

*Selected information about
the Aerospace and Defence
Industry in Mexico
May 2015*



Aerospace Industry in Mexico



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Executive Summary

According to North American Industry Classification System (NAICS), the Aerospace and Defense (A&D) industry is divided into 6 categories:

- Aircraft manufacturing
- Aircraft engine and engine parts manufacturing
- Other aircraft parts and auxiliary equipment manufacturing
- Guided missile and space vehicle manufacturing
- Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing
- Other guided missile and space vehicle parts and auxiliary equipment manufacturing.

Though the A&D industry in Mexico fell behind in the global aerospace attractiveness ranking, it is one of the most important industries in Mexico. In recent 5 years, the Gross Domestic Product (GDP) of the A&D industry grew more than 20% each year and reached around 18,759.8 million MXN in 2014.

With the help of the Free Trade Agreement (FTA) and the geographic location, Mexico is home to most of the global main players in the A&D industry, which brought a total of 3,183.7 million USD to Mexico from 1999 to 2014 and contributed to the surplus of the trade balance of the industry.

In order to fully develop its A&D industry, the Mexican government paid attention to the talent management and established many research centers or institutions to serve the industry and enhance its current situation in the A&D industry.

The value of the A&D industry is expected to grow in the near future. Mexican government has carried out the *Pro-Aeréo 2012 – 2020* to guide the industry, aiming to place Mexico among the top 10 suppliers in the A&D industry worldwide.

This publication provides basic information about the Mexico A&D industry including the trade balance information, Foreign Direct Investment (FDI) information, regulation information, five forces analysis and future forecasts. In addition, the paper also analyzes the impacts that the five megatrends (demographic shifts, shifts in global economic power, accelerating urbanization, climate change and resource scarcity, and technological breakthroughs) have on the industry.

Global Perspective

In 2013, the total revenue of the global A&D industry amounted to 1,167.7 billion USD, representing an increase of 0.8% compared to 2012. Americas was the biggest market, accounting for 49.8% of the global A&D industry value. Asia-Pacific, with a share of 22.8% in value, ranked the second. The most lucrative sector in the industry was the defense sector, equivalent to 66.9% of the market's overall value. ¹

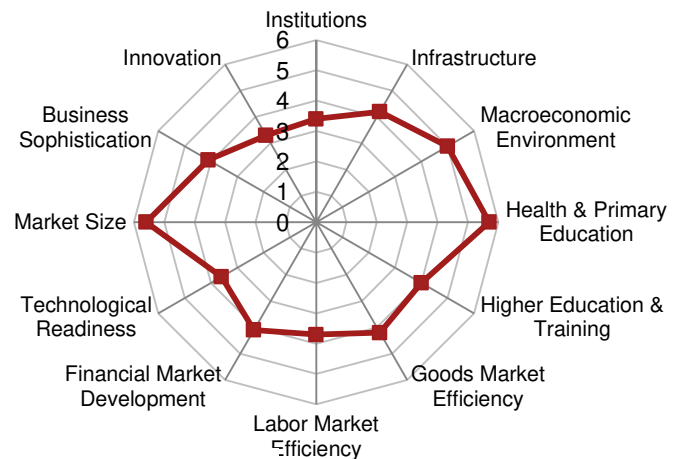
Measured by the top 100 players, the revenue of the global A&D industry grew 4.9% in 2013 to reach 719 billion USD compared to 692 billion USD in 2012. The operating profit of the industry was 66 billion USD in 2013, an increase of 10% from the former year. The continuing surge in the commercial aviation market marked the year 2013 the best year in the industry in terms of both revenue and operating profit. ²

As for the Mexican A&D industry, the total revenue reached 7.1 billion USD in 2013, representing an increase of 9.7% compared to 2012, accounting for around 0.6% of the total global value in the A&D industry. Mexico's A&D was the fourth largest in the Americas, after the US, Canada and Brazil. The civil aerospace segment was the most lucrative segment in Mexico, accounting for 65.1% of the total market value.³

Mexico ranked 61st out of the 144 countries in the global competitiveness index rank, which defines the competitiveness as the set of institutions, policies and factors that determine the level of productivity of a country.⁴

The US ranked the first in the global aerospace manufacturing attractiveness rankings, followed by Singapore and Hong Kong SAR, China. The ranking weighed the variables like cost (taxes, manufacturing wages, productivity), industry size (number of existing suppliers) and infrastructure/ stability/ talent (quality of electrical and transportation infrastructure, regulatory / legal/ corruption rankings and enrollments in, and quality of, engineering programs). Mexico ranked 105 out of the total 142 countries by raw data, with 112th in cost rank, 142nd in industry rank and 80 in the infrastructure/ stability/ talent rank.⁵

Scores of Categories that Contributed for Mexico Competitiveness Index 2014 - 2015



Source: World Economic Forum

¹ MarketLine

² PwC

³ MarketLine

⁴ World Economic Forum

⁵ PwC

Mexican Perspective

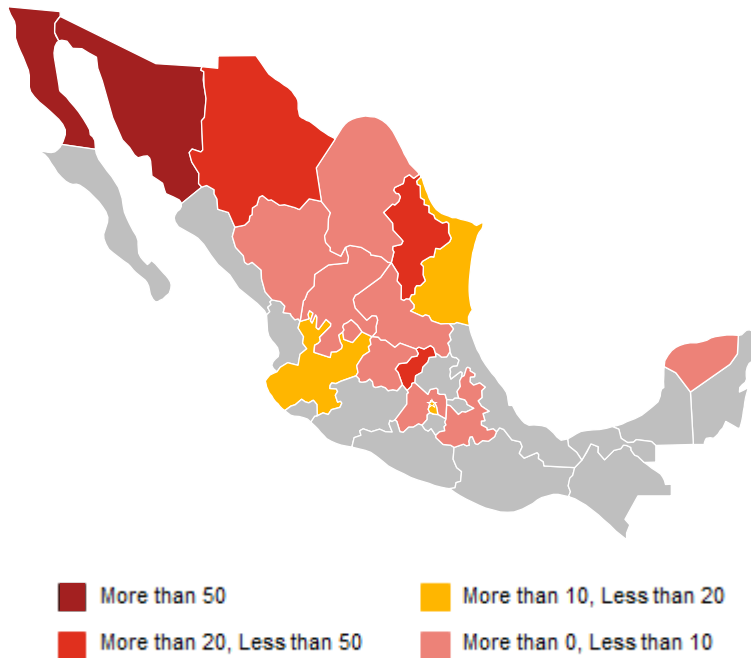
The aerospace industry is getting more and more important in Mexico. From 2010 to 2014, the average Gross Domestic Product (GDP) growth rate of the industry was around 21%, far higher than the GDP growth of the country.⁶

The industry witnessed the groundbreaking technological development the last decade. The comings of glass cockpit avionics, composite materials, lightweight engines and ultra-large airliners have made the aerospace industry more complex together with industrial processes and the supply chain.

The aeronautical international firms in Mexico have also turned around from harness assembly to produce full structural aircraft components, composite airframes and micro-tolerance turbine parts.

Unlike most of the aeronautical manufacturing operations in Mexico which only produce independent aircraft parts and components, there are four platforms which will produce practically the full aircraft airframe, to which, the other systems could be added on to produce a finished product.⁷

Number of Companies in Each States in Mexico's A&D Industry, 2014



Source: MexicoNow

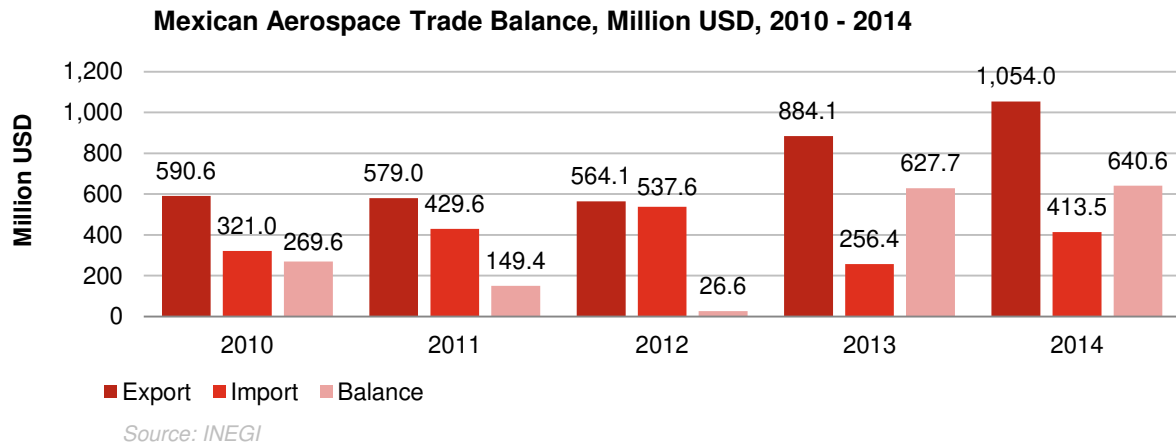
⁶ INEGI

⁷ MexicoNow

Trade Balance

The exportation of Mexican aerospace industry has been increasing from 2010 to 2014, reaching 1,054 million USD in 2014, which also took around 0.3% of the total exportation that year. The importation of the Mexican aerospace industry experienced some variation. In 2014, the importation reached 413 million USD, 0.1% of the total importation.

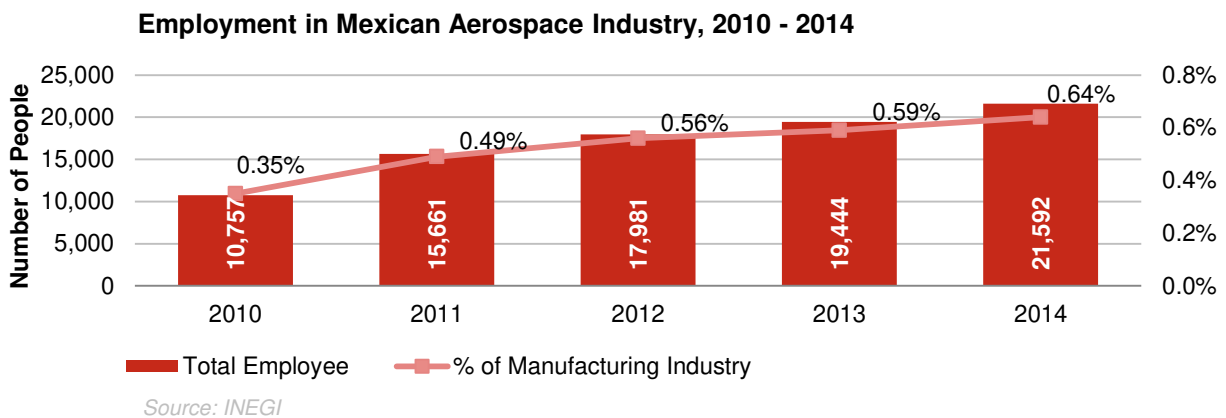
The trade balance was around 640.6 million USD in 2014⁸.



Employment

The number of employees working the Mexican aerospace industry has been increasing from 2010 to 2014. In 2014, there were on average 21,592 people working in the industry, among which there were 17,989 people working as the labor and 3,603 people working as the staff, taking around 0.64% of all the people who work in the manufacturing industry.

In 2014, the total hours worked per month were 4,105.7 thousand hours on average, and the total monthly remuneration paid was 196.2 million MXN on average in the Mexican aerospace industry⁹.



⁸ INEGI

⁹ INEGI

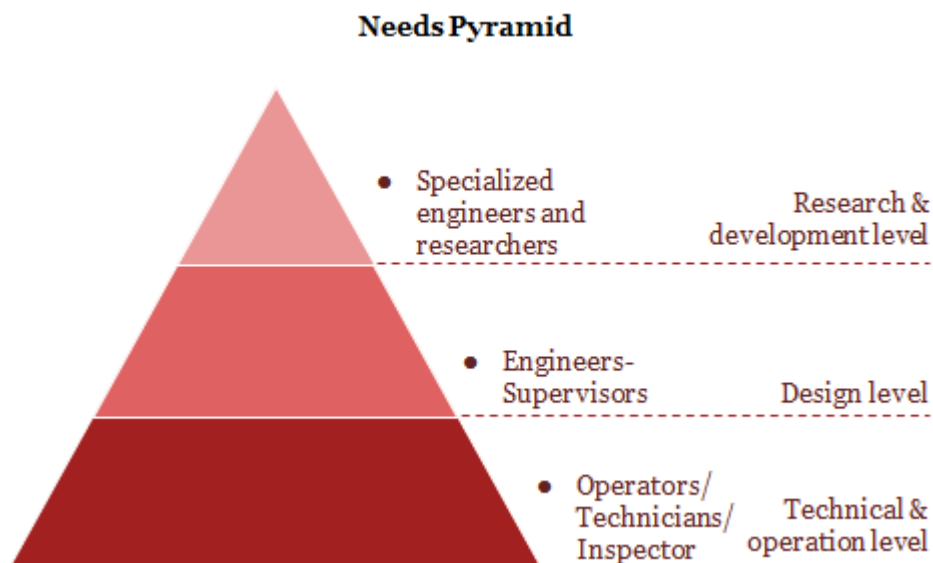
Talent

There is a large network of technological institutions and research centers in Mexico which support the aerospace sectors:

- *Centro de Ingeniería y Desarrollo Industrial (CIDESI)*
- *Centro de Investigación y Desarrollo Tecnológico en Electroquímica, S.C. (CIDETEQ)*
- *Centro Nacional de Metrología (CENAM)*
- *Centro de Tecnología Avanzada (CIATEQ)*
- *Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (CINVESTAV)*
- *Centro de Investigación en Materiales Avanzados (CIMAV)*
- *Etc.*

Those institutions and research centers all have the coverage over the country's main aerospace clusters, expanding technology and testing spaces that provide technical services, infrastructure, equipment technology and technical and administrative support. The aerospace clusters also form their own organizations to coordinate between industry and higher education and research institutions.

The schools and universities have been offering the programs to educate the technicians and engineers since 1937. These education programs cover core courses, high school, technical degrees, higher technical university, professional licenses, engineering degrees and some master programs¹⁰.



Source: National Flight Plan

¹⁰ National Flight Plan

Foreign Direct Investment (FDI)

From 1999 to 2014, there were 3,183.7 million USD investments in the Mexican aerospace industry, which was 0.8% of the total FDI flow into Mexico.

The United States was the country with the most FDI in the Mexican aerospace industry. It invested 816.8 million USD from 1999 to 2014 and there were 52 US companies working in the industry in Mexico. The second country with the most FDI was Canada with 791.3 million USD and 6 companies¹¹.

Information of Main Countries with FDI into the Mexican Aerospace Industry, 1999-2014

Rank	Origin Countries	FDIs (Million USD)	Participation %	Number of Companies
1	USA	816.8	41.5%	52
2	Canada	791.3	40.2%	6
3	Spain	105.5	5.4%	14
4	Luxemburg	85.4	4.3%	3
5	France	84.7	4.3%	7
	Total	1,883.7	95.7%	82

Source: Secretaría de Economía

As for the states, *Querétaro* received 48.4% of the total FDIs in the industry, followed by *Baja California* receiving 12.5% and *Chihuahua* receiving 11.2%.

Manufacture of civil aircraft and business took around 54% of all the FDI in the aerospace industry in Mexico, followed by the manufacture of other components aerospace.

Regulation

Controlling Institutions

Several institutions in Mexico are regulating, promoting and establishing the aerospace industry to a higher level:

- The *Federación Mexicana de la Industria Aeroespacial* (FEMIA)
- The *Dirección General de Aeronáutica Civil* (DGCA)
- The Mexican Council of Aerospace Education (COMEAE)
- The *Agencia Espacial Mexicana* (AEM)

¹¹ Secretaría de Economía

Industry Competitiveness

Free Trade Agreement (FTA)

Mexico has one of the most extensive free trade networks in the world, boasting treaties with 45 countries.

This privileged position can partly be credited to geography –the fact that Mexico has a common border with the US, one of the largest markets in the world, is indubitably a plus for foreign investors– yet an attractive domestic market and readily available material, human and infrastructure resources are also relevant factors.

In terms of regional trade negotiations, the signing of the North American Free Trade Agreement (NAFTA) was a turning point for Mexico¹².

Bilateral Air Safety Agreement (BASA)

The BASA is another very important agreement for the Mexico's aerospace industry.

It allows the *Dirección General de Aeronáutica Civil* (DGAC) to certify parts, components, aviation systems and even a full aircraft which is manufactured and/ or assembled in Mexico and exported to the US or other markets according to the relevant regulations.¹³

The benefits of BASA include:¹⁴

- The growth of the industry and the creation of jobs.
- Enhancement of the air transport safety between the U.S. and Mexico.
- Reduction of regulatory burdens for airlines and aviation authorities of both countries.
- Elimination of a step in the supply-chain since products no longer have to be inspected international before being shipped off the assembly companies.
- Cost reduction for both the governments and the manufacturers.

Currently, the Implementation Procedures for Airworthiness (IPA) are in force while the signing of the chapter on Maintenance Implementation Procedures (MRO) is still in process. ¹⁵

¹² FEMIA

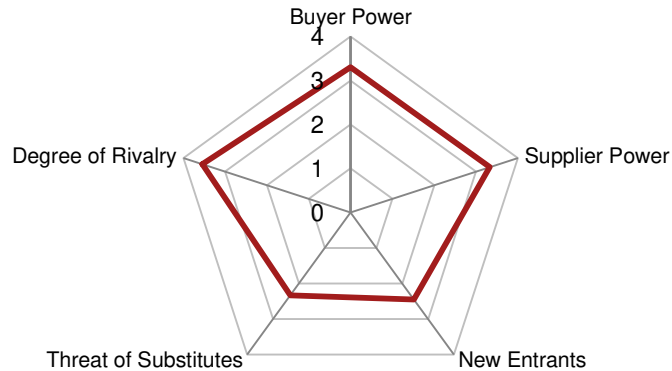
¹³ National Flight Plan

¹⁴ PwC

¹⁵ National Flight Plan

Five Forces

Forces Driving Competition in the A&D Sector in Mexico, 2013



Source: MarketLine

The players in the A&D industry are defined as manufacturers of aerospace and defense equipment, products and systems. Government organizations, militaries, airline companies, and space programs such as NASA are the buyers. The entities providing raw materials and parts for manufacture are the key suppliers.

Buyer Power: Several companies dominated the commercial aircraft sector though some countries favor local incumbents, which limited the buyers' choice. However, the government organizations or large multinational companies, who are the main buyers of the defense segment, have considerable financial muscle. Overall, buyer power is moderate.

Supplier Power: In addition to the A&D industry, the suppliers usually provide their products to other industries like automotive, which reduces their dependence on the A&D industry. However, the players can also choose from a large number of suppliers. Overall, supplier power is moderate.

New Entrants: Though existing companies have very strong brands, large capital reserves are needed and the regulation is strict, the strong historical growth in the market will attract the potential new entrants. In addition, Mexico's position and low labor costs make it an appealing area to establish a manufacturing base to export into the US. Overall, the threat of new entrants is weak.

Threat of Substitutes: There are no real substitutes in the defense segment while there are alternatives to commercial aircraft. Given the convenience of faster delivery provided by air transportation, but with increasing concerns about global warming, it is possible that alternative transport modes may be attractive. Overall, the threat of substitutes is weak.

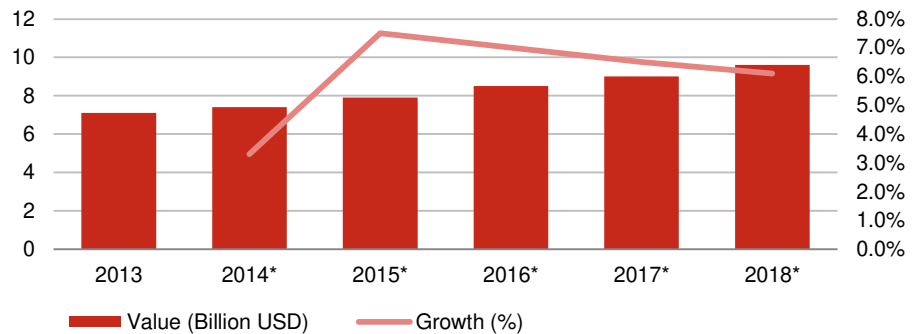
Degree of Rivalry: large companies dominate the A&D industry. The Mexico defense budget is used to acquire light weapons and ammunition rather than to develop their domestic defense industrial base, which may make it difficult for players producing heavier equipment to thrive. Overall, the rivalry is strong¹⁶.

¹⁶ MarketLine

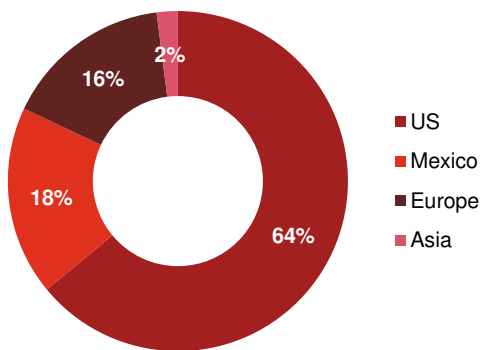
Industry Forecast

The growth of the market is expected to decelerate to a CAGR of 6.1% between 2013 and 2018. The total market value is forecasted to reach 9.6 billion USD in 2018, an increase of 35.2% compared to 2013.¹⁷

Mexico A&D Industry Value Forecast, 2013 - 2018



Aerospace Companies in Mexico, by Origin, 2020



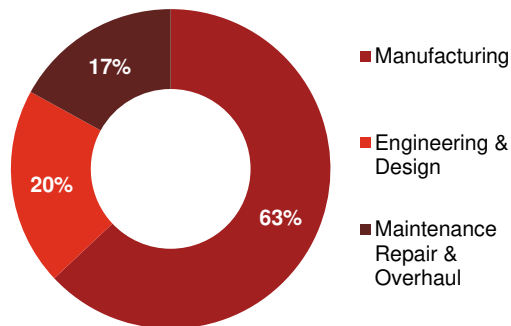
Source: MexicoNow

In 2013, there were around 300 companies working in the A&D industry and US companies represented around 80%. By 2020, it is expected that there were around 420 companies and US companies will represent around 64%.

Companies from Europe and Mexico will erode the share of the US companies. Domestic firms, which used to have quality, volume and financial constraints, have evolved. By 2020, it is estimated that there will be about 75 companies of Mexican origin in the country's aerospace industry.¹⁸

In 2014, 70% of the companies working in the A&D industry were manufacturing companies. By 2020, it is expected that the stronger growth of the Maintenance repair & overhaul and engineering & design firms will leave 63% of the share to manufacturing firms.¹⁹

Aerospace Companies in Mexico by Type, 2020



Source: MexicoNow

¹⁷ MarketLine

¹⁸ MexicoNow

¹⁹ MexicoNow

ProAéreo 2012 - 2020

ProAéreo 2012 – 2020, also known as the national strategic program, is a program to place Mexico among the top 10 countries in the world in the aerospace production.

Its key strategies include:

1. Promotion and development of internal and external market, defining niches and creating the instruments to support a continuous growth.
2. Strengthening and development of the aerospace industry capabilities with a linked Supply Chain, as well as development of local suppliers and encouragement of cluster development throughout Mexico.
3. Development of the necessary human resources, with well-defined technical and training programs and education-industry links.
4. Development of the necessary technology including specialized clusters, new areas and technology, R&D labs and development of new materials.
5. Development of the public-private programs required to assist the growth of the industry, with an institutional frame, Governmental leadership, incentives and financing, international covenants and including infrastructure, certifications required by the industry, logistics and technical centers.

There are some milestones that are planned to be reached:

- Establishment of a formal coordination and administrative-management mechanism between industry and government.
- Manufacturing participation in international programs to access new technologies and markets.
- Establishment and implementation of “Offsets” compensation systems to benefit corporations established in the country.
- Creation of specific support and incentive programs for the aerospace industry.
- An access to a specific financial line for the aerospace industry.
- The opening of a Proof Testing Aerospace Lab to service the industry.
- Design, development, assembling and manufacturing of an engine module.
- Assemble support of the first series airplane with 50% local content.
- Positioning of Mexico as the first aerospace service HUB in Latin America²⁰.

Goals to 2020

Be within
10th
Largest
suppliers in
the industry

Reach over
12
Billion USD
in exports a
year






Have over
110
Thousand
workers in the
industry

Reach
50%
Of local content
in raw materials
and production
in the industry

²⁰ FEMIA

Megatrends

PwC has identified five megatrends (demographic shifts, shifts in global economic power, accelerating urbanization, climate change and resource scarcity, and technological breakthroughs) that will impact the future of both PwC and its clients from different industries, including the aerospace industry over the next decade.

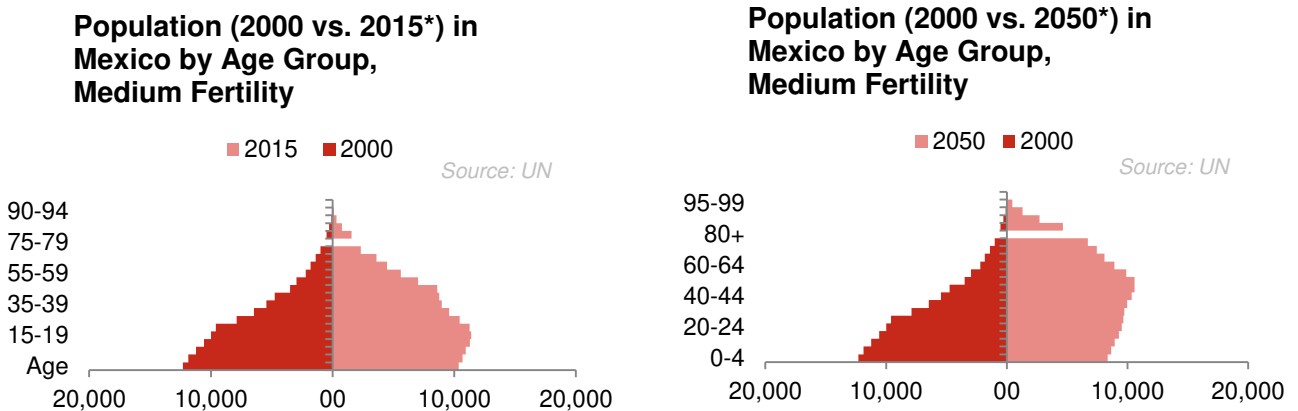
Trend	Underlying Trend	Implications
 Demographic Shifts	Talent loss	Knowledge management and transfer
 Accelerating Urbanization	More infrastructure	Growth in commercial aerospace
 Climate Change and Resource Scarcity	Create a sustainable aviation	New designs
 Technology Breakthroughs	Digitization of aircraft	Data analytics Cyber security Materials evolvement
 Economic Power Shift	Shift in markets	Competition Globalization

Demographic Shifts

There are two major demographic shifts:²¹

1. The percentage of people aged 60 or more is expected to increase from 8% to 21% by 2050.
2. The rate of population growth is expected to slow down.

In 2010, the number of Mexicans aged 55 and older was 10,273 thousand (10% of total population); by 2015, it is projected to reach 25,862 thousands (19% of total population) while by 2050, 50,367 thousands (32%). The growth pattern reflects the global demographic outlook: in 2000, an estimated 818,924 (13%) were in the old age group (55+); in 2015, 1,233,607 thousands (17%); in 2050, 2,562,877 thousands (27%).²²



Thus, the steady loss of experienced senior personnel and the need to attract skilled talent have become the two significant challenges the A&D industry is facing.

Taking the US as an example, the hiring in defense and national security is expected to increase from 61% in 2012 to 86% by 2016 while only 44,000 of the 70,000 engineers that graduate each year are qualified to work in the aerospace sector. Europe faces the similar situation with only about 10,000 graduates choosing to work in the A&D industry every year when the need is at least 12,500 annually. It means the competition for skilled labor force will become more and more intense in the A&D industry.

How to manage and transfer the knowledge of the retired employees is another challenge in the A&D industry. Companies are carrying out the mentoring programs and training sessions to retain key knowledge and skills. Recruiting partnerships with universities and cross-functional collaborations are also designed to attract top talent.²³

²¹ PwC

²² UN

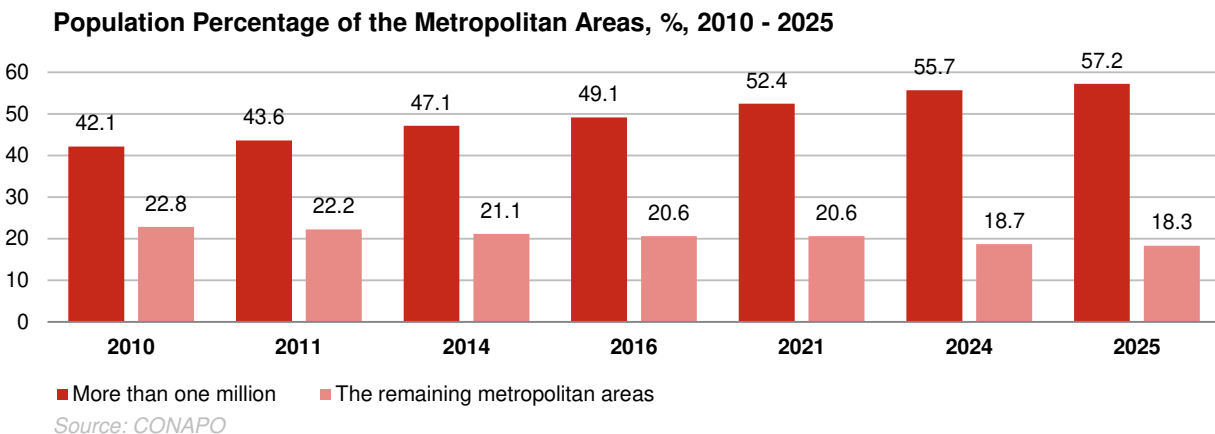
²³ PwC

Accelerating Urbanization

The number of people who live in the urban areas is projected to reach 72% of the total population by 2050 around the world.²⁴

Data identified that in 2010, almost 50% of Mexican urban population lived in cities with more than 1 million of inhabitants, higher than the global average (approximately 40%).²⁵ During the period of 1990 and 2025, some states are expected a significant growth in terms of urban and total population, such as Chiapas, Vera Cruz, Puebla, Estado de México, Michoacán, Guanajuato and Jalisco.²⁶

The percentage of population living in the metropolitan areas is set to increase continuously until the end of 2025. The metropolitan areas will accommodate 57.2% of total country's population in 2025. The remaining metropolitan areas will see a slight decline in the percentage of population, from 22.8% in 2010 to 18.3% in 2025. However, the total number of metropolitan areas is going to rise.²⁷



With the urbanization, more infrastructures, including airports and upgraded air traffic systems are needed to keep pace with the demand.

In 2013, Mexico's president, *Enrique Peña Nieto*, unveiled the “*Transport and Communications Infrastructure Investment Program 2013-2018*” that planned to invest 4 trillion MXN in the nation's infrastructure over the six-year period.²⁸ For the same period of time, *Colegio de Ingenieros Civiles de México* defined a portfolio of 1,138 strategic projects in infrastructure. 69 projects were identified to increase logistical competitiveness, with transport infrastructure having 24 projects.²⁹

In 2013, 1,274 large commercial aircraft were delivered by the global A&D industry globally, a more than 25% increase in just two years. In the long term, the demand can reach around 1,700 aircraft annually, which means the annual production rate will continue to grow by another 40% globally.³⁰

²⁴ PwC

²⁵ UN

²⁶ UNAM

²⁷ CONAPO

²⁸ Presidencia de la Republica

²⁹ IMEF

³⁰ PwC

Climate Change and Resource Scarcity

It is expected that the total population of the world will reach 8.3 billion which means the world will need 50% more energy, 40% more clean water and 35% more food. ³¹

The main pollutions from the aircrafts are:³²

1. Greenhouse gases
2. Acid rain, eutrophication and smog precursors
3. Dust and particles
4. Ozone depleting substances
5. Volatile organic compounds
6. Metal emissions to air

The international aviation consumed around 142 million metric tonnes of fuel, which result in an estimated 448 million metric tonnes of Carbon Dioxide (CO₂) emissions in 2010. The fuel consumption is projected to increase by between 2.8 and 3.9 times the 2010 value by 2040 and between 4 to 6 times the 2010 value by 2050. The increase of fuel consumption will certainly lead to an increase of CO₂ emissions.³³

One of the potential negative effects on the climate with the large emission of the CO₂ will be the increase of the temperature.

Mexico is vulnerable to the impacts of climate change on many fronts with 68% of the Mexican population and 71% of GDP are strongly exposed to climate change risk.³⁴

In 2080, the temperature in the north part of Mexico is projected to increase up to 4.8°C, while that in the southern part of the country could rise up to 2.8°C.³⁵

The ways to reduce the noise and the air pollutions include the leveraging the technologies such as the alternative fuels, hybrid engines and new model of airplanes.

Aerospace companies are providing solutions, such as retrofitting existing aircraft wings with winglets which can reduce drag and improve fuel efficiency, to improve the carbon profile of existing aircrafts.

A lifecycle management approach in the development of energy efficient aircraft and engines is being used by many aerospace companies.³⁶

Mexican projected temperature increase, 2020-2080

Period	North Mexico	South Mexico
2020	1.3 ±0.8 °C	0.5 ±0.5 °C
2050	2.3 ±1.0 °C	1.3 ±0.3 °C
2080	3.5 ±1.3 °C	2.5 ±0.3 °C

Source: Ministry of Environmental and Natural Resources, 2012

³¹ PwC

³² Global Reporting

³³ ICAO

³⁴ OECD

³⁵ SEMARNAT

³⁶ PwC

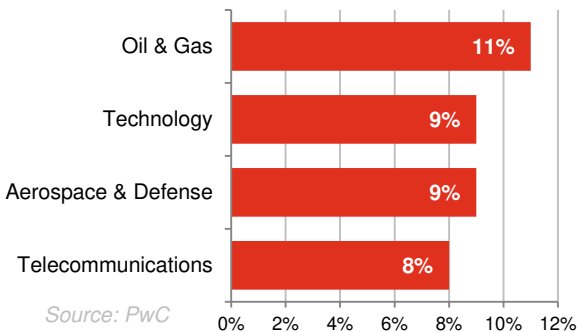
Technology Breakthrough

With the development of technology, the opportunities for more remote monitoring of aircraft performance and data analytics are created. Big data can not only used on human being, but also used on the aircrafts to predict their maintenance and digitalize them. New materials are developed to make plans lighter and more fuel-efficient. Alternative fuel is discovered to reduce the green gas emission from the flights.

However, with more great possibilities, more potential threats come.

With interconnected and ubiquitous Information Technology (IT) systems driving every phase of the A&D industry, cyber security has become one of the top concerns. The reliance on joint ventures, partnerships and manufacturing and Research & Development (R&D) facilities in expanding markets have opened new access for invaders, which adds more challenges to keep corporate IT system secure.

Frequency of Global Nation-State Incidents in the Industry, %, 2015



In 2015, the respondents from the A&D industry reported a 97% increase in hard Intellectual Property (IP) theft and a 66% increase in soft IP compromise, which are far higher than any other sector.



Government and companies should work together to fight with the cybercrimes and keep the important information.

- Government should establish baseline security minimums for companies which deal with the government information or provide components to the government.
- The executive order beyond the current administration and participation in voluntary information-sharing with the federal government should be sustained by legislation.
- Companies must develop their own cyber security programs and enhance their capabilities to detect and prevent the cybercrimes under the direction of law³⁷.

Economic Power Shift

Projected ranking of E7 and G7 economies based on GDP in PPP terms, in billions USD, 2011 and 2030

Country	PPP 2011 Rank	Country	PPP 2030 Rank	Projected GDP in PPP (constant USD billions)
US	1	China	1	30,634
China	2	US	2	23,376
India	3	India	3	13,716
Japan	4	Japan	4	5,842
Germany	5	Russia	5	5,308
Russia	6	Brazil	6	4,685
Brazil	7	Germany	7	4,118
France	8	Mexico	8	3,662
UK	9	UK	9	3,499
Italy	10	France	10	3,427
Mexico	11	Indonesia	11	2,912

Source: PwC

The seven largest emerging market economies, which are collectively referred to as the “E7” (China, India, Brazil, Russia, Indonesia, Mexico and Turkey) could overtake the “G7” countries US, Japan, Germany, United Kingdom (UK), France, Italy and Canada) as early as 2017 in Purchasing Power Parity (PPP) terms. Mexico will move from 11th place in 2011 to the 8th place in 2030, with a projected GDP of 3,662 billion USD.

The growth of the global economy powers the booming growth of the commercial aviation, which experiences

its largest and longest expansion in history. The global market for new aircraft is expected to be more than 35,000 and 4 trillion USD over the next 20 years, with Asia-Pacific to take delivery of nearly as many aircraft as North America and Europe combined.

The shift of the economic power also brings challenges to the A&D industry.

- **Competition:** Companies in the emerging market, like companies from China and Russia, are attracted by the growth in the A&D industry and lure of high technology. The competition in the narrow-body market is among the regional jet makers who want to increase the size and range of their jets.
- **Globalization:** The A&D industry also shifts to the international market to increase intimacy with customers and suppliers, improve responsiveness and service and leverage international talent or low costs.

The economic shifts not only let the emerging countries increase the demand but also let them aspire to build aerospace industries. Survey with 139 A&D companies showed that only 26 of them are both operationally and financially ready for the demand in customer growth regions and 20 of the 26 companies were indigenous to the emerging markets. Manufacturers from the developed countries need to move from an export-oriented business model to a global business model and to localize the production and procurement³⁸.

³⁸ PwC

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Knowledge Center Mexico

Knowledge Center Mexico acts as a knowledge, innovation and best practices provider to PwC practitioners. This enables the practitioners to successfully identify new service offerings, approach the market and complete projects.

The expert staff of Knowledge Center designs innovative solutions for PwC partners and managers. The Knowledge Center delivers knowledge and experience through:



Provide consulting and training in the use of various knowledge management tools.



Research and information searches, based on the information needs of PwC staff & partners.



Participating in the strategy design, related to global Knowledge Management & Innovation Management.

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