Research Report

Kansas Aerospace Industry Forecast

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Prepared for:

Kansas, Inc.

May 2006

Kansas, Inc.

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Stan Ahlerich, *President*

During 1992, Kansas, Inc. contracted with the Center for Economic Development and Business Research to provide an *Analysis of the Impact of the Aviation Industry on the Kansas Economy.* This study analyzed the industry's impact on employment, earnings, and personal taxes. Specifically, the study focused on the manufacturing sector of the aviation industry. In 1991, an estimated 50,288 persons were employed in the Kansas' aviation industry with a payroll of $1,839.5 million, representing 26.3 percent of all manufacturing jobs and $31 of every $100 earned within the Kansas manufacturing industry. The four major aircraft manufacturing companies in Kansas were Beech Aircraft Corporation, Learjet, Boeing, and Cessna Aircraft Company. These companies were supplied by a host of other manufacturing firms making tools, electronic components, communications equipment, and parts.

Concurrently during 1992, Kansas, Inc. contracted with the Center to provide an *Impact of Job Reductions on the Wichita and Kansas Economies.* Several major employers, including aviation manufacturers in the Wichita MSA had announced employment reductions during early 1993, and this study was commissioned to estimate the impact of these reductions on the local and state economies. In summary, the large number of layoffs facing the Wichita economy posed serious challenges, however, Wichita was in a relatively good position to absorb the shock and downturn provided it would reverse by 1996. Overall, it was determined that it would be a mistake to project a serious downturn in the total Wichita or Kansas economy due to these layoffs.

Based on these previous studies, the Kansas, Inc. Board of Directors commissioned a study to estimate and analyze the impact of the aerospace industry on the Kansas economy. Within Kansas, the aerospace industry relies primarily on commercial aviation parts manufacturing, defense aerospace manufacturing, avionics manufacturing, and general aviation manufacturing, and a significant number of suppliers to all of the industry sub-sectors. This study forecasts the current and future impact of the aerospace industry on Kansas. Based on some key assumptions, employment in the Kansas aerospace industry will continue to grow over the next decade.

We hope you will find this publication to be of value to you in the course of your work. If you would like further information regarding this study or others produced by Kansas, Inc., feel free to contact us.

Sincerely,

Stan R. Ahlerich
President

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Table of Contents

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Introduction

Kansas Inc. requested a forecast of the state's aerospace industry to be produced by the Center for Economic Development and Business Research. It is expected that the forecast will be used to inform decisions regarding economic development efforts as the state's economy and aerospace employment recover from the downturn in overall employment after the 9/11 attacks.

Methodology

Overview

The Center used two approaches to conduct this analysis. The Center created an econometric model of the Kansas aviation sector to accompany an in-depth qualitative analysis of the industry. Input from a wide array of industry specialists, organizations, published forecasts as well as statistical histories of all sub-sectors of the aerospace industry within Kansas were included. Based on these inputs, three scenarios were forecasted including an optimistic, a pessimistic and an expected forecast.

The qualitative analysis involved the examination of the trends in factors that have the potential to impact the aerospace industry in Kansas. These include:

- Commercial aircraft demand
- U.S. and world-wide defense spending
- The size of the general aviation fleet
- Pending regulatory issues
- Business model changes
- Research and new product development
- Aerospace industry business cycle
- Workforce issues

In addition, the Center created an econometric model to reflect the national economy, current and historical aerospace employment, gross state product, U.S. exports, FAA aircraft fleet forecasts, commercial airline fleet forecasts, and industry productivity rates. The multiple regression analysis identified a sinusoidal[1] formula, which reflects the unique cyclical behavior of the Kansas aerospace industry, both in history and into the future. As with the qualitative analysis, the model was used to create an optimistic, a pessimistic and an expected forecast.

[1] A sinusoidal formula describes a wave (or sine) pattern, rather than a straight line. The length (in this case how long the cycle lasts) and height (in this case, the number of job increases and decreases) of the wave are incorporated into this type of formula.

Industry Sector

The industry sector analyzed in the model is Aerospace Product and Parts Manufacturing (NAICS code 33641) which includes:

- Aircraft Manufacturing
  - Aircraft Engine and Engine Parts Manufacturing
  - Other Aircraft Parts and Auxiliary Equipment Manufacturing
  - Guided Missile and Space Vehicle Manufacturing
  - Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
  - Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing

Employment Forecasting Model

In addition, the Center created an econometric model for aerospace employment to reflect the national economy, current and historical aerospace employment, gross state product, U.S. exports, FAA aircraft fleet forecasts, commercial airline fleet forecasts, and industry productivity rates. The multiple regression analysis identified a sinusoidal[2] formula, which reflects the unique cyclical behavior of the Kansas aerospace industry, both in history and into the future. As with the qualitative analysis, the model was used to create an optimistic, a pessimistic and a likely forecast.

The model output includes direct aerospace product and parts manufacturing employment and the proportion of employment in related industry sectors such as professional and technical services and wholesale trade, attributable to aviation employment growth.

Output and conclusions from both approaches were integrated into a composite forecast of the Kansas aerospace industry.

Economic Impact Model

Several models exist for calculating economic impacts, perhaps the best known of which is the Regional Input-Output Modeling System known as the RIMS II multipliers, created and published by the U.S. Bureau of Economic Analysis. RIMS II provides multiplier information by industry aggregation and detailed industry. Other models, such as IMPLAN and REMI, are based on the RIMS II data but are actual software products that incorporate additional data sets and allow detailed industry aggregation. For this reason, the Center chose IMPLAN for the economic analysis of the aerospace industry in Kansas.

IMPLAN uses the terms Type I and Type II multipliers, compared to RIMS II Direct Effect multipliers, both of which are based on employment and earnings. A comparison of the two is shown in Table 1.

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[2] A sinusoidal formula describes a wave (or sine) pattern, rather than a straight line. The length (in this case how long the cycle lasts) and height (in this case, the number of job increases and decreases) of the wave, are incorporated into this type of formula.

Table 1. IMPLAN[3] and RIMS II[4] Multipliers

Source	Multiplier	Definition	Values for Kansas
IMPLAN	Type I (direct plus indirect effects)	Industries buying from industries. Household expenditure effects are not estimated.	1.9 for employment 1.6 for wages
IMPLAN	Type II (direct plus indirect plus induced)	Type I plus household expenditures	3.9 for employment 2.6 for wages
RIMS II	Direct Effect Employment (direct plus indirect plus induced)	Total change in employment in the region that results from a change of one job in the specific industry	3.5 for Aircraft Manufacturing (Detailed Industry) 3.1 for Aircraft Engine and Engine Parts Manufacturing
RIMS II	Direct Effect Earnings (direct plus indirect plus induced)	Total change in earnings in the region that results from a $1 change in earnings in the specific industry	2.4 for Aircraft Manufacturing 2.3 for Aircraft Engine and Engine Parts Manufacturing (Industry Aggregation)

[3] IMPLAN Professional Social Accounting & Impact Analysis Software, Minnesota IMPLAN Group, Inc.
[4] RIMS II Multipliers, Bureau of Economic Analysis, U.S. Department of Commerce.

Aerospace Industry

Aerospace by definition includes general aviation and commercial aviation airplanes, helicopters, defense aircraft and parts, service centers, fixed base operators, as well as spacecraft. However, in Kansas aerospace relies primarily on commercial aviation parts manufacturing, defense aerospace manufacturing, avionics manufacturing, and general aviation manufacturing, as well as a significant number of suppliers to all of the industry sub-sectors. The companies include many familiar names, such as Spirit AeroSystems, Boeing Integrated Defense Systems, Garmin International, Honeywell, Raytheon, Bombardier-Learjet and Cessna.

More than four years after 9/11, the commercial and general aviation industries are in rebound mode. Historically, this has meant both job and income growth for workers at all levels and it is expected to have much the same impact in the coming years. However, the true heyday of aviation employment growth may be in the past.

Commercial Aviation

With the sale of the Wichita Boeing Commercial plant, Kansas has become a supplier to commercial airline manufacturers. Companies such as Spirit AeroSystems and Airbus Engineering, Garmin and Honeywell, as well as many smaller companies, rely to varying degrees on the commercial airline industry.

While commercial air travel continues to grow worldwide, there are now only two manufacturers of commercial airliners, Boeing and Airbus, with Boeing the only U.S. producer of commercial aircraft. Between 1970 and 2004, the number of U.S. produced and shipped commercial aircraft has ranged from a low of 155 in 1977 to a high of 620 in 2000, with an average of 353 per year for an average annual growth rate of 3 percent. Since 1990, the average is 428 U.S. aircraft shipped, with an average annual growth rate of just 0.6 percent. Both Boeing's and Airbus's long-range forecasts predict continued growth in worldwide passenger airline travel of about 5 percent on average over the next 20 years, with comparable growth in demand for their aircraft.

As of 2005, both Boeing and Airbus appear to be delivering and receiving orders for similar numbers of commercial airliners, as Airbus has slowly increased deliveries over its 35-year history. To date, Boeing continues to have higher billings, even when the number of units delivered by Airbus is higher. There is no apparent reason to predict that either company will achieve significant market dominance over the next 10 years. They are positioned to share the growing world airliner market approximately equally for the foreseeable future.

Military & Defense Aerospace

Defense spending, which supports the Boeing Integrated Defense Systems (IDS) plant in Wichita as well as numerous suppliers throughout the state, is subject to significant changes over time. While the parent companies of many Kansas manufacturers (for example, Boeing, Raytheon, Textron, and Honeywell) may benefit from increases in defense spending, the specialized skill sets of Kansas employees may or may not be in great demand depending on the programs being supported by Congress. Very little Raytheon or Textron defense production is based in Kansas, and Boeing IDS plans to reduce its staff by 25 percent, or 900 of approximately 3,500 employees, during 2006 as a result of program changes and project completion, with little or no new work in the wings.

Boeing IDS in Wichita has reported that it is under pressure from the Boeing Company to significantly reduce operating costs so that it has the opportunity to win additional work. In a time of dramatic increases in defense spending, from approximately $50 - $60 billion before 2002, to $109 billion in 2006, the lay-offs are a "serious aberration" according to Teal Group's Richard Aboulafia[5], and invite speculation about the Boeing Company's plans for future use of the Wichita plant.

General Aviation

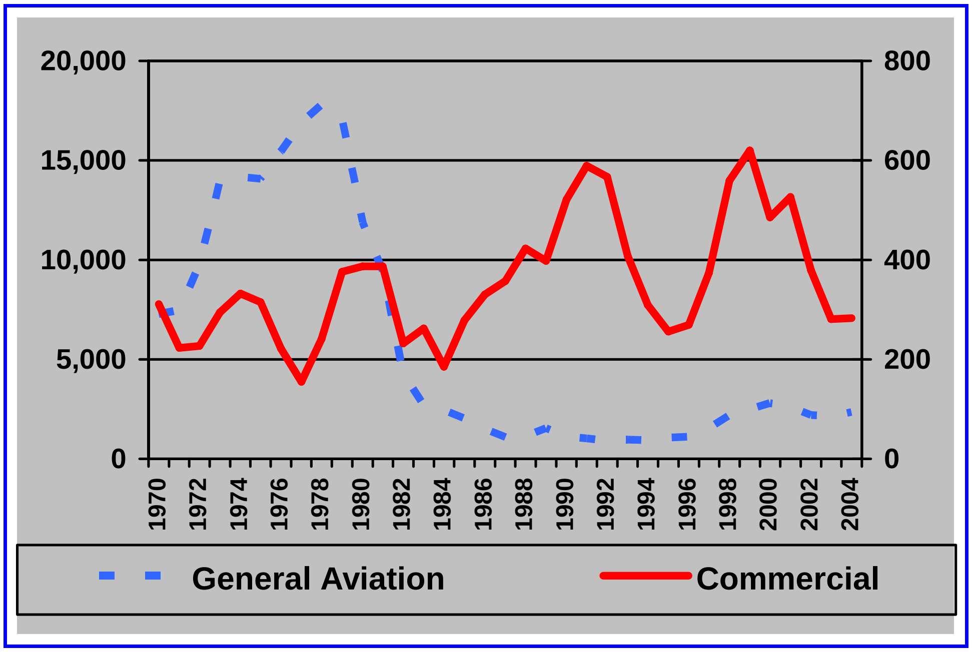
While on an upward trend for the last few years, general aviation deliveries reached an all-time high of 17,817 U.S. built airplanes in 1978, growing steadily from 7,283 in 1970 and from a historic low of 2,302 in 1951. Shipments in 1980 were 11,881, in 1985 were 2,029, and by 1992 had declined to an all-time low of 899.

With the General Aviation Revitalization Act of 1994 (GARA), it was hoped that general aviation manufacturers would be able to renew production without the concerns and costs related to open-ended product liability, and that production would rebound to its former high levels. In addition to the GARA limits on manufacturers' liability, interest rates were low and the economy was strong. U.S. deliveries increased to 2,857 in 2005, more than triple the 1992 low, but nowhere near the production levels of 25 years ago. It does not appear that general aviation deliveries will again attain the levels of the late 1970s anytime in the foreseeable future.

The following graph shows deliveries of U.S. manufactured airplanes from 1970 to 2004. It is easy to see the erratic but overall steady growth of commercial airline deliveries. It is even easier to see the dramatic drop with no significant recovery, of general aviation deliveries from the high levels of 1977 to 1979 to the low levels of the past 20 or more years.

[5] Boeing to Lay Off About 900 Kan. Workers, www.kiplingerforecasts.com, April 2006.

Table 2. U.S. Manufactured Aircraft Deliveries[6]



The FAA's forecast through 2017 describes expected increases in the general aviation fleet as shown in Table 2. The largest increases are expected to be in turbo prop and jet airplanes, with much smaller increases in piston powered single-engine and multi-engine airplanes. The forecast calls for an average annual growth rate for the overall fleet of 0.7 percent from 2006 through 2017, with the jet airplane growth rate for the same period at just over 6 percent, based on entry into the fleet of 100 very light jets (VLJs) in 2007, increasing to 400 to 500 additional VLJs per year by 2017, or a total of 4,950 VLJs in the general aviation fleet by 2017.[7]

[6] Aerospace Industries Association, Aerospace Facts & Figures 2005-2006.
[7] FAA Aerospace Forecasts, Fiscal Years 2006-2017, USDOT, FAA Office of Policy & Plans.

Table 3. FAA Fixed Wing Aircraft Fleet Forecast[8]

Historical	Single-Engine (Piston)	Multi-Engine (Piston)	Turboprop	Business Jets
1999	150,886	21,038	5,679	7,120
2000	149,422	21,091	5,762	7,001
2001	145,034	18,281	6,596	7,787
2002	143,503	17,584	6,841	8,355
2003	143,265	17,491	7,689	7,997
2004	143,831	17,456	7,806	8,280
2005	144,530	17,481	8,030	8,628
Forecast				
2006	145,110	17,505	8,230	9,025
2007	145,660	17,520	8,430	9,520
2008	146,185	17,540	8,630	10,125
2009	146,680	17,555	8,830	10,825
2010	147,150	17,575	9,030	11,575
2011	147,590	17,590	9,230	12,385
2012	148,005	17,605	9,430	13,165
2013	148,390	17,625	9,630	13,970
2014	148,745	17,640	9,830	14,785
2015	149,075	17,660	10,030	15,605
2016	149,370	17,675	10,230	16,430
2017	149,670	17,690	10,430	17,270

The VLJs, sometimes called microjets, are lighter in weight, smaller in size, and lower in price, with current prices in the $1 to $2 million range. They are expected to boost the business jet market as well as support the development of on-demand air taxi service. In addition to the Cessna Mustang, being built in Independence, Kan., and expecting certification at the end of 2006, there are as many as 11 other companies worldwide that have begun development of VLJs. The major competitors appear to be Eclipse Aviation in Albuquerque, N.M., which began production on its first customer airplane in March of 2006 and reported more than 2,350 orders in November 2005[9], and the A700 AdamJet, being built in Englewood, Colo., with more than 250 units on order and deliveries expected to start in early 2007.[10]

Competition throughout the general aviation market has increased over recent years. Cessna still dominates the general aviation market, with 822 piston airplane deliveries (built in Kansas) of 2,465 in 2005, or one-third of U.S. airplanes. However, the company's share of the market is down from 46 percent in 2000, when Cessna delivered 912 of 1,980 piston airplanes. Between 2000 and 2005, other companies began deliveries of new airplanes that are direct competitors to the Cessna line, including Cirrus Design in

[8] FAA Aerospace Forecasts, Fiscal Years 2006-2017, USDOT, FAA Office of Policy & Plans.
[9] Eclipse 500 Order Book Tops 2,350 Jets, www.eclipseaviation.com, November 2005.
[10] Adam Aircraft Announces First Flight of A700 AdamJet Production Aircraft, www.adamaircraft.com, February 2006.

Duluth, Minn., which increased its deliveries from 95 to 600 and outside the United States, Diamond Aircraft in Ontario, Canada, which increased its deliveries from none in 2000 to 329 in 2005.[11]

The turboprop market was somewhat more stable, with Cessna delivering 86 Caravan turboprops of a total of 365 in 2005 (23.6 percent of total U.S. manufactured turboprops) compared with 92 of 415 in 2000 (22.2 percent of the total). However, Raytheon's Wichita-built King Air deliveries were down to in both number of units delivered and in share of market, with 114 in 2005 (47.5 percent of the total) compared with 205 in 2000 (65.1 percent of the total). While the performance of new entrants was not dramatic, Pilatus Aircraft deliveries increased steadily, with 80 airplanes delivered in 2005, up from 69 in 2000 and the New Piper Meridian had increased to 40 airplanes delivered in 2005 after 18 in its first year of deliveries in 2000.[12]

Regulatory Issues

An overall threat to general aviation demand is the move by the FAA and airlines, proposing that user fees be charged to all airplanes in the same manner that they are now charged just to airliners. No specific amounts are suggested, but there is concern that any additional cost to operate corporate or personal airplanes will lower the use and demand for them.

Business Climate

In addition to slow growth in demand and increased competition by non-Kansas-based companies, the era of huge aircraft factories appears to be waning. Boeing and Raytheon have announced that they are final assemblers and want to be less and less directly involved in parts manufacturing, while Bombardier-Learjet long ago moved toward that business model, most notably by having Learjet wings manufactured in Ireland. Boeing sold its Wichita commercial aircraft manufacturing facility, which is now Spirit AeroSystems and is a major Boeing supplier.

Separating parts manufacturing from final assembly and certification as a business model allows the manufacturers to focus on the highest level of value-added work, and also allows them to purchase parts and subassemblies from vendors throughout the world, usually at far lower costs. The most recent demonstration of this in Kansas is the outsourcing of wiring harness work to companies in Mexico. Cessna announced in September that it would be moving its harness work to a facility in Mexico. Bombardier announced in October that it would build a $200 million factory and move its harness work to Mexico. With Bombardier's announcement, all three of Wichita's general aviation manufacturers have moved their harness work to Mexican facilities. (Raytheon made the move in 2003). Learjet wings have been manufactured in Ireland for many years. The new Boeing 787 is described by Boeing as "the most global thing we have ever done".[13] Its landing gear will be manufactured in France, and Japan will be the

[11] 2005 General Aviation Statistical Databook, General Aviation Manufacturers Association.
[12] Ibid.
[13] Washington Times, Jetting parts around the world, April 12, 2006.

source of the raw materials for the composite skin as well as more than a third of the aircraft's structure, including wings.

Finally, productivity increases have been dramatic in the aircraft manufacturing industry both as processes have been mechanized and streamlined, and as outsourcing has lowered labor costs as a percent of total output. Productivity gains mean that there are fewer people needed, and typically that those who are employed are required to have greater skill levels and earn more money. In ideal circumstances, productivity gains also lead to lower prices, which support increased demand and increased production.

Additional Industry Issues

Research & Development

The aerospace industry, particularly the aircraft-manufacturing sector, historically has benefited hugely from government funded research. This very likely explains the enormous growth in units sold after World War II, when airplanes were taken from daredevil status to effective modes of transporting people and cargo. Manufacturers were able to pass on the benefits of government-sponsored development to private or corporate buyers. However, in the absence of comparable investment into new research and design, the industry saw few significant changes or improvements in airplane design and particularly in the design of piston powered airplanes. The development of the VLJs or microjets represents significant investments in new designs as well as new manufacturing techniques in order to create and fill a new market niche in the area of economical business jet ownership and travel.

Incremental changes in production and testing have resulted in more reliable and safe airplanes, both piston and turbine powered, as reflected in the industry safety statistics, which show a decrease in accidents per 100,000 hours flown from 18.1 in 1970 to 6.22 in 2004, and a decrease in fatal accidents per 100,000 hours flown from 2.46 in 1970 to 1.2 in 2004.[14]

Pricing

General aviation airplane prices increased dramatically year over year, as production levels were steadily rising. Between 1965 and 1980, when production levels ranged from a low of 7,292 to a high of 17,811, the average annual price increase was 16 percent. The average annual increase in price from 1980 to 1990 was 26 percent. In 1965, the average price of a general aviation airplane was $26,848 and by 1990, the average price was $1.75 million. At the time, manufacturers attributed the price increases to the need to cover potential liability costs. However, with few changes in the actual products delivered, the price increases certainly contributed to lowered demand, such that by 1992, production levels were just 5 percent of the high in 1978. The average annual price increase since the General Aviation Revitalization Act of 1994 is just 2 percent. In 2005 the average price for a general aviation aircraft was more than $3 million.

[14] 2005 General Aviation Statistical Databook, General Aviation Manufacturers Association.

In a recently published journal article a Wichita State University professor, Dr. Dong Cho, created a price index for the business aviation market from 1968 to 2003. The index compensates for a changing product mix over this time period, particularly the move toward larger and larger business jets since the 1990s, which makes simple comparisons of average price over time problematic. While there are many comparisons for the index, a comparison to the Gross Domestic Product deflator shows that while the GDP deflator grew at 4.2 percent annually from 1968 to 2003, the average price of new business jets increased at an annual average rate of 6.1 percent. In the same time period, other manufactured goods increased at an even lower annual rate of 3.2 percent. It is not clear why the industry has been able to command these price increases, but some suggestions are industry consolidation, brand identity, new product development and fractional ownership. However, the price index strongly indicates that business jets now cost twice as much as in 1968 in terms of real dollars. It is an open question whether or when buyers of business jets will begin to resist continuing price increases of this magnitude.[15]

Industry Cycle

The aerospace, commercial aviation and general aviation industries are subject to both national and world economic cycles and what looks to be an industry specific cycle. The industry specific cycle appears to occur approximately every 10 years. When the downside of the aviation cycle coincides with larger economic downturns or shocks, the changes are dramatic.

Workforce

Demographic trends and an aging workforce indicate a potentially severe shortage of new workers for all industries nationwide over the next 30 years, which will certainly constrain industry growth. The projected labor shortage is one of the key long-term reasons that corporations look off shore for future labor. This is especially pronounced for Kansas, whose population is aging faster than that of the nation as a whole and whose total population is growing more slowly than the nation overall. The average manufacturing worker is 48 years old, by most measures more than halfway to retirement. It is an open question and a serious concern to the manufacturing industry, whether there will be enough young, incoming workers to replace the current workforce as it retires, and an even more challenging question whether there will be enough workers to support any industry expansion.

[15] A Chain-Type Price Index for New Business Jet Aircraft by Dr. Dong Cho, Business Economics, January 2006.

Forecast

Industry Analysis

Historically, the Kansas share of U.S. aviation manufacturing jobs has ranged from as low as 2.7 percent in 1970 to almost 6 percent in 2001. In the heyday of airplane manufacturing, Kansas had just over 4 percent of total U.S. jobs in this sector. It appears that the Kansas share of aerospace jobs may be increasing, although all signs point to fewer total U.S. jobs in this sector to achieve the same output.

Countering the expectation of Kansas enjoying an increasing share of aviation jobs is the success of non-Kansas companies in entering the general aviation market at all levels, and the assembly-focused business model of the largest Kansas manufacturing companies.

Scenarios

Three scenarios have been defined, all reflecting reasonably realistic situations excluding any "shocks" to the system, such as dramatically escalating fuel prices, user fees, major national or international economic downturns, bird flu or other disease scare, etc., since both the timing and the impact of such events cannot be anticipated with any accuracy. Also excluded are any possible limitations due to labor shortages in the state.

Optimistic Scenario

- Worldwide commercial aircraft demand would increase in proportion to the projected worldwide increase of approximately 5 percent per year of air passenger miles.
- Commercial airline manufacturing suppliers statewide would enjoy related increases in demand.
- Defense contractors and suppliers in Kansas would grow at a similar rate to the civilian aviation supplier base.
- Productivity gains and globalization would have minimal impact on Kansas' aerospace employment.
- The demand for general aviation airplanes would continue to grow as forecast by the FAA, with Kansas manufacturers and suppliers enjoying a growth rate higher than that being forecasted for units manufactured, due to their established positions in the higher dollar business jet market.

Pessimistic Scenario

- U.S. commercial airline manufacturing loses market share, instead of remaining relatively even.
- Productivity gains and globalization further erode U.S. and Kansas employment levels.
- Defense contractors in Kansas lose significant amounts of work.
- The Kansas share of U.S. aerospace manufacturing jobs does not increase.

Likely Scenario

The most likely scenario would be an average of the best and worst pictures. Based on past patterns, it is likely that the hiring would not be distributed evenly over the 10 years, but would be concentrated heavily in the years from 2006 through 2011, as factories rush to fill orders that were delayed until the end of the previous economic downturn. As the backlog of orders is filled, and new orders slow, hiring will also slow before increasing again.

Model Output

To arrive at detailed employment projections, the aerospace manufacturing sector was modeled using historical data from 1990 through 2005 with projections based on the analysis. The underlying formula captures the magnitude and duration of the Kansas aviation cycle, along with the effects of the national economy, and worldwide forecasts for general aviation aircraft and commercial aviation aircraft. This resulted in a sinusoidal or cyclical formula that shows increasing employment through 2010, decreasing employment for the following three years, and further employment gains from 2014 through 2016.

Direct Impacts

Direct aviation manufacturing employment is all employment included in the NAICS code 336. NAICS 336 Aerospace Product and Parts Manufacturing includes:

- Aircraft Manufacturing
    - Aircraft Engine and Engine Parts Manufacturing
    - Other Aircraft Parts and Auxiliary Equipment Manufacturing
    - Guided Missile and Space Vehicle Manufacturing
    - Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
    - Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing

Unlike employment, wage rates do not exhibit a sinusoidal or cyclical pattern. In fact, due to the first hired, first laid off patterns of this highly unionized industry, wage rates often continue to rise even as employment declines. Therefore, the historical trend pattern for wages is an upwardly sloped line. Between 1990 and 2005 Kansas wages in the aerospace manufacturing sector increased on average 4.1 percent annually. Between 2006 and 2016, the Center is forecasting an average annual wage increase of 6.4 percent. This higher growth rate is expected to reflect productivity gains and higher inflation rates. The forecasted wage rates were multiplied by forecast employment levels to calculate forecasted total payroll amounts.

Table 4. Aerospace Employment and Wages 1990 through 2016[16]

		Employment			Total Wages		
	Year	***Pessimistic***	***Optimistic***	***Actual/ Expected***	***Pessimistic***	***Optimistic***	***Actual/ Expected***
Historic	1990			40,435			$1,335,000,000
Historic	1991			40,223			$1,399,000,000
Historic	1992			38,874			$1,436,000,000
Historic	1993			35,345			$1,345,000,000
Historic	1994			32,696			$1,313,000,000
Historic	1995			32,591			$1,322,000,000
Historic	1996			37,324			$1,605,000,000
Historic	1997			44,586			$2,048,000,000
Historic	1998			48,766			$2,272,000,000
Historic	1999			48,464			$2,238,000,000
Historic	2000			46,465			$2,305,000,000
Historic	2001			47,716			$2,446,000,000
Historic	2002			40,860			$2,094,000,000
Historic	2003			34,735			$1,796,000,000
Historic	2004			34,281			$1,914,000,000
Historic	2005			35,800			$2,156,000,000
Projected	*2006*	*36,362*	*36,633*	***36,498***	*$2,365,000,000*	*$2,383,000,000*	*$2,374,000,000*
Projected	*2007*	*37,012*	*37,683*	***37,347***	*$2,552,000,000*	*$2,599,000,000*	*$2,575,000,000*
Projected	*2008*	*37,808*	*39,034*	***38,421***	*$2,770,000,000*	*$2,860,000,000*	*$2,815,000,000*
Projected	*2009*	*39,092*	*41,503*	***40,298***	*$3,074,000,000*	*$3,263,000,000*	*$3,169,000,000*
Projected	*2010*	*39,905*	*42,678*	***41,292***	*$3,330,000,000*	*$3,561,000,000*	*$3,446,000,000*
Projected	*2011*	*36,710*	*37,553*	***37,131***	*$3,084,000,000*	*$3,154,000,000*	*$3,119,000,000*
Projected	*2012*	*36,712*	*38,280*	***37,496***	*$3,279,000,000*	*$3,419,000,000*	*$3,349,000,000*
Projected	*2013*	*35,712*	*37,317*	***36,514***	*$3,328,000,000*	*$3,478,000,000*	*$3,403,000,000*
Projected	*2014*	*39,819*	*41,589*	***40,704***	*$4,069,000,000*	*$4,250,000,000*	*$4,159,000,000*
Projected	*2015*	*42,768*	*46,887*	***44,828***	*$4,807,000,000*	*$5,270,000,000*	*$5,038,000,000*
Projected	*2016*	*44,849*	*48,217*	***46,533***	*$5,325,000,000*	*$5,725,000,000*	*$5,525,000,000*
Projected	**Average Annual Growth Rate 2005-2016**	**2.07%**	**2.74%**	**2.41%**	**8.57%**	**9.28%**	**8.93%**

[16] Actual data from 1990 through 2005 from Bureau of Labor Statistics. Forecasted data from IMPLAN Professional Social Accounting & Impact Analysis Software, Minnesota IMPLAN Group, Inc.

Economic Impacts

In addition to the direct impacts of employment and payroll, both the firms and the employees in this sector make purchases from other firms and throughout the economy. The impacts of the direct employment and payroll plus industry's transactions with other firms are captured in the IMPLAN Type I analysis. The total impacts, including the direct employment and payroll, the transactions of the industry and employee spending and transactions are captured in the Type II output. (Please see the Methodology section for a more detailed discussion of the IMPLAN multipliers.)

Table 5. Total Economic Impacts of Kansas Aerospace Growth

		Employment			Wages		
		Direct	**Type I Firm transactions only**	**Type II TOTAL of Firm and Employee transactions**	**Direct**	**Type I Firm transactions only**	**Type II TOTAL of Firm and Employee transactions**
	Multipliers		***1.892794***	***3.901214***		***1.642879***	***2.598335***
	Year						
Historic	1990	40,435	76,536	157,747	$1,334,777,077	$2,192,877,229	$3,468,197,995
Historic	1991	40,223	76,134	156,919	$1,399,149,934	$2,298,634,044	$3,635,460,243
Historic	1992	38,874	73,581	151,656	$1,435,852,721	$2,358,932,283	$3,730,826,381
Historic	1993	35,345	66,901	137,889	$1,345,374,150	$2,210,286,939	$3,495,732,743
Historic	1994	32,696	61,887	127,554	$1,313,431,841	$2,157,809,589	$3,412,735,921
Historic	1995	32,591	61,688	127,143	$1,322,389,396	$2,172,525,768	$3,436,010,651
Historic	1996	37,324	70,646	145,608	$1,604,682,719	$2,636,299,541	$4,169,503,273
Historic	1997	44,586	84,392	173,939	$2,048,126,771	$3,364,824,461	$5,321,719,473
Historic	1998	48,766	92,304	190,247	$2,271,821,589	$3,732,327,980	$5,902,953,548
Historic	1999	48,464	91,732	189,069	$2,237,675,647	$3,676,230,329	$5,814,230,951
Historic	2000	46,465	87,949	181,271	$2,304,595,708	$3,786,171,893	$5,988,111,690
Historic	2001	47,716	90,316	186,150	$2,445,693,720	$4,017,978,853	$6,354,731,592
Historic	2002	40,860	77,340	159,405	$2,093,514,443	$3,439,390,914	$5,439,651,849
Historic	2003	34,735	65,746	135,508	$1,795,993,799	$2,950,600,496	$4,666,593,547
Historic	2004	34,281	64,888	133,739	$1,914,427,192	$3,145,172,231	$4,974,323,179
Projected	***2005***	***35,800***	***67,761***	***139,662***	***$2,155,756,775***	***$3,541,647,535***	***$5,601,378,281***
Projected	***2006***	***36,498***	***69,083***	***142,385***	***$2,373,752,976***	***$3,899,788,916***	***$6,167,805,439***
Projected	***2007***	***37,347***	***70,691***	***145,701***	***$2,575,371,806***	***$4,231,024,258***	***$6,691,678,702***
Projected	***2008***	***38,421***	***72,723***	***149,889***	***$2,814,726,733***	***$4,624,255,441***	***$7,313,602,986***
Projected	***2009***	***40,298***	***76,275***	***157,210***	***$3,168,711,654***	***$5,205,809,834***	***$8,233,374,397***
Projected	***2010***	***41,292***	***78,157***	***161,088***	***$3,445,734,696***	***$5,660,925,172***	***$8,953,173,062***
Projected	***2011***	***37,131***	***70,282***	***144,858***	***$3,119,068,199***	***$5,124,251,643***	***$8,104,384,068***
Projected	***2012***	***37,496***	***70,972***	***146,280***	***$3,349,123,388***	***$5,502,204,482***	***$8,702,144,517***
Projected	***2013***	***36,514***	***69,114***	***142,449***	***$3,403,138,779***	***$5,590,945,235***	***$8,842,494,600***
Projected	***2014***	***40,704***	***77,044***	***158,794***	***$4,159,109,171***	***$6,832,913,115***	***$10,806,758,927***
Projected	***2015***	***44,828***	***84,849***	***174,882***	***$5,038,053,838***	***$8,276,912,851***	***$13,090,551,618***
Projected	***2016***	***46,533***	***88,077***	***181,535***	***$5,524,735,495***	***$9,076,471,925***	***$14,355,113,602***
Projected	**Growth Rate 2005-2016**	**2.41%**	**2.41%**	**2.41%**	**8.93%**	**8.93%**	**8.93%**

Aerospace and Overall Employment

Between 1990 and 2005, the aerospace manufacturing industry directly accounted for 3.2 percent of jobs and 5.2 percent of payroll. The forecast for 2006 through 2016 shows direct aerospace manufacturing jobs accounting for 2.6 percent of Kansas jobs and 6.2 percent of payroll. Taking into account the multiplier impacts of both firms and employees, the aviation manufacturing sector is forecast to account for 10.2 percent of jobs and 16.1 percent of payroll, reflecting increases in pay rates due to increasing productivity and skill levels of employees.[17]

Aerospace Industry and Tax Revenues

The aerospace industry in Kansas is also an important source of tax revenues for the state. Taking into account indirect business taxes calculated on a per worker basis, and state sales and personal income taxes paid by workers, the industry is expected to generate slightly more than $208 million in 2006 and more than $223 million in 2007 based on direct employment and $900 million in 2006 and slightly more than $1 billion in 2007 based on total employment. [18] These totals include indirect business taxes,[19] and state sales tax and personal income tax generated by employee payroll.

[17] Based on total employment and wage and salary income data forecasted by CEDBR.
[18] IMPLAN Professional Social Accounting & Impact Analysis Software, Minnesota IMPLAN Group, Inc.
[19] Indirect business taxes include taxes on production and imports (tax liabilities, such as general sales and property taxes that are chargeable to business expense in the calculation of profit-type incomes) and special assessments, nonpersonal property taxes, licenses, and sales and gross receipts taxes, and Federal excise taxes and customs duties on goods and services. It does not include corporate income tax.

Summary and Key Findings

Key Findings

Both commercial aviation and general aviation are in growth modes that are forecast to continue for some time into the future. Although defense aerospace spending nationally has increased dramatically in recent years, the pending lay-offs of Boeing IDS employees may be more of a threat to both the plant and its supplier base than is reflected in this forecast. In any case, the forecast under all scenarios is for aerospace employment growth, ranging from an average annual of 2.07 percent to 2.74 percent over the years 2006 to 2016.

Employment in the Kansas aerospace industry is forecast to experience growth over the next ten years, based on some key assumptions. That Kansas continues to be a national and world center of aerospace manufacturing activity is the fundamental assumption underlying this forecast. Given the size and skill level of the workforce, this would seem to be reasonable.

Another key assumption is that Kansas firms maintain their approximate levels of market share in both commercial and general aviation aircraft and aircraft parts manufacturing. While this is a likely assumption, the gains in market share by non-Kansas manufacturers in recent years, including the development of a number of very light jets by other companies, present a challenge that may become more significant over time.

Finally, all scenarios are based on an absence of significant negative events, such as a bird flu pandemic or another major terrorist act such as the attacks on the World Trade Center. These events cannot be predicted, but would present a significant shock to the aerospace industry worldwide and in Kansas.

Summary

- Aerospace employment is expected to increase at an average rate of 2.41 percent per year from 2006 through 2016.
- Aerospace payroll is forecast to increase at an average rate of 8.93 percent per year from 2006 through 2016.
- Aerospace employment is forecast to account for 2.6 percent of Kansas jobs from 2006 through 2016.
- Aerospace payroll is forecast to account for 6.2 percent of Kansas payroll from 2006 through 2016.
- Each aerospace job generates approximately 3.9 total jobs throughout the state based on both the firm’s and the employee’s spending.
- Each aerospace wage dollar generates approximately 2.6 total dollars in the state based on both the firm’s and the employee’s spending.
- Aerospace employment is forecast to generate approximately $208 million in tax revenues in 2006 as a result of direct employment and $900 million in tax revenues in 2006 as a result of total employment ($223 million and $1 billion in 2007).

KANSAS, INC.

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Through analysis and open dialogue, Kansas, Inc. identifies policy options and builds the consensus essential for concerted action on vital economic issues. Kansas, Inc. is designed to be a public-private partnership with expectations that state investments are leveraged with other funds to maintain a strong research portfolio.

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