for aircraft delivered since the late 1990s. This surge in heavy maintenance visits (HMVs) is expected to begin in 2004 when heavy check hangar days jump to more than 15,000 from around 11,000. Demand is expected to peak in 2008 at well over 25,000 HMV hangar days, according to BACK/SAI data.²³

A good deal of this surge work could go to third-party MROs, especially if Strand's predictions about airline outsourcing come true. This past spring, Strand said that 2003 would be the first year in which worldwide airline MRO outsourcing would reach and surpass the 50% level. Strand now says that airline outsourcing could reach 68% to 70% of total airline MRO work within five years, as fewer carriers can justify the 20% to 40% cost differentials between in-house and vendor costs.²⁴

Summary

Ironically, the same forces that have beleaguered the aerospace sector have buoyed the defense sector of the A&D industry. Post 9/11, aerospace declined, as the public, fearful of additional terrorist attacks, cancelled or delayed flight plans, or drifted to other means of transport deemed less terror-prone. Fewer passengers eventually meant fewer orders for new airplanes and a decreased need for parts and equipment for those planes. Add to all this the general economic malaise, and you have an aerospace sector that was and in many ways is still truly suffering.

On the other hand, 9/11 led to a significantly more aggressive global war on terror, including military actions in Afghanistan and Iraq, necessitating the need for more and better weapons. High-tech defense equipment received its baptism under fire, and for the most part the defense sector fulfilled its mission of providing U.S. and coalition forces with the technical means and know-how to defeat the enemy. Whether the military victories will make people less afraid of flying again and cause the aerospace sector to return to its pre-9/11 passenger levels remains to be seen, but there are already signs that people are returning to the skies.

²³ Ibid.

²⁴ Ibid.

Business Initiatives and Risks

Global issues and trends affect the aerospace and defense industry. These issues create business initiatives that industry players must consider for growth and survival. Pursuing, and not pursuing, these initiatives come with risks to companies in the industry. Business initiatives for the aerospace and defense industry fall across five main areas: strategy, service and support, channel management, marketing and sales, and supply chain and fulfillment. Strategy business initiatives refer to further consolidation and the importance of serving clients globally, leading to global expansion and partnerships. The service and support initiatives explain the trend toward customer relationship management. Channel management business initiatives refer to the importance of keeping pace with cutting-edge technological developments, especially the use of the Internet and other forms of electronic communications. Marketing and sales initiatives revolve around finding new markets for both established and new products, while supply chain initiatives stress improvements to the inventory management process.

Strategy

A&D manufacturers are experiencing declining revenue growth and tight margins. Accordingly, companies must employ new strategies to assure their success and survival during these times of increased competition and economic uncertainty. Manufacturers are continuing their strategic shift from a product-centric view focused on innovation and cost-cutting tactics to one that embraces a service-centric view focused on customer service and loyalty. In addition, the industry continues to be characterized by frequent merger and acquisition activity.

Worldwide, defense and aerospace companies announced or completed M&A deals worth more than \$27 billion in 2002, the fourth straight year in which deal volume surpassed \$25 billion. The year saw Northrop Grumman use acquisitions to catapult to second place among the industry's leading companies, reported *Defense Mergers & Acquisitions* in its 2002 year-end review.²⁵ Stuart McCutchan, editor of the *DM&A* newsletter, commented: "In our 14 years of publication, we've never before seen a market in which government spending on defense was expanding, not contracting. In this new marketplace, companies are no longer buying just to maintain critical mass. They're taking a targeted approach to building presence in attractive market sectors. And they're equally ready to sell pieces that don't fit."²⁶

Key markets in which *DM&A* tracked activity included homeland security (25 deals in 2002), the intelligence sector, and professional services. Deal activity was strong among smaller and mid-sized companies. Ten defense firms took themselves public in a succession of strong IPOs that brought \$1.5 billion worth of new money into the defense industry. "While the IPO craze has passed and defense valuations have fallen in recent months," McCutchan said, "the defense marketplace is clearly here to stay. The Bush Administration's decision to approve the Northrop Grumman/TRW deal provides the first substantive signal that the regulatory clampdown of the latter Clinton years is over. This is an Administration that wants new war-fighting tools, and it's willing to accept M&A activity as a legitimate means to that end."²⁷

Another recent initiative in the A&D industry that should deliver competitive advantage is the "virtual enterprise." As commonly interpreted, the virtual enterprise business model focuses on companies retaining only strategic

²⁵ "Defense Mergers & Acquisitions Tallies \$27 Billion in Deals in 2002," PR Newswire, 1/24/03.

²⁶ "Defense Mergers & Acquisitions Tallies \$27 Billion in Deals in 2002," PR Newswire, 1/24/03.

²⁷ Ibid.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

functions and outsourcing tactical functions to suppliers. The outsourced tactical functions may include selected engineering design and development activities in the product life cycle. The virtual enterprise model is not limited to just suppliers, as customers may be included for collaborative product design and development. In other words, Product Data Management (PDM) systems are no longer just for engineering work groups. They have become virtual enterprise PDM systems in an environment of geographical dispersion. The virtual enterprise model requires the introduction of collaborative business processes to facilitate the everyday tasks performed by personnel in coordination with customers and suppliers.²⁸

Like many business initiatives, the virtual enterprise imposes fresh demands on IT processes and resources. The fundamental need is to move product data quickly, accurately, and efficiently throughout the supply chain regardless of location, including intercontinental. Fully functional PDM systems address this key need. In addition to quickly moving accurate product data, PDM systems are able to: translate heterogeneous file formats into compatible formats, and operate with other PDM systems, a crucial requirement since continuing consolidation in the industry brings more legacy systems within a specific company's domain. In addition, with Web-enabling technology, companies can cost-effectively establish collaborative business processes throughout the virtual enterprise. Inexpensive browsers allow more people to have ready access to the information in the PDM system. For instance, in engineering design and development, Web enabled viewing and mark-up of designs provides more efficient collaborative efforts among those in disperse locations.²⁹

Components of Strategy business initiatives include:

- Pursue growth through acquisitions;
- Redefine the business model; and
- Grow through innovative, non-traditional approaches.

The following tables outline risks associated with these Strategy business initiatives.

Strategic	Operational
<ul style="list-style-type: none">• Failure of acquisitions, joint ventures, or alliances• Ineffective business model/positioning strategy• International initiative leads to expropriation and currency and convertibility risks	<ul style="list-style-type: none">• Product development stalls from ineffective sourcing of resources• Oversized overhead renders initiative unprofitable• Inadequate support cause products/services to fail

²⁸ "New Directions in the Aerospace and Defense Industry: The Integration of Product Data Management and Enterprise Resource Planning Systems," PDM Information Company, 2003.

²⁹ Ibid.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

Financial	Hazard
<ul style="list-style-type: none">• Currency fluctuations cause earnings volatility in home currency• Large capital investments cause cash strain• Inadequate capital investments restrain future growth• Highly leveraged capital structure causes burdensome interest payments or default• Decline in credit rating	<ul style="list-style-type: none">• Lawsuits arising from contract disputes• Lawsuits by shareholders arising from errors or omissions of directors or officers

Service and Support

A&D manufacturers and MRO service providers are turning to customer relationship management (CRM) as an enabling platform allowing them to become more competitive in selling to and servicing customers, and most importantly in earning and keeping customer loyalty. These companies recognize the link between customer loyalty and profitability, driving a lower cost-to-serve model, higher revenue and margins associated with quality service offerings, and resulting decrease in revenue cyclicality.

With the aging of aircraft fleets increasing and the expanding number of aircraft, engines, and parts, manufacturers recognize the revenue and profit potential in aftermarket parts and services. To capitalize on this opportunity, manufacturers are leveraging CRM as a platform to deliver superior customer service, ensuring aircraft safety and maximizing flying hours. Manufacturers are taking a holistic approach in delivering a closed-loop service delivery process encompassing key processes such as service and sales bundling, contract management and entitlement verification, preventive maintenance, skills-based service request routing, solutions knowledge-based management, and product defect management.

Beyond providing an integrated set of best practice business processes, a CRM platform also delivers to manufacturers a unified view of customer and product information, enabling them to seamlessly interact with and effectively service customers across multiple channels -- from the Web and call centers to field technicians, or through third-party service providers.

Components of Service and Support business initiatives include:

- Develop and improve customer relationship management programs;
- Implement technology to improve the efficiency and effectiveness of customer service areas; and
- Streamline the customer service process.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

The following tables outline risks associated with these Service and Support business initiatives.

Strategic	Operational
<ul style="list-style-type: none">• Ineffective business model/positioning strategy• Business initiative damages company's reputation• Inadequate or ineffectual allocation of resources• Liability assumed by contract	<ul style="list-style-type: none">• Business initiative fails from lack of qualified human capital• Customer satisfaction suffers from poor service and support• Breakdown in supply chain cause production/service irregularities• Inadequate information processing systems create inefficiencies
Financial	Hazard
<ul style="list-style-type: none">• Inadequate cash flow to support daily operations• Low bank borrowing capacity/inadequate lines of credit• Decline in credit rating	<ul style="list-style-type: none">• Lawsuits arising from contract disputes• Lawsuits by shareholders arising from errors or omissions of directors or officers

Channel Management

Leading-edge manufacturers are leveraging the Internet for design collaboration and to make smarter sourcing decisions. Incorporating standard components from low-cost sources both accelerates the product development process and lowers launch costs. In addition, sophisticated obsolescence planning significantly reduces the lifetime cost of supporting an asset. Collaborative solutions quickly locate parts meeting specific design and cost targets while simultaneously meeting demanding quality standards.

Companies say they are committed to long-term transformation to e-business, but the economic slump has focused their Internet priorities on improved customer service, a survey from the National Association of Manufacturers and Ernst & Young has found. By industry, A&D was the most advanced user of e-business, followed by the technology and electronics industries. A&D also had the highest percentage of companies with an Intranet and by far the largest share, nearly half, of customers that share product specifications and designs online.³⁰

In order to keep pace with competitors and other industries, A&D is moving ahead with Internet strategies at an accelerated pace, many using business-to-business exchanges to reduce supply chain costs. But long-term, companies that haven't standardized their data and integrated their systems will face roadblocks that companies in other industries don't face, according to an e-business survey sponsored by Deloitte Consulting and *Aviation Week & Space Technology*.³¹ A majority of executives surveyed indicated that they will conduct 25% of their business over the Internet in one year, and that they will fully conduct business over the Internet within three years. However, Deloitte believes that such optimistic forecasts fail to take into account the enormous amount of time it takes for implementation, as well as the resources required to standardize data and integrate e-business applications into back-end systems. This integration is more time-consuming for A&D companies as a result of the industry's highly customized products and complex supply chains.

Without back-end systems in place, A&D companies will face more challenges implementing supply chain e-business applications for direct materials because data standardization and systems integration will be required. Despite the optimistic timeline cited by aerospace executives, Deloitte anticipates that the pace of e-business adoption will slow as more robust supply chain capabilities go on line.

There were a number of unexpected findings in Computer Sciences Corporation's second annual Aerospace and Defense 2003 Information Technology (IT) Survey entitled "A CEO Perspective on the Strategic Use of IT." The results showed that business processes, and not technology, represent the biggest challenge facing companies as they look for new and better ways of doing business. The study also revealed that companies are raising the hurdle on their expectations of tangible payback and returns for IT spending. The more than 200 CEOs at A&D companies polled by CSC identified several significant executive perspectives on IT:

- Improving business processes is a key factor in reaping the benefits of IT.
- IT needs to demonstrate stronger returns on investments.
- Many companies have not gained the benefits from IT that they expected.

³⁰ "Manufacturers Turn Net Focus From E-Biz To Customer Service," InternetWeek.com, 2003.

³¹ "Deloitte Consulting Survey Finds Aerospace And Defense Companies Are Optimistic On Future Of E-Business Despite Hidden Obstacles," PRNewswire, 7/24/03.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

These findings indicate that only after business and IT alignment has been achieved can companies meaningfully enhance business processes and effectively apply IT as an enabler to realize business benefits.³²

Components of Channel Management business initiatives include:

- Reach customers through an e-commerce strategy; and
- Improve the effectiveness of the sales team through the implementation of technology.

The following tables outline risks associated with these Channel Management business initiatives.

Strategic	Operational
<ul style="list-style-type: none">• Business initiative damages company's reputation• New geographic initiative leads to regulatory and political exposures• Inadequate or ineffectual allocation of resources• Liability assumed by contract	<ul style="list-style-type: none">• Inefficient operations render initiative unprofitable• Inadequate support cause products/services to fail• Inadequate production capacity to support initiative• Customer satisfaction suffers from poor service and support• Breakdown in supply chain cause production/service irregularities• Breakdown of internal controls

³² "CSC's Aerospace and Defense 2003 Information Technology Survey Reveals Chief Executives Want Stronger Business/IT Alignment, Higher Return On Investment," PR Newswire, 9/8/03.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

Financial	Hazard
<ul style="list-style-type: none">• Decline in credit rating• Inadequate cash flow to support daily operations• Low bank borrowing capacity/inadequate lines of credit• Off-balance sheet liabilities and commitments larger than expected	<ul style="list-style-type: none">• Facilities, equipment, data or inventory damaged or destroyed by fire, explosion or catastrophe• Theft, robbery or fraud by third parties• Lawsuits by shareholders arising from errors or omissions of directors or officers• Lawsuits arising from storage, transportation or disposal of hazardous substances

Marketing and Sales

In today's A&D value chain, most revenue from current and future government programs is "locked up" in long-term manufacturing agreements. Integrators have bid competitively for the right to assemble heavy equipment (aircraft, tanks, etc), and have established a tight margin on a finite quantity of business for the future. However, A&D manufacturers are realizing that a large revenue opportunity exists in supporting the total lifecycle of the asset. Most integrators are capturing less than 15% of the aftermarket support, where revenue can be up to 10 times the initial manufacturing run.

Also, government and commercial operators recognize that the original manufacturer can potentially provide this total lifecycle support at a much lower cost than the operator. In order to capture this revenue opportunity, many A&D firms have developed independent divisions to support aftermarket requirements. The problem is that the aftermarket division rarely has any influence or control over manufacturing. This opens up huge potential revenues for those companies that are positioned to offer total lifecycle services in a coordinated and efficient fashion.

Components of Marketing and Sales business initiatives include:

- Grow revenue through increased penetration of existing markets with existing products and services; and
- Grow revenue through increased penetration of existing markets with new products and services.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

The following tables outline risks associated with these Marketing and Sales business initiatives.

Strategic	Operational
<ul style="list-style-type: none">• Business initiative damages company's reputation• New geographic initiative leads to regulatory and political exposures• Inadequate or ineffectual allocation of resources• Liability assumed by contract	<ul style="list-style-type: none">• Inefficient operations render initiative unprofitable• Inadequate support cause products/services to fail• Inadequate production capacity to support initiative• Customer satisfaction suffers from poor service and support• Breakdown in supply chain cause production/service irregularities• Breakdown of internal controls
Financial	Hazard
<ul style="list-style-type: none">• Decline in credit rating• Inadequate cash flow to support daily operations• Low bank borrowing capacity/inadequate lines of credit• Off-balance sheet liabilities and commitments larger than expected	<ul style="list-style-type: none">• Facilities, equipment, data or inventory damaged or destroyed by fire, explosion or catastrophe• Theft, robbery or fraud by third parties• Lawsuits arising from storage, transportation or disposal of hazardous substances

Supply Chain and Fulfillment

Manufacturers are doing more with fewer core resources, serving multiple product lines, satisfying more constraints, and ultimately delivering greater profitability. When all functional areas become leaner, each function must share plans and schedules earlier and more often within and outside the enterprise. This greater coordination of purchasing, logistics, maintenance, and stocking can save money in inventory reductions and better inventory management. Collaborative solutions, particularly demand planning, collaborative forecasting, and spares planning, permit companies to meet the greater flexibility required by the market.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

More than ever, in the fast-moving technology-driven marketplace, intelligent designs and sourcing decisions are key to long-term success in A&D. As many companies have grown into new facilities, product lines, and support initiatives, people have been scattered geographically. Collaboration between parties can no longer be handled by yelling over the cubicle wall. Collaborative design that allows for intelligent choices of parts based on cost, other areas of use, and obsolescence is critical for success. Common repositories of information that are constantly updated with the latest information that can be accessed from anywhere provide the requisite support to engineering and design processes. Finding solutions that do not require costly internal maintenance and support is a must for this to be a cost-effective way to pursue intelligent and profitable product design.

The manufacturing of aircraft, helicopters, tanks, and other complex assets can be outsourced to a broad variety of manufacturers, with the integrator responsible for only the design and end-assembly of the asset. Components and sub-components that make up the final can be sole-sourced or custom designed specifically for the asset. Because of these business conditions, the manufacturing chain for complex assets has evolved into a multi-tier, multi-company environment in which each tier of the supply chain is heavily dependent on the plans of the earlier tiers. The most common problem in assembling these assets is material delays from component suppliers. Since each asset is highly configured, the exact sequencing of the assembly operation is rarely coordinated with the material delivery schedule. So the material requirements are often not well known until partially through the assembly process. This type of environment demands the ability to include multiple tiers of suppliers in the planning cycle and to define constraints at their suppliers' locations.

Collaboration and integration across multiple enterprises, allowing the entire value chain to be aligned to operational demands is necessary for A&D companies today. Forecasting and planning increase in accuracy and nimbleness, because of the exchange of key information such as operational tempo, asset configurations, and repaired material requirements. Rapid planning and execution processes respond to any changes, continually synchronizing all customer needs, while respecting real-world constraints in supply, production, and distribution. The result is that the entire value chain can operate with minimal inventory, while achieving much-improved operational readiness.

Collaborative solutions are allowing companies to efficiently fulfill demand by integrating forward-facing systems to the back office. Order fulfillment and inventory management solutions help achieve extremely lean operations. From the earliest stages of the project cycle, through order fulfillment and service, all customer contracts and data can now be instantly available. This includes accessing suppliers' schedules and capacities, in-transit shipments, inventory levels, and current customer orders.

Components of Supply Chain and Fulfillment business initiatives include:

- Streamline the supply chain; and
- Improve the inventory management process through monitoring the flow of products.

ADVISEN

INSIGHT FOR INSURANCE PROFESSIONALS

The following tables outline risks associated with these Supply Chain business initiatives.

Strategic	Operational
<ul style="list-style-type: none">• Business initiative damages company's reputation• New geographic initiative leads to regulatory and political exposures• Inadequate or ineffectual allocation of resources• Liability assumed by contract	<ul style="list-style-type: none">• Inefficient operations render initiative unprofitable• Inadequate support cause products/services to fail• Inadequate production capacity to support initiative• Customer satisfaction suffers from poor service and support• Breakdown in supply chain cause production/service irregularities• Breakdown of internal controls
Financial	Hazard
<ul style="list-style-type: none">• Decline in credit rating• Inadequate cash flow to support daily operations• Low bank borrowing capacity/inadequate lines of credit• Off-balance sheet liabilities and commitments larger than expected	<ul style="list-style-type: none">• Facilities, equipment, data or inventory damaged or destroyed by fire, explosion or catastrophe• Theft, robbery or fraud by third parties• Lawsuits arising from performance or non-performance of professional services• Lawsuits by shareholders arising from errors or omissions of directors or officers• Lawsuits arising from storage, transportation or disposal of hazardous substances