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2016 Top Markets Report **Aircraft Parts**

A Market Assessment Tool for U.S. Exporters

April 2016



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Executive Summary

This report provides an update to the *2015 Aircraft Parts Top Markets Report* issued by the International Trade Administration (ITA), U.S. Department of Commerce in May 2015. This update includes a revised ranking of the top markets based on more recent trade data, an analysis of recent changes that affect the international competitiveness of U.S. suppliers of aircraft parts, updates to five country case studies from the previous report (Canada, China, Germany, Saudi Arabia and Singapore) and the inclusion of two additional country case studies (Australia and Brazil).

The ranking of top markets is based on 13 factors, such as the value of aircraft parts exported to particular foreign markets, identified by ITA's team of aerospace industry specialists. The team assigned varying weights to each factor based on its assessment of the relative importance of one factor to another. In making judgments about which factors to select and their relative values, the team drew from its experience in international trade in aerospace products, including global marketing strategies and the dynamics of particular aerospace markets outside the United States.

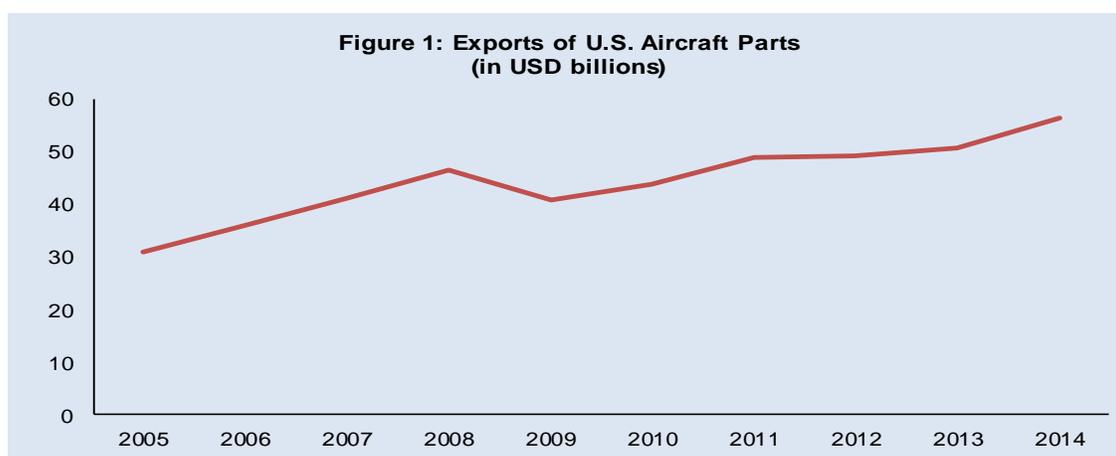
U.S. suppliers of aircraft parts may find this report to be of most value when used in conjunction with other materials related to the specific products they seek to export.

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Overview and Key Findings

According to United Nations data,ⁱ the value of U.S. exports of aircraft parts (measured in current dollars, that is, not adjusted for inflation) rose moderately over the decade ending in 2014. These exports reached a record amount in 2014 - \$56.2 billion. This was an increase of 10.6 percent from the prior year's value of U.S. exports of aircraft parts. By comparison, U.S. exports of all goods increased by 2.6 percent from 2013 to 2014, according to data from the U.S. Department of Commerce, Census Bureau.

East, dampening those governments' future ability to purchase aircraft parts (and goods and services in general). Countries in the Middle East and elsewhere, for which oil accounts for 80 percent or more of their total exports, may be particularly affected. These countries include Algeria, Azerbaijan, Brunei Darussalam, Iraq, Kuwait, Libya, Oman, Nigeria, Qatar, Saudi Arabia, Sudan and Venezuela, according to one scholar.ⁱⁱ



Aircraft parts are an important element in U.S. international trade of aerospace products, accounting for 46 percent of all U.S. aerospace exports in 2014. The 2014 figure is at the low end of this proportion during the decade ending in 2014, when the percentage of total U.S. aerospace exports that were aircraft parts ranged from 45 to 54 percent.

The dramatic decline in the price of oil that began in the summer of 2014 and continued throughout 2015 has significantly reduced the export revenues of oil-producing countries, such as those of the Middle

Key Findings: Top Markets and Methodology

The 2016 ranking of top markets for U.S. exports of aircraft parts is in Figure 2 below. The 2016 rankings show little variance from the 2015 rankings. In the top ten markets, the two changes are that (a) Germany moved from rank #5 to #4 (changing places with Canada) and that (b) the Netherlands moved from rank #11 to #10. Similarly, the countries in ranks #11-30 showed little movement between the 2015 and 2016 reports. A full listing of our 2016 ranking of top markets is in Appendix 1.

Figure 2: Projected Top Markets for Aircraft Parts Exports (2016)

1	France	7	China	13	Norway	19	Israel	25	New Zealand
2	Singapore	8	Australia	14	India	20	Sweden	26	Ireland
3	United Kingdom	9	Qatar	15	Malaysia	21	Panama	27	Denmark
4	Germany	10	Netherlands	16	Poland	22	Italy	28	Costa Rica
5	Canada	11	Brazil	17	Mexico	23	Indonesia	29	Spain
6	Japan	12	Korea	18	Saudi Arabia	24	Belgium	30	UAE

The essence of our methodology used in assessing priority markets for U.S. exports of aircraft parts was to (a) select factors that, in our view, represent favorable conditions for increased exports of aircraft parts, (b) assign a relative value to each of the factors, and (c) aggregate the weighted values of the factors to assign a single numerical score to each country market.

We identified 13 factors. While many are specific to the aerospace industry, such as whether a given foreign country has a Bilateral Aviation Safety Agreement with the United States, other factors relate to U.S. exports in general, such as the World Bank measure of ease of doing business, which includes the number of documents required for import transactions.

In some cases, we were not able to include a desired factor of interest to us due to lack of data. For example, one indication of the demand for aircraft parts is the extent to which maintenance, repair and overhaul (MRO) facilities are present in any given market. In accordance with the countries' national laws, MRO facilities overseas may be approved by the local civil aeronautical authority (CAA), the U.S. CAA (the FAA), the European CAA, or the CAA of other countries. Because the only data readily available about MROs is that of FAA-approved facilities, we used that as our factor (rather than the more expansive undertaking of all CAA-approved MROs).

Four of the 13 factors concern trade data:

- the value of a country's average annual imports of aircraft parts from the United States,
- the value of a country's average annual imports of aircraft parts from all its trading partners,
- the proportion of a country's total aerospace imports from the United States that are aircraft parts, and
- the proportion of a country's total imports of aircraft parts that are from the United States.

In the 2015 study, we used United Nations data for these four factors that covered the ten year period ending in 2013. For the present (2016) report, we have updated the values for these factors using UN data for the ten year period ending in 2014. We did not revise the values used in the other nine factors.

The natures of many of these nine factors lend themselves to having largely static values. For example, the list of countries that are signatories to the WTO Agreement on Trade in Civil Aircraft or a Free Trade Agreement with the United States did not change between 2015 and 2016.

Further details of our methodology can be found with the factors in Appendix 2 and their weights in Appendix 3.

Industry Overview and Competitiveness

The U.S. aerospace industry, including manufacturers of aircraft parts, plays an important role in the U.S. government's efforts to boost job growth through increased exports. American aerospace manufacturers produce the highest trade surplus of all manufacturing sectors, account for more American jobs tied to exports than any other industry, and provide high-tech and higher than average wages for the manufacturing sector in general. Increasing exports in the sector is therefore a priority for the U.S. Government, with several agencies supporting a broad portfolio of activities in support of export competitiveness.

The aerospace manufacturing industry is comprised of companies that produce complete aircraft and spacecraft, satellites, rockets and missiles, and parts of the aforementioned products. More broadly defined, it includes products used in air traffic control and at airports, as well as in aircraft MRO facilities.

This report focuses on one aspect of the aerospace industry: parts of aircraft, including both civil and military aircraft, whether fixed-wing or helicopters. Aircraft parts include, but are not limited to, the following:

- avionics;
- aircraft interiors;
- wings;
- fuselages;
- nose and tail sections;
- bulkheads;
- aircraft wiring;
- wheels and brakes;
- windows;
- passenger entertainment systems;

- different types of fasteners; and
- small aircraft engines, including piston engine and turbo-propellers.

Complete jet engines are not included because the market dynamics for jet engines closely parallel those of jetliners, while the same is not true for other aircraft parts. Components of all aircraft engines, including jet engines, are included. (See Appendix 4 for the six-digit Harmonized System codes and product descriptions of the aircraft parts covered in this report.)

Why a Focus on Aircraft Parts?

Manufacturers of complete aircraft, rockets and missiles are principally large corporations. Such companies frequently have well-staffed international marketing departments.

In contrast, most manufacturers of aircraft parts are small and medium-size enterprises (SMEs) with as few as half a dozen employees, representing an important customer base for both ITA and other export promotion agencies. By focusing on aircraft parts, this study provides helpful market information specifically related to the kinds of companies that are identified as strategically important to economic growth and export competitiveness.

Aircraft parts represent an important segment of total U.S. aerospace exports. In 2008, the last year for which detailed U.S. aerospace export data was made available, the value of U.S. exports of aircraft parts was greater than the value of U.S. exports of business jets and general aviation aircraft, military fixed aircraft, military helicopters and civil helicopters combined. Moreover, in contrast to other aerospace industry segments, such as military and civil helicopters that experienced virtually no growth in U.S. exports, exports of U.S. aircraft parts have experienced steady and strong growth (See Appendix 5.)

Global Industry Landscape

Foreign customers of U.S. suppliers of aircraft parts can be categorized into three broad groups: manufacturers overseas of complete aircraft and complete, large aircraft jet engines that source components from U.S. suppliers; first tier manufacturers overseas of parts used in complete

aircraft or complete large, aircraft engines that source second tier components from U.S. suppliers; and airlines and other aircraft operators, MRO shops, and aircraft completion centers overseas seeking components to maintain, repair and/or refurbish aircraft.

There are three primary overseas manufacturers of large civil aircraft and regional jets: Airbus (based in Europe), Bombardier (based in Canada) and Embraer (based in Brazil). According to various reports, the U.S. content of parts used in the production of these manufacturers' aircraft is significant: about 40 percent for Airbus, 53 percent for the Bombardier "CSeries" jetliner, and 70 percent for Embraer regional jets.

The cost of research and development required to launch new models of large aircraft can reach many billions of dollars. Some airframe manufacturers seek to reduce the extent to which they must shoulder all of these R&D expenses by contracting with "risk-sharing" suppliers, especially companies that agree to design aircraft components, as well as produce them. A "risk-sharing" supplier agrees to assume some of the risk in bringing a new product to market. Under this arrangement, a supplier commits to designing and manufacturing a given aircraft component with the understanding that it will be repaid as each aircraft is delivered (that is, a certain percentage of each sale will be provided to the supplier). Suppliers will only recoup their expenses and begin to make a profit when the number of sales of a particular aircraft are sufficient to reach a break-even point.

First tier manufacturers of aircraft parts that wish to export to airframe and aircraft engines manufacturers overseas may need to consider their willingness to enter into a "risk-sharing" relationship. Second and third tier suppliers of aircraft parts, including those whose customers are U.S.-based, may also be asked to assume engineering/design functions and a "risk-sharing" role given that some first tier suppliers "flow-down" the "risk-sharing" requirement from their customers.

It is difficult to judge the extent to which U.S. exports of aircraft parts are used in MRO shops and the like. Analysts of global MRO activity frequently cite figures related to industry trends, but these figures focus on the totality of the industry (where

value added includes a service component, as well as products) and not aircraft parts per se. At the same time, the dramatic decline in oil prices (and, consequently, the price of jet fuel) may lead some airlines to retain aging, less fuel efficient jetliners in lieu of acquiring more recent—and more expensive—fuel efficient jetliners. To the extent that this is the case, those airlines may have an increased demand for MRO services, including the parts necessary to perform those services.

Challenges and Barriers

Overseas challenges to the competitiveness of U.S. manufacturers of civil aircraft parts include:

- subsidies,
- “localization” requirements, and
- questionable airworthiness approval procedures.

In addition, aviation is an emerging industry in many countries. Even countries with world-class airlines may not have much domestic maintenance capacity. Developing countries may require a higher degree of technical assistance than is usually offered by an SME manufacturer.

Some competitors of U.S. civil aircraft parts manufacturers are subsidized. For example, the federal government of Belgium, in coordination with Belgium’s three regional governments, subsidizes Belgian manufacturers that supply parts to Airbus. The French government, through OSEO (the state-backed company that provides financial support to innovative SMEs), provides “reimbursable advances” to assist French manufacturers.

In 2010, OSEO announced €80 million (\$91 million using a March 2016 exchange rate), in reimbursable advances over two years for French SME sub-contractors and suppliers of large aerospace firms. Zodiac Aerospace received €230 million (\$260 million) in reimbursable advances during the August 2008 to August 2009 period. In 2009, Latécoère received €50.4 million (\$57 million) in reimbursable advances. In 2011, Figeac Aero received €10 million (\$11 million), and Slicom received €1 million (\$1.1 million).ⁱⁱⁱ

Several governments have formal policies aimed at the creation of a vibrant, domestic aerospace manufacturing industry. When purchasing major

aerospace products, such as large civil aircraft to be operated by state-owned or state-controlled airlines, these governments may seek to encourage foreign airframe and aircraft engine manufacturers to establish in-country manufacturing sites, purchase aircraft and engine components from in-country suppliers, or transfer technology to in-country organizations. Such measures may or may not be explicit.

The most explicit of such measures, government mandated offset requirements have been applied to military aircraft procurement for decades. It appears there may be interest by some governments to apply offset requirements to civil aircraft purchases, with the effect of requiring airframe manufacturers to source components from in-country suppliers and not U.S. suppliers.

Taken as a whole, the European Union (EU) is the largest export market for U.S. suppliers of aircraft parts. The most important regulatory hurdles facing U.S. aircraft parts exporters concern the European Aviation Safety Agency (EASA), the pan-European counterpart to the U.S. Federal Aviation Administration (FAA). There are two concerns with how EASA provides airworthiness approval for U.S. civil aircraft parts.

First, in at least one case, it appeared that EASA may have deliberately delayed the granting of approval for U.S. parts intended to be used on an American-made aircraft while speeding approval for the same U.S. part to be installed on a competitive European-aircraft. This provides a market advantage to sellers of the European aircraft.

Second, the level of fees charged by EASA to validate the FAA’s original airworthiness certification discourages small and medium-size U.S. manufacturers from pursuing entry into the European market. The basis for the fees is questionable because EASA charges almost the same amount of fees to validate the FAA’s airworthiness approval of a U.S. aircraft part as it does to provide original airworthiness approval for a European aircraft part. The resources required for validation, however, are substantially fewer because the FAA has already completed the work necessary to provide airworthiness approval (for the U.S. aircraft part), and under a bilateral aviation agreement, EASA in large part is merely verifying that the

applicant has satisfied airworthiness standards that the FAA and EASA have harmonized.

European aircraft parts manufacturers have another advantage over U.S. competitors with respect to export certificates of airworthiness. (For U.S. exporters, the certificate is FAA Form 8130-3.) Many U.S. manufacturers have been compelled to pay a fee (often in the range of \$200 to \$600) to FAA-designated representatives to obtain a certificate because the FAA lacks the resources to issue the certificates required for exports. Separate certificates are required for each shipment of a part. In contrast, European manufacturers are permitted to issue certificates of airworthiness on their own authority and are not required to make any payment to an EASA-authorized representative. (See changes discussed below under “Opportunities”.)

The value of the U.S. dollar has appreciated markedly against major foreign currencies, with the effect that purchasers abroad of U.S. aircraft parts (and other U.S. goods and services) face higher prices when converting their currencies to import from a U.S. supplier. Some U.S. parts manufacturers seek to ameliorate this disadvantage by offering increased service (e.g., guaranteed delivery dates) or improvements in the quality of their products.

Opportunities

There are several bright spots on the horizon with respect to the challenges previously mentioned. In regard to EASA fees, the FAA concluded an agreement with European authorities on March 2, 2016 concerning aircraft parts the airworthiness approval of which is granted by the FAA through a “Technical Standard Order Authorization,” or TSOA (and by EASA through a European Technical Standard Order Authorization, or ETSOA).^{iv} The thrust of the agreement is that EASA now accepts all U.S. TSOA aircraft parts without any further review by EASA. Consequently, U.S. exporters will no longer have to pay any fee to EASA for the validation of TSOA parts. This change is especially meaningful because in the most recent revision to EASA fees from March 2014, the fees related to TSOA parts were significantly raised – on the order of 300 to 500 percent – in contrast to other types of aircraft parts.

Regarding export certificates of airworthiness, on October 1, 2015, the FAA published a final rule in the

Federal Register that permits Production Approval Holders (PAHs) to sign copies of FAA Form 8130-3 on their own authority, effective March 29, 2016.^v This places U.S. manufacturers of aircraft parts that have an FAA PAH certificate on an equal footing with their European competitors. Manufacturers with a PAH include companies that manufacture aircraft parts under these FAA authorities: Parts Manufacturer Approval (PMA), Supplemental Type Certificate (STC) and TSOA.^{vi}

In addition to these changes, the regulatory environment benefits U.S. exporters of aircraft parts in several other ways:

- **Duties** - The EU and the United States are both bound to provide duty-free entry to some 250 specified civil aircraft parts under the WTO Agreement on Trade in Civil Aircraft. In addition, the EU provides duty-free entry of other aircraft parts under an EU temporary duty suspension that took effect in 2002. It appears that there are no plans to end the suspension. Other signatories to the WTO Agreement on Trade in Civil Aircraft that provide duty-free access to their markets include Japan and Canada.
- **Bilateral Aviation Safety Agreement (BASA)** - While there are certain difficulties associated with EASA approval of U.S. aircraft parts (noted above), the implementation in 2009 of the U.S.-EU BASA institutionalizes transatlantic efforts to harmonize aircraft safety standards with the goal of reducing the need for duplicative regulatory oversight. Under the BASA, certain aircraft parts (i.e., TSOA and non-critical PMA parts) approved by the FAA may be exported to Europe with no EASA approval required. The BASA provides a vehicle for continued cooperation between the FAA and EASA with the prospect of additional regulatory liberalization in the future.
- **“Parts Manufacturer Approval” parts** - The United States is unique in allowing the production of aircraft parts under an FAA authority known as “Parts Manufacturer Approval,” or PMA. In connection with after-market use, PMA parts can provide

significant advantages over original equipment manufacturers (OEM) parts to aircraft operators and MRO shops.

Manufacturers of PMA parts may offer customers significant price discounts. Because other countries do not offer this type of airworthiness approval, U.S. PMA producers often have an advantage in foreign markets.

- Stringent standards - The FAA's rigor in ensuring the airworthiness of U.S. aircraft and parts is second to none in the world. Whereas the quality of aircraft parts manufactured in some countries could be held in question, customers around the globe readily accept U.S. aircraft parts

knowing that they have been approved by the FAA.

In addition to these regulatory advantages, U.S. aircraft parts manufactures also benefit from a strong domestic customer base that generates demand for parts related to a wide variety of aeronautical applications. U.S. aircraft parts manufacturers therefore have the experience and technology to satisfy a broad range of demanding requirements in contrast to manufacturers in other countries with less of an aerospace legacy. Advanced manufacturing technology in the private sector will be complemented by the establishment of a U.S. network of public-private manufacturing innovation institutes, such as the Lightweight and Modern Metals Manufacturing Innovation Institute.

Country Case Studies

The following pages include country case studies that summarize U.S. aircraft parts export opportunities in selected markets. The overviews outline ITA's analysis of the U.S. export potential in each market and offer recommendations to exporters that can improve their competitiveness. The markets represent a range of countries to illustrate a variety of points – and not the top markets overall.

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Australia

Though Australia is the 52nd largest country in the world in terms of population, it is consistently one of our top 20 markets for aerospace exports. Australia is roughly the size of the continental United States, which makes aircraft a necessary mode of domestic travel transportation, and the country has about as many aircraft per capita as the U.S. does. In April 2015, Australia's civil registry had 15,275 aircraft, 86 percent of which were imported. Australia is an especially attractive market for SMEs and companies looking to expand their export relationships beyond North America.

Overall Rank

8

Australia is one of the United States' closest trading partners and one of our closest strategic partners. 2015 was the 10th anniversary of the U.S.-Australia Free Trade Agreement, and the United States and Australia signed a Defense Trade Cooperation Treaty in 2010. Sixty-three percent of the aircraft on Australia's civil aircraft registry were made in the United States.

According to the Australian government, Australia's aviation and aerospace industry had about 830 firms with a total of 14,000 employees in 2013. These firms are spread across manufacturing, maintenance, research and development, and training. Given the wide variety of aerospace activity in Australia and its distance from the United States, U.S. manufacturers may need guidance to find opportunities for their products.

Overview of the Aviation and Aerospace Manufacturing Market

Australia had 15,275 aircraft on its civil registry in April 2015. The median aircraft on that list was manufactured in 1980, and over 10,000 were manufactured prior to 1995. The list can be broken down into the following airframe types:

Airship	1
Glider	1,002
Manned Free Balloon	386
Motor-Glider	256
Power Driven Airplane	11,511
Rotorcraft	2,119

The largest category, power driven airplanes, has over 200 distinct manufacturers listed (discounting name variants listed as distinct manufacturers such as The Beechcraft Corporation and Hawker Beechcraft Corporation). Top manufacturers include the following:

CESSNA AIRCRAFT COMPANY	3,740
PIPER AIRCRAFT CORP	1,891
AMATEUR BUILT AIRCRAFT	1,326
BEECH AIRCRAFT CORP	664
THE BOEING COMPANY	250
DE HAVILLAND AIRCRAFT COMPANY	246
AIR TRACTOR INC	164
MOONEY AIRCRAFT CORP	159
CIRRUS DESIGN CORPORATION	142
AUSTER AIRCRAFT LTD	133
AIRBUS INDUSTRIE	124

Note that the third largest category of fixed-wing aircraft is "amateur built". Nearly 62 percent of aircraft actually manufactured in Australia are amateur built. The largest OEMs are GippsAero (formerly Gippsland, now owned by Mahindra) and a hot air balloon manufacturer named Kavanagh.

Qantas is by far the largest airline in Australia (19.8 million passengers in 2015 compared to Virgin Australia's 5.6 million). It also owns two subsidiary brands, QantasLink and Jetstar. Other airlines include Regional Express, Virgin Australia, and its two subsidiaries, Virgin Australia Regional Airline and Tiger Airways Australia. Australian airlines served 146 million passengers from 2013-14. There are over 100 airports in Australia, but only 40 airports handle

more than 100,000 passengers in a year. Most of the commercial passengers transit through Sydney, Melbourne and Brisbane.

There are 2,119 helicopters on Australia's registry. Half of these were made by Robinson Helicopter Company. The list below represents 94 percent of all helicopters on the registry.

AgustaWestland (all iterations)	67
Bell (all iterations)	367
Airbus (including Eurocopter)	273
Amateur Built	101
Kawasaki	44
Robinson	1,077
Sikorsky/Schweizer	39

According to the government of Australia, the domestic aerospace industry generated \$4.4 billion (Australian) in revenue from 2012 to 2013. Commercial aircraft parts, military aircraft and parts, and maintenance each represented around 30 to 33 percent of this revenue with the remainder derived from light aircraft and parts. Many aircraft manufacturers in Australia are suppliers to non-Australian aircraft programs. Boeing's largest workforce outside of the United States is in Australia, and its employees are disbursed at various facilities throughout the country. Australia is also a partner on the F-35. Eleven aircraft repair stations in Australia are certified by the FAA. Qantas's main maintenance facilities are in Sydney and Melbourne. More information can be found on the [Australian Trade Commission](#) and [Aviation/Aerospace Australia](#) website.

Australia is a major customer of U.S. defense products, including the F-35A, which will eventually replace all F/A-18Fs currently in service. Recent other aircraft ordered by the Australian military include the P-8, the CH-47F, the EA-18G and the C-27J. The Australian military operates aircraft produced by a variety of countries in Europe and from Israel.

Challenges and Barriers to Aircraft Parts Exports

The Australian aircraft fleet is diverse and old, representing only limited opportunity for those who produce parts for some aircraft models, especially

newer aircraft models. Companies should explore [the Australian aircraft registry](#) in detail for specifics. The registry is downloadable in Microsoft Excel and can be sorted in multiple ways, including manufacturer, age, and aircraft and engine type.

Though Australia is a close defense partner, U.S. companies should conduct regular due diligence on export regulations applicable to their specific product and end user.

Australia is generally an easy market to navigate, with legal protections and business practices similar to those of the United States. The time difference is manageable, particularly on the east coast, though geographic distance may deter some firms.

Opportunities for U.S. Companies

There are opportunities for aircraft parts manufacturers in multiple product lines, though clearly the largest category of aircraft is fixed-wing general aviation aircraft, particularly those made by Cessna, Piper and Beechcraft.

Brazil

Brazil is the third largest domestic aviation market in the world and has six of the 10 busiest airports in Latin America. As one of only five countries that manufacture commercial jets, Brazil has been a top market for U.S. aerospace exports for over 10 years. Brazil's aviation community is decades-old and diverse, representing opportunities for U.S. parts suppliers across the full range of aircraft, from commercial airliners, to military aircraft, to general aviation and helicopters. Parts manufacturers considering Brazil ought to look beyond Embraer and explore opportunities in the Brazilian airline industry and aftermarket.

Overall Rank

11

Brazil's presence on a top markets list for aircraft parts exports is not particularly surprising. Brazil's Embraer is globally recognized as a leading manufacturer of regional and business jets, and Brazil has significant domestic demand for aviation services. The fact that Brazil is not in the top 10 of the top markets lists is mostly due to government policies—if Brazil were a signatory to the Agreement on Trade in Civil Aircraft, it would rank 10th rather than 11th. If it were both a signatory and a Bureau of Industry and Security (BIS) "Licensing Destination Strategic Trade Authorization" then it would have ranked above Australia.

On purely commercial terms, therefore, Brazil is an attractive market for U.S. aircraft parts exporters. Exporters must take into account the normal challenges of doing business in Brazil, which are well known and can be difficult for some companies to manage without local representation. This is especially true in the area of defense, where government preferences for locally-sourced materials may prevent companies from competing without a Brazilian partner.

Overview of the Aviation and Aerospace Manufacturing Market

Brazil has an established aerospace manufacturing sector and produces a wide range of aerospace products. Perhaps best known for producing regional jets, Brazilian manufacturers also make turboprops, military aircraft, agricultural aircraft, business aircraft, helicopters and other general aviation aircraft. Brazil's aerospace manufacturing industry employed 26,239 people in 2013. Most of these employees are in Sao Jose dos Campos.

The most well-known Brazilian manufacturer is Embraer, which has delivered more regional jets than its only competitor (Canada's Bombardier) each year since 2006. Embraer's importance to Brazil's aerospace manufacturing cluster cannot be overstated—the only other major Brazilian airframe manufacturer is Helibras (owned by Airbus Helicopter). Embraer is the only Brazilian firm that plays a significant role in global aircraft sales: total revenue for Brazilian aerospace companies in 2013 was \$7 billion, and the total revenue for Embraer was \$6.24 billion.

Brazil is a major supplier of aerospace equipment to the United States, but it competes more in sales of final aircraft than in sales of parts and components. Indeed, Brazilian manufacturers import a significant amount of parts and components from non-Brazilian suppliers, including suppliers in the United States. It was only in the 2000s that Brazil consistently became one of the top 10 U.S. export destinations for aerospace equipment, likely due to the increasing success of Embraer's regional jet and business aircraft programs. In 2014, U.S. firms exported \$5.2 billion worth of aerospace products to Brazil while imports totaled \$2.3 billion.

Brazil also has a complex domestic aviation industry, including a growing network of airports and services for commercial and business aviation. Improving access to aviation services in Brazil's underserved regions is a national priority. After Brazil deregulated its aviation industry in the 1990s, the number of airports served by regular airline service declined. In order to resolve this problem and to address the growing demand for air travel, the government announced a program to develop 270 regional

airports, with groups of projects being rolled out as they are ready. Due to the economic downturn in 2016 and declining government revenue, Brazil has announced plans to accelerate privatization of airports.

Between 2004 and 2014, passenger traffic to, from and within Brazil grew 170 percent to reach 117 million travelers in 2014. In 2012, 473,000 tons of air freight were carried in the Brazilian system. Brazil has four major airlines: TAM, GOL, Azul and Avianca Brasil. One hundred and six airports were served by scheduled flights as of September 2014, most of these in the south and east. Many of Brazil's airlines have maintenance and purchasing arms at hubs in Rio de Janeiro, Sao Paulo and Belo Horizonte.

Oversight and management of Brazil's aviation industry is divided amongst several government agencies. Aircraft certification and production falls under ANAC, an independent federal agency. Air traffic control however, is managed by Brazil's Ministry of Defense, with both civilian and military traffic managed by a department called DECEA. Federally-owned airports are managed by INFRAERO, another public entity, though there are also a significant number of airfields operated at the state and local levels. There has been a move to privatize airports under public-private partnerships. In order to improve coordination and planning for aviation policy, the Brazilian government created the Secretariat of Civil Aviation in 2011.

The Federal Aviation Administration has a Bilateral Aviation Safety Agreement to facilitate cooperation with Brazil and accepts Brazilian certification of large civil transport aircraft.

Challenges and Barriers to Aircraft Parts Exports

At the time this report went to publication, Brazil was going through significant economic and political disruptions. Some of these may affect specific aviation industry customers.

Brazil is a geographically large country with a sprawling and growing aviation industry. Aircraft

parts manufacturers without local representation may find it difficult to build relationships, get timely information, and gain access to decision-makers.

Brazilian government officials and local manufacturers are concerned that Brazil's success in aircraft manufacturing has not translated into the development of a diverse aerospace cluster. The Brazilian government is trying to increase employment in aerospace and defense manufacturing and may leverage its purchasing power to encourage local production, particularly for defense products.

Companies that supply aircraft parts only to OEMs may find limited opportunities in Brazil. Companies interested in becoming part of Embraer's supplier database can do so by contacting the Foreign Commercial Service office in Sao Paulo for instructions and forms.

Exporters frequently report problems navigating Brazil's customs regime, which can present particular problems for companies trying to repair or replace aircraft parts on tight deadlines.

Exporters should ensure that they have conducted proper due diligence before signing contracts.

Opportunities for U.S. Companies

ITA's Aerospace Team believes that Brazil ought to be a priority market for aircraft parts export promotion. Over the past several years, ITA has successfully recruited two programs focused on Brazil's aviation industry, and domestic outreach activities have been well attended. Going forward, separate programs ought to be considered based on company size, subsector and market experience.

The best immediate opportunities for U.S. companies will be in supplying parts for Brazil's commercial, business and general aviation aircraft fleet, including helicopters. Programs (roadshows, demonstration projects and reverse trade missions) should target sales to Brazilian airlines, Brazilian airports and maintenance facilities in Brazil.

Canada

Canada consistently has been a prime destination for U.S. aerospace exports; in fact, Canada was among the top five markets in five of the last six years (2010-2015). Moreover, Canada has the world's fifth largest aerospace industry, with production in almost every aerospace subsector. According to Boeing, Canada's two largest airlines (Air Canada and West Jet) have outpaced U.S. airline traffic and capacity growth since 2009.

Overall Rank

5

Canada ranks high in terms of overall U.S. aerospace exports, U.S. aircraft parts, and the overall size of its domestic aviation and aerospace industry. U.S. exporters to Canada face virtually no barriers to market entry due to various bilateral agreements between Canada and the United States. The robustness of the Canadian aerospace market creates a high level of competition for new entrants from local Canadian, European and other U.S. companies.

Overview of the Aviation and Aerospace Manufacturing Market

Canada's diverse and mature aerospace industry is dominated by four subsectors: aircraft and aircraft components (42 percent), MRO (31 percent), engines and engine parts (11 percent), and avionics and electrical systems (7 percent).^{vii} The top 19 Canadian aerospace companies account for 87 percent of Canada's aerospace production and include companies such as Bombardier, Pratt & Whitney Canada, Bell Helicopter Textron, and Vector Aerospace.

The Canadian aerospace industry focuses primarily on civil aircraft manufacturing and invests more in research and development than any other Canadian industry (approximately US\$1.5 billion per year). The industry of late has focused on implementing lean manufacturing and supply chain principles, with OEMs increasingly working with fewer suppliers and larger system integrators in order to offset risk, hedge against business cycle volatility, and better manage the costs of large aircraft platforms. Canadian aerospace R&D supports the development of new technologies such as new materials (*e.g.*, composites), improved de-icing, noise reduction, enhanced fuel efficiency and engines more capable of operating in extreme weather. Canada

also has experienced increased demand for unmanned aircraft systems (UAS) for tasks such as mapping and land surveys. Transport Canada has authorized the use of UAS for multiple law enforcement and commercial applications.

In 2015, Canada was the fourth largest overall export destination for U.S. aerospace products at approximately US\$8.9 billion. Furthermore, over the past 10 years, on average, approximately 61 percent of U.S. aerospace exports to Canada were aircraft parts. In addition, about 57 percent, on average, of the aircraft parts imported into Canada from 2005 to 2014 were from the United States. The U.S. share of Canadian aircraft parts imports is larger (by percentage) than the U.S. share of total Canadian imports of all goods (which is more than 40 percent, larger than any other country).

Canada's commercial aviation fleet is quite significant with 279 Boeing aircraft, 116 Airbus aircraft, 106 Bombardier aircraft and 66 Embraer aircraft (567 total aircraft) in service through 2014. This large fleet creates demand for a high level of parts for MRO activity. While the 183 large civil aircraft that Canadian airlines have on order places Canada 16th in that metric (behind Japan and Brazil), Air Canada and West Jet (Canada's two largest airlines) have increased their airline traffic and capacity growth by 5 percent and 4 percent, respectively, since 2009.^{viii} By comparison, U.S. passenger traffic grew an average of 2 percent, and U.S. capacity grew between 1 and 2 percent since 2009.^{ix}

Challenges and Barriers to Aircraft Parts Exports

As a result of a number of bilateral agreements between the United States and Canada, there are virtually no barriers of entry for U.S. companies

exporting aerospace goods to Canada. These agreements include: the North American Free Trade Agreement (NAFTA), the North American Defense Production Sharing Agreement, Canada's ITAR Exemption (Section 126) and a U.S.-Canada Bilateral Aviation Safety Agreement that streamlines regulatory requirements, such as Canadian airworthiness approval for U.S. aircraft parts. Moreover, Canada is a signatory to the WTO Agreement on Trade in Civil Aircraft and is thus committed to free trade principles for civil aircraft and aircraft parts.

Canada's current market environment does pose a few challenges to would be exporters. New entrants from the U.S. most likely would face competition from current U.S. exporters to Canada, as well as from European and local Canadian companies. As well, exporters from China, Mexico and other countries are attempting to capture opportunities in Canada. Per best practices established by U.S. companies already integrated into the Canadian aerospace market, U.S. exporters, especially those seeking to participate in Canada's aerospace supply chain, have often succeeded when they were willing and able to:

- commit to long term partnerships with Canadian customers,
- take on risk,
- continuously improve and innovate,
- price competitively, and
- demonstrate financial soundness.

The maturity of the Canadian aerospace market also presents a challenge. New entrants will need to adhere to lean supply chain and manufacturing principles in order to compete and, most likely, will have to integrate into the supply chains of Canada's larger systems integrators. While these systems integrators will work with OEMs to support and manage the supply chain, business cycle variations will have greater effect on suppliers.

Moreover, U.S. suppliers will have to uncover who the various system integrators are that have been selected by Bombardier and present their business cases to them. Many of these integrators are U.S.-based, and therefore, it is highly likely that a company wanting to export to Bombardier will do so indirectly. Another important note is that in many cases, suppliers at lower levels of the supply chain need to be Bombardier approved. Bombardier does not approve suppliers unless they are either doing business directly with the

company or have been referred to them by a risk-sharing partner, such as a system integrator.

Another challenge to consider is the existence and effects of Canadian subsidies to Bombardier. The Canadian federal and Quebec provincial governments provided funds to Bombardier to help it develop the CSeries. The federal funding, C\$350 million, appears similar to the "launch aid" provided by EU countries to Airbus that the United States has challenged as being WTO-inconsistent.

Bombardier has stated that the CSeries aircraft will contain approximately 53 percent U.S. content. It is not clear, however, whether the U.S. content will generate new U.S. jobs or merely shift the supply of U.S. manufactured components away from Boeing. Boeing's aircraft have higher U.S. content than the CSeries, are not improperly subsidized, and could fill airlines' demand for aircraft in the CSeries class.

Opportunities for U.S. Exporters

While the maturity of the Canadian aerospace market and the heavy competition within it present some challenges to U.S. exporters, ITA considers Canada to be a priority market for aircraft parts export promotion. The favorable conditions for U.S. aerospace companies in Canada and the extent of integration between the aerospace supply chains of the U.S. and Canada suggest that large scale ITA efforts to create market openings or remove barriers are not necessary. Rather, ITA should find ways to support individual opportunities to serve specific subsectors or supply chain needs in Canada.

The recent growth in airline traffic and capacity in Canada suggests that U.S. aircraft parts suppliers should target sales to Canadian airlines and MRO facilities in Canada as these services experience a corresponding uptick.

China

China is expected to be the world's largest single-country market for civil aircraft sales over the next 20 years. Boeing estimates that China will need to add more than 6,000 planes to its commercial fleet to meet traffic demand; at the same time, China's fleet of business jets, helicopters, training aircraft, and other general aviation planes is expanding quickly. China currently imports most of its civil aircraft, presenting opportunities for companies that supply parts to many current aircraft and engines, particularly equipment produced by Boeing, Airbus, Gulfstream, General Electric, and Pratt & Whitney. However, China's aspirations in aircraft manufacturing may lead to increased competition from domestic Chinese firms as well as policies that favor domestic manufacturers.

Overall Rank
7

China ranks high in terms of U.S. exports, projected growth and increasing manufacturing. Its overall desirability as an export destination is limited by intellectual property rights (IPR) concerns, localization requirements and general difficulty of doing business.

China's aviation industry is a national priority, and the Chinese government is expending significant resources to develop domestic manufacturing capabilities, build new airports, train new pilots, and increase domestic maintenance capacity. In 2015, China was the largest overall export market for U.S. aerospace products at nearly \$15.9 billion. Most of that figure was complete aircraft and is likely to rise as China's fleet ages and China does more maintenance at home.

The expansion of China's market creates both opportunities and challenges for U.S. companies. Companies that supply spare parts to aircraft operators and maintenance and overhaul shops should consider the growth of China's aircraft fleet in their sales and marketing plans. U.S. parts suppliers might also find new opportunities as suppliers to Chinese manufacturing programs. However, since aerospace manufacturing is a national priority in China, U.S. companies may face localization pressures or may be disadvantaged by government policies in favor of local firms.

Overview of the Aviation and Aerospace Manufacturing Market

China has the second largest domestic aviation market in the world. It also has the world's fastest growing domestic aviation industry with passenger traffic increasing at a rate of 6.6 percent per year.^x

Given that there are only about 2,570 commercial jets operating in China in comparison to roughly 7,000 in the United States, industry analysts predict that Chinese airlines will need to add 6,330, mostly single-aisle, aircraft to their fleets over the next two decades to meet this projected demand (new and replacement aircraft).^{xi} Not surprisingly, Boeing and Airbus have identified China as the single most important market for sales over the next 20 years, and both companies are working hard to win orders from Chinese airlines.

Business opportunities in China are not limited to sales of large aircraft. China is also a growing market for business aircraft, helicopters and other general aviation aircraft. According to the Civil Aviation Administration of China (CAAC), the general aviation fleet totaled 1,798 aircraft in 2014.^{xii}

Though the total current fleet is still relatively small, the potential importance of this industry to the Chinese economy in the long-term has led aircraft OEMs and Chinese government officials to devote significant resources toward capacity-building for general aviation. In the short-term, however, the overall cooling of the Chinese economy has slowed growth in this segment of the industry.

In addition to capacity-building for its domestic aviation industry, China is also developing a globally competitive

manufacturing industry. This has manifested itself in several ways.

First, non-Chinese companies have increased their purchases from Chinese suppliers. U.S. imports of aerospace equipment from China nearly doubled between 2009 and 2013 to about \$900 million. In many cases, the imports are essentially transfers between U.S.-China joint ventures and the U.S. parent. China also has long-standing industrial relationships with suppliers in Russia and Ukraine and is deepening newer relationships with firms in Europe, Canada and Brazil.

Second, the Chinese government is supporting the development of indigenous Chinese aircraft, most notably the ARJ21 regional jet and the C919 large civil aircraft. The first ARJ21 was delivered to Chengdu Airlines in November 2015. While the aircraft structures are often made by Chinese firms, most of the major subsystems are being supplied by manufacturers headquartered in the United States and Europe. In the long-term, Chinese manufacturers may seek to shift production to Chinese-owned firms, but at least in the near-term, China's capacity to produce the more high-tech elements is limited.

Third, China is encouraging Chinese companies to invest in non-Chinese aerospace firms outside of China. So far, most of China's purchases have been in general aviation manufacturing, general aviation maintenance and helicopter manufacturing. In the short term, these acquisitions do not seem to have had a major effect on the business strategy of the purchased company; no production facilities have moved overseas. In some cases, however, China has announced intentions to open new assembly lines in China for domestic Chinese use. This may create new export opportunities for those that have relationships with the companies acquired by the Chinese.

Challenges and Barriers to Aircraft Parts Exports

China is a large country with a sprawling and rapidly growing aviation industry. Aircraft parts manufacturers without local representation may find it difficult to build relationships, get timely information, and gain access to decision-makers.

Chinese corporate or corporate/government relationships are often difficult to decipher, even for large companies with significant local resources; SME suppliers may find navigating the market to be even

more challenging. For general aviation in particular, it may be difficult for companies to determine which planned projects are likely to succeed. Though the aircraft manufacturing industry is a national priority, a significant amount of activity is controlled at provincial and local levels. The Aviation Industry Corporation of China (AVIC), one of the largest aircraft manufacturers in China and a state-owned enterprise (SOE), is actually a conglomerate of many state and local aerospace enterprises, some of which are in competition with one another.

China's major airlines and its aircraft manufacturers are mostly SOEs, and the high-end equipment manufacturing industry, which includes aircraft manufacturing, is one of China's designated Strategic Emerging Industries. As a result, U.S. suppliers may face pressure to form a joint venture with a Chinese firm in order to win a contract, particularly with a Chinese manufacturer, or they may be passed over for a supplier who has already formed such a joint venture. Furthermore, China's Catalogue for the Guidance of Foreign Investment Industries restricts non-Chinese ownership for general aviation aircraft and requires the use of joint ventures in the regional aviation aircraft subsector.

China's civil aviation authority has a relatively small staff and thus faces resource challenges in validating FAA certification of products so that they can enter the Chinese market. They use a queuing system that favors companies that already have a Chinese customer. Suppliers who want certification prior to market entry may face significant delays. There have also been reported instances of China's civil aviation authority (the Civil Aviation Administration of China), using the certification/validation process to either demand technical data from U.S. firms that is not required by the U.S.-China Bilateral Aviation Safety Agreement (BASA) or to delay entry of U.S. products for which there is no current Chinese competitor. This problem does not seem to be universal but does occasionally arise.

Chinese counterfeit parts have become a major problem in the aerospace and defense industries, and U.S. suppliers are being increasingly held liable for any counterfeit parts that enter into their supply chains. In addition to counterfeiting, companies trying to enter China's market should be aware of pervasive industrial espionage and take precautions to protect critical technologies, including registering patents in China,

consulting with local IPR attorneys, and protecting computer systems.

Export control regulations limit the export of certain products and technical data to China. In addition, U.S. exporters are prohibited from working with certain Chinese enterprises and individuals. Exporters should ensure that they have conducted proper due diligence before signing contracts.

Though the industry is growing, China has a shortage of technical personnel for both manufacturing and maintenance. This shortage may require foreign firms to invest significant resources towards developing human capital in China.

Finally, the current U.S.-China Bilateral Aviation Safety Agreement does not cover the jet aircraft China currently has under production.

Opportunities for U.S. Exporters

The best immediate opportunity for U.S. companies will be in supplying parts for China's commercial aircraft fleet. It is the largest and most well-established segment of China's aviation market and is currently dominated by western aircraft with many U.S. suppliers. Programs (roadshows, demonstration projects and reverse trade missions) should target sales to Chinese airlines, Chinese airports and Chinese aircraft finishing and MRO facilities.

Programs targeted at supplying parts for business aircraft, general aviation aircraft and helicopters are unlikely to lead to major sales in the short term, but these will be important as China's fleet expands. Working with OEMs to establish an aftermarket supply chain will be a component of the overall capacity-building effort for this segment of the industry.

Another immediate opportunity is the non-Chinese manufacturing supply chain in China. In some cases, the best way to enter this supply chain will be through traditional contacts in the company's home country; in other cases, making contacts at the China-based facility may be required. The best opportunities will be available when China-based assembly facilities intend to increase overall production of a particular aircraft model.

Prospects for entering China's domestic manufacturing supply chain are more mixed. Again, the most immediate opportunities will be in working with Chinese sub-suppliers to western aircraft programs, since those are likely to yield the highest volume of sales. China's domestic aircraft programs should not be ignored, but efforts should focus more on large companies who supply major systems until the long-term viability of the aircraft are clearer.

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Germany

Germany ranks fourth in the aircraft parts top markets study, immediately behind the United Kingdom and ahead of Canada. Major opportunities for U.S. exports of aircraft parts are to large tier 1 aircraft component manufacturers, Airbus, and Lufthansa Technik (a leading MRO provider).

Overall Rank

4

According to the German Aerospace Industries Association (BDLI), revenues of the Germany aerospace manufacturing industry reached €32.1 billion (\$42.6 billion) in 2014, a 4.9 percent increase over the 2013 figure. By comparison, the revenues of the U.S. aerospace manufacturing industry increased at roughly the same rate, 4.1 percent, during the same period. The 2014 growth rate in the German industry follows the growth experienced in earlier years, according to BDLI: 7.8 percent in 2013, 10.3 percent in 2012, and 4.1 percent in 2011.

It is difficult to determine the extent to which aircraft parts comprise the output of aerospace products in Germany. The German Aerospace Industries Association data categorizes output by “aerospace and space systems, propulsion systems, equipment, and material technologies.”

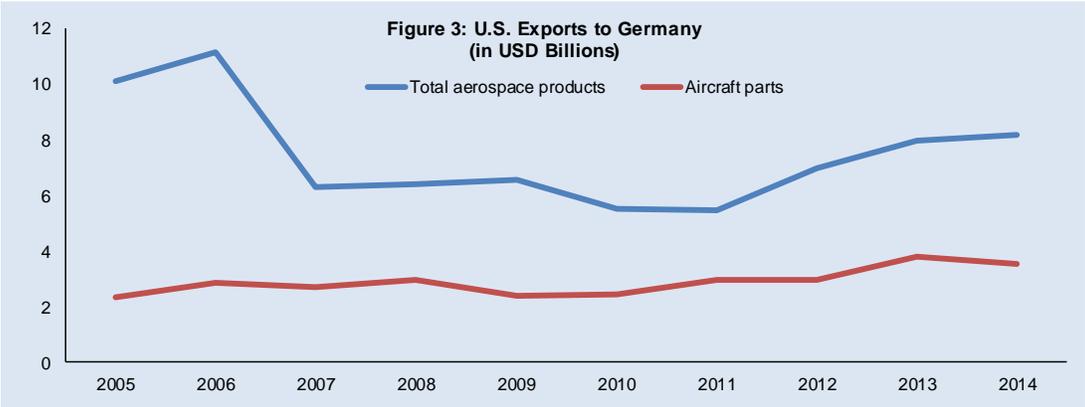
Based on United Nations trade data, the value of all U.S. aerospace exports to Germany has fluctuated significantly over the past 10 years, while U.S. exports of aircraft parts have risen fairly steadily. The proportion of total U.S. aerospace exports to Germany comprised of aircraft parts rose from 25 percent in 2004 to 47 percent in 2013.

The extent to which the increase in U.S. aircraft parts exports to Germany reflects an increase in German demand is not clear. Some of the increase can be attributed to the expansion of an Airbus aircraft manufacturing facility in Hamburg in the mid-2000s for the purpose of assembling A380 fuselage sections as well as completing cabin interiors for A380s delivered to customers in Europe and Middle East.

Increased demand for deliveries of A320 family aircraft may have played a role as well, given the assembly of that aircraft in Hamburg. In addition, the Hamburg facility is a global distribution center for Airbus aircraft spare parts with a stock of some 120,000 different types of parts. Because of the extent that these various activities shifted the demand for aircraft parts from other Airbus locations (notably Toulouse), it would appear that the increase in U.S. exports may have occurred whether or not the activities in Hamburg were expanded, with the U.S. exports going instead to alternative locations like Toulouse.

Challenges and Barriers to Aircraft Parts Exports

The most important regulatory hurdles facing U.S. aircraft parts exporters to Germany concern EASA.



These hurdles are discussed in this report's *Overview and Key Findings* section, under *Challenges and Barriers*.

Opportunities for U.S. Exporters

In addition to the challenges, the regulatory environment benefits U.S. exporters of aircraft parts in several ways:

- Duties - Germany, as an EU Member State, and the United States are both bound to provide duty-free entry to some 250 specified civil aircraft parts under the WTO Agreement on Trade in Civil Aircraft. In addition, Germany (and other EU Member States) provides duty-free entry of other aircraft parts under an EU temporary duty suspension that took effect in 2002. It appears that there are no plans to end the suspension.
- Bilateral Aviation Safety Agreement (BASA) - While there are certain difficulties associated with EASA approval of U.S. aircraft parts (noted above), the implementation in 2009 of the U.S.-EU BASA institutionalizes transatlantic efforts to harmonize aircraft safety standards, with the goal of reducing the need for duplicative regulatory oversight. Under the BASA, certain aircraft parts approved by the FAA may be exported to Germany with no EASA approval required.
- "Parts Manufacturer Approval" parts - The United States is unique in allowing the production of aircraft parts under an FAA authority known as "Parts Manufacturer Approval," or PMA. In connection with after-market use, PMA parts can provide significant

advantages over OEM parts to aircraft operators and MRO shops. Because there is no equivalent to PMA parts in Europe, German customers seeking to use PMA parts must buy from U.S. suppliers.

The Commercial Service in Germany has identified engine parts, airborne equipment and systems, aircraft interiors, pilot controls and avionics, composite materials, structural components, forgings, and fasteners as the best prospects for U.S. aerospace exports to Germany. Potential customers include major German Tier I suppliers and systems integrators such as Diehl Aerosystems, Liebherr-Aerospace Lindenberg, MTU AeroEngines and Premium AEROTEC, as well as the large German MRO provider, Lufthansa Technik. In general, U.S. suppliers of aircraft parts seeking to sell to Airbus are encouraged to contact Airbus North America in Herndon, Virginia.

Trade events relevant to the German market include:

- Aircraft Interiors Expo 2016, Hamburg;
- AERO 2016, Friedrichshafen;
- ILA Air Show 2016, Berlin; and
- AIRTEC 2016, Munich.

Under a Market Development Cooperator Program partnership with the U.S. trade association representing PMA parts manufacturers, ITA is co-hosting a PMA conference in Madrid scheduled for May 2015. A major objective for this event is to attract European airlines, including those from Germany, as potential customers. The trade association, the Modification and Replacement Parts Association, is working closely with the Association of European Airlines to frame the conference agenda.

Saudi Arabia

Saudi Arabia ranks 18th on our list of top markets for U.S. aircraft parts exports and is the largest market for aircraft parts in the Middle East region. The rapid growth of numerous Middle Eastern airlines has created a demand for parts and repair stations, which has fueled Saudi Arabia's aerospace parts import growth and will continue to do so for at least the next decade. Simultaneously, falling oil prices are more strongly impacting Saudi Arabia's budget than other Middle East countries, which will create uncertainty for several years. Saudi Arabia's large fleet of U.S. manufactured military aircraft requires parts for routine MRO activity but may also be impacted by potentially shrinking budgets. While the percentage growth of GDP in neighboring countries may be larger, Saudi Arabia's 5.3 percent average GDP growth from 2004 to 2014, its close ties with the United States, its ease of doing business in this sector and the growing demand for MRO services for aircraft operating in the region make the country an excellent starting place for U.S. manufacturers seeking to enter the Middle East market or for established exporters seeking new opportunities in the region.

Overall Rank

18

The rapid growth of numerous Middle Eastern airlines has created a demand for parts and repair stations, which has fueled Saudi Arabia's aerospace parts import growth and will continue to do so for at least the next decade. Saudi Arabia is the largest market for aircraft parts in the Middle East region. Due to the country's large fleet of operating aircraft and the high number of aircraft on order, as well as the six FAA-certified MRO facilities, Saudi Arabia generates an ongoing demand for U.S. aircraft parts.

Saudi Arabia also operates a large fleet of U.S. manufactured military aircraft that requires parts for routine MRO activity. While the percentage growth of GDP in neighboring countries may be larger, Saudi Arabia's 5.3 percent average GDP growth from 2004 to 2014, its close ties with the United States, its ease of doing business and the growing demand for MRO services for aircraft operating in the region make the country an excellent starting place for U.S. manufacturers seeking to enter the Middle East market or for established exporters seeking new opportunities in the region.

Saudi Arabia is the leading importer of U.S. aircraft parts within a region experiencing rapid financial growth and customer demand. The combination of the country's economic diversification plan that hopes to stimulate domestic manufacturing, an ever-

growing fleet of commercial aircraft, and a wide array of U.S. military aircraft creates opportunities for U.S. aerospace parts exporters. The country also boasts six FAA-certified commercial aircraft repair stations, clearly demonstrating its role as an important hub for MRO activity in the region.

Unfortunately, the decline in oil prices that began in mid-2014 is forcing Saudi Arabia to re-evaluate spending plans. As the world's largest oil exporter, Saudi Arabia's budgets are highly dependent upon oil prices but can withstand lower prices due to large reserve funds. The economy will need to diversify, which could imply an increased focus on airline expansion; however, reduction in fuel subsidies could mean lower profits in that sector. This uncertainty will remain until oil prices rebound closer to the range of \$100 per barrel.

Overview of the Aviation and Aerospace Manufacturing Market

U.S. aerospace parts exports to Saudi Arabia averaged over \$1.5 billion annually between 2004 and 2013. Parts represented 96 percent of Saudi Arabia's aerospace imports from the United States during that period. U.S. companies have established a dominant position in the country, with 59 percent

of Saudi Arabia's aircraft parts imports originating from the United States.

Saudi Arabia has two domestic airlines. Saudi Arabian Airlines, a major international carrier, is growing quickly and operates a cross-section of 122 wide and narrow-body aircraft with another 80 large civil aircraft on order, as of January 2016. The airline serves over 80 cities in Europe, North America, Asia and Africa from five hub cities—Riyadh, Jeddah, Madinah, Dammam and Abha. Saudi Arabia's low-cost carrier, Nas Air, has mainly served the domestic market and is now solely flying 26 Airbus A320-200 passenger jets while expanding service into international markets in Europe, North Africa and South America.

Saudi Arabia is the second largest MRO market in the Middle East, behind the United Arab Emirates. With the local fleets in the Middle East expected to double in size over the next 10 years, Saudi Arabia has positioned itself through infrastructure development, funding and high-technology skills to become an increasingly important MRO market. Many of the current MRO providers benefit from Saudi Arabia's location, just a few hours' flight time from Europe, India and Africa. Western companies, such as Rockwell Collins, Bell, Bombardier, Cessna and Gulfstream, among others, have opened offices and facilities in Saudi Arabia, and many U.S. companies are now entering into joint ventures with local firms in order to position themselves for military procurements.

The Ministry of Defense and Aviation is responsible for the Kingdom's Army, Navy and Air Force, as well as for the construction of civilian airports. Unifying these activities within one organization allows sellers to more simply work throughout various sectors within one country. The \$11.3 billion King Abdulaziz International Airport expansion project in Jeddah intends to increase the airport's capacity to 80 million passengers per year by 2035, creating additional MRO activity with the corresponding sales opportunities for U.S. parts exporters. The first phase is expected to boost capacity to 30 million passengers and will begin operations in 2016.

The Royal Saudi Air Force utilizes a wide-range of U.S. military aircraft. The Air Force operates over 300 F-15 fighter aircraft, 42 C-130J transport aircraft, 61 Bell helicopters, 25 Cirrus trainers, 16 S-70 Black

Hawks, several narrow and wide-body large civil aircraft, and a number of business jets (Raytheon King Air, Gulfstream, Lear Jet and Cessna aircraft), among others. Other government entities that make significant purchases of aircraft include the Ministry of Interior, the Saudi Arabian National Guard and the Saudi Red Crescent Authority. U.S. aerospace companies that produce parts for these aircraft have a natural market for follow-up sales.

Challenges and Barriers to Aircraft Parts Exports

According to the World Bank, Saudi Arabia is the 82nd out of 169 countries in terms of ease of doing business. The United States and Saudi Arabia, however, have neither a Bilateral Aviation Safety Agreement nor a Free Trade Agreement in place. Either or both of these frameworks would institutionalize obligations to the benefit of U.S. exporters. Saudi Arabia has taken other steps that partially mitigate the lack of these agreements. Saudi Arabia committed during its accession to the WTO to apply a zero rate of tariff on imports of goods related to the WTO's Agreement on Trade in Civil Aircraft. This includes aircraft parts and engines. As a result, U.S. companies do not face tariff obstacles in Saudi Arabia.

For government procurements, contractors are required to subcontract at least 30 percent of the contract's value to firms that are majority-owned by Saudi nationals and to establish a training program for Saudi nationals. The government may also favor bids that involve a joint venture with a Saudi company.

Thus, many U.S. companies have found it helpful to establish themselves in-country to increase their chances of success on government contracts. Due to the skilled, yet low-cost, labor in Saudi Arabia, this has generally provided an overall benefit for U.S. firms who have been able to stand up a presence there.

Opportunities for U.S. Exporters

U.S. aircraft parts and related products are very competitive in Saudi Arabia. The relative ease of doing business, zero tariffs and growing regional market make Saudi Arabia a good starting point for U.S. firms wishing to enter the Middle Eastern regional market. Many large companies are already

established there and work closely with domestic companies throughout the sector.

Key activities and trade events include:

- MRO Middle East Show, Dubai World Trade Center, Dubai, UAE, February 3-4, 2016;
- Aircraft Interiors Middle East, Dubai World Trade Center, Dubai, UAE, February 3-4, 2016;
- Abu Dhabi Air Expo, Abu Dhabi, UAE, March 8-10, 2016;
- Middle East Business Aircraft Association Show, December 6-8, 2016;
- International Defense Exhibition, Abu Dhabi, UAE, February 19-23, 2017;
- Dubai Air Show, Dubai, UAE, November 12-16, 2017;
- Regional Gold Key Services; and
- Global Aerospace Summit, Abu Dhabi, UAE, April 18-19, 2016.

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Singapore

Singapore ranks second in our list of top markets for U.S. aircraft parts exports due to the country's status as a major aircraft maintenance hub. Singapore's favorable customs regime and its location in a rapidly growing regional aviation market have attracted many firms from the United States and Europe to set up subsidiaries in Singapore. Singaporean maintenance firms such as ST Aerospace and SIA Engineering Company are major global players in their own right. While the growth of aircraft fleets in other Asian countries (like China) and the high cost of doing business in Singapore may challenge Singapore's dominance in the future, today it remains a solid means of entry to the Southeast Asia market.

Overall Rank

2

Unlike other top markets for aircraft parts, which have a large domestic manufacturing industry and/or a large domestic aviation market, Singapore's parts market is centered on the maintenance industry. Much of the maintenance work done in Singapore is performed on aircraft registered outside of Singapore.

Aircraft maintenance can be divided into several segments, most of which are conducted to some degree in Singapore. These segments include: airframe maintenance and overhaul, engine maintenance and overhaul, line maintenance (performed by airlines), component maintenance, cabin upgrades and design, and aircraft painting. In some cases, U.S. suppliers of spare parts may find themselves in competition with products available locally in Singapore.

Overview of the Aviation and Aerospace Manufacturing Market

Singapore is consistently a top market for U.S. aerospace parts exports, and parts exports averaged over \$5.7 billion between 2005 and 2014. Parts represented 81 percent of Singapore's aerospace imports from the United States during that period and 65 percent of Singapore's parts imports were from the United States.

Singapore's MRO industry is robust. Singapore's economy is based on its status as a major port and regional hub. Its infrastructure and regulations are designed to facilitate the movement of goods, making it a convenient place to operate an MRO facility, where being able to quickly clear parts through customs is a plus.

In addition to the hometown facilities of ST Aerospace and SIA Engineering, many foreign OEMs have facilities in Singapore including Bell/Cessna, Airbus Helicopter, Bombardier, GE Aircraft Engines, and Pratt & Whitney. In 2012, Aviation Week listed ST Aerospace and SIA as the world's first and fourth largest airframe MRO firms by total-man hours; however, those figures represent those companies' activities at a network of facilities spanning the globe. Singapore is also a center for regional parts distribution and warehousing.

Singapore only has six domestic airlines, but the country's Changi airport is served by over 100 airlines with routes to 300 cities in 70 countries and territories. The top 10 countries served by Changi airport were Indonesia, Australia, Malaysia, Thailand, China, Hong Kong, India, Philippines, Japan and Vietnam. It was the fifth largest airport by passenger traffic in 2013. This traffic helps drive the maintenance business and it also makes Singapore a convenient location from which to pursue regional opportunities.

Though MRO is the main focus, there is a limited amount of manufacturing in Singapore. Notably, the three major commercial engine manufacturers (GE, Pratt & Whitney and Rolls Royce) all have facilities in Singapore.

Singapore owns and operates U.S.-produced military aircraft, as well as aircraft from manufacturers in Europe and Israel. Its current fleet includes the F-15, the F-16, and the F-5; Apache, Chinook, Seahawk, Super Puma and Cougar helicopters; the C-135, the C-130, and the IAI Scout UAV; along with other

UAVs, support aircraft and trainer aircraft. Singapore is also a probable customer of the F-35.

U.S. manufacturers interested in Singapore should consider using Singapore to access opportunities elsewhere in the region. Several other Asian countries also rank in the top 30 countries in this top markets report. These include Indonesia and Malaysia, which can be easily accessed from Singapore.

Asia is one of the world's fastest growing regions for aviation. In 2015, over 600 airport construction projects were underway, valued at \$125 billion. Boeing projects that regional airlines will require over 14,000 aircraft by 2034 to meet rising demand for air travel. Bombardier has forecasted another 1,500 business craft will be sold to Asian customers by 2025. U.S. firms exported approximately \$50 billion worth of aerospace equipment to customers in the Asia-Pacific region in 2014. As with Singapore, however, aircraft manufacturing in these countries is limited, and most opportunities for parts exports will be for the aftermarket and for the military.

Challenges and Barriers to Aircraft Parts Exports

According to the World Bank, Singapore is the world's top market in terms of ease of doing business. It also ranks first in two subcategories highly relevant to the MRO industry: trading across borders and enforcing contracts. In addition, under the Bilateral Aviation Safety Agreement (BASA) between the FAA and the Singaporean Civil Aviation Authority, Singapore accepts all FAA certificates for aircraft and parts. ITA is not aware of any systemic problems between the FAA and Singapore; the FAA's regional office for Asia-Pacific is based in Singapore.

A free trade agreement between Singapore and the United States has been in place since 2004, further ensuring ease of exporting to Singapore. As a result, U.S. companies do not face many regulatory obstacles in Singapore. In fact, in February 2016, the FAA and the Civil Aviation Authority of Singapore (CAAS) signed a Maintenance Implementation Procedures agreement, which allows for reciprocal acceptance of each party's maintenance surveillance work.

On the U.S. end, exporters should conduct due diligence to ensure compliance with U.S. export control regulations. The Embassy reports that in some cases International Traffic in Arms Regulations (ITAR) discourages Singapore firms from doing business with U.S. companies. Nonetheless, some challenges exist, mostly related to Singapore's distance from the United States: there are no direct flights between the U.S. and Singapore; the time difference is substantial; and companies generally lack familiarity with key players. In addition, the high cost of travel to Singapore may make accessing this market cost prohibitive for some SMEs. Finally, manufacturers of PMA parts should be aware that, according to the U.S. Commercial Service in Singapore, their products are generally not accepted in Singapore.

Opportunities for U.S. Exporters

Despite some moderate logistical hurdles, U.S. products are generally competitive in Singapore, and the favorable business climate makes Singapore a reasonable means by which SMEs can enter the market in Southeast Asia.

Addendum: Resources for U.S. Exporters

The U.S. Government has numerous resources available to help U.S. exporters: from additional market research, to guides to export financing, to overseas trade missions, to staff around the country and the world. A few key resources are highlighted below. For additional information about services from the International Trade Administration (ITA), please visit www.export.gov.

Country Commercial Guides

<http://export.gov/ccg/>

Written by U.S. Embassy trade experts worldwide, the *Country Commercial Guides* provide an excellent starting point for what you need to know about exporting and doing business in a foreign market. The reports include sections addressing market overview, challenges, opportunities and entry strategies; political environment; selling U.S. products and services; trade regulations, customs, and standards; and much more.

Basic Guide to Exporting

<http://export.gov/basicguide/>

A Basic Guide to Exporting addresses virtually every issue a company looking to export might face. Numerous sections, charts, lists and definitions throughout the book's 19 chapters provide in-depth information and solid advice about the key activities and issues relevant to any prospective exporter.

Trade Finance Guide: A Quick Reference for U.S. Exporters

<http://www.export.gov/tradefinanceguide/index.asp>

Trade Finance Guide: A Quick Reference for U.S. Exporters is designed to help U.S. companies, especially small and medium-sized enterprises, learn the basics of trade finance so that they can turn their export opportunities into actual sales and achieve the ultimate goal of getting paid on time for those sales. Concise, two-page chapters offer the basics of numerous financing techniques, from open accounts to forfaiting and government assisted foreign-buyer financing.

Trade Missions

<http://www.export.gov/trademissions/>

Department of Commerce trade missions are overseas programs for U.S. firms that wish to explore and pursue export opportunities by meeting directly with potential clients in local markets. Trade missions include among other activities: one-on-one meetings with foreign industry executives

and government officials that are pre-screened to match specific business objectives.

Certified Trade Fairs

http://www.export.gov/eac/show_short_trade_events.asp?CountryName=null&StateName=null&IndustryName=null&TypeName=International%20Trade%20Fair&StartDate=null&EndDate=null

The Department of Commerce's trade fair certification program endorses overseas trade shows that are a reliable venue and a good market for U.S. firms to sell their products and services abroad. These shows serve as a vital access vehicle for U.S. firms to enter and expand to foreign markets. The certified show/U.S. pavilion ensures a high-quality, multi-faceted opportunity for American companies to successfully market overseas. Among other benefits, certified trade fairs provide U.S. exhibitors with help facilitating contacts, market information, counseling, and other services to enhance their marketing efforts.

International Buyer Program

<http://export.gov/ibp/>

The International Buyer Program (IBP) brings thousands of international buyers to the United States for business-to-business matchmaking with U.S. firms exhibiting at major industry trade shows. Every year, the International Buyer Program results in millions of dollars in new business for U.S. companies by bringing pre-screened international buyers, representatives and distributors to selected shows. U.S. country and industry experts are on site at IBP shows to provide hands-on export counseling, market analysis, and matchmaking services. Each IBP show also has an International Business Center, where U.S. companies can meet privately with prospective international buyers, prospective sales representatives, and business partners and obtain assistance from experienced ITA staff.

The Advocacy Center

<http://www.export.gov/advocacy/>

The Advocacy Center coordinates U.S. government interagency advocacy efforts on behalf of U.S. exporters bidding on public-sector contracts with overseas governments and government agencies. The Advocacy Center helps to ensure that sales of U.S. products and services have the best possible chance competing abroad. Advocacy assistance is wide and varied but often involves companies that want the U.S. Government to communicate a message to foreign governments or government-owned corporations on behalf of their commercial interest, typically in a competitive bid contest.

U.S. Commercial Service

<http://www.export.gov/usoffices/index.asp>

With offices throughout the United States and in U.S. Embassies and consulates in nearly 80 countries, the U.S. Commercial Service utilizes its global network of trade professionals to connect U.S. companies with international buyers worldwide. Whether looking to make their first export sale or expand to additional international markets, companies will find the expertise they need to tap into lucrative opportunities and increase their bottom line. This includes trade counseling, actionable market intelligence, business matchmaking and commercial diplomacy.

Aerospace Specific Resources

ITA's Aerospace Teams

<http://trade.gov/td/otm/aero.asp>

The International Trade Administration's (ITA) *Aerospace Team* is staffed by industry experts in various aerospace industry sub-sectors, such as space vehicles, UAVs, general aviation aircraft, military aircraft and aircraft parts. Team members seek to advance government policies, in the United States and abroad, that improve the international competitiveness of U.S. aerospace manufacturers. The team seeks to create or maintain access to markets overseas for U.S. aerospace exporters.

The *Aerospace and Defense home page*, produced by the Global Aerospace Team, is an excellent launching pad for information about ITA's trade promotion resources of special interest for exporters of aircraft parts and other aerospace products. It includes a listing of aerospace trade events in both the United States and overseas, research on aerospace markets outside the United States, contact information for Global Aerospace Team members, and special reports on aerospace activities. The [2014-2015](#)

[Aerospace Market Resource Guide](#) contains snapshots of 37 aerospace markets overseas, including market entry strategies and best prospects for U.S. exporters.

www.export.gov/industry/aerospace/index.asp

Market Development Cooperator Program

ITA's *Market Development Cooperator Program* (MDCP) provides technical and financial assistance to trade associations and other organizations to promote U.S. exports with the aim of creating jobs for American workers. ITA's financial contribution is met on a two-to-one basis by the MDCP partner, including with "in-kind" contributions. ITA has two current MDCP partnerships related to the promotion of aerospace exports.

- The Washington State Department of Commerce received an award of almost \$300,000 in 2014 to help fund an aerospace export promotion program. Among other things, the program provides vouchers to companies to reduce their costs of exhibiting at aerospace trade shows overseas. Participation in this, and in all MDCP programs, is open to U.S. companies throughout the United States. (Contact: Alexis Haakensen, ITA/Aerospace Team, 202-482-6235, Alexis.Haakensen@trade.gov)
- The Modification and Replacement Parts Association (MARPA) received an award of \$300,000 in 2014 to promote the export of U.S. aircraft parts produced under the FAA's PMA authority. PMA aircraft parts are used in the aftermarket by organizations, such as MRO shops. (Contact: Fred Elliott, ITA/Aerospace Team, 202-482-1233, Fred.Elliott@trade.gov)

Industry Trade Advisory Committee

The *Industry Trade Advisory Committee on Aerospace Equipment* consists of representatives of U.S. aerospace manufacturers and their trade associations, as well as labor organizations, who advise the Secretary of Commerce and the U.S. Trade Representative on international trade issues related to the aerospace industry. Among the issues are pending trade agreements, such as the Trans-Pacific Partnership (TPP), and concerns with access to markets overseas. (Contact: Alexis Haakensen, , 202-482-6235, Alexis.Haakensen@trade.gov) or Jonathan Alvear, ITA/Aerospace Team, 202-482-4125, Jonathan.Alvear@trade.gov)

Appendix 1: 2016 Ranking of Top Markets for Exports of U.S. Aircraft Parts

Rank	Country	Overall Score	Rank	Country	Overall Score	Rank	Country	Overall Score
1	France	60.32	59	Bahrain	27.72	117	Nigeria	22.66
2	Singapore	59.11	60	Guatemala	27.56	118	Serbia	22.55
3	United Kingdom	51.00	61	Croatia	27.51	119	Pakistan	22.44
4	Germany	48.05	62	St Lucia	27.50	120	Kuwait	22.16
5	Canada	47.84	63	Mauritius	27.23	121	Moldova	22.11
6	Japan	47.39	64	Austria	27.10	122	St Christopher-Nevis	22.10
7	China	44.27	65	Taiwan	27.00	123	Botswana	21.98
8	Australia	40.12	66	Guyana	26.79	124	Barbados	21.95
9	Qatar	39.96	67	Slovenia	26.34	125	Tonga	21.79
10	Netherlands	38.24	68	Belize	26.25	126	Seychelles	21.75
11	Brazil	38.18	69	Montenegro	26.15	127	Western Samoa	21.62
12	Korea	38.16	70	Nicaragua	25.86	128	Bosnia-Herzegovina	21.60
13	Norway	37.99	71	Antigua Barbuda	25.81	129	Bangladesh	21.54
14	India	37.99	72	Vietnam	25.80	130	Cameroon	21.53
15	Malaysia	37.13	73	Mongolia	25.69	131	Benin	21.51
16	Poland	36.76	74	Ecuador	25.61	132	Macedonia	21.38
17	Mexico	35.65	75	Greece	25.52	133	Lesotho	21.37
18	Saudi Arabia	35.29	76	Republic of South Africa	25.44	134	Kenya	21.08
19	Israel	35.11	77	Cyprus	24.97	135	Papua New Guinea	21.02
20	Sweden	35.05	78	Bhutan	24.95	136	Tunisia	20.80
21	Panama	34.86	79	Jamaica	24.77	137	Guinea	20.75
22	Italy	34.61	80	Thailand	24.77	138	Malawi	20.75
23	Indonesia	34.08	81	Grenada	24.72	139	Kyrgyzstan	20.73
24	Belgium	33.90	82	Albania	24.58	140	Chile	20.67
25	New Zealand	33.75	83	Malta and Gozo	24.53	141	Mali	20.16
26	Ireland	33.53	84	Ghana	24.47	142	Kazakhstan	20.14
27	Denmark	33.33	85	Bolivia	24.44	143	Gambia	20.02
28	Costa Rica	32.85	86	Georgia	24.37	144	Macao	19.85
29	Spain	32.37	87	Brunei	24.37	145	Algeria	19.62
30	United Arab Emirates	32.36	88	Hong Kong	24.36	146	Morocco	19.57
31	Finland	32.32	89	Fiji	24.29	147	Senegal	19.53
32	Iceland	31.92	90	Syria	24.20	148	Paraguay	19.51
33	Switzerland	31.86	91	Burkina (Upper Volta)	24.19	149	Namibia	19.30
34	Luxembourg	31.54	92	Belarus	24.08	150	Zambia	19.03
35	Portugal	31.15	93	Philippines	24.06	151	Burma (Myanmar)	19.01
36	Estonia	30.94	94	Rwanda	23.97	152	Congo	18.71
37	Turkey	30.82	95	Solomon Islands	23.88	153	Gabon	18.49
38	Argentina	30.46	96	Trinidad and Tobago	23.84	154	Palau	18.34
39	Bahamas	30.37	97	Nepal	23.77	155	Zimbabwe (Rhodesia)	18.32
40	Colombia	30.32	98	Vanuatu (New Hebrides)	23.72	156	Ukraine	17.67
41	Anguilla	30.32	99	Armenia	23.69	157	Sudan	17.55
42	Mozambique	29.96	100	Uganda	23.69	158	Burundi	17.23
43	Czech Republic	29.93	101	Azerbaijan	23.68	159	Ivory Coast	16.52
44	Honduras	29.63	102	Cape Verde	23.57	160	Iran	15.35
45	Ethiopia	29.62	103	Maldives	23.54	161	Central African Republic	15.16
46	Dominica	29.47	104	Venezuela	23.52	162	Libya	14.88
47	Slovakia	29.12	105	Oman	23.52			
48	Hungary	28.95	106	Russia	23.45			
49	Bulgaria	28.75	107	Cambodia (Kampuchea)	23.35			
50	Suriname	28.61	108	Madagascar	23.32			
51	Lebanon	28.30	109	Uruguay	23.26			
52	Dominican Republic	28.19	110	Djibouti	23.20			
53	Romania	28.16	111	Egypt	23.02			
54	Jordan	28.04	112	El Salvador	22.89			
55	Lithuania	27.98	113	Niger	22.87			
56	Latvia	27.97	114	Togo	22.86			
57	Peru	27.89	115	Sri Lanka (Ceylon)	22.82			
58	St Vincent & Grenadines	27.76	116	Tanzania	22.75			

Appendix 2: Methodology Used to Establish the Country Rankings

To establish a priority of foreign markets that offer the best prospects for exports of U.S. aircraft parts over the next two years, we identified 13 factors that, in our view, contribute positively to the prospect of increased U.S. exports of aircraft parts to any given country.

Nine of these factors involve quantitative data, such as the value of U.S. aircraft parts exports to a given country, the proportion of a given country's total imports of aircraft parts accounted for by parts imported from the United States and the number of large civil aircraft on order. For any of these nine factors that allowed for values to be reported over time (such as the value of U.S. aircraft parts exports to a given country), we calculated the average annual value over the ten year period ending in 2014. The use of average annual values helps to prevent statistical aberrations in any given year from skewing that factor's effect on a country's overall score.

Four factors were "yes/no" considerations, such as whether a given country has a Bilateral Aviation Safety Agreement (BASA) with the United States or whether U.S. exports of military aircraft parts to a given country are eligible to receive an exemption from BIS licensing requirements under a certain rule ("Licensing Exemption Strategic Trade Authorization").

The importance of these 13 factors varies. We attributed higher and lower weights, accordingly, based on our experience with international trade in aerospace products and our judgments of industry dynamics that bear on the relative importance of each factor vis-à-vis the other factors.

The process by which we assigned weights to each factor began by focusing on those factors which we judged to be particularly important. Three factors were assigned especially high weights:

- total \$ value of U.S. aircraft parts exported, average annual, 2005 to 2014;
- \$ value of average annual aircraft parts imported from the world, 2005 to 2014; and
- percent change in GDP growth rate, 10 year linear average, 2004 to 2013.

We then determined factors which appeared to be at the opposite end of spectrum, *i.e.*, that have the least importance. Five factors are in this category:

- foreign exchange fluctuations (US\$ vs. foreign currencies);
- does the country have a Bilateral Aviation Safety Agreement (BASA) with the United States?;
- is the country eligible for BIS's "Licensing Exemption STA" status?;
- is the country a signatory to the WTO Agreement on Trade in Civil Aircraft or an FTA with the United States?; and
- is there a lack of onerous "special requirements" by the importing civil aeronautical authority?

This resulted in five remaining factors for which we assigned weights between the two extremes, *i.e.*, the extreme highs and the extreme lows:

- percent of U.S. aerospace exports that were aircraft parts, average annual, 2005 to 2014;
- percent of total imported aircraft parts that were imported from the United States, average annual, 2005 to 2014;
- number of aircraft on order from Boeing and Airbus;
- World Bank measure of ease of doing business; and
- number of FAA-approved aircraft MRO shops.

Within these broad categories, we then tested several permutations of different weighting schemes that assigned specific values to each factor, some of which produced results that were clearly at odds with our experiences in aerospace trade. (Example: in one permutation, China was assigned an overall ranking value far lower than warranted by empirical evidence.) After modification, we settled on a scheme with factors' weights varying from 1 to 15. See Appendix 3.

Aggregating the absolute values for the 13 factors in order to rank countries would be comparing apples to oranges because certain values (e.g., dollar value of U.S. exports—such as \$4 billion) would have no meaning in relation to other values (e.g., number of aircraft on order – such as 10 units). To address this, we normalized (also called “rationalized”) the 13 factors. This means that scores were assigned, for all countries for each factor, between 0.0 and 1.0. For example, with respect to the value of average annual exports of U.S. aircraft parts, the country with the highest absolute value, France (with \$6.6 billion) received a normalized score of 1.0000000. Argentina, with an absolute value of \$36.1 million in imports of U.S. aircraft parts, received a normalized score of 0.00548757315497454 for this factor.

The weights we assigned to the 13 factors total 100. A country's overall priority ranking was determined by adding the values of the 13 factors. Had any given country received a normalized score of “1” for all factors, that country would have an overall score of 100. Conversely, had any country received a “0” for each of the 13 factors, that country would have an overall score of 0.

Our starting point for assembling data was a United Nations trade data base, UN COMTRADE. We used this database because it contains export and import data reported at the six digit HS level, that is, capable of culling aircraft parts from aerospace products in general. This is not the case with U.S. data beginning with trade reported since 2009.

UN COMTRADE includes data reported for 170 countries. We deleted from this data base eight countries, including French Polynesia and New Caledonia, which lacked sufficient reporting of data for the 13 factors. These eight countries accounted for about 0.05 percent of U.S. aircraft parts exports. Some countries lacked data for a single factor. For those countries, we assigned a value equal to the average value of all other countries for that factor. The normalized value of the currency exchange rate factor was inverted because it measures changes in the local currency per U.S. dollar. (Without the inversion, a high score for this factor would run counter to the effect of increased U.S. exports linked to depreciation in the value of the dollar.)

Appendix 3: Factors and Their Weights Used to Establish Country Rankings

<u>No.</u>	<u>Wt.</u>	<u>Description</u>
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Quantitative Data

1	14	Total \$ value of U.S. aircraft parts exported, average annual, 2005 to 2014
2	14	\$ value of average annual aircraft parts imported from the world, 2005 to 2014
3	6	Percent of U.S. aerospace exports that were aircraft parts, average annual, 2005 to 2014
4	12	Percent of total imported aircraft parts that were imported from the United States, average annual, 2005 to 2014
5	15	Percent change in GDP growth rate, 10 year linear trend, 2004 to 2013
6	8	Number of aircraft on order from Boeing and Airbus
7	4	Foreign exchange fluctuations (US\$ vs. foreign currencies)
8	7	World Bank measure of ease of doing business
9	10	Number of FAA-approved MRO shops

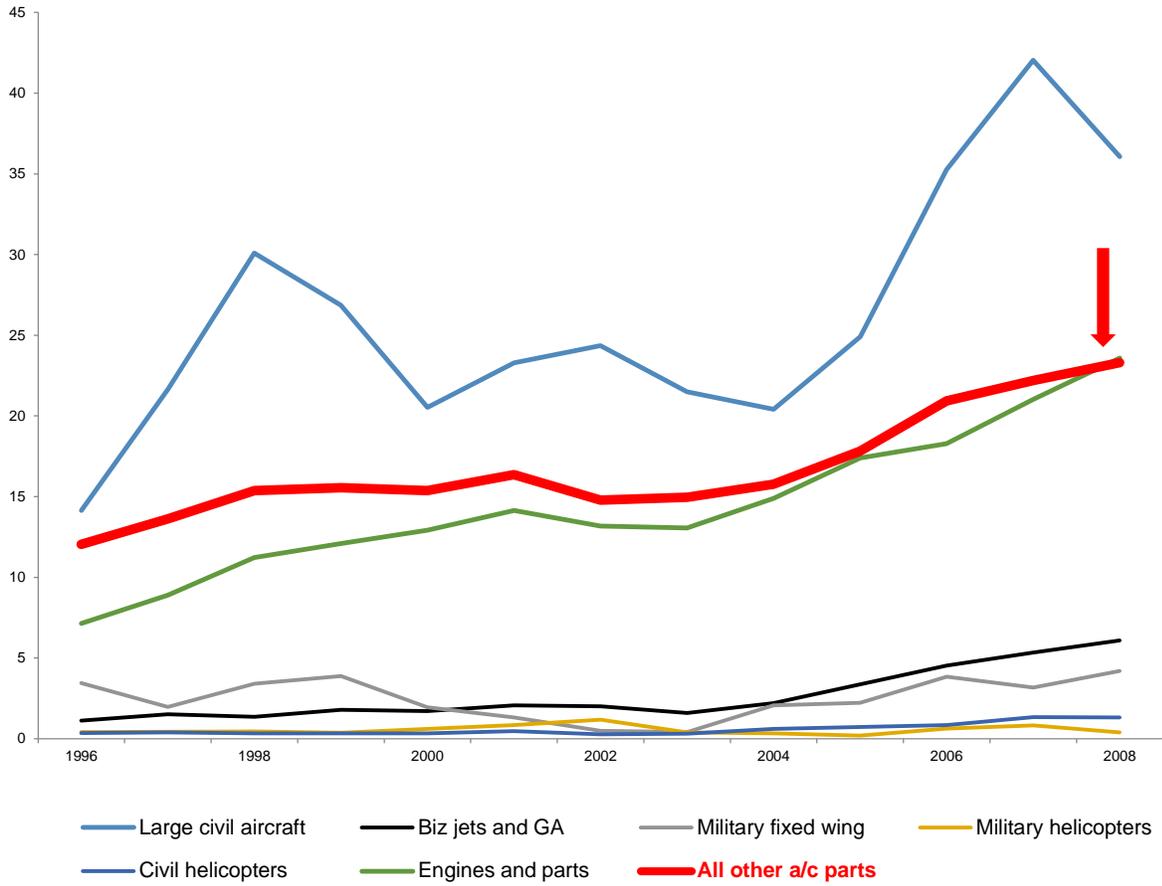
Yes/No Questions

10	4	Does the country have a Bilateral Aviation Safety Agreement (BASA) with the United States?
11	4	Is the country eligible for BIS's "Licensing Exemption STA" status?
12	1	Is the country a signatory to the WTO Agreement on Trade in Civil Aircraft or an FTA with the United States?
13	1	Is there a lack of onerous "special requirements" by the importing civil aeronautical authority?

Appendix 4: Aircraft Parts Included in this Study

HS #	Product description
401130	New pneumatic tyres, of rubber, of a kind used on aircraft
401213	Retreaded pneumatic tyres, of rubber, of a kind used on aircraft
840710	Spark-ignition reciprocating or rotary internal combustion piston aircraft engines
840890	Compression-ignition internal combustion piston aircraft engines (diesel or semi-diesel engines)
840910	Parts suitable for use solely or principally with aircraft engines of 8407.10 or 8408.90
841121	Turbo-propellers of a power not exceeding 1,100 kW
841122	Turbo-propellers of a power exceeding 1,100 kW
841181	Gas turbines, other than turbo-jets or turbo-propellers, of a power not exceeding 5,000 kW - 40 percent is aircraft
841182	Gas turbines, other than turbo-jets or turbo-propellers, of a power exceeding 5,000 kW - 40 percent is aircraft
841191	Parts of turbo-jets or turbo propellers
841199	Parts of gas turbines, other than turbo-jets or turbo-propellers -- 27 percent is aircraft
880310	Propellers and rotors and parts thereof
880320	Undercarriages and parts thereof
880330	Parts of airplanes or helicopters other than those of 8803.10 or 8803.20
880390	Other parts of the goods of headings 88.01 or 88.02
880510	Aircraft launching gear and parts thereof; deck-arrestor or similar gear and parts thereof
940110	Seats of a kind used in aircraft
901420	Instruments and appliances for aeronautical or space navigation (other than compasses) -- 90 percent is aircraft

Appendix 5: U.S. Exports of Aerospace Products, 1996-2008, USD Billions



Appendix 6: Notes and Citations

ⁱ UN trade data has several drawbacks, including countries that have questionably reported “0” as the value of their aircraft parts imports from the United States for particular years and/or reported no data at all for such imports. UN trade data, and not Commerce Department data, is used because beginning in 2009 the Commerce Department no longer reported U.S. exports of aerospace products at a granular level, i.e., such that aircraft parts could be segregated from other aerospace products.

ⁱⁱ Dr. Marek Dabrowski, Non-Resident Scholar at Bruegel and Professor at the Higher School of Economics in Moscow. Website accessed on February 22, 2016.

ⁱⁱⁱ *2013 National Trade Estimates Report on Foreign Trade Barriers*, p. 159, issued by the Office of the U.S. Trade Representative

^{iv} Unlike other aircraft parts, TSOA parts are manufactured to design standards promulgated by the FAA. An FAA approval for a TSOA application is still needed because manufacturers have some discretion in the design of some of the specifications of the part.

^v Production Approval Holders do not include manufacturers of aircraft parts who produce them on a “build-to-print” basis specified by another company, such as the holder of an FAA Type Certificate that is producing complete aircraft. Such aircraft parts manufacturers lack FAA approval to offer their parts directly to the public, including airlines and MRO shops.

^{vi} The change in FAA rule has an additional benefit for U.S. manufacturers. Some U.S. customers of aircraft parts request that U.S. suppliers of aircraft parts provide an FAA Form 8130-3 with their shipments, believing that this adds further authenticity to the parts’ airworthiness approval. For such shipments, PAHs no longer need to seek a signature from the FAA or an FAA authorized representative.

^{vii} This and other data regarding the Canadian aerospace market is drawn from the *2014-2015 U.S. Commercial Service Aerospace Resource Guide*

^{viii} Boeing Current Market Outlook 2014-2033

^{ix} *Ibid.*

^x Boeing Current Market Outlook 2015

^{xi} Boeing Current Market Outlook 2014

^{xii} CAAC 2014 Civil Aviation Development Statistics Bulletin

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