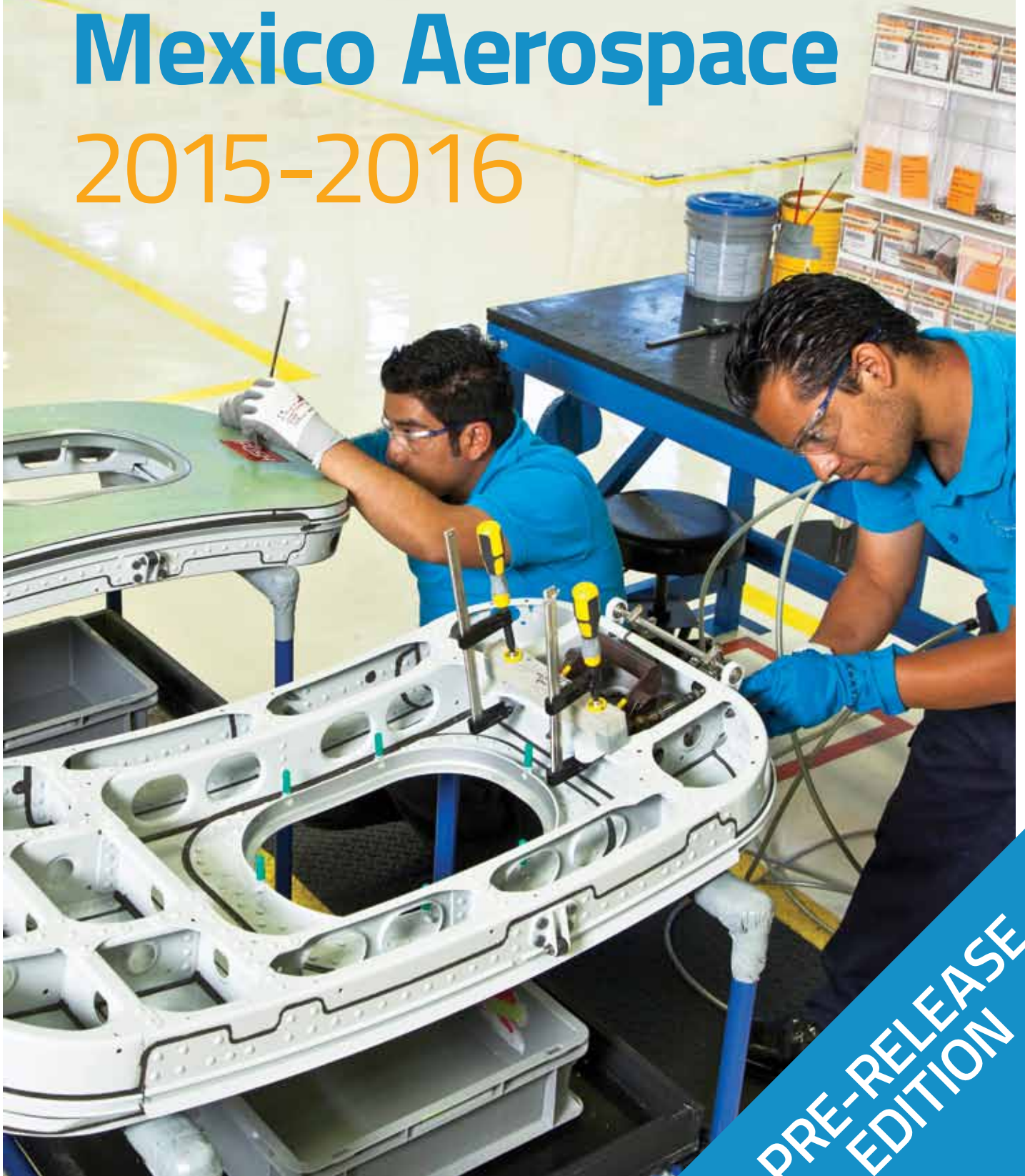


GBR

GLOBAL BUSINESS REPORTS

Mexico Aerospace

2015-2016



PRE-RELEASE
EDITION

PRO MÉXICO SUPPORT AND SERVICES CATALOGUE



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Synergy through Diversity

Exploring Mexico's five aerospace clusters

In the past decade, there has been more aerospace-related foreign direct investment in Mexico than in any other country in the world. According to Fernando González Díaz, CEO of ProMéxico, “the sustained growth of the Mexican aerospace industry is the result of coordinated industry, academia and government jobs.” The continued development of the aerospace sector in Mexico has given rise to five distinct clusters: Querétaro, Baja California, Sonora, Chihuahua and Nuevo León. We began our research in August 2015, and, when we conclude it in the 2016, we will have conducted in-depth research throughout all five of these states.

This pre-release report will cover our research in Querétaro and our initial findings in Baja California. Baja California's aerospace cluster began fifty years; today, it is the largest and most established aerospace cluster in Mexico. Its 80-plus aerospace companies are spread between the clusters of Tijuana and Mexicali and the cities of Ensenada and Tecate. The state is home to companies like Honeywell, UTC, GKN, and Eaton, and has a clear focus on electrical and electronic, engine parts, assembly of interior and seats, control and navigation instruments, engineering and design.

Querétaro's aerospace sector, on the other hand, emerged much more recently, in 2006 with the arrival of Bombardier. Today, the two other major players in the state are Airbus Helicopters and SAFRAN Group. The state's 40-plus companies also include a few international tier-one and tier-two companies, which are all centered around the state's capital, Santiago de Querétaro. The state is developing its specialties in parts for fuselage, landing gear, cables, harnesses and precision machining, and the joint venture between AeroMéxico and Delta Airlines led to the inauguration in 2014 of TechOps maintenance, repair and overhaul (MRO)—Latin America's largest MRO. The opening of the Aerospace University in Querétaro (UNAQ) further burnishes Querétaro's reputation of the strongest emerging cluster in Mexico.

The central focus of our research across Mexico's five aerospace clusters will be on the development of the supply chain. In Baja California, the industry has reached a point where there are too few suppliers to absorb continued growth and, as such, the state is facing the problem of an inverted pyramid. The Tijuana and Mexicali clusters in Baja California are focused on developing providers of special processes such as heat-treatment and non-destructive testing, for which contractors still look abroad. In Querétaro, there is a lack of machine shops and access to raw materials. We will seek to describe how the industry is overcoming the challenges of building a sustainable local supply chain, most notably certification, the lack of qualified skilled labor, and access to capital funding.

We would especially like to thank our partners, ProMéxico and FEMIA, for their continued support and show our gratitude to the Governments of Querétaro and Baja California for their assistance throughout our project. We look forward to completing our chapter on Baja California and to continuing our research in Sonora, Chihuahua and Nuevo León. The final report will be launched at the Farnborough Airshow in July 2016.

Gabrielle Morin,
Senior Project Director

James Hogan,
Journalist

Ty Jeevaratnam,
Project Coordinator



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Francisco N. González Díaz

CEO, ProMéxico



"The sustained growth of the Mexican aerospace industry is the result of the coordination of industry, academia, and government."

Can you provide a brief overview of ProMéxico's role in the promotion of the Mexican aerospace industry?

The sustained growth of the Mexican aerospace industry is the result of the coordination of industry, academia, and government. This triple helix has built a collective vision of the future of this sector, establishing multiple actions to develop and promote their competitiveness. From this vision, ProMéxico, in coordination with key industry players, created and orchestrated in 2010 a comprehensive plan called National Plan of Flight (PVN), which has been the basis for developing the national strategy of Mexican aerospace (ProAero). The PVN is the point of reflection and assessment that refines the strategy defined in the previous years, considering the developments and evaluating results for its tactical and operational implementation. Now in its fifth version, the PVN presents the result of projects and lines of action proposed since its inception, including a prospective analysis of global trends in aerospace and defense, with particular emphasis on the implications for Mexico. The results collected in this publication have materialized from the proposals of the first versions of the PVN. As may be noted, it has been shown how various actors can coordinate the Mexican aerospace industry in order to trigger their growth and increase their added value.

This year we celebrated together the first Mexican Aerospace Fair, which was attended by 190 companies from 11 different countries. The success of this first edition confirms the strength of the Mexican aerospace sector around the globe. Our country reaches higher altitudes every day. Proof of this are the results obtained in the last years in the aerospace sector and its growing success.

Can you talk about some of the main qualities Mexico offers today to encourage international investment into the aerospace industry?

Mexico is a country that is flying high in the aerospace industry. This is possible thanks to our experience in high-tech sectors, our proximity to the United States—the most important market in the world—our infrastructure and major transport and logistics networks, having joined the Wassenaar Arrangement and, above all, our talent and human capital. These competitive advantages have enabled the operations of major aerospace companies in Mexico. Some relevant figures demonstrate our success: at the beginning of the 21st century, our aerospace exports were almost zero. In 2014 we exported over 6.3 billion dollars. Another fact illustrates our growth: in 2005 there were 61 aerospace companies established in Mexico. Today, more than 300 companies and agencies make up the sector.

Mexico's aerospace industry has grown 17.2% annually for the past nine years. Can you talk about some of the key drivers for his growth?

Major international companies like Bombardier, Safran Group, GE, Honeywell and Eurocopter have found in Mexico the conditions to develop design and engineering centers, laboratories and production lines capable of evolving quickly to handle more complex assignments in the race for next generation engines and airframe components. This has been possible due to the wealth and availability of specialized human capital. Mexico is the most important talent pool in America, with more than 100,000 graduates per year from engineering and technology courses. In addition to new graduates, Mexico has highly qualified personnel with decades of experience in the automotive, electronics, medical devices and advanced manufacturing-related industries. The overall quality of infrastructure has also played a major role in creating favorable conditions with the availability of laboratories, certification units and the presence of Mexican civil aviation authorities. This facilitated the signing of the Bilateral Aviation Safety Agreement with the United States Federal Aviation Administration. The agreement involves the recognition by the United States government of aeronautical certification systems and products made in Mexico. This allows components to be designed and manufactured in the country and encourages the development and strengthening of national procurement for the parts manufacturing industry.

What initiatives does ProMéxico have to accelerate the country's ascent in the production ladder?

In order to support the development of the industry and to encourage innovation and the value-added activities, ProMéxico is supporting this industry in two strategic areas: developing exports and attracting foreign direct investment. In order to promote exports, ProMéxico organizes Mexican Pavilions every year at the major international trade shows, buyer missions, business encounters, and other events. This year, a Mexican Pavilion was installed at the International Paris Air Show at the Paris-Le Bourget Airport, with a significant number of Mexican companies. ProMéxico held a seminar on issues of foreign investment with FEMIA at the first edition of the Aerospace Fair Mexico 2015, organized recently by the Mexican Air Force (FAM). Moreover, at the initiative of Boeing, a seminar was organized under the First Forum of International Procurement that this aeronautical company held in Mexico.

Luis Lizcano

General Director, Mexican Federation of Aerospace Industries, A.C. (FEMIA)



"FEMIA is very optimistic about the future, but we are aware of some of the challenges."

Can you introduce FEMIA by providing a brief history of the association?

There has been a constant growth within the aerospace industry in Mexico. From 2004 to 2014, we have been growing at an average rate of 17% per year. This growth necessitated the emergence of some kind of association of aerospace companies. In 2007, FEMIA was established under that premise, and currently includes around 90 member companies.

Can you describe the organizational structure FEMIA and discuss some of the principle needs of the industry that it seeks to address?

Comprised by a very small staff that supports a board, we work under the following four pillars: competitiveness (supply chain development), human capital development (working together with industry and academic institutions to pursue new skilled human capital), institutional relations (interact with agencies, various levels of government in Mexico, and different clusters and organizations like FEMIA globally to share and develop relationships), and promotion (we have a group that is in charge of promoting the aerospace sector in Mexico and internationally).

Can you talk about the efforts that FEMIA are making to grow the local network of small and medium-sized enterprises (SMEs) supporting the aerospace industry and ensuring that corporations have access to the supplies they need?

FEMIA is currently developing and monitoring a system, which takes an inventory of the companies in the sector as well as the kinds of skills and capabilities that they possess, and matching them with the requirements of other companies.

The aerospace industry in Mexico resembles an inverted pyramid, in that there are many original equipment manufacturers but a shortage of local suppliers. What is causing this and what is the solution?

This inverted pyramid is not a long-term trend but a snapshot of the current landscape of aerospace in Mexico. The development of a supply chain is an ongoing process, and the aerospace sector in Mexico is fairly young. We have some very important companies that are in Mexico and we recognize the need to develop the rest of the supply chain pyramid adequately –but this is all part of a process, within which we are trying to accelerate this progression through developing the companies who have the proper skills to then grow the supply chain. And where technologies that are not available in Mexico are required we then invite companies to operate in Mexico to supply the North American market.

How does FEMIA link academia to industry?

We serve as the linkage point between academia and some companies, by actively working to fill the gaps in academia identified by companies' requirements. For example we have a close relationship with the Mexican Aerospace Education Council, which is an organization that groups some of the major educational institutions. Furthermore, we recognize that this is one of the most important factors for the future of the industry in Mexico.

Companies have identified a lack of skilled labor. Has this also been identified by FEMIA?

This is another example of the process that Mexico is undergoing. To curtail this issue, we are promoting technical level educational institutions in the areas which industry has identified as lacking.

What are some of the areas for lobbying that FEMIA is involved?

We are working with the Ministry of Economy in Mexico and ProMéxico to jointly promote Mexico's aerospace industry. We are promoting as one entity so we might coordinate all of our efforts together to employ a more efficient and clear message. Another example is the Mexican Aerospace Show that we work jointly with Mexico's Air Force in order to promote and organize, in which 250 exhibitors participated in the first year and for the 2017 show expect close to 500 exhibitors.

What is FEMIA's strategy for achieving its goal of 400 foreign companies in Mexico and what are some of the potential challenges?

FEMIA is very optimistic about the future, but we are aware of some of the challenges we might encounter. The first one is to consolidate the integration of the supply chain as we see this as only a Mexican aerospace industry market and would like to consolidate the supply chain as a platform for North America. The second challenge is to fulfill the human capital requirements with the growth of the aerospace industry, which is why we work closely with academic institutions.

Do you have a final message for the international aerospace community?

The first message is to Mexican companies who are looking to participate within the industry, and that is to engage in their due diligence and learn about the industry in order to understand what is necessary for them to achieve this goal. To the international community, we want them to get to know Mexico beyond the headlines. Mexico has much to offer to foreign companies that can benefit the growth of the aerospace industry in Mexico.

The Emerging Aerocluster

Querétaro leverages its anchor OEMs to build a sustainable supply chain

The State of Querétaro is flush with competitive advantages that are helping it to grow its aerospace cluster. Its proximity to Mexico City and major ports serving both Europe and Asia makes it favorable to foreign investors. The state also has solid infrastructure of roads and industrial parks. The modern, well-designed airport is another attractive asset for aerospace companies. The region is also one of the safest in Mexico. Querétaro has a population of 2 million people, but has the potential to attract 45 million from a radius of 350 kilometers. Finally, Querétaro has a rich background in automotive manufacturing, which has laid the framework for the aerospace industry to flourish.

Through promoting these strengths abroad, the Secretariat for Industrial Development of Querétaro has attracted foreign investment that has been crucial in the development of the state's aerospace sector. This remains a key strategy of the government.

As the strongest emerging aerospace cluster, the focus in Querétaro has now turned to developing a local supplier base. Secretary Marco Antonio del Prete Tercero said: "the only challenge that lies ahead for potential companies wanting to break into the global supply chain is a matter of financing." ProMéxico has pinpointed Querétaro's specializations as being in parts for fuselage, landing gear, cables, harnesses, precision machining, and maintenance, repair, and overhaul (MRO), which are being attended to by the state's 40-plus companies.

Though ITP has been operating MRO services in Querétaro since the 1980s, Querétaro's aerospace industry boom began with the arrival of Bombardier in 2006. This globally recognized original equipment manufacturer (OEM) uses its Querétaro facility to manufacture aerostructures for its family of business jets and for its harnesses and electrical components. Bombardier has been labeled an anchor company and part of

its strategy has been "to attract other companies in the aerospace industry to set up manufacturing capacity in Mexico." Some of Bombardier's suppliers that have come to Mexico after the company's arrival are A.E. Petsche, PCC Aerostructures and Aernnova.

Beyond attracting foreign suppliers, Bombardier has created a team dedicated to developing a local supply base, whereas Airbus Helicopters, which established a manufacturing presence in Querétaro in 2013, has adopted a vertically integrated business model. Airbus Helicopters claims that what is lacking is a consolidated network of tier-two and tier-three companies supporting the OEMs and tier-one companies. Another player, SAFRAN Group, has two main companies in Querétaro, Snecma and Messiers-Bugatti-Dowty, which focus on engines and landing gear, respectively. Daniel Parfait, country delegate for SAFRAN Group also cites the benefits of Querétaro's "strong, skilled labor force." The company is now dedicated to growing its base of suppliers and has developed a tool called the Franco-Mexican strategic counsel, which is directing funds to the development of a local supply chain.

The joint venture between AeroMéxico and Delta Airlines led to the establishment of TechOps, the largest MRO company in Latin America. TechOps moved to Querétaro in 2013, but has identified a gap in the local supply chain in plating services. TechOps is now in the process of reaching out to local suppliers of metals, but first needs to ensure that these companies have the necessary certification.

For local companies wanting to enter the aerospace sector, another major challenge is obtaining certification. For small and medium-sized enterprises (SMEs) to receive the AS9100 certification, they not only need funding, but also guidance. TechFab, a Québec-headquartered machining company, has also identified the

need for SMEs in Querétaro's aerospace industry. It hopes to grow the network of local suppliers by sharing its knowledge and expertise.

Due to Querétaro's history in the automotive industry, most SMEs are geared towards a low-mix, high-volume business. Expanding to encompass the high-mix, low-volume of the aerospace industry is somewhat unrealistic. RYMSA, a family-owned Mexican company that offers machining services, has its core competency in oil and gas, which faces similar dynamics as aerospace. The challenge facing RYMSA is to find certified secondary processes such as heat treatment and coating, and it is looking to consolidate this aspect of its supply chain. Aeroprocess TTT, part of the Spanish Grupo TTT, has identified these growing needs in Querétaro and recently began offering heat treatment services. Meanwhile, companies throughout the supply chain are still sourcing raw materials from overseas, as Querétaro has no certified distributors. Alex Slouka, CEO of Omni-X MX, a tooling company that provides bending services, said: "the establishment of a distribution center for raw materials in the area would mean that Omni-X would be able to offer a much more value-added product to our customers."

The inauguration of the Aeronautical University of Querétaro (UNAQ) in 2007 means that companies in the area have access to talent that has been trained solely for the purpose of serving the aerospace sector. Initially established to support Bombardier's harness assembly, today the university provides bachelors and masters degrees, Ph.D.s, and the technical training required for personnel working on aerospace factory floors. Beyond supplying human capital, the university also takes on board projects from the industry and is able combine training with serving the industry. Jorge de Velasco Rodríguez, the school's president, said: "every in-

vestment is focused on being as transversal as possible, with shared resources amongst students researchers and companies."

Developing the available talent in the state is fundamental to supply chain progression. It provides the essential skills needed to operate CNC machinery, for welding and for other processes currently lacking in Querétaro. It also creates an environment in which the state can evolve the role of design in its aerospace sector by training engineers. GEIQ, GE's engineering center in Querétaro, is leading this development, has over two thirds of its staff dedicated to aviation, and is adopting a personal strategy of hiring from local schools. Currently, GEIQ has 100 engineers working on GENx—the next-generation advanced dual rotor, axial flow, high-bypass turbofan jet engine used in Boeing 787 and 747-8 aircraft. President Vladimiro de la Mora boasted: "globally, every two seconds there is an aircraft flying with GE engines serviced by Mexican talent."

The aerospace cluster of Querétaro is an efficient networking platform that fosters collaborative efforts to address the needs and directions of the state's aerospace industry. The local government is continuing its strategy of attracting foreign investment, but the common focus is to address the evident gaps in the supply chain. CIATEQ, a leading public research center in Mexico is currently in the process of developing its own in-house reliability-testing laboratory. The center's director Dr. Francisco Anton believes that "in order for Mexico to establish a strong network of suppliers we must have more in the way of reliability testing capabilities." The Mexican Federation of Aerospace Industry (FEMIA), the industry's trade association, views Querétaro as pivotal in growing the country's reputation as a major international player not just in manufacturing, but also in innovation and design.

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Marco Antonio del Prete Tercero

Secretary, Secretariat of Sustainable Development (SEDESU), State of Querétaro



"Today, Querétaro's main areas of expertise are in the machining of complex components, aerostructures, components for braking systems, engine MRO, and components for engines."

Can you provide background on the State of Querétaro and how its aerospace cluster has evolved?

The history of Querétaro's industrialization starts in the 1960s with textile, food, and beverage companies establishing a presence here with a view to serving the markets of Mexico City. Over the years the state saw the arrival of companies from metals, mechanics, home appliances, and a range of other industries, but up until the 1990s these were all focused on the internal markets. It was in 1994, when Mexico signed the North American Free Trade Agreement (NAFTA) with the United States and Canada, that the biggest change came about and projects began to be geared towards international markets. It was then that Querétaro became an attractive destination for foreign direct investment (FDI).

Querétaro's aerospace industry began nine years ago when the Mexican government learned that Bombardier was looking for an opportunity to move to a low cost manufacturing location. Following a bidding process, Querétaro was selected as the site of choice and the industry has since grown from there. Today, the state's aerospace sector boasts 80 active members including two major original equipment manufacturers; five maintenance, repair and overhaul (MRO) companies; 12 design and engineering centers; and a range of general service companies that complete the supply chain. Valued at over \$1.2 billion and with more than 8,000 workers, Querétaro ranks first in aerospace FDI nationwide.

What are some of the main qualities that Querétaro offers to the global aerospace community?

Being in the center of the country, Querétaro's geographical location lends it a highly efficient logistics framework. It is favored for its proximity to Mexico City and its equidistance from ports serving Europe and Asia. Though having a population of 2 million, the state has the possibility to attract 45 million people from a radius of 350 kilometers. The business environment is important for the development of any industry and being one of the most peaceful regions in the country, Querétaro offers great security and a high quality of life.

What types of aerospace companies operate in Querétaro?

Today, Querétaro's main areas of expertise are in the machining of complex components, aerostructures, components for braking systems, engine MRO, and components for engines. Companies in the state also operate in landing gear MRO, components for landing gears, heat and surface treatments, harnesses, and flight/motion control actuation. Querétaro has the resources and capacity to branch into a range of other products and processes when the demand arises.

What are the state's main strategies and areas of focus in ensuring the growth and success of its aerospace industry?

It is important to note that a key part of the development of the aerospace industry was FDI, and it continues to be today. Without the arrival of Bombardier and the SAFRAN group Querétaro, the growth of this sector would not nearly have been as substantial as it has been. A major driver now is education. The state is focusing on the core competencies related to the aerospace sector and also on internationalizing its academic institutes. Through partnerships with France and Canada, our universities are ensuring that students are receiving the correct training and formation in all levels of the aerospace HR chain. It is the development of Querétaro's education system that has nurtured Querétaro's reputation as a national leader in innovation and research and development. The Aeronautic University of Querétaro (UNAQ) has seen more than 5,000 technical graduates since 2006. It is through the alignment of industry, academia, and government that the aerospace industry in Querétaro will truly thrive.

Two years ago, the Aerospace Cluster of Querétaro was made official. How important has this been for the state government's efforts in supporting the aerospace industry?

With the rapid growth of the aerospace industry, its consolidation became important for the state government so as to be able to quickly and efficiently meet the demands of the companies operating within it. Querétaro Aerocluster has been hugely successful in achieving this and now is helping to promote and strengthen the state's aerospace industry and is increasing its competitiveness both nationally and internationally.

What is the most significant goal for the State of Querétaro in order to guarantee the continued growth of its aerospace industry?

Investment attraction depends on many factors, but what is crucial for us is to become more prolific through our own local companies, a number of which have developed some great opportunities for themselves within the aerospace sector. It is of these success stories that the international aerospace community must become more aware to truly strengthen our local supply chain and reduce imports. The only challenge that lies ahead for potential companies wanting to break into the global supply chain is a matter of financing. Outside of financing, Querétaro has every component needed to nurture the growth of local suppliers that support the aerospace industry. Once this is achieved, Querétaro will very much be seen as one of the most competitive aerospace destinations throughout the world.

Alfredo Nolasco

Chief Country Representative, Bombardier, Mexico



"We are proud of our partnership with the Mexican government in developing an industry that is attracting investments, highly qualified labor, technology and new expertise."

Having been operational in Mexico since 1992, what is the strategic importance of the country today to your aerospace operations?

Mexico has a strategic importance for Bombardier's global manufacturing operations. At present, Querétaro conducts design, manufacturing and assembly activities of large metallic and composite structures, as well as electrical harnesses for Bombardier business and commercial aircraft. Likewise, in the context of the creation of Bombardier Aerostructures and Engineering Services, Querétaro's site will support the new division business objectives, by enabling the Company to further market its expertise in these fields of the aerospace industry, thus generating new revenues. Bombardier is proud of its partnership with the Mexican government in developing an industry that is attracting investments, highly qualified labor, technology, and new expertise in many business sectors in addition to aerospace.

Can you talk about the facilities you have in Mexico, the components you manufacture and how they are fitting into your global supply chain?

We have four facilities in Querétaro in which we conduct design, manufacture and assemble large metallic and composite structures, as well as electrical harnesses. Main products manufactured at the facility are: the aft fuselage of the Bombardier Global family of business jets (5000, 6000, 7000, and 8000); and electrical harnesses and electrical components for Bombardier business and commercial aircraft, and the forward fuselage and doors for the CSeries family of aircraft.

What are some of the key strengths that Querétaro offers as Bombardier's base of its aerospace operations in Mexico?

Before we made our decision to set operations in Querétaro, we evaluated several different locations around the world and we determined Mexico to be the best option because it is a country with very solid macroeconomic indicators for the future. It is part of the NAFTA agreement, and is within a similar time zone as our headquarters in Canada. It has a solid infrastructure, such as the dedicated aerospace park in Querétaro, a good road infrastructure; Querétaro's international airport; and a vast industrial experience through the automotive industry. It also has an important pool of skilled human resources, and a strong commitment from the federal and state governments to develop an aerospace industry.

Can you talk about the work that you have done with universities and academic institutes to foster the local talent pool?

In Bombardier we know that an industry as complex as the aero-

space industry requires a solid team of workers, trained in the different areas of the processes we use to manufacture our products. We think education is one of the three pillars that support the development of the aerospace industry, and for this reason we recognize the efforts done in the matter, such as the inauguration of the UNAQ in 2009, with the support of the Federal and State Governments, as well as the ITESM CEDIA, in 2012. We currently have collaboration agreements with the UNAQ and the Universidad Tecnológica de San Juan del Río, to develop aerospace training programs. We also have collaboration agreements that include working internships, thesis projects, recruitment programs and job opportunities with the Universidad del Valle de Mexico, the Instituto Politécnico Nacional, the Instituto Tecnológico de Querétaro, the Universidad Autónoma de Querétaro, and the ITESM.

How far away do you think we are from seeing whole aircraft assembled here and what challenges lie ahead in achieving this goal?

We do not have plans for assembling a complete aircraft in Mexico at this moment. However, any other of the international manufacturers present in Mexico will find the appropriate conditions to achieve this goal if it is part of their business plans. The Mexican aerospace industry has shown a continuous and increasing growth throughout the last years, which has strengthened all the components of the national aerospace supply chain. We think the industry needs to keep working as a team with the authorities and the research institutions in order to keep supporting its long-term development into the future.

What does Bombardier hope to achieve in Mexico in the next five years?

Over the coming years, we will keep focused on strengthening our operations in the country within the new Aerostructures and Engineering Services business segment, which will enable us to further market our expertise on this field to the aerospace industry, thus generating new revenues. We will also continue collaborating with the authorities, academic institutions, and other companies of the sector, to strengthen the Mexican aerospace industry. At Bombardier, we are proud of our partnership with the Mexican government in developing an industry that is attracting investments, highly qualified labor, technology and new expertise in many business sectors in addition to aerospace.

We only want to endorse our long-term commitment with the evolution of mobility, by achieving our goal of finding better ways to bridge distances and bring people together. Across cities, countries and the globe.

Julien Fabreguette

Director, Airbus Helicopters' Site, Querétaro



"The next and ultimate step, on which I believe Mexico is on the brink, is design."

What role is the Querétaro facility playing for Airbus Helicopters' global operations?

This plant is dedicated to the production of metallic aero-structures for Airbus Group. Currently, we are a vertically integrated business and practically all of our production is carried out in-house. The first work package that we transferred was actually the emergency exit doors for the fixed wing A320, but future work packages will include a mix of fixed wings and helicopter parts to be integrated in Airbus Helicopters' world assembly lines.

Can you provide more details on how Airbus Helicopters has grown since it established itself in Mexico in 2013?

As a reminder, Airbus Helicopters has been present in Mexico for nearly 35 years. Since then, our activities in the country have grown steadily, and so has our commitment with our customers and with the country.

We started our activities by providing maintenance, support, and training for our customers in the region. Two years ago, seeking more opportunities to further develop our global supply chain, we decided to further extend our footprint in the country by investing in the aeronautical manufacturing industry in Querétaro. We inaugurated our plant in Querétaro in February 2013, and it was an honour to have President Peña Nieto as one of our guests.

Our company has a fleet of 500 helicopters in the region and is currently the only helicopter manufacturer with maintenance and industrial sites in Mexico, where we employ more than 300 people, 140 of which work in Querétaro. Our plan is to increase the production capacity of the Querétaro site in order to pass from the current 120,000 hours of work per year to 800,000 hours per year by 2020. We expect to achieve this by transferring more products from Airbus Helicopters.

Despite being vertically integrated, does Airbus Helicopters intend to adopt a more horizontal business model?

We have recently begun the process of sourcing local suppliers. The current situation in Querétaro is that there are a number of original equipment manufacturers and tier-one companies, but what is lacking is a consolidated network of tier-two and tier three suppliers. We are working together through the Aero-cluster of Querétaro to resolve this by sharing our knowledge and experience with potential suppliers and integrating small and medium-sized enterprises into the cluster. It is very important for the companies here and for the growth of Querétaro's aerospace industry that we work together to build this base of suppliers. For that, we also need strong leadership from both

federal and state levels to accompany this industrial maturity. Despite starting with an integrated business model, Airbus Helicopters facility in Querétaro plans to change this to a horizontal one, but, in order to achieve this, we will have to get a sustainable network of suppliers in place.

What efforts are being made to create this strong base of lower level suppliers for the aerospace industry?

With regards to establishing tier-two and tier-three suppliers, there are two scenarios. The first one is to have a pre-existing supplier from either Europe or North America migrate to a facility in Mexico in order to reduce their production costs. In that case, the support on our part will simply be in terms of discussing the volume of business that we will require from them. They will already be mature enough and have the internal support to be able to obtain the necessary certifications.

The second scenario is to develop a purely local company to be able to serve the needs of the aerospace company. This case is more complex. The support here will come through the Aerospace Cluster as, collectively, we are able to offer advice and intelligence. This applies, for example, in any adjustment of the potential supplier's business model and how to gain the certifications. The government is also very supportive in this regard and through organizations such as CONACYT and INADEM, companies are now able to secure the funding needed to break into the aerospace supply chain.

Will Mexico become more involved in the design aspect of the aerospace industry?

The evolution of Querétaro's aerospace industry has a clear model that is being defined by the large corporations like Airbus Helicopters and Bombardier that came here in order to manufacture products at best-cost. The first step is technology and knowledge transfer. After a few years, we embark on the second step, which is to establish an engineering department to support production. After a while, the local facility starts to understand the product better than the mother company, which no longer manufactures it. When that moment arrives, the local facility shifts from workbench to build to print, at which point we are able to incorporate our own improvements and modifications in the manufacturing process.

The next and ultimate step, on which I believe Mexico is on the brink, is design. GE is already incorporating this into their operations as it is designing and certifying parts and system for use in aircraft from its Querétaro design center. In my opinion, it only makes sense for Mexico to start becoming more involved in the design aspect of the aerospace industry.

Daniel Parfait

Country Delegate, SAFRAN Group



"There is a strong sense of confidence after 25 years present in Mexico, and we have the intention to stay and continue our development."

Can you provide some background on SAFRAN Group in Mexico, as well as the different companies operating in Mexico under the umbrella?

We began operating in Mexico 25 years ago by buying factories in Chihuahua which now fabricate cables for Boeing, Airbus, etc. Today we have more than 4,000 employees and five factories in Chihuahua with Labinal Power Systems. We also have five factories in Querétaro, which started developing mid 2000s. Within the Safran family we have Snecma, which produces motor parts for the CFM56 and will shortly produce LEAP engine parts. We then also have Messier-Bugatti-Dowty (MBD) who produces landing gear. Finally to round out our portfolio in Mexico we have two maintenance, repair, and overhaul centers, one with MBD that does maintenance on landing brakes and one with Snecma that does maintenance on engines. A new factory of Snecma will be inaugurated in the coming months but is already in operation.

Two other subsidiaries also have an important presence in Mexico; those being Turbomeca, which provides customer support services to 250 helicopter engines in Mexico and Morpho, world leader in biometric systems and smart cards who has established contracts with the government, airports banks and telecommunication companies. There is also a lot of interest for SAGEM.

Can you give more details regarding the role and importance that each of these operations has for SAFRAN's global operations?

In terms of employment, SAFRAN Group in Mexico is third after France and the United States. Therefore Mexico represents a fundamental platform notably in aerospace regarding our proximity to the United States.

What advantages does Querétaro offer to SAFRAN?

Chihuahua and Querétaro are both pro-business and are both good environments for investment. In terms of human capital development, the Aeronautical University of Querétaro has played a key role. For the development of the Franco-Mexican campus, we donated a CFM 56 engine and two landing gears so students might work directly on these products to promote their technical formation. Furthermore, we maintain a dialogue with the governments of both states who both express willingness to support investment and business.

Can you elaborate on SAFRAN's efforts to grow and support the local supply chain?

Developing this local supply chain is a priority for us. We put a lot of our efforts and human capital in a tool called the Franco-Mexican Strategic Counsel that was put in place by the French

and Mexican governments. It permitted the creation of an aero-fund that channels millions of dollars into the development of the local supply chain.

What role do design and engineering play in SAFRAN's operations in Mexico?

Mexico is currently moving from its reputation of solely a manufacturing industry to an industry more involved with design and innovation. The country realized that they had achieved a certain level of maturity and that for them to move up in the value chain they had to launch into innovation.

In Chihuahua, one of our subsidiary, Safran Engineering Services, employs about 250 engineers focused on design and innovation. This is a clear representation of SAFRAN's commitment to this important transition.

What are doing to support your human capital needs?

In partnership with Airbus Helicopters and the government we have created this Franco-Mexican campus in Querétaro, and we would like to develop a replica campus in Chihuahua but with the inclusion of broader scope of training.

We also have had success with our work-study exchange program in partnership with the French-Mexican high school of Mexico City in which students receive a bachelor's in aeronautics. We work with Mexican officials through Mexprotec to allow us to invite students in our factories and train them in France. This internationalization is an important factor in aerospace education.

What are SAFRAN's next plans in Mexico?

We are in period of growth and Mexico is going to play an important part. For example for the development of the upcoming LEAP engine, which will take over from CFM56. This will be commercialized in the coming two years, for which we already have nearly 10,000 orders and Mexico will play a major part of this demand.

Do you have a final message?

Mexico for us is strategically important and we are experiencing very fast development. There is also a strong sense of confidence after 25 years present in Mexico and we have the intention to stay and continue our development. There are three factors which define our reason for our continued commitment to Mexico: the presence of a strong skilled labor force, which is very involved in our operations; the federal and local governments, which are focused on creating a pro-business environment in which we can develop; and thirdly, geographically, we are at the door to one of the biggest markets in the world for aerospace.

Rick Uber

CEO, TechOps Mexico



"TechOps Mexico is a big facility, with a large number of personnel, which cares for the environment, for quality, for security, and for compliance."

Can you provide a brief overview of the joint venture between the two airlines that led to TechOps Mexico being formed?

The CEOs of Grupo AeroMéxico and Delta Airlines began conversations about working together more closely, in trying to provide better service and considering that great workmanship in Mexico. With this, the TechOps Mexico project began with the help and vision of Miguel Uribe (TechOps Mexico founding CEO). Originally, the idea was to expand the facilities of the original MRO in Guadalajara, problems were found in the land in Guadalajara. The airports in Mexico City, Toluca, and Tijuana were among those considered, but Querétaro presented itself as the most appealing. Its geographical location, in the center of the country, and government aperture to help with a joint venture were advantages that Querétaro provided.

TechOps moved at the end of 2013, a significant accomplishment, considering 800 people relocated from Guadalajara to Querétaro. During the six month move TechOps provided housing, moving services and transportation between Querétaro, Guadalajara, and Mexico City. It was the only time an effort this large has been done by the company in Mexico. After the move, TechOps began hiring personnel from Querétaro and strengthened its relationship with the government, which put the company in touch with the Universidad Aeronáutica en Querétaro (UNAQ) to train TechOps's personnel. Making this move required constant work, and our staff has been great, with relevant players, just as our Attorney General Mr. Omar Cuevas.

What key competitive advantages does TechOps offer over other MROs in the region?

TechOps competes against other MROs for the same work and on the same criteria, competing on turn times, cost, and quality. If anything, Delta and AeroMéxico hold TechOps to a higher standard than other MROs they have worked with because their name is in the building, and therefore want this MRO operating better than the competition.

All of TechOps's personnel have a license, unlike other MROs. TechOps also has a geographical advantage over competition. Querétaro's weather is good for fuselage, not needing climate conditions in the interior of the facilities. It also well positioned with quick access to U.S. and local suppliers.

What challenges did you face establishing yourself as the largest MRO in Latin America?

Building these facilities was a huge project. Most MROs begin as a small outfit and then grow, but TechOps Mexico was designed to be very big, with corporate offices, hangars, spaces for work-

shops, among others. The negotiation for the land was also a challenge. In Mexico, land for a facility with direct contact with an airport implies a complex negotiation.

How have you been working with local academic institutions here to support your human resources needs?

TechOps trains its own technicians, since the aeronautical technicians needed are rare. Training occurs through TechOpsU, which then the MRO reviews, making sure they have a great profile for the company's needs. After a year or so, they should have the knowledge base to acquire a license. With the license, they come on as interns and if they pass a final evaluation are hired as technicians with TechOps Mexico. TechOpsU was developed with the UNAQ and Dirección General de Aeronáutica Civil (DGAC). Training its own technicians, TechOps assures it counts with the human resources needed. For example, a class of 120 students will graduate in January, and ideally they will all work at TechOps.

Where are you focusing most to innovate?

Most of TechOps attention must be focused on new technology in the aerospace industry. This airplane, 25 years old, will be operated by Delta another 10 years. As aircrafts are retired, some will just kind of go away, replaced by newer products, such as Boeing 717s or 757s. Focus on new technology can be in flight structures or avionics. The 787 that Aeromexico currently operates is essentially a flying computer.

Do you have a final message about TechOps Mexico?

TechOps Mexico is an ecofriendly facility, using 30% solar energy. The roof is designed to take rainwater, clean it, and use it for the facilities. Beneath them, the facilities have a surface covering to avoid soil damage. The MRO also has a state of the art wash rack, reducing the time of washing an aircraft from three days to 16 hours, saving a significant amount of water. The chemicals used when washing the aircraft are ecofriendly, not damaging the environment. Water is also recycled, potentially used six times when washing an aircraft, and when the water is returned to city sewage, it complies with city standards. Hazardous materials are well treated and processed correctly for disposal. Metals and titanium are taken to company to reuse. TechOps Mexico is a big facility, with a large number of personnel, which cares for the environment, for quality, for security, and for compliance.

Jorge Gutiérrez de Velasco Rodríguez

President, Aeronautical University in Querétaro (UNAQ)



"Due to the established close relationships, the institution reproduces company environments as closely as possible, both in manufacturing and maintenance."

Can you please provide a history of UNAQ and any recent major milestones?

Mexico's commitments with the arrival of Bombardier included firstly setting up a Fast Track Training Program, started in 2006, and secondly creating a new institution formed as part of the long term commitments. The team, along federal and state government, decided to found not only a technical institution but a university. This began analyzing the most representative manufacturing aerospace clusters in the world, like the ones in Wichita, Montreal and Toulouse, looking for a model that could be adapted to the specific circumstances of the country. With this in mind, the idea of a new university began to take shape with the creation of the UNAQ, which provides technical training, associate degree, bachelor's degree, and master's degrees, and eventually PhDs. All training is embedded in one institution, which fulfills the needs and grows together with the industry.

UNAQ was born in November 2007 and opened its first associate's degree in avionics, maintenance, and aeronautic engineering, focused on manufacturing. Bachelor's degrees with competencies for setting up manufacturing processes, aircraft components and maintenance activities launched at the end of 2008, beginning of 2009, responding to the existing needs of the industry at that time. UNAQ continues adding new bachelor's degrees, such as the two newest—one in mechanical, other in tooling and mechanical components design, and another in embedded systems design; all focused in the aeronautical field.

Can you please provide details of the nature of the work UNAQ undergoes with aerospace companies today?

Fortunately, companies consider UNAQ more than simply a technical training provider. The university receives several aeronautical related projects, at any point in the process. Here at the UNAQ, we work also on technical issues, such as applied research and technology development for companies. Many companies initially visualize Mexico as a country with basic manufacturing activities, but now with Bombardier's involvement and engineering services develop, companies are beginning to perceive the country differently.

How does UNAQ tailor its courses to cater to the needs of Mexico's aerospace industry?

UNAQ's college programs work differently. Ideally, the institution counts with a profile of students at the end of the technical degree, developed together with the companies looking to hire

UNAQ graduates. The profile typically includes English fluency, understanding blueprints, drawing, competency with certain programs, among others, to fulfill minimum competences the company wants. After that, UNAQ develops a matrix with basic or generic competences, then used to develop the program curriculum, whether for the 2 or 4 year program, for the associate's or bachelor's, respectively.

The company develops the initial profile, UNAQ provides it, and companies hire a large percentage of graduates, and UNAQ follows up. The follow up includes asking how the graduates perform. If their performance is not up to standard, UNAQ fine tunes its program, developing skills that they underperformed or lacked, for example. In some cases, UNAQ develops and sets up labs, which will help foster skills for other companies as well. For example, nondestructive testing is a process applicable to many industries and with many activities in aerospace. UNAQ enters joint ventures to set up labs and choose equipment, and companies either have time to use the equipment they purchased in the university or there is an exchange of technical training with them. This close relationship is part of the successful activities UNAQ achieves and why its training programs remain pertinent.

What role has the institution played in the evolution and growth of the country's aerospace industry?

UNAQ's faculty, that is to say professors, technicians, and trainers, come from the industry. The faculty's profile in general is more technical or with hands on experiences than having scientific backgrounds. UNAQ keeps its faculty well trained, they already have degrees or certifications in the field, and the university asks companies if they can include UNAQ's faculty in their trainings.

Due to the established close relationships, the institution reproduces company environments as closely as possible, both in manufacturing and maintenance. On a daily basis, UNAQ members use raw materials, consumables, equipment, and documentation, reducing the learning curve of graduates because they are already totally embedded in training environments.

Do you have a final message for our GBR readers?

The UNAQ has a vision of becoming a worldwide leading institution in the aeronautics sector. It will also continue contributing to change the perception of others about what we as a country are capable of doing. At the UNAQ we are ready, willing, and so far able to do big things in Mexico."

Vladimiro de la Mora

President, General Electric Infrastructure Querétaro (GEIQ)



"For GEIQ, new composite materials and 3-D manufacturing will be an important step forward; engines will become lighter and more efficient."

Can we begin with a brief overview of GE's aviation history in Mexico and the circumstances that initiated GEIQ?

GE has been present in Mexico since 1896 with manufacturing plants in the north of the country. In 1999, GE's infrastructure business combined aviation, power and water, and looked at the opportunities of globalizing engineering: selected locations were India; Mexico; Poland and China; the rationale being that engineering talent was readily available in these countries. Today, Mexico has one of the highest number of engineers per capita globally, ranging from 80,000 to 100,000. Other reasons for the selected locations were that GE wished to be close to its customers, and favorable operating costs. GE launched its power and water engineering initiatives with steam turbines and steadily gathered expertise on turbo machinery. In 2000, aviation joined GE's power and water service offering in Mexico, majoring on the external part of the aircraft's engine, performance analysis of new/existing aircraft engines, tool designs for assembly of new engines and maintenance of current engines. Today, GEIQ has gathered sufficient expertise to be considered competent in a specific area of aviation. The company's personnel strategy has been to hire from local schools and invest considerable capital in training/assignments in the United States; GEIQ's work performance is continuously appraised by its superiors in the United States. Mexico was the first engineering center outside the United States to sign drawings, a major milestone in the aerospace industry.

How many personnel does GEIQ have in its engineering center and how does it operate with its other global engineering centers?

Today, GEIQ has 1,800 personnel: 1,100 being in the aviation sector; 550 in power and water; the remainder in oil and gas, a new business for GEIQ. GE's engineering centers have specific expertise; however, all centers do interact and cooperate on drawings and analysis of components, i.e. stress and strain.

Are there any case histories that would demonstrate GEIQ's capabilities?

A big part of GEIQ's operations is to support legacy engines and major periodic inspections (MPI). Currently, GEIQ has 100 engineers working on GENx—the next-generation advanced dual rotor, axial flow, high-bypass turbofan jet engine used in Boeing 787 and 747-8 aircraft. Other work includes MPI on Passport engine for Bombardier, and analysis and component work for CFM International's (a joint venture between GE and Snecma) LEAP, a high-bypass turbofan aircraft engine.

How has the local supply chain developed to accommodate the aerospace industry?

GEIQ is an engineering center and does not manage supplier relationships, but works directly with GE in the United States. The aerospace supply chain in Mexico is evolving; many suppliers are diversifying from the automotive industry into aerospace, but there is a difference in regulations between these two industries. Companies such as Bombardier are helping local vendors to develop and introducing vendors from outside Mexico; this will generate opportunities for tier-two and tier-three companies. It takes time to be recognized as a tier-one supplier. There are many machining and electrical harness vendors, but there are gaps in Mexico's aero supply chain, e.g. heat treatment, special materials machining. To be efficient and cost effective, the home value chain has to be closed. There are 300 companies focused on aerospace in Mexico; the sector is growing at 18% year-over-year. To ensure a continued supply chain of talent, the Universidad Aeronautica en Querétaro (UNAQ) was established in 2007 to focus on technician development primarily to support Bombardier's electrical harness assembly. Master degree programs are offered in association with universities outside of Mexico.

How does GEIQ collaborate with universities in Mexico?

The company sends engineers to UNAQ to be exposed to aircraft and instruments to fully understand when writing the code for the end function of a device, i.e. navigation systems. GEIQ also has collaboration with the biggest university in Mexico—the Universidad Nacional Autónoma de México, which has a master degree program in mechanical engineering. GEIQ also associates with Instituto Politécnico Nacional in Mexico, which accredits the company's internal classes as part of the university's master degree program.

What affect will the proposed construction in Querétaro of the National Center for the Research of Composite Materials have?

Laboratories have been lacking in Querétaro, and the center will be a great addition. Its emphasis on composite materials will complement the work of Bombardier and others in composite materials; the center proposes to expand into other disciplines.

What are GEIQ's focused areas in aviation and in what areas will it look to innovate?

GEIQ's focused areas in aviation are the external part of the engine, external performance analysis, and software development for aviation systems. The aerospace industry will look to complete the value stream and develop the manufacturing process.

Dr. Francisco Anton Gabelich

Director, CIATEQ



"Our vision is for CIATEQ to become a well-established productivity lab serving not only the aerospace industry, but also all industries in Mexico."

Can you provide an introduction to CIATEQ and its role in Mexico's aerospace industry?

CIATEQ, part of CONACYT, is a public research center that was founded in November 1978. Today it is an organization of centers specializing in advanced manufacturing and operates across nine states in the country. To date CIATEQ has undertaken over 3,700 projects and ultimately strives to link advances in technology with all industries operating in Mexico. Another principle mission of the center is to connect academia and industry, which has been slow to occur in Mexico but is crucial for growth. CIATEQ plays a very active role in ensuring that academia becomes more integrated with industry, in particular the aerospace sector. Currently the majority of the foreign companies operating Mexico's aerospace industry have imported their manufacturing processes. CIATEQ aims to reduce this amount by raising awareness of the potential that Mexico offers not simply in manufacturing, but also in the conception and development of manufacturing processes. In doing this, we are increasing Mexico's competitiveness in the international aerospace community.

How is CIATEQ involved in manufacturing processes in Mexico's aerospace industry?

There are two main columns in the work carried out at CIATEQ. One is devoted to mechanical systems and the other to chemical process systems. Within these two columns, we have six areas of expertise: electronics and control, measurement systems, mechanical systems, plant engineering and construction, virtual engineering and manufacturing, and plastics and advanced materials. In addition to our design capabilities in these areas, CIATEQ also boasts manufacturing facilities that are able to accommodate a range of projects from the aerospace industry for example our CNC machining capabilities are able to produce components for major tier-one companies operating in the country. For this we are fully certified in the AS9100 for every part in all of our centers. CIATEQ's other core offering is human resources. It offers a number of masters and doctorate degrees to the industry, four of which are not available at any other academic institutions in Mexico.

What are some of the major challenges in promoting the development of manufacturing processes in Mexico?

The tradition of importing all manufacturing processes from abroad has become too ingrained in peoples' minds. As such, academia is geared towards supplying the industry with personnel capable of operating controlling and maintaining manufacturing equipment, but not those with the ability to design, develop, and apply new manufacturing processes. CIATEQ is trying to change this. Currently, Mexico offers some of the best operators in the

world, but we must focus more on design to remain competitive.

How is CIATEQ aiding local companies to break into the aerospace supply chain?

Though not our main area of focus, we view the aerospace sector as a growing one and an important one to watch. A main focus for CIATEQ is to help local companies that initially had been serving the automotive industry gear their offerings towards the aerospace sector. The first major step is to achieve certification. CIATEQ, along with ProMéxico, has a very successful program in place to help around 15 companies a year achieve certification. We then work with the company to identify and address the needs to of their potential clients.

Beyond certification, what must a local company also consider in order to be successful in the aerospace industry?

Certification is certainly the most important factor. However, for a company that is new to manufacturing a particular component for the aerospace industry, they will have to conduct reliability tests. Mexico is currently lacking in reliability testing and this is something the CIATEQ hopes to change. We are in the process of developing our own in-house reliability-testing laboratory. At the moment, all tests must be outsourced to the United States or Europe, which adds to both delivery time and cost. This will be a long development process, but in order for Mexico to establish a strong network of suppliers, we must have more in the way of reliability testing capabilities.

What makes Querétaro a competitive aerospace hub?

Querétaro's airport is very modern and well designed, an attractive asset for aerospace companies. The talent pool is also particularly strong, providing a constant stream of engineers to support aerospace companies' human resources needs. The geographical location of the state also lends it considerable advantage, boasting a strong logistics framework and business environment that is suitable for manufacturing operations. The automotive industry in this area has certainly paved the way for the aerospace industry.

Do you have a final message?

Our vision is for CIATEQ to become a well-established productivity lab serving not only the aerospace industry, but also all industries in Mexico, though we foresee considerable growth in the aeronautics sector. It is important now that we raise awareness about the potential that Mexico offers not only as a manufacturing site, but also for the design and development of new manufacturing processes. We have the necessary talent pool, which we hope that the international aerospace community will recognize.

Jatziri Barrios

Program Manager, **Especialistas en Turbopartes S.A. De C.V.**



"ETU intends to have a new shop constructed close to the aerospace OEMs in Querétaro; it will have an integrated division for special processing and manufacturing."

Can we begin with a brief history of Especialistas en Turbopartes and its recent major milestones?

ETU is a privately owned, 100% Mexican family business, established in 1991 as a specialist in parts of turbomachinery. Today, the company leads the Mexican market in the manufacture and assembly of low-pressure turbines. In 2010, ETU launched its aerospace division to build a new manufactured cell with certified quality standard AS9100, and hire and train a specialized team dedicated to aerospace requirements; currently, the team consists of 12 personnel, 10% of the 120 that ETU employ. The company is divided into three divisions: turbomachinery; R&D supporting the core business; and aerospace.

What is your service offering to the aerospace sector and your profile of customers in Mexico?

ETU's current offering to aerospace is advanced manufacture in three different sectors: landing gear, engine and aero structures. The company's capabilities include: titanium; stainless steel; aluminium; and inconel, with a parts diameter of 4", 36" and 56". All of ETU's manufactured parts are exported to Canada and United States; this includes bearing carriers in titanium for the main landing gear of Boeing 737 aircraft. New customers that we are developing are: Airbus Helicopter, Messier-Buggatti-Dowty, and those in the aero engine sector.

Can you give details of your facility, business cell, equipment and certification that support your operation?

ETU opened its new facility in 2010; all equipment is new, has numerical control, and was purchased between 2010 and 2014. The company has a vertical turning lathe with a diameter capacity of 56"; a Mazak 550 with a maximum machine capacity to 36", Mazak 350 and 450 for the smaller diameters, and a Mazak Nexus 510 installed at high pressure of 1,000 psi capable to deep drill on exotic metals, i.e. titanium and inconel.

Do you have in-house secondary process capabilities?

Within ETU's facility, it has complementary processes for its core business turbomachinery, such as non-destructive testing (MPI & FPI), HVOF, and plasma spray. As the company's aerospace division manufacturing expertise increases, its capabilities in special processes will also grow.

How does ETU ensure quality for its customers?

ETU has configuration management; this includes an installed in-process quality system plus risk management. Each time a request for a quote is received, a complete analysis and gap analysis of what is required is carried out to achieve customer's

requirements. The company has in place key performance indicators, and has management revisions every quarter to follow up on them to improve company development; it also examines yearly feedback from customers about the company's performance, achieving an average 85% to 90% qualification.

From where does ETU source its raw materials and how does this affect on-time delivery?

Raw materials come from the United States or via customers under concession. Sourcing outside Querétaro mainly affects price negotiation; the main cost is logistics. It is not viable to look at alternative jurisdictions for raw materials, including Turkey or China. Raw material companies are predominantly in North America and deliver to warehouses close to the Mexican border: Tijuana, Monterrey, and Chihuahua. There are currently no warehouses in Querétaro that supply raw materials.

How long will be needed to develop a local supply chain?

Small and medium-sized enterprises (SMEs) in Mexico are unfamiliar with medium to long-term planning and seek profitability within a year rather than five. SMEs should appreciate that the aerospace industry affords steady growth with medium and long-term contracts; long-term agreements run from three to five years, upon three years an SME should break even. Companies must be willing to be patient for a profit.

Arguably, in the last two years, there has been a favorable change of business demeanor by original equipment manufacturers (OEMs) towards Mexico's SMEs. ETU recently secured Airbus Helicopters and Messier-Buggatti-Dowty as new customers; five years ago, there was no business permeating from OEMs. Currently, some Mexican SMEs do not have certification, capabilities, infrastructure, and supply chain development to the standard of OEM requirements. The Mexican government needs to coerce the OEMs to recognize that Mexico has a supply chain to support an aerospace industry, and the SMEs to commit to deliver the product on time.

Are there any further goals that ETU wish to achieve over the next five years?

ETU intends to have a new shop constructed close to the aerospace OEMs in Querétaro; it will have an integrated division for special processing and manufacturing. Land for the shop has been acquired; completion date for construction of the new shop will be 2018 where ETU will service the three divisions of the aerospace industry in Mexico: engines in Sonora; aero structures in Chihuahua and Tijuana; and landing gear in Querétaro. In five years, ETU will have an active role in all three markets.

Rene Trulin

Vice President, Operations, **RYMSA S.A. de C.V.**



"We are working on a strategy to offer not only complex machining services, but also engineering capabilities."

Could you provide an introduction to the company with a brief history and details of any recent major milestones?

RYMSA was founded in 1989 and has always been dedicated to offering machine services. Having initially catered primarily to the appliances industry, we shifted our focus to the oil and gas industry in 2000. Today, aerospace and oil and gas are our principle target markets.

In 2006, RYMSA became ISO-certified and started working with a number of companies in Houston from the oil and gas sector. At that time, 80% of our products were being exported to the United States, Canada, Malaysia, and China.

Our move into the aerospace sector came in 2008 with our first customer being Messier Services. We are now able to offer a range of machining services to original equipment manufacturers and tier-one companies from the aerospace industry, and, in taking care of our whole supply chain, we can provide a full, turnkey product.

What was behind the decision to expand into the aerospace industry?

With our core business being oil and gas, we found that aerospace tends to be contra-cyclical to oil and gas. When one is in a downward flux, there will be more in the way of purchasing from the other. In this sense, it was a logical decision to move into aerospace, as it provides a natural safety net.

The requirements regarding safety, quality, and delivery times of both the oil and gas and aerospace industries are also very similar. Our work is geared towards low volumes with highly specialized labor.

What strategy are you using to grow into the aerospace industry and define the profile of customer with whom you hope to work?

We recently attended both the Boeing summit in Mexico City and the manufacturing show in San Diego, California. This gave us the opportunity to establish our first contact with potential clients and develop a deep understanding of what their machining requirements were. Our current expertise is in the machining of small- to medium-sized components. Additionally, we identified the need for certifications on all aspects of our own supply chain and so recognized the importance of consolidation on our side with regards to secondary processes such as heat treatment and coating.

What are some of the other challenges and complexities of making the transition from your core industries to aerospace?

Currently, 80% of our machines are CNC lathes, and 20% are vertical, four-axis machines. In general, we have found that the

aerospace industry requires more in the way of milling than turning. Our first challenge will be to develop our expertise and capabilities on machines that work on a five-axis model. The second major challenge is making our supply chain more efficient, particularly with regards to sourcing raw materials. The majority of raw materials found locally are for the automotive industry. Currently, we source our materials for aerospace from the United States, which increases the time of our delivery.

What steps does RYMSA take to ensure the quality and on-time delivery?

In order to assure delivery, RYMSA uses constant communication and transparency through its supply chain. RYMSA seeks to establish firm partnerships with both our suppliers of raw materials and the companies offering the secondary processes services. Communication with our customers and understanding their needs is equally important. With this in mind, we can prepare our partners for what our requirements will be on a particular project, thus significantly reducing delivery time.

We are committed to the constant training of our team regarding quality. In the same way, our team embraces the industry's standards as their own principles and this is reflected in the company's results. Also, we do not skimp on investment in quality equipment to provide the necessary tools to ensure good results.

How have you seen academic institutions evolve with the growth of the aerospace industry and how do you work with them to support your human resources needs?

The opening of the National Aerospace University in Querétaro has significantly raised the bar in terms of the level of expertise needed for the industry. We have hired a number of operators and engineers from this institute and the heightened quality is instantly noticeable. The efforts that the government is making with regards to education in this industry are hugely beneficial.

What is your major goal for the next five years in the aerospace industry?

In five years, we hope to have 50% of our operations are dedicated to aerospace. To achieve this we will have to ensure that we maintain pace with advances in technology, so as to provide the reliability that is essential for working in the aerospace sector. We have the space in our facility for machines that will be solely involved in the production of aerospace components.

We are working on a strategy to offer not only complex machining services, but also engineering capabilities that help us to provide our clients with the insights to reduce costs and improve the designs of their components.

Esteban Sánchez and Jerónimo Sánchez

Operations Manager, and Executive Director, **HYRSA Aerospace**



Can you provide a brief history of HYRSA and any recent major milestones?

ES: HYRSA was established fifty years ago as a supplier of high-precision parts to the food and automotive sectors. Decades of experience with Computer Numerical Control (CNC) equipment paved the way for HYRSA to enter the booming Mexican aerospace market in 2013. HYRSA Aerospace has grown considerably in the past two years, the AS certificate put us on the map.

What products does HYRSA manufacture for the aerospace industry?

ES: HYRSA Aerospace is the only company of its kind in Mexico. OEMs and other large players currently import many small parts required to produce turbines and other aerospace products. Therefore, we see potential for HYRSA to substitute some of the parts that original equipment manufacturers (OEMs) and tier-one companies import.

JS: HYRSA's machining capabilities cover high-precision small parts ranging from one quarter of an inch to six inches. Our products are used in the construction of turbines, hydraulics, and pneumatics.

ES: HYRSA mainly serves the Mexican market by supplying parts to OEMs that they previously had to import. However, we plan on exporting in the near future, particularly to the United States and Canada.

What materials does HYRSA work with?

JS: Stainless steel is the main component used in the food and beverage industry. HYRSA has several decades of experience in these industries and continues to employ a mix of 75% stainless steel for some products. HYRSA Aerospace has capabilities to work with specialty materials such as nickel alloys, titanium, and aluminum.

What partnerships have you formed locally in order to establish an efficient supply chain for special processes?

JS: HYRSA works with companies in the Querétaro region to complete special processes required for its products. The arrival of new players to the Querétaro area has increased the availability of companies performing secondary processes such as heating-treatment and coating. This growing network of suppliers has, in turn, attracted additional players to come to the region. In the coming years, additional suppliers entering the aerospace business will solidify supply chains in Querétaro.

How does HYRSA utilize the academic institutes in Querétaro to acquire talent?

ES: HYRSA works extensively with Universidad Aeronáutica en Querétaro (UNAQ) to create internships and job opportunities for students. These programs help us examine worker's aptitudes and skills in order to retain the best talent. With the help of the state government, and in coordination with aerospace companies, these institutes are able to teach practical skills that can be of service to the industry.

JS: Workforce mobility has increased with the arrival of new aerospace companies to the region. The supply of skilled labor has increased exponentially and, since the aerospace industry absorbs most graduates, the demand for skilled labor remains high.

In what ways has Mexico grown as a player in design and innovation in the global aerospace industry?

ES: Several companies in Mexico already conduct conceptual design work and testing. The industry has taken note of Mexico's cost competitiveness in manufacturing. Now, it is moving to utilize the abundance of highly skilled engineers to gain a competitive advantage not only in manufacturing but also in design and innovation.

JS: Recent private sector investments in Mexico demonstrate this trend. GE operates an advanced engineering center in Mexico that specializes in research and design of airplane turbines and power systems. These investments bode well for the companies and for Mexico as a center of innovation in aerospace. What advice can you give other small, local enterprises trying to break into the aerospace market?

ES: Aerospace companies have voiced the need for suppliers to enter the market. However, the high barriers to entry make it difficult for local suppliers to acquire the capacitation required. It is important for OEMs and tier-one companies to invest in suppliers to consolidate the local supply chain by offering training and assistance. With training and consulting services from experienced players, local suppliers will be able to break into the industry and reach the necessary level to become an aerospace company.

What does the aerospace industry represent for you?

ES: At HYRSA, we see aerospace as a life project. It is a difficult industry to penetrate, and we understand that long-term strategies are the keys to success. HYRSA will continue to invest to make sure aerospace players have the suppliers that they need to succeed in Mexico and raise the global profile of the country's aerospace sector.

Olivier Jay-Rayon

General Manager, **TechFab Inc, Mexico**



"TechFab shares the Mexican government's vision of reducing imports and having a fully independent supply chain."

Could you provide a brief introduction to TechFab?

TechFab is a privately owned Canadian company based in Québec that was founded in 1990 and specializes in the gun drilling, machining, and tooling of industrial components. With a strong focus on the aerospace industry, TechFab is able to offer turnkey solutions to our clients from design and conception, production, assembly and laser inspection. Furthermore, we work closely with our clients in design and conception of custom machinery.

Having only been in Mexico since February, what was behind this decision and what is Techfab's strategy in establishing itself as a key player in the country's aerospace industry?

Having studied closely the evolution of this country's aerospace industry, TechFab identified the opportunities for small to medium-sized enterprises (SMEs) to support its supply chain. We see it as important for the continued development of the industry and for Mexico's economy that there be a strong network of SMEs working within the aerospace sector. TechFab hopes to be a pioneer in achieving this. From our facility in Querétaro, we are now able to offer all TechFab competencies in which we have 25 years of experience. We began the process of obtaining purchase orders three months ago and hope to become a key strategic partner for aerospace companies operating in Mexico.

What do you see as being the most important factor for the continued growth of Mexico's aerospace industry?

Part of our business in Canada was the knowledge aspect of the industry, which is something that we want to bring to Mexico. We feel that Mexico, and in particular Querétaro, has great potential to not only manufacture aircraft components, but also to be involved in the design. A key factor in achieving this is education. We are working closely with the academic institutes here to establish effective training programs that will ensure a deep talent pool of qualified personnel available to serve the human resources needs of the aerospace industry. Our eventual goal is to no longer be dependent on our counterpart in Montreal for human resources. Pursuing the design facet of this industry will not only give TechFab a competitive edge among other similar companies, but will also considerably strengthen Mexico's reputation as a popular destination for the aerospace community.

Do you see Mexico offering opportunities for pursuing a strategy of acquisitions?

We certainly see potential for this. Our main goal is to establish a strong SME network within the aerospace industry. There are

many companies that offer the services needed but they lack the certification or financial means to break into the aerospace market. Through a strategy of acquisition or simply sharing our knowledge and expertise with these companies, we will ensure reliable local suppliers are ready to meet the needs of the aerospace industry in this country. The local and federal governments here are very active and supportive when it comes to funding, which is extremely beneficial to the industry as a whole. TechFab shares the Mexican government's vision of reducing imports and having a fully independent supply chain. Mexico can boast an extremely capable skilled labor force. This needs to be fully utilized by the aerospace industry.

Where does TechFab hope to be in five years in terms of market positioning and service offerings?

We estimate that our entire work force will comprise over 100 people in five years. We see the potential for this in Mexico, so we are hopeful that our efforts will complete our vision. In terms of technical expertise, we will continue to engage in single-parts manufacturing and build on the applications of our products. The market for our product and service offering in Mexico is large, therefore there is plenty of potential and scope for growth.

Do you have a final message for readers?

Mexico is a vast country with a large, extremely talented young population. It is a stable environment for our business, and the economy is growing. Finally, Mexico offers talent in the aerospace and engineering fields. These factors make Mexico a viable place for investment and manufacturing in the aerospace industry.



Itziar Larrañaga

General Director, [Aeroproces TTT](#)

"Aeroproces TTT is very excited about its future in Mexico. We see a lot of opportunity here and expect considerable growth over the coming years."

Can you provide some background on Grupo TTT?

Grupo TTT is a Spanish company with over 50 years experience in the field of heat treatment. We have been working in the aerospace industry for more than 30 years, and today 35% of our total business is focused on this sector. We have four facilities in the Basque Country that offer a total of 23 different special processes, all of which are NADCAP-certified. All laboratory processes that we have supporting our operations there are also NADCAP approved. Each facility is dedicated to different processes from vacuum heat treatment to hard chrome and shot peening.

What were the opportunities you identified in Mexico?

When Grupo TTT initially decided to expand overseas we began a process of identifying which market would offer us the most opportunity and would be most in need of our services. Three years ago, our CEO visited Mexico and noted how the state of the aerospace industry was very similar to what it had been in the Basque Country 25 years ago and what was lacking was com-

panies that were able to offer special processes, particularly in Querétaro. After the decision was taken to migrate to Mexico, we embarked on a thorough exploration of the market to seek out what we would be able to bring to the table. The most important part for us to address first was ensuring that we had sufficient power to run our furnaces, which all run on electricity. This facility was completed in October 2014, and Aeroproces TTT began operations in May 2015. Since we arrived without a contract from an existing partner, we have been focused mostly on establishing ourselves as the partner of choice for all companies needing heat-treatment services in Querétaro.

How important is heat treatment to the supply chain of a metal component?

Heat-treatment and other special processes come last in the supply chain for a metal component and are the most important. The processes are designed to increase the hardness and resistance of a metal so that is able to stand up to extreme conditions.



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Dr. William Kelley

Manager, Aerospace, Defense & Special Tooling Operations, [Gonzalez Aerospace - Defense](#)

"Our company, over the course of nine years, has been a proponent of developing the supply chain base in Querétaro."

Can you provide an overview of Gonzalez Aerospace and the company's operations in Mexico?

Gonzalez is an automotive, aerospace and defense industry supplier founded just over 40 years ago. We are a family-owned, privately held business with locations in Michigan in the United States and Querétaro in Mexico. The Querétaro operation focuses primarily on the aerospace market with a secondary focus in automotive supply and our Michigan operations focus primarily on automotive with a secondary interest in aerospace and defense. We are an ASQ- and ITAR-certified organization and maintain ITAR-compliance guidelines at all of our locations.

Why did Gonzalez expand its operations to Mexico?

The initial opportunity was automotive supply chain-based, and we had a natural migration through our manufacturing capabilities and engineering experience to fully develop an aerospace operation that supported local demand. We have been operational for nine years in Mexico.

What are the specific services and products that you are able to bring to the aerospace industry in Mexico?

We specialize in ground support mechanisms, carts, jigs, fixtures and platforms for servicing aircraft and building aircraft. We are currently working towards some automation processes that can be involved with aircraft manufacturing.

Can you provide details of the certifications and equipment that you have here that are supporting your operations?

All of our fabricators here in Mexico are American Welding Society-certified in a number of different positions and disciplines for steel and aluminum. Our fabricating capability encompasses about 22,000 square feet in Querétaro. We also have machining capabilities including manual machining and CNC machining on a smaller scale of batches of 3 pieces to 10,000 pieces. Our quality certifications also include: ISO 9001:2008, ISO 14001:2004, and AS-9100 Rev. C.

Can you provide a case study of a defining project within Mexico's aerospace industry?

Gonzalez recently manufactured a lifting device for Boeing, which was essentially designed to move entire fuselage sections as part of their final assembly process. That required a great deal of load-certification as well as weld-certification studies to be completed before the product could be delivered to the customer. We also completed transportation dollies for Bombardier that are used to move entire fuselage components internationally.

How have you been working with local academic institutions to fulfill your human resources needs?

I am part of an ongoing initiative in the United States that involves several universities that specialize in engineering disciplines. I will be bringing this program to Mexico to develop an internship and mentoring program for recent graduates. It is very important to internationalize the educational experience and potential in the aerospace industry. It is a crucial component in developing succession plans to those people who will be the leaders of the industry in the next cycle.

What role has Gonzalez played in developing Querétaro's local supply chain?

Our company, over the course of nine years, has been a proponent of developing the supply chain base in Querétaro. We have been reviewing local manufacturers requirements and understanding what the various MRO needs are for the aerospace industry. We then fulfill them by providing assembly tooling, automated assembly systems, fabrication and machining, facilities and ground support equipment, material handling equipment, robotic work cells, transportation fixtures, jigs, and metrology services. Our unparalleled capability for providing the best-certified laser tracker services available in Mexico is well known.

What does Mexico offer the global aerospace community?

The consistent climate is a major advantage. It offers companies like ours a cost-effective solution to managing interior climate control for manufacturing, which is critical in aerospace.

What plans does Gonzalez have for its future in the Mexican aerospace industry?

We are continually increasing our facility offerings and at the same time increase our capacity and stake in the area through development of the internship and mentoring programs. We are also looking at potentially partnering with local universities for final year externship programs. These will aim to create teams of people with a variety of disciplines and ultimately offer a company a turnkey employee base.

Do you have a final message for GBR's readers?

Gonzalez aerospace is a market leader here in Querétaro. We intend on staying within that portion of the curve, providing cost-effective, efficient solutions for all of our clients including program management services and taking on those issues that allow companies to focus on their core competencies.

Miguel Saldamando Rangel, Miguel Saldamando Flanagan, and Israel Salas

General Director, Technical Director and Commercial Director,
Técnica Test S.A. de C.V.



Could you provide a brief overview and history of Técnica Test-CEAT?

MSR: Técnica Test began offering non-destructive testing (NDT) services in 1993 and expanded to become a provider of quality-control equipment for the aerospace and automotive markets. Through partnerships with vendors, such as Institut Dr. Foerster, Carl Zeiss, Karl Deutsch, etc., we offer dimensional metrology, magnetic particle and ultrasonic inspection, coordinate measuring, Eddy-current inspection, and microscope equipment, among others.

CEAT was founded as a design center and was part of an incubator project at Tecnológico de Monterrey. Through this program, CEAT grew from a small, family project to a structured business unit. In 2010, CEAT did a joint venture with Técnica Test. We noticed manufacturing companies offered free design services if a customer decides to buy the final manufactured product as a key turn project. Therefore, CEAT experimented with this business model (turnkey projects) to offer competitive services and address the low demand for stand-alone design services.

What projects demonstrate the company's capabilities?

MSR: Técnica Test-CEAT helped Sigma Aerospace establish a design center and train its new engineers. Our company embarked on a one-month training to fast track the specialization of our

engineers for work in the aerospace industry. We offered several courses including finite element and flow analysis. Técnica Test is proud to witness the continued success of this project.

What will be the capabilities of Técnica Test's new plant?

MSR: Técnica Test-CEAT will open a new Querétaro plant in October, which will possess conventional machines for the assembly of our integration and automation solutions. The new plant will also house a lab specializing on application development and testing.

IS: Many clients prefer single-supplier contracts for the provision of an entire solution, and, with this new plant, Técnica Test seeks to consolidate our clients' supply chain.

How has research and development (R&D) grown in Mexico and how is Tecnica Test contributing?

MSF: Companies are aware of Mexico's cost-competitive advantages. Today, however, companies are eager to relocate R&D projects to Mexico and utilize the growing talent pool of engineers. The addition of CEAT at Técnica Test demonstrates our belief in the bright future for Mexican innovation and research.

MSR: Today, Técnica Test-CEAT engages in reverse engineering and conducts complex technical tests for our clients. We have some of the best talent in the industry.

Leonardo Romero

Senior Sales Manager, Helmut Fischer,
S. De R.L. De C.V.



"One of the main reasons for Fischer to locate itself in Querétaro was security. The state offers one of the highest qualities of life in the country."

Could you provide an introduction to the company and a brief overview of Helmut Fischer's move into Mexico?

Helmut Fischer offers a broad range of measuring and analysis instruments for the most diverse applications and industries, and our products have been used in Mexico for a long time. It was in 2012 that we established a permanent office here in Querétaro in response to a growing demand for a number of our product lines. Since then, we have been very active in raising our profile amongst companies here and have steadily gained recognition from a number of large businesses. Our name has lent us a significant advantage in assuring our clients of the highest standard of service with full certification. Though currently accounting for 25% of our business in Mexico, we view the country's aerospace industry as being a key area of growth of our operations.

What products does Helmut Fischer offer?

Helmut Fischer products are an integral part of any form of inspection. We offer high-quality measurement instruments for material analysis, hardness, coating thickness amongst providing a number of other assays. We can also conduct the essential quality checks on a company's product, something that is of the utmost importance in the aerospace industry. With our office now established in Mexico, we are able to offer full product application services. We will soon be certified here in Mexico, thus allowing us to further contribute to the aerospace industry.

Can you provide a case study or example that demonstrates your role in implementing the services that you provide to a company?

We were recently requested to conduct measurements on titanium hydraulic components. For this we carried out an imparalel microscopy analysis in a third party laboratory. The client had asked that we use our X-ray fluorescence (XRF) method, as this is a non-destructive examination for a faster evaluation of the coating thickness. We ended up incorporating our XRF product into the client's company laboratory in order to run the test. Another example is a project that we carried out with a large American company, which requested a hardness evaluation without marking the component. For this, we use a nano-indentation instrument, which is able to measure the hardness of a material in a tiny area.

Why was the State of Querétaro chosen as a base for Mexican operations?

One of the main reasons for Fischer to locate itself in Querétaro was security. The state offers one of the highest qualities of life in

the country. Another reason is proximity to other companies in the aerospace and automotive industries. The geographic location of Querétaro is also beneficial as we can make day trips to Guadalajara, Mexico City, and many other places from here for work purposes.

Have you noticed a stronger emphasis on innovation and research and development (R&D) in Querétaro?

Yes, it is interesting because there have been many research centers in Querétaro for a long time. Within the aerospace sector, there has been a boom coming not only from government institutions but also from private companies. Fischer just joined an association for surface finishing, and we have been partaking in the conventions and lessons for the expertise and technique of operations for this. People from research institutions are also coming and speaking to the association in order to provide education on certain topics, so there is certainly a trend towards R&D in Querétaro.

What must local companies address in order to succeed in Mexico's growing aerospace industry?

Certification is crucial. Currently the AS9000 certificate is barely known in Mexico. I was able to attend a speech by someone from SGS, which has the certification to provide an audit on AS9000, and there were very few companies mentioned that are behind this. There is a large scope for businesses to get certified on AS9000, and while it would be a challenge financially to get involved and accredited, it would also lead to massive gains for the company. The level of qualification needs to grow in Mexico, and this is in the process of happening. I believe that it is possible that this will be achieved in the next few years.

Where will Helmut Fischer be in five years?

I hope that we can begin manufacturing in Mexico of our complex instruments, in addition to offering full service on laboratory testing and quality checks. With regards to manufacturing, we are aiming to initially start doing the final assembly of components in addition to selling more complex solutions that we are working on. We are also beginning to work with non-destructive radioactive measurements, and we have a few customers lined up for this product. We will be training our staff to handle isotopes and the equipment for radioactive material testing. I am excited about the discoveries we will make here in Mexico, and my expectation is that we will find opportunities to grow and develop in the coming years.

Your trustful technology partner

Técnica Test is a Mexican company focused on delivering services and equipment regarding quality control. Since 1985 we have been providing the local automotive, metal-mechanic and aerospace sectors. Our products are divided in 4 lines: Material Analysis, Physical Testing, Non Destructive Testing and Dimensional Metrology. Among these lines, some of our products include: Eddy Current devices (FOERSTER), ultrasonic equipment (KARL DEUTSCH), magnetical-particle inspection equipment (KARL DEUTSCH), optical comparators (J&L), CMMs (ZEISS), 3D scan arms (kreon), microscopes (ZEISS), metalography equipment (metkon), universal testing machines (SHIMADZU) and all range of hardness testers (INNOVATEST).

Attending to the market needs for automation, in 2006 Técnica Test forged a key alliance with the company Center of Engineering and Advanced Technology. For 2016, we are unifying the companies (including CEAT's recent manufacturing division Ceat Design and Manufacturing Systems) as an integrated corporate group.

Phone: +52 (442) 2 16 82 65 Fax: +52 (442) 2 16 83 07 www.ceat.com.mx www.tecnicatest.com
Israel Salas Velasco - isalas@ceat.com.mx / Miguel Saldamando Flanagan - m.saldamando@tecnicatest.com

Gene Morrison

Global Aviation, Space and Defence Program Manager, [Intertek](#)



"We have a strong focus on Querétaro and have recently hired a local auditor to reduce costs for our customers in the state."

Can you provide a brief history of Intertek's operations in the Mexican aerospace industry?

Intertek has been operational in Mexico for 12 years now and started initially in the commercial sector. Seven years ago, it began servicing the country's aerospace industry. The sector is incredibly active and vibrant and has grown rapidly over the past decade. We expect to see significant exponential growth in the future.

What services do you offer to the aerospace industry in Mexico?

Intertek offers quality-management systems certifications to international quality standards. With regards to the aerospace industry, these certificates include the AS9100, AS9110, AS9120. These standards encompass manufacturing and service companies, MROs and warehouse and distribution companies. Currently Intertek has approximately 35 strategic customers in Mexico, but we hope to increase this number substantially. We have a strong focus on Querétaro and have recently hired a local auditor to reduce costs for our customers in the state.

How do you leverage your global capabilities to ensure companies in Mexico are receiving a value-added service?

Intertek is unique amongst other third-party certification businesses in that we tailor our services completely to the individual customer's needs. During our primary approach we integrate ourselves fully with the client to discern what we can do specifi-

cally to help them, whether this be a small family-owned company or a large multinational. Another key advantage is our large global network of existing customers. Intertek offers a networking platform through which our certified clients can meet potential customers. This has been hugely successful in Mexico and has brought a wealth of opportunity to the smaller businesses trying to break into the global aerospace supply chain.

What is the main challenge local companies are facing to achieve certification?

One the main challenges is the business mentality. Intertek is trying to change the view that standards are simply there to be met for an audit and show that these guidelines help achieve the highest operational efficiency. We are encouraging companies not to rewrite their management system to accommodate the certification's requirements and scrape through an audit.

To what extent does Intertek remain a strategic partner for a company following a successful audit?

Intertek is constantly thinking of the future and the services that we can offer companies post certification. Following a successful audit we will return once or twice a year to not only confirm that the practices are still meeting the standard's requirements, but also to assess whether the quality management system is truly helping a customer achieve their strategic goals. In addition to this we can provide a number of other services such as training services and second party supplier audits.

Alexandr M. Slouka and Nora Guerra

CEO, and General Manager, [Omni-X MX](#)



"Our goal is to establish ourselves as a leader not only in Mexico, but also in Latin America, by using this facility as a base for those operations."

Can you provide a brief overview of Omni-X's history and global operations?

AS: We are a family business started by my father, my brother and myself in 1987 in Colorado. We expanded to the Czech Republic in 2000 and started our facility in Querétaro three years ago. We have invested a lot of time and energy into this site, as we see Mexico as a growing market for us in the aerospace and automotive industries. We are a tier-two supplier of bending tools. All of our locations are strategically placed to supply that specific region. Overall about 30% of our business is focused on the aerospace industry and in Mexico this is about 25%, but a figure we are looking to grow.

Why is Querétaro's aerospace sector important for Omni-X?

AS: We offer a very niche service and, as such, do not have a lot of competition in the aerospace industry. We identified the rapid growth that Querétaro was experiencing in its aerospace sector and acted on the opportunity.

NG: We also felt that we could contribute to the growth of the country's aerospace industry by transferring our knowledge from our other global sites. Companies here are very willing to develop their operations in this sector, but many lack the internal structure to do so. We have been interacting with a number of local businesses to aid Querétaro in successfully shifting from the automotive to the aerospace sector.

What are the services and products that you are able to offer to the aerospace industry?

NG: We manufacture bending tools for tubes. We are given specifications of the tube and an idea of what the customer wants in terms of the bend. We then design, engineer and manufacture the tools with which to achieve this. We have strong relationships with the machine makers on which our tools are used to ensure that the customer receives the greatest value product.

AS: There are a great many components that go into an aircraft and a lot of tubing. We are able to work with tubes ranging in sizes from half an inch to four inches and in any metals, though typically in the aerospace industry we work with Inconel and titanium.

What measures does Omni-X have in place to ensure the quality of its products?

AS: We have rigorous quality checks in place, but really what lends us our level of quality is significant experience in this field. The bending sector requires a lot of science, but also a great deal of knowledge from the staff working in it. This is something that Omni-X has built up over the last 28 years.

What are the specific advantages that Querétaro offers to Omni-X as its regional base?

AS: A number of our pre-existing customers are based here, but beyond that, the central location of Querétaro and the security of state makes for a very strong business environment. Because of this, we are seeing a constant flow of new companies to the area and, as such, our business is growing.

NG: The state government's commitment to growing the aerospace industry has also meant that it has been easy for companies like Omni-X to establish itself in Querétaro.

How have you seen Querétaro's supply chain grow in recent years?

AS: Querétaro is home to many great machining shops and a lot of these have been able to transfer their skills to the aerospace industry. What we are seeing is a distinct lack of raw materials, not only in this state but also in the whole of Mexico. 90% of our raw materials are coming from the United States, as is the case for other companies here. This increases overheads and lead times. The establishment of a distribution center for raw materials would allow Omni-X to offer a much more value-added product to our customers.

How have you found the quality of the talent pool in supporting your human resources needs in Mexico?

NG: Unfortunately, the academic centers and training schools in Querétaro have not yet caught up with high-quality demands of the aerospace industry. We have found that the talent coming out of these schools is not up to par with our needs. To address this, Omni-X has used its experience from the Czech republic and the United States to establish its own in-house training.

AS: However, the general education is good, and, most importantly, the Mexican people are incredibly dedicated to self improvement and will always complete a task to the best of their ability.

What are some of the goals that Omni-X hopes to achieve in Mexico over the coming five years?

AS: We hope to be moving next year to a larger facility in order to accommodate our rapid growth. Our goal is to establish ourselves as a leader not only in Mexico, but also in Latin America, by using this facility as a base for those operations.

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Addressing the Inverted Pyramid

Growing the Supply Base

As the aerospace industry in Mexico grows, a stronger supplier base will be required, and a combined effort of government, academia and industry is being made to address this issue. The Baja California and Querétaro clusters face similar challenges but are starting from different places. Baja consists of an inverted pyramid, meaning that there are too few suppliers to support the original equipment manufacturers (OEMs) and tier-one companies, while the newer cluster, Querétaro, has yet to develop a supplier base capable of supporting its booming aerospace sector, thus reducing imports. Airbus Helicopters, recently established in Querétaro, has adopted a fully vertically integrated business model. Baja California, on the other hand, has partly relied on the maquiladora program, which was developed to encourage U.S. manufacturers to establish operations in Mexico roughly 50 years ago.

Many processes, including heat-treatment and non-destructive testing, are still mostly outsourced to the United States, but Eduardo Solis, sourcing and global offset manager for Eaton Aerospace in Tijuana, believes the environment is right to start localizing the supply chain. Solis has been tasked with having “50% of expenditure on materials for [the Tijuana] facility sourced in Mexico” by 2020. Meanwhile, in Querétaro, Bombardier has created a “dedicated team that is in charge of developing local Mexican suppliers.” The maquiladora program in Baja California has allowed machine shops to leverage the experience as well as the mature structure of their U.S. counterparts, whereas in Querétaro there is a greater need for suppliers of machining services.

Yet as demand rises and local Mexican small and medium-sized enterprises (SMEs) look to enter this market, they are meeting high barriers to entry, including the expensive and time-consuming process of obtaining customer approvals. Esteban Sanchez, operations manager

at HYRSA Aerospace, a family-owned CNC-machining company that recently received its AS9100 certification and is currently in the process of obtaining customer approvals, says that “long-term strategies are the key to success” for SMEs.

Government funding is also available in Querétaro to support an SME’s process of entry through organizations such as CONACYT and INADEM, but what is needed is guidance. According to Julien Fabreguette, director of Airbus Helicopter’s site in Querétaro, “support here will come through the Aerospace Cluster as, collectively, we are able to offer advice and intelligence.” Still, even with certification, it can be difficult to attract businesses without the support of a globally recognized name. Especialistas en Turbopartes (ETU) say that the difference in the culture of work between the United States and Mexico has meant that it is challenging to establish credibility in the aerospace sector. The local government is using success stories such as ETU’s to convince OEMs to permeate more of their business to the local supply chain.

Special processes also continue to be a much sought after service in Mexico, as companies that are looking to reduce the costs that are incurred by sending components to the United States or Canada. An example of the significance of a name is Barry Avenue Plating Company, a Los Angeles-based company that expanded to Baja California to meet the plating needs of the aerospace industry. Their president, Cruz Maldonado, said that companies were more willing to seek plating services locally from Barry Avenue Plating Aerospace de Mexico because the company is “a widely known name and has a reputation of delivering high-quality services.”

The special processes segment is still underdeveloped in Mexico, as the high level of training needed is not offered at preparatory schools in Baja California, which are more focused on CNC machin-

ing. Anodimex, a Tijuana-based company that offers anodizing services recently attained NADCAP certification and is now making efforts to share its expertise by talking about these processes in local schools. In Querétaro, these services are equally difficult to find, though a number of foreign suppliers have been attracted to the business opportunities presented by the OEMs in the state. NDT Expert Mexico, a subsidiary of the European Testia Group was established to cater to Bombardier’s NDT needs. Aeroprocess TTT, part of the Spanish Grupo TTT, also identified the growing needs in Querétaro and recently began offering heat-treatment services. What Querétaro is seeing the beginnings of, Baja California still lacks. And vice versa.

Baja California’s closer proximity to the United States lends easier access to raw materials than Querétaro. Companies further benefit from swifter border processes and a more robust logistics framework. Tijuana, not centrally located like Querétaro, has also seen the arrival of certified raw materials distributors. U.S.-owned Ryerson opened in Mexico to better serve its existing customers and provide quicker delivery times. Certified to the AS920, Ryerson are planning future expansion to Querétaro, where as yet there are still no warehouses for aerospace raw materials. However, according to Gianfranco Pesenti, business manager of Dishon in Querétaro, “several international companies have expressed strong interest, and urgency in opening warehouses in Querétaro,” which would improve Querétaro’s competitiveness.

The mission to grow the local supply chain is shared by the two states, but each takes a different approach. Baja California, as the more experienced cluster, is collaborating to develop its human resources to support a communal center of suppliers, while Querétaro is leveraging the presence of its large players such as Airbus Helicopters, Bombardier and SAFRAN to attract suppliers from abroad.

Baja California's Aerospace Community

With fifty years of experience, Mexico's largest cluster seeks to strengthen its position

Baja California, the oldest and largest of Mexico’s aerospace hubs, is home to almost a third of the total number of aerospace companies in Mexico. Located in the north-western corner of the country, the state’s major advantage is that it shares a border with the

United States, thus giving companies easier access to North American suppliers. Quick access to major ports and border crossings are additional strengths.

Baja California’s 80-plus aerospace companies are located around Tijuana and Mexicali with smaller concentrations around the cities of Ensenada and Tecate. With 50 years experience in the industry, Baja California’s maquiladora program allows companies usually from the United States to open manufacturing operations in Mexico for significant tax reductions. 70% of the aerospace companies established in the state have a direct relation with California. “In 2015 we brought \$2.5 billion of direct foreign investment into the state, and are expecting to increase that figure next year.” Said Carlo Bonfante, the Secretary of Economic Development for Baja California. The prevailing focus of the government is to develop a greater presence of small and medium-sized companies engaged in the aerospace industry.

More associated with Tijuana, Baja California has developed a specialization in electronics. Benchmark Electronics Tijuana was formed in 1985 and today manufactures circuit card assemblies, subassemblies, box build, and very large scale integration in our Tijuana facility. General manager Rod Gunther said that Benchmark Electronics “has designated its Tijuana facility to be its avionics center of excellence.” The biculturalism pres-



ent in Baja California persuades sister companies in the United States to export more complex processes to the region. For instance, Switch Luz is the Mexican counterpart of Electro-Mech, which manufactures joystick and autopilot switches and has been present in Baja California since 1966. Esterline’s presence in Tijuana further strengthens Baja California’s reputation in the field of electronics.

Zodiac Aerospace, a globally recognized aircraft interiors company has a facility in Baja California in addition to its operations in Chihuahua. The presence of international giants however, does not mean there is a shortage of opportunity for smaller Mexican companies. Innocentro is a recently established interiors company in Mexicali. Roberto Corral said, “The aerospace industry is moving towards lighter and more convenient equipment.” Baja California is mature enough that it can be more progressive in global trends. UTC Aerospace broke ground last year on a new facility in Mexicali that is focused on composite bonding. Also in Mexicali is GKN Aerospace composite structures, but general manager Loren Engel expressed more tempered hopes for progress: “In terms of the engineers, the technical transfer is still challenging and we are still moving towards getting the right systems accessed.”

Honeywell Research and Technology Center in Mexicali is a good example of the innovation and intellectual capabili-

ties available in Baja California, and is focused on the design, engineering and testing of components for aircraft systems. Gulfstream as well has a design group of thirty employees. Design is a major step for the aerospace industry to take, and Baja Califor-

nia will have to leverage the outcomes of projects such as Honeywell’s to persuade the global aerospace community of the state’s potential.

CETYS University is a private school in Baja California that has identified design as the direction the industry is heading, and recently opened its Center of Innovation and Design (CEID). The university’s president Dr. Fernando Leon Garcia said: “we aim to generate knowledge and human capital in innovation and design fields of engineering with the purpose of increasing the competitiveness of Baja California.” The available talent will be critical for companies wishing for design to play a greater role in their operations. Hutchinson Aerospace in Ensenada is one such company that is now developing projects that are being designed internally.

Baja California’s aerospace ecosystem still resembles an inverted pyramid, with gaps being identified in special processes and non-destructive testing. More support for suppliers will be required, including government funding and learning from the experience of other companies in the cluster. “It is not easy to substitute or change global suppliers for our tier-one or tier-two companies,” said Tomas Sibaja, President of the Aerospace Cluster for Baja California. “Therefore, if we want to submit more [local] candidates, these new companies should be supported during the entire process.”

Carlo Bonfante Olache

Secretary, Secretariat of Economic Development (SEDECO) Baja California



"Baja California will continue to be a prime location for aerospace, partly due to its history, advances in education/industry and availability of a trained workforce."

As the oldest aerospace cluster in the country, can you talk about its development over the past fifty years?

Baja California has a 50-year-old aerospace cluster, leading Mexico in the number of aerospace companies established in the state, which represents 21% nationwide. Our aerocluster is a diverse set of aerospace companies, from single assembly to those with more complex processes. Companies like Rockwell Collins, Chromalloy, Gulfstream, Honeywell or UTC are the ones that have been here the longest and represent important pillars to our industry.

Geographically we are in close proximity to the United States, and importantly next to California, which is one of the seven biggest economies in the world. This has allowed us to increase employment in the area, and to develop a local supply chain. We recognize that we have to grow and develop a clear and supportive pro business environment in order for companies to have the confidence to establish here. Therefore SEDECO operates through strategies and processes by which we promote these strengths to encourage foreign investment. In 2015 we brought \$2.5 billion of direct foreign investment into the state, and are expecting to increase that figure next year. This will allow us to develop Baja California's competitiveness, and attractiveness for companies to establish themselves here – for example to offer companies operating here a cheaper rate of energy; 10% to 20% cheaper rate than any other state in Mexico. We are also developing training centers here in Tijuana and Mexicali, which represents a combined effort within the industry to create a better labor force. As well, we work with federal funding offices in order to determine how companies can qualify for grants that are available to them. Finally we operate offices in London, Japan, San Jose and Mexico city, all of which allow us to continue the promotion of Baja California.

How important is Baja California's aerospace industry today for both the state and the country as a whole?

It is very important for a number of reasons. Most crucially employment, there are 28 000 people employed within the Aerospace industry. Having a vibrant aerospace industry also invites knowledge, and innovation to the area which in effect will help us create a local supply chain, which will in turn help our economy. Currently the percentage of integration that we have on suppliers is from 3% to 4.5%, and by the end of our term we would like that to be 15% to 20%.

The aeroclusters, of which there are two in Baja California, were established to address the needs of the industry and

convey them to the government. Can you talk about the relationship you have with these two clusters and the relationship that they have with each other?

There are two main cities that each had a necessity for their own cluster: Mexicali and Tijuana. They should merge to form one cluster, which is something that I am working on. The reasoning for having one cluster is simple; they would have much more strength and power if there were one single cluster. They have a mutual respect for one another, and SEDECO works with both equally – but I think the future is that there needs to be one cluster. This way it will be simpler, and the message will be more representative and valuable for Baja California as a whole.

Looking ahead, how does SEDECO hope to keep Baja California a competitive aerospace hub on an international scale?

In the challenges we are presented with we find opportunities for growth. The aerospace industry in Mexico has low local and national supply chain integration, and many of the processes necessitate crossing and international border in order to be completed, as many of the supplies come from outside of Mexico. Even with the possible exemption of import/export taxes, the additional expense, time and logistics implications of such low-integration-level processes open up an obvious question: could the Mexican aerospace sector be more efficient through further supply chain integration? We believe that so. Part of the state's activities is to achieve a better-integrated supply chain, includes seeking opportunities for potential suppliers. Aimed to these efforts, we planned events such as the Advanced Manufacture Meetings in early November at which will be the first one-to-one meetings platform, which connects decision makers with suppliers in the advanced manufacturing and technologies sector. With the continuation of the National Aerospace and Defense Contractors Accreditation Program and implementation of the BASA, Baja California will likely see important growth in the sector. However, competition inside the country is fierce, with other states offering incentives in the form of tax exemptions and reductions, as well as a lower land cost. Nevertheless, Baja California will continue to be a prime location for aerospace, partly due to its history, advances in education/industry and availability of a trained workforce.

Tomas Sibaja

Executive President, Aerospace Cluster of Baja California



"The Aerospace Cluster of Baja California should be identified as a tool of global efficiency and expertise."

How has the aerospace cluster in Baja California evolved to become the most important region for aerospace production in the country?

Michael Porter coined the "clustering" theory in the early 1990s in his book The Competitive Advantage of Nations and reinforced this notion in an article published in the Harvard Business Review in 1998, 'Clusters and the New Economics of Competition'. Mr. Porter encouraged companies from a given industry in close proximity to benefit with suppliers of specialized inputs such as components, machinery, services, and providers of infrastructure - including academia and stakeholders. This way, larger and smaller firms could experience collective benefits. This idea was not specific to the aerospace industry, and has been adopted in many countries across various sectors.

The development of this type of cluster, along with an accompanying mindset of competitive collaboration, has been an effective means of growing our aerospace cluster in Baja California. In the 1960s, Mexico partnered with its northern neighbor, the United States, in its new capacity as the country's supply manufacturing base, mostly in the northern Mexican states at the border. California with the 7th largest defense and aerospace fleet in the world located minutes away from our border here in San Diego did its part stimulating Baja's aerospace production, and eventually led to an ecosystem of five major aerospace segments currently active: commercial aviation, defense, space, unmanned aerial vehicles and maintenance, repair and overhaul services". In fact, the first aerospace company establishing a presence in Mexico did so in Baja California in 1966. The Aerospace Cluster of Baja California started officially in 2006 with the idea to improve inner relations amongst companies located here.

The task was at times discouraging. The aerospace industry moved into the region solely market-driven by convenience of location. There was no coherent industrial policy specialized per sector showcasing the advantages of being under a cluster initiative. The cluster term was more commonly known as a concept in research education than as an active organization in the field. The industry knew better flying solo following the trails of competitors or clients to their business, why bother with an extra layer of data provision? Nonetheless, we succeeded.

What strategic advantages does Baja California offer?

As the northernmost state in Mexico, Baja California shares its border with a strategic ally, California. More than 70% of the aerospace companies established in our state have a direct relation with California. Additionally, biculturalism stemming and technical support from such proximate relations has proven especially conducive to continued investment and business. Yet we have to

offer more than proximity to welcome complex projects. Location is a great value, if offered with a value proposition well structured and saleable. For example, while other clusters offer labor, land, and logistics, members of our cluster are actively engaged in collaborative efforts at different levels of production or specific market requirements. We have various cluster-wide initiatives and projects and operate truly as a cluster value shared offer, rather than a generic promotional tool that it is better served for promotional entities or government agencies.

What challenges do companies in Baja California face?

Today, the aerospace supply chain requires more small and medium-sized companies in the market. New entrants should be supported during the entire process. Schools also require more involvement from our industry in their educational programs. We need to start providing content aimed at technical training institutes and engineering areas that demand particular base-knowledge in the field, for example.

As Baja California's aerospace industry matures beyond the traditional maquiladora program, what will be the role of design?

Honeywell MRTC Center is a great example of how Baja California's young talent is being leveraged to incorporate design into the aerospace field. Leyman Engineering is a private firm offering custom-made services in design engineering. Catia and Solid-Works also offer training courses to a young cadre of people interested in offering third-party services with an entrepreneurial base. Spectrum Integrity also collaborates with academia to groom young kids to participate in complex defense projects. Our mission now is to show that Baja California and Mexico can operate in the field of design.

What goals do you have for the growth of Baja California's aerospace industry?

Firstly, the active collaboration, exchange of information, and sharing of best-business practices is the way forward. As one of the leading clusters in Mexico in the aerospace sector with strong ties to clusters abroad, we want to showcase our Mexican strengths and business opportunities that benefit the global industry. Rather than competing with other clusters abroad, we want to clearly articulate our capabilities and strengths to the international market. In this way, we will be better equipped to strategically serve original equipment manufacturers, based on their specific competencies and requirements. The Aerospace Cluster of Baja California should be identified as a tool of global efficiency and expertise.

John Ortega

Vice President and General Manager,
Gulfstream Mexicali



"Gulfstream Mexicali has a design group of 30 employees who support engineering needs for production and completions."

Can you please introduce us to Gulfstream and provide a brief history of the group's operations in Mexico?

Gulfstream Aerospace Corporation designs, develops, manufactures, markets, services and supports the world's most technologically advanced business-jet aircraft. The company, based in Savannah, Georgia, is a wholly owned subsidiary of General Dynamics. Gulfstream, which has more than 16,000 employees, has built more than 2,400 aircraft for corporations, governments and individuals around the world. In 2014, the company had 150 outfitted customer deliveries. Its backlog at the end of 2014 was \$13.23 billion.

Gulfstream began its manufacturing operation in Mexicali, Baja California, in 1986. The workforce has doubled in the last 10 years to more than 1,600 employees. The size of the current Gulfstream Mexicali facility is 335,000 square feet (31,123 square meters).

What role does the Mexico facility play for Gulfstream's overall global manufacturing operations?

Gulfstream Mexicali plays a significant role in the manufacturing process for Gulfstream aircraft. The site's employees make wiring harnesses, sheet metal components, subassemblies and machined parts that are used in the manufacturing process of Gulfstream's full fleet of in-production aircraft (G650/G650ER, G550, G450, G280 and G150).

Could you provide details about the facilities, equipment and certifications that are supporting your Mexican operations?

As mentioned earlier, Gulfstream Mexicali is a manufacturing facility. We do not provide details on the specific equipment used there. However, we would like to note the continuous improvement culture found throughout Gulfstream, perhaps no more so than at Mexicali.

Employee involvement is encouraged along with the incorporation of lean tools and philosophies into ongoing processes at the site: manufacturing, engineering, business-support activities and management.

A culture of continuous improvement empowers all employees to submit ideas that make their job easier, foster a more innovative work environment and transform their abilities, capabilities and knowledge.

In 2004, Mexicali employees submitted more than 500 ideas to improve the site's processes. By 2008, the submissions grew to nearly 34,000. In 2009, Gulfstream Mexicali was awarded the Shingo Prize for Operational Excellence for its focus on lean manufacturing and elimination of waste. It has been named

among the 100 Great Places to Work in Mexico for the past four years. Gulfstream Mexicali was named the 12th Best Place to Work in Mexico for 2015.

What are the key advantages that Baja California offers to Gulfstream and the global aerospace community?

According to a 2012 George Washington University study, Baja California has more than 40 years of experience in the aerospace industry. The study indicates that the state's large concentration of aerospace companies is due mainly to the supply chain proximity to California and Arizona and the availability of a strong labor force. The study adds that Baja California has a big competitive advantage over other Mexican states in terms of infrastructure (highways connecting Mexico to the United States, major cargo seaports, international airports, railway services and direct border crossing sites, with several ports of entry to the United States).

Can you discuss how Gulfstream collaborates with local academic institutions to support its human resources needs?

Gulfstream Mexicali pays for employees to pursue training and academic degrees at a local college, CETYS Universidad. Employee family members are eligible for CETYS Universidad scholarships sponsored by Gulfstream Mexicali.

How is Gulfstream Mexicali growing its capacities in design?

Gulfstream Mexicali has a design group of 30 employees who support engineering needs for production and completions.

What are Gulfstream's major goals for the coming five years?

Gulfstream Mexicali will be instrumental in the manufacturing of our newest aircraft, the wide-cabin and long-range G500 and G600, producing wiring harnesses, sheet metal components, sub-assemblies and machined parts. The G500 is scheduled to enter service in 2018, while the G600 will follow in 2019.



Eduardo Solis

Sourcing/Global Offset Manager,
Eaton Aerospace



"Eaton's Tijuana facility is in a position to start significantly localizing its supply chain."

Can you provide an overview of Eaton's operations in the aerospace industry?

Eaton is a diversified corporation with headquarters in the United States and annual sales of around \$23 billion. About sixty percent of Eaton's business is in electrical components/solutions and the rest in the industrial business. The latter is divided into three pillars: automotive, hydraulics and finally aerospace, which accounts for \$1.9 billion of our overall business. Eaton is defining itself as a provider of system solutions to our aerospace customers. Those solutions fall into four main areas: hydraulic systems, fuel and inerting systems, motion control, and engine solutions.

What is the importance of the Tijuana facility to your global aerospace operations?

With 20 facilities in the country, Eaton Corp. has a strong presence in Mexico, though this facility in Tijuana is the only one dedicated to the aerospace business. The operation was started in 2006, is in a 282,000-square feet facility, and has a workforce of 600+ people. The three main product lines manufactured here are ducting for high and low pressure applications, assembly of solenoid valves, and assembly of fluid distribution components (hoses, fittings). The majority of the components manufactured at this site are shipped to other Eaton Aerospace facilities to integrate shipsets for customers. The Eaton Aerospace Tijuana facility is positioned as a center of excellence for ducting solutions, and today is one of the best facilities worldwide for Eaton Aerospace.

Where have you identified gaps in the human resources chain supporting the aerospace industry in Mexico?

Over the last ten years Mexico has received more in the way of aerospace FDI than any other country in the world. Last year as a country we exported \$6.4 billion in aerospace business. However, around 60% of this was material and less than 10% of that was purchased in Mexico. This proves the significant gap that we have in our local supply chain. In a sustainable aerospace industry a pyramid is formed from a wide base of small to medium sized suppliers above which you have a smaller number of tier-one and tier-two companies and then at the top the original equipment manufacturers. In Mexico, this is inverted; we need more in the way of small and medium-sized enterprises (SMEs) to satisfy the base of the pyramid, but what those companies need in order to do so is technical talent, of which there is a distinct shortage in Mexico. There are a great many universities that are graduating aeronautical engineers, but having enough technicians in fields like CNC-programing, welding, composites, air-

frame assembly, complex assemblies, quality inspectors, chemical processing, thermal processing, etc. is critical to support the development of a supply chain in Mexico.

How has Eaton sourced its local suppliers?

Mexico is a strategic area of sourcing for Eaton. The last decade has seen Baja California go through an intense learning curve and process in establishing its reputation as a destination for aerospace, during which the region was not in a position to be supporting local suppliers. However, now the environment is right and Eaton's Tijuana facility is in a position to start significantly localizing its supply chain. Our task for 2020 is to have 50% of our spending on direct materials for this facility sourced in Mexico.

What are the major challenges you expect to encounter in achieving this?

One is the aerospace business model. The aerospace industry is high-mix and low-volume; companies need to be able to absorb business in this scenario, which implies not only the machines and technology, but also having the technical talent to be able to develop multiple part numbers. Second, is the implementation of a AS9100 certified quality system or in the case of special processes (chemical processing, thermal processes, welding, non-destructive testing, etc.) a NADCAP accreditation, and this is only the entry, since in cases several customer approvals are required in top of AS9100 and NADCAP. Of course this has meant that the process of bringing on a new supplier in Mexico is extremely slow, in part also, due to all the validations required to put our parts in the air. Another major challenge is that unlike the automotive industry, where a supplier can dedicate an entire facility as the source of all its business with one customer, a supplier to the aerospace industry must have a number of customers in order to have a sustainable operation.

Eaton is very active in encouraging the growth SMEs operating in the aerospace industry in Mexico not only for its own needs, but also to ensure that the country's industry as a whole increases its competitiveness. We have a good success story with Barry Avenue Plating from Los Angeles or BAP Aerospace de Mexico in Tijuana, which has an excellent reputation in the global aerospace industry with more than 60 years in business of aerospace plating/chemical processing. As aerospace companies in Mexico are embracing this NADCAP accredited company, BAP Aerospace de Mexico is today the most recognized aerospace plater in Latin America.

Loren Engel

General Manager, **GKN Aerospace Composite Structures**



"What I like about doing business in Mexico is that what you see is what you get; business relationships are very transparent."

Can you give a brief introduction to GKN and the company's operations in Mexico?

GKN is a British firm that was established in 1959. Over the decades the company has transformed itself into four primary businesses. The largest component of GKN is the automotive business with the aerospace component being the second largest. As of 2014, aerospace makes up 30% of GKN's revenue. Within GKN aerospace there are different divisions including aero structures, engine products and special products. The company has a presence all over the world, but is predominantly in Europe and North America.

Within aero structures North America, there is a business unit called advanced composite structures. The corporate office for this business unit is in Tallassee, Alabama and until 2012 it was the only site within the advanced composite structures group. There have been four location additions and currently there are five sites within the group. The site in Mexicali was established in 2012.

The Mexicali site was strategically established to be a competitive enabler for GKN aerospace. The aim was also to help the original equipment manufacturers in their pursuit of the Mexican market in providing off set credit to these companies. Currently, the Mexicali site is qualified for doing defense work and most of the work being done is U.S. military work.

Can you elaborate on GKN's facility, the equipment, and the certifications that the company has?

In terms of the physical facility, GKN has 80,000 square feet that the company leases on a long-term basis. Before the facility was started, a workshop with the landlord and the contractor was held as to determine the requirements for the site. Within two days, the site was laid out, and the company decided to lease the whole 80,000 square feet and grow into the space in two phases.

In terms of certifications, the first priority was to get ISO 9000 and AS 9100 certifications. GKN earned these in 2013. As of March 2015, the company also has NADCAP certification, which is very important in any aerospace business, especially in composites. Earning certifications are dependent on a strong team environment. GKN Mexicali has a significant amount of support from our Alabama parent site, both in terms of quality and engineering and insuring that we have our processes under control. GKN has also recruited a very experienced leadership team in Mexicali, which includes an operations manager, engineering and quality manager and a program manager.

What are some of the key advantages GKN identified in Mexicali before establishing a facility?

The cost structure was the key consideration. The lower cost structure enables GKN to improve its profit margins on existing products and provides a competitive enabler for pursuing new business. Mexicali offers opportunities to GKN as the company can leverage the cost structure here to lower the average cost and be competitive. The location was also a very important consideration, and Mexicali is perfect as it is right across the border. The stability of the city in terms of lower crime rates and the strong work force is also an advantage.

Can you elaborate on the strategy of knowledge and technical transfer that GKN has undergone and how successful this strategy has been?

GKN has a lean operation in terms of indirect to direct. The company has 110 employees and only 15% of the employees is on salary or indirect. The transfer of knowledge has been largely from the technical staff in Alabama in terms of supporting and training in product and process knowledge. This transfer of manufacturing know-how in order to successfully build product has been very successful. One area that has been a challenge for us is providing our engineering staff with the access to technical data in GKN systems that they need to do their jobs. The issue has been how to give our engineers access to the data for which we have export licenses in place while preventing access to data for customers and product for which we do not have licenses. GKN is in the process of testing an ITAR compliant version of our MRP system which will allow the company to have better technology transfer to our engineering staff.

Does GKN source supplies locally?

To this point, local sourcing has been limited to operating supplies. The raw materials are all imported from the United States. GKN wants to develop local suppliers for non-destructive testing, CNC machining and tooling, as outsourcing these services to U.S. companies is difficult and expensive. Finding local suppliers can sometimes be difficult in Mexicali, but there are opportunities for suppliers to enter the local markets. The government is also running programs to encourage them.

Do you have a final message?

What I like about doing business in Mexico is that what you see is what you get; business relationships are very transparent. GKN Composite Structures is happy to be in Mexico and is ready to serve our customers' aerospace composites needs.

Tad Shiner

President and CEO, **Hutchinson Aerospace and Industry, Mexico**



"We are just at the beginning of our five-year plan and are set to make a considerable contribution to Baja California's aerospace industry."

Can you give us an overview of Hutchinson's operations in Mexico and the role this facility is playing?

Hutchinson is part of the French oil company, TOTAL SA Oil. There are three Hutchinson sites in Mexico, but this is the only one focused on aerospace operations. The four main groups of products within Hutchinson aerospace are thermal insulation, fabric, mechanical sealing systems, and structures. Our facility in Ensenada is AS9100- and NADCAP-certified, with customer approvals including Bombardier, Boeing, GE, Honeywell, Triumph, UTC and Gulfstream. What separates us from other maquiladoras in Baja California is that we are completely self-contained, including design and development of new products. This facility has seen substantial growth over the past three years, and we expect to double in size again over the next two years and our product line to grow by 300%. We are developing projects that are being designed internally here. Currently our facility is 90,000 square feet, with a staff of 330.

Does the Mexican aerospace market present an opportunity for growth?

The majority of our products are exported to the United States, but we have on-going projects with Eaton Aerospace in Tijuana and SNECMA in Querétaro. These projects are in support of Boeing and Airbus aircraft.

How have you found the process of product transfer?

This process certainly has its challenges, as with any transfer projects. We have two teams in Mexico and Europe that coordinate the transfer activities and requirements. We also involve the customer and make sure there is constant dialogue between all three parties. Once that communication is in place, we can begin the process of developing the right plan based on customer requirements from Europe to our Mexico factory. We are currently working on a product for the Boeing 737 MAX that was developed in Europe with the help of our Mexican design team and is now in the beginning phase of transfer to Ensenada.

How have you incorporated design into your operations in Mexico?

This is something that we had to develop because it did not exist in our organization. Our engineering team has become successful and stronger over the last ten years. This is something that takes time, and I am proud of the team that we have created. As part of this process, we have sent our Mexican engineers to Europe to gain experience and bring the knowledge back to Ensenada.

Most of our customers support this transfer, and we have not encountered much resistance in bringing design into Mexico. They have found it favorable to be dealing with someone in the same time zone. Most of our engineers speak English, which is a requirement to do business with U.S. engineers.

How have you worked to develop the young talent in the area?

Hutchinson is working with local universities in Northern Baja to find talented engineering students who are skilled on CAD systems. We have developed a program that starts these engineers as 'interns' and ultimately hire the best qualified. It is important to note again that our engineering team members are as bright and talented as any engineers I have worked with during my career.

Do you see Ensenada playing a more prominent role in Baja California's aerospace industry?

Ensenada needs to do more to promote itself to be recognized alongside Tijuana and Mexicali, and we are working with the Baja California Aerospace Cluster to achieve this as well as attending crucial events. There are many opportunities for companies here, and the available talent is a significant strength of the area.

What is your strategy for achieving your projected 100% growth over the next two years?

Winning new programs will be key, including products used on the new Boeing, Airbus, Gulfstream, and Bombardier aircraft. This will help us achieve the high goals we have set ourselves. There is still a vast amount of opportunity in the United States that we can benefit from.

Do you have a final message for our readers?

It is an exciting time for Hutchinson aerospace in Mexico. We are just at the beginning of our five-year plan and are set to make a considerable contribution to Baja California's aerospace industry. We have tapped into the hugely talented human resources pool and as a company with a strong Mexican staff, we want to promote to the world that our organization and engineers from this country are as capable as those from the United States or Europe.

Rod Gunther

General Manager, Benchmark Electronics Inc.



"Benchmark has designated its Tijuana facility to be its Avionics Center of Excellence."

Can we begin with a brief history and overview of Benchmark Electronics' operations in Mexico?

Benchmark Electronics Tijuana was formed in 1985; it was a spin-off from Sperry Flight Systems, which was then acquired by Honeywell, which, in turn, transferred its manufacturing operations to a contract manufacturer in 1999. Our manufacturing operation was acquired by Benchmark Electronics in 2013. Benchmark's service offering in avionics includes: box build, Circuit Card Assemblies, cables; and harnesses. We manufacture CCAs (Circuit Card Assemblies) subassemblies, box build, and very large scale integration in our Tijuana facility. Our experience in Aviation ranges from electronics found in the avionics bay, cockpit, cabin, engine and actuators for the surfaces of aircraft. Worldwide, almost every commercial aircraft contains a Benchmark Electronics product.

How important is aerospace to Benchmark and why did it acquire the Tijuana site?

Benchmark desired to have a northern Mexico presence to complement its central Mexico facility in Guadalajara. Benchmark focuses on high reliability markets and as such The Tijuana facility is dedicated to avionics, medical and high-end industries.

Can you give details about your facility and its key equipment and certifications?

The company's facility in Tijuana is 107,000 square feet, with 525 employees. Equipment includes: seven surface mount technology (SMT) lines; six wave soldering machines; two selective soldering machines; six selective conformal coating machines (85% of CCAs will be conformal coated). Benchmark's certifications include: AS 9100, ISO 9k2k; ANSI S20.20; and, in early 2016, will have NADCAP certification.

What aircraft are you currently working on?

Benchmark is currently building actuators that are used to control aileron, elevator, rudder and spoiler for the Airbus A350 and Boeing 787. It entails building circuit cards, putting the end item together, recording the automatic torque for traceability including the running and final torque. When built, functional test and highly accelerated stress screening is required, as well as random vibration to simulate actual stresses during flight.

What were the biggest challenges for the company in its tech-transfer to Tijuana? What are the major strengths that Baja California offers as a hub for aerospace?

The biggest challenge is the thought-pattern shift of aerospace companies in United States that the low-cost region of Tijuana

is a good destination to source products for original equipment manufacturers (OEMs). However, geographically, Tijuana is ideally situated, being close to San Diego, having bilingual personnel, and sharing a time zone; Benchmark's Tijuana facility is only 45 minutes' drive from San Diego's airport. Benchmark has been established in Tijuana for 25 years; its avionics business surged 12 to 15 years ago upon the introduction in 1997 of the North American Free Trade Agreement. This agreement initiated steady jobs in Mexico giving parents the financial stability to send the next generation to college, resulting in a plethora of four-year degree students from Baja California in engineering and international business. In the last 10 years, Tijuana's infrastructure has markedly improved.

Is the supply chain of small and medium-sized enterprises adequate for Tijuana's aerospace industry?

Many of Benchmark's parts are sourced from United States and Asia. It has been working on localizing its supply chain in sheet metal and plastics, although many OEMs select their own materials. The company's daily needs are contracted locally, e.g. stencils for SMT assembly equipment; benches; and maintenance, repair and MRO supplies. There are some special process gaps that are being addressed in the supply chain locally to fulfill the requirements in the aerospace sector. Within the next few years, local companies will be filling the niche-market of special processing to fulfill the NADCAP requirements.

What is your involvement with research and development (R&D) and are you incorporating automation?

Our involvement in R&D will be with our approximately 300 design engineers located around the globe. While we will work with our customers to assist them in these areas, at that site level, we are focused on the product realization side of the business. With regards to automation, we are very fortunate to have some of the best automation engineering available in our engineering community. We do incorporate automation and semi-automation in the process where it makes reasonable and financial sense based upon the complexity and volume of the task.

What goals do you have for the next five years?

Benchmark will grow its facility and capabilities within the Tijuana area with anticipated growth in mid-double digits year-over-year. OEMs in United States and Europe have a financial desire to continue moving product to a high talent, low cost region area. Companies are finding that Mexico provides a better total cost of ownership than many of the Asia sourcing decisions they made a number of years ago.

Joaquín Jiménez

Director of Innovation and Government Affairs, Skyworks Solutions de México S. de R.L. de C.V.



"Our solutions enable a number of applications within the automotive, broadband, cellular infrastructure, connected home, industrial, medical, aerospace, smartphone, tablet and wearable markets."

Can you introduce us to Skyworks Solutions?

Skyworks Solutions, Inc. is empowering the wireless networking revolution. Our highly innovative analog semiconductors are linking people, places and things spanning a number of new and previously unimagined applications within the automotive, broadband, cellular infrastructure, connected home, industrial, medical, military, smartphone, tablet and wearable markets. Headquartered in Woburn, Massachusetts, Skyworks is a global company with engineering, marketing, operations, sales, and service facilities located throughout Asia, Europe and North America.

Can you talk about the importance of the Mexicali facility to Skyworks' global operations?

Skyworks' Mexicali facility provides assembly, test and finishing services for a wide portfolio of semiconductor solutions. Mexicali is the largest manufacturer of multichip models and Skyworks is the largest supplier worldwide. Our assembly capacity is almost 9 million units a day and test capability is 12 million units a day. We operate in a 360,000 square foot facility and are certified to ISO 9000, ISO 14000 and the TS 4969. Our staff of 3,500 employees works four shifts. We are fully integrated vertically and have around 1,800 automated machines that run 24/7. We are constantly exploring new ways in which to reduce cost and increase productivity. From fiscal year 2011 to fiscal year 2014, we increased our capacity by 145% and saved \$20 million through cost saving initiatives.

How important is the aerospace industry to Skyworks Solutions?

Skyworks sells a majority of its aerospace and defense solutions through distributors, who in turn sell directly to larger industry customers. Mexico has experienced an aerospace boom over the past ten years and certainly there has been an increased need for our commercial, off the shelf sector devices that are then incorporated into larger platforms.

How does Skyworks help develop talent in Baja California to support its human resources needs?

One major advantage the Baja California area offers the industry, and in particular Mexicali, is access to a wealth of talented individuals. Skyworks Solutions is very involved in developing this. The linkage committee in Mexicali is an effective communications platform for companies to come together with representatives of academic institutions and discuss the current needs and requirements of the various industries operating in the area and ultimately develop the talent that we need. Linkage activities will ultimately define the future of industry, and we have been

doing so for over 20 years. In Baja California, we have 12 universities and over 48 technical schools, which together produce up to 15,000 engineers on a yearly basis. Skyworks Solutions also has a program in place whereby we scout universities for some of the best students to offer them internships after which they will have the choice to stay on in full time employment with the company. We currently have 26 students with us as part of this scheme and another 25 on what is called social services required by universities.

Can you provide more detail as to how Skyworks Solutions fosters innovation?

Around five years ago, we established the Skyworks center of innovation (CISEM) in Mexicali. This was in response to study we conducted that showed that the work that was being undertaken in universities across the country was not the type of work that was needed by the industry. We invited students and professors from all over Mexico to come together at Skyworks and focus on what was really required for industry to progress. Today, we work with universities and government agencies to establish what the next technology is going to be and where it will take us. We encourage innovative thinking and even have our own patent office to protect the constant stream of new ideas.

How is this being applied in the aerospace sector?

Skyworks Solutions is an active member of the aerospace cluster in Mexicali and is in tune with the current thoughts and needs of this sector. Innovation is certainly a new step for the aerospace industry. The most important asset is the talent available here in Mexico. For innovation, you need keen minds, and Mexico is in no short supply. With the right guidance and efficient knowledge transfer, Mexico's aerospace industry could be competitive internationally. What is crucial is maintaining that strong link between academia, government and industry.

Do you have a final message?

It is an exciting time at Skyworks. Our solutions enable a number of applications within the automotive, broadband, cellular infrastructure, connected home, industrial, medical, aerospace, smartphone, tablet and wearable markets. In Mexicali, we continue to expand and increase our capacity to meet this growing demand. We are very customer-centric with quality, cost and productivity all key elements of our success. Our growth is fuelled by the wealth of talent available and the people's collective determination to succeed. This is one of Mexico's greatest strengths and what the international aerospace community needs to know.

Roberto Corral, Bill Jordan, and Sergio Segura

General Manager, Operations Manager, and Quality Manager,
Innocentro LLC



Can you give a brief introduction to Innocentro and the company's involvement in aerospace?

RC: The original company was established 13 years ago and in 2014 the company became Innocentro LLC. Innocentro is a Mexican company that can offer various services and skills to the aerospace industry. It is making progress in relation to cabin interiors, offering solutions for the equipment mounted on the galleys and galleys themselves. The aerospace industry is moving towards lighter and more convenient equipment. All the materials used in this industry need to be certified and thus all the designs have to make sense.

Aerospace offers significant opportunities, as there is equipment that can be reused, refurbished and retrofitted. Retrofits are becoming the focus, as one does not need a huge factory with thousands of people. They are the core of the MRO industry. In Mexico, this industry has been growing substantially, as there are not too many companies that do specialty work on specific parts of aircrafts.

Innocentro's core competency does not only come from the engineering side, but has transferred to the manufacturing side. The company is starting to build its own brand in terms of manufacturing, and the brand is called Ingeniom.

BJ: Innocentro has full metal shop capabilities. The company has CNC machining of all metals, lasers and sheet metal punch and bending equipment. Innocentro has a significant amount of experience in making parts in different materials for airplanes as the company has been in the aerospace industry since day one. Innocentro is very aware of all of the requirements for AS 9100 and certification. The company mostly does contract manufacturing and most of the manufacturing is done in Mexico. As Innocentro complies with U.S. standards, it can subcontract manufacturing jobs to North American companies.

What is Innocentro's strategy for defining the product portfolio and what is the company's added value with this range of products?

RC: Innocentro LLC just created the Ingeniom brand. The company intends to target the customers that we already have a good relationship with. Innocentro is no longer going to subcontract manufacturing, but rather evolve our own branding. The strategy for 2016 to 2017 is related to our interiors repair/assembly cell. Innocentro will have a strategic alliance with a company in Singapore and will interchange our two companies' expertise. From there on, Innocentro will build a shop in Mexico, of which part will be a repair station.

A repair station is an airworthy, caged area authorized by the Federal Aviation Authorities (FAA) through Mexican authorities, which is called DGAC. The authorization can take as long as six to nine months and is very costly. It is worth having a repair station as Innocentro will then have the authority to repair different parts of aircrafts in regards to interiors. Innocentro believes that repairs will be growing at a very fast rate, as the slowdown in the economy is making people hesitate to buy new equipment.

What measures will Innocentro take to ensure its quality of services and products?

RC: The equivalents of AS and ISO are currently in the works. Innocentro is going to keep the high level of certification and quality. The company is in the process of having a person working specifically on the quality of its services and products. The quality department is not responsible for revising only the end product, which can be seen as internal rework. The tolerance for scrap is near zero, and Innocentro has become a near zero company. The company has achieved this as we kept along the lines of doing less rework.

BJ: In terms of on time delivery with cost effectiveness, it is about having the experience. One has to know what you are doing and how long it is going to take. Delivering on time, agreed upon with the customer, is a very important aspect in the business.

What key strengths does Mexicali offer as a destination for the aerospace sector?

BJ: In Mexicali, the people like to work and want to work as to improve their lives. As a result, the city has major opportunities. There is a very stable and skilled population. There are also numerous engineering training institutes, and the government is investing a significant amount of money in its own people.

RC: Mexicali and Tijuana both have specializations that have paved the way for the aerospace industry. Between the two clusters, there is a significant amount of advantage for the state as a whole. Tijuana has more companies employing fewer people with niche capabilities, while in Mexicali you will see larger companies with a more in-depth knowledge base.

As these two clusters have evolved, what are your observations on the local growth of the supply chain?

BJ: The local suppliers are definitely growing. In order to sustain a very large manufacturing push in development, more still needs to come. For the aerospace sector to really take off, the local supply chain needs to grow significantly. Over 95% of supplies are still imported.

Roberto Limón

President, Anodimex de Mexico, S. de R.L. de C.V.



"We are currently in the process of establishing salt spray testing capabilities, for which we have the certification."

Can you provide a brief history of Anodimex and any recent major milestones?

Anodimex is special-process company offering a range of anodizing services to the aerospace industry. We started as small, family-owned business with only three people. Today, we have grown to a staff of 20 and are able to boast having obtained both the ISO and NADCAP certifications. Beyond those certifications, we also have customer approval from Gulfstream and are currently in the process of obtaining approval from Boeing.

What specific services do you offer to the industry?

Our core competency is in anodizing. We offer all types of anodizing, those being types I, II and III. Type I is chromic anodizing, which allows companies to weld or adhere cloth into aluminum to prevent separation. Type II is a corrosion preventative and type III is hard anodizing. We are also a provider of electroless nickel plating and we also do some chem film, a process which prevents corrosion, but also allows the customer to then paint over the metal as it lends a good adhesion to the paint. 90% of our business is focused on the aerospace sector and, as such, aluminum is the most common metal we work with. All our equipment is in sequence and operated manually. Everything is monitored extremely closely and we have a laboratory that is also NADCAP-certified to support our analyses of chemicals. The NADCAP certification requires that all of our equipment is centrally controlled and monitored, for which we use top of the range software.

Can you talk through the process of achieving NADCAP certification?

Achieving this certificate was a very long process. It became apparent that in order for us to be successful in the aeronautics sector, we must have all the necessary accreditation. In 2000 the NADCAP certificate started becoming more and more enforced in the aerospace industry, it had been the same case previously with the ISO certification, which Anodimex also has. The first nine years we spent identifying and understanding the precise requirements of the certification. At the time there was much confusion within the industry in Mexico as to what these exactly were. The way in which Anodimex addressed this was to approach directly our potential customers and work with them to establish what they required and how we could perform this to a NADCAP standard. Companies such as Eaton and Zodiac were able to then guide us through the process. Once we had a system in place, we embarked on a two-year period of gathering all the necessary documentation and work records required by the auditors. This eventually led to what was for Anodimex a successful audit, which lasted around eight days in total.

What are some of Anodimex's major goals for the next five years?

We are currently in the process of establishing salt spray testing capabilities, for which we have the certification, but the equipment is yet to arrive. I also hope that in the next five years we will be able to move to a larger facility.



Guillermo González

Plant Manager, [Platinadora Baja](#)



"One of Platinadora Baja's growth interests is to offer non-destructive testing, as it is sought after. This service does, however, require a significant amount of funding and training."

Can you give a brief history of Platinadora Baja and the company's presence in Mexico?

Platinadora Baja was established in 1996 and started plating products for commercial applications. Over the years the company has acquired a strong knowledge and expertise on different processes and became more technical and focused on compliance to several specifications. The growth and diversification of the company has been directed by shifts of the economy and the fluctuations of different fields or industries. In the region, the strongest fields are the medical industry and some sectors of the military and aerospace industry. In 2010, Platinadora Baja decided to increase its presence in the military and aerospace sector by opening a pilot line dedicated to this purpose. Our customers helped us significantly in developing our knowledge and quality standards in this sector.

In 2012, Platinadora Baja decided to build a new facility dedicated for the aerospace sector with the idea to become one of the main chemical-processing supplier for this industry. The construction of the new facility took approximately three years and simultaneously our staff developed our quality system and got ready for NADCAP certification, which the company obtained in 2015. The quality system can be broken up into two parts which include the AC7004, basic quality system, and AC7108 for chemical processing.

To obtain these certifications, the team has to make a big commitment, work as a group and dedicate a lot of time and effort analyzing all specs and requirements to determine existing capabilities to run the processes and to determine which ones will be subject to certification. All processes need to be measured and tested. Some of the testing activities like thickness measurement, solder ability and salt spray are done in-house while other more complex and expensive to operate are outsourced. Outsourced tests include gold purity tests and micro hardness tests.

How important is the aerospace industry to Platinadora's overall operations?

When Platinadora started considering to entirely enter the aerospace market, the company already had a substantial amount of work within the sector. Over the years, it has earned the trust of its customers and been very busy in aerospace. Adding all our facilities, the company currently employs 450 people. In the aerospace facility alone, Platinadora has 70 to 80 employees.

What are the typical finishing needs of the industry?

Currently Platinadora Baja has focused its attention on the connector niche of the industry. The company does a significant amount of electroless nickel plating, which includes mid-phos-

phorus and high-phosphorus solutions. Platinadora Baja also does cadmium plating for the military, as this finish provides great resistance against corrosion and has excellent performance qualities. The finishes offered are olive drab or military green, yellow and clear chromates.

The use of cadmium is decreasing as the use of this metal has some environmental restrictions. Platinadora, however, has very strict regulations and pollution control in our plant to prevent contamination and unnecessary exposure to heavy metals. The company makes sure that all waste is neutralized, properly treated and confined.

Is Platinadora able to work with the range of specialty materials used in the aerospace industry?

Under NADCAP certification, the plating supplier selects the processes willing to offer and then gets qualified for them. Platinadora Baja offers electroless nickel plating, cadmium plating, gold plating which include copper and nickel under layers, zinc-cobalt plating, zinc-nickel plating, passivation, trivalent and hexavalent chemical conversion coatings, tin and tin-lead plating, type-II and type-III anodizing and the application on solid film lubricants. These finishes cover great part of our current and potential customer demands.

Does Platinadora do composite work for aerospace?

Platinadora Baja does plating of plastics and has done successful trials on composite materials for a couple of customers. We currently do some plating on plastics jobs for commercial customers, but not any aerospace or defense composite or plastic materials. If the need arises from aerospace customers, we consider ourselves ready to offer this service.

Is there a gap between the demands of the aerospace industry and what the local suppliers can provide?

One of Platinadora Baja's growth interests is to offer non-destructive testing, as it is sought after. This service does, however, require a significant amount of funding and training. There is a big gap between the aerospace industry and the local suppliers. Local suppliers still need to undergo a culture change in terms of quality systems. An additional challenge is finding funding to enter the market. It is the government's responsibility to make markets more accessible for them. It can play a significant role in academia, training, and providing funding opportunities for smaller companies to enter markets. Achieving Nadcap certification has been another major roadblock that small companies are forced to deal with due to its training and facility development costs.

Angel Torres

General Manager, [Ryerson, Tijuana](#)



"As a corporation Ryerson is seeking to grow in the aerospace sector, and the Tijuana facility is pioneering this."

Can you provide some background on Ryerson's history in Mexico?

Ryerson is a U.S.-owned company and as a corporation has been in the metals industry for 170 years. We have been operating in Mexico for five years and have facilities in Monterrey, Hermosillo and Tijuana. As a raw-materials distributor we serve any industry that has need for both ferrous and non-ferrous metals as well as a range of special alloys. Our sites in Mexico are strategically located in order to best serve the respective industry clusters. Ryerson have plans of expansion in Mexico in the near future.

How important is the aerospace industry in Mexico for Ryerson?

In terms of business percentage the aerospace industry does not currently account for much, only 5%. However we have identified this industry as a key area for growth. We recently received our AS9120 certification and as such are now an approved distributor for the aerospace industry. Today we are actively trying to increase our business in this sector, particularly in Baja California, where we are witnessing a boom in aerospace.

Can you talk about the process you undertook to obtain the AS9120 certification?

It has been one year since we received the AS certification, which we achieved with our own resources. However, we did receive support from the aerospace cluster here in Baja California as well as from a local consultant. We also worked closely with SEDECO who supported us in this process.

What are the typical products you are supplying to the aerospace industry and what are the services you are able to offer?

Typically for the aerospace industry we sell mainly stainless steel and aluminum in different forms and shapes. We also are able to provide some special alloys. With regards to our processes we have a leveler to flatten the coil we buy from the mills. We also have a laser cutter, a bar saw and two aluminum plate saws. Our offerings are based on the experience we have from our U.S. sites, which were previously serving some of our customers here in Tijuana.

How do you ensure the quality and on-time delivery of your products?

As part of our quality system we measure on-time delivery, quality scales and defects using a number of different metrics. We hold meetings regularly to discuss our results and operate all ways to the standards imposed by the aerospace industry.

What other key strengths of Tijuana has Ryerson benefited from?

All our sites are strategically located to best serve our customers. Our Tijuana facility offers a number of advantages with regards to our own supply chain. We are close to the border, which allows us to quickly receive products directly from the United States. We also have the port in Ensenada, which enables us to receive material from our suppliers from Europe and Asia.

Why do you think that there is this gap with regards to raw materials for the aerospace industry in Mexico?

This is certainly an issue that is discussed regularly amongst the clusters and with the government. The challenge is that it is not easy to develop a Mexican source of raw materials for the aerospace industry. To develop a local Mexican supplier to be at the level able to serve the aerospace sector is a process that can take years. The industry in Mexico is behind in this sense either in being able to develop local sources or to have U.S. vendors open facilities here. The cluster is working hard on resolving this, and it will change. It will be a case of allowing a foreign supplier to justify an investment into the country. The low-volume, high-mix nature of the industry means that it is often difficult for a company to have a high enough level of business to justify a migration.

Do you have a final message for GBR's readers?

As a corporation Ryerson is seeking to grow in the aerospace sector, and the Tijuana facility is pioneering this. Looking ahead we need to establish strategic relationships with mills that are able to supply us with the materials needed for this industry. We must also create quality teams dedicated to aerospace. For Mexico, we are looking at diversifying not only in our product offering, but also in the industries we serve. The past five years have been very successful for Ryerson in Mexico and we will continue to be engaged in the aerospace industry and are actively exploring how we can evolve to better meet its needs.



Dr. Fernando León García

President, CETYS University



"The aspiration for CETYS has always been to contribute to the economic, cultural and social growth of the region."

Can you introduce CETYS by providing a brief overview of the university?

CETYS is a private university that was founded in 1961 by business and industry leaders who envisioned a high-quality institution for talented youngsters from Baja California who would otherwise migrate to other regions in Mexico. Today the university is governed by more than 100 of Baja California's business and industry leaders, is ranked among the top-ten private universities in Mexico, and is only one of eight universities in Latin America with U.S. accreditation. The aspiration for CETYS has always been to contribute to the economic, cultural and social growth of the region. In addition to instilling humanism and values across the curriculum, we emphasize six key, distinctive, CETYS learning outcomes into our programs: entrepreneurship, linkages with industry and business, internationalization, information literacy, social responsibility and sustainability. CETYS currently serves a total of 7,200 students across the state and hopes to grow to 8,000 by 2020. We are intensifying and reorganizing our interaction with business and industry by focusing on three themes through each of our colleges: competitiveness and entrepreneurship (business), innovation and design (engineering), and human and social development (social science and humanities). This will help us be more active and in tune to what is happening in business, industry and society.

Can you provide more details as to the type of engineering formation that you offer and how the curriculum is defined?

Through our college of engineering we offer a variety of engineering and technology programs in Mexicali, Tijuana, and Ensenada that are closely linked to regional industry including the extensive presence of multinationals. Through our Center of

Excellence in Innovation and Design (CEID), based on the Warwick Manufacturing Institute in the UK and the Arizona State University Polytechnic Campus in Chandler in the United States, we aim to generate knowledge and human capital in innovation and design fields of engineering with the purpose of increasing the competitiveness and economic development of the Baja California region. Furthermore, we hope to achieve national and international recognition in applied research and technological development supported by high-level researchers and based on an agile and sustainable linkage model with industry.

What are the strategies and processes by which CETYS is establishing linkage with industry?

While we continue to work with key individual industries, we are increasingly focusing our work on the main clusters in the region. An organized cluster makes the linkage process with industry more strategic in reach and impact. With regards to the aerospace industry in Baja California, we are working with the leading companies in Mexicali and Tijuana, trying to take this collaboration to a new level, and ensuring that the needs of the cluster are better addressed and more seamlessly integrated. In the area of engineering, we are focused on six industry clusters and working with each to identify their needs. For example, with the aerospace industry we are seeing a current need for design and engineering. From here we can take these elements and incorporate them across our academic programs and find commonalities. CETYS is constantly making efforts to reorganize and look at how we can better collaborate. We recently met with Honeywell who shared with us the long-term vision for its facility in Mexicali and, accordingly, we can incorporate into program enhancement and training of current and future engineers, as well as applied research and problem solving projects. We also

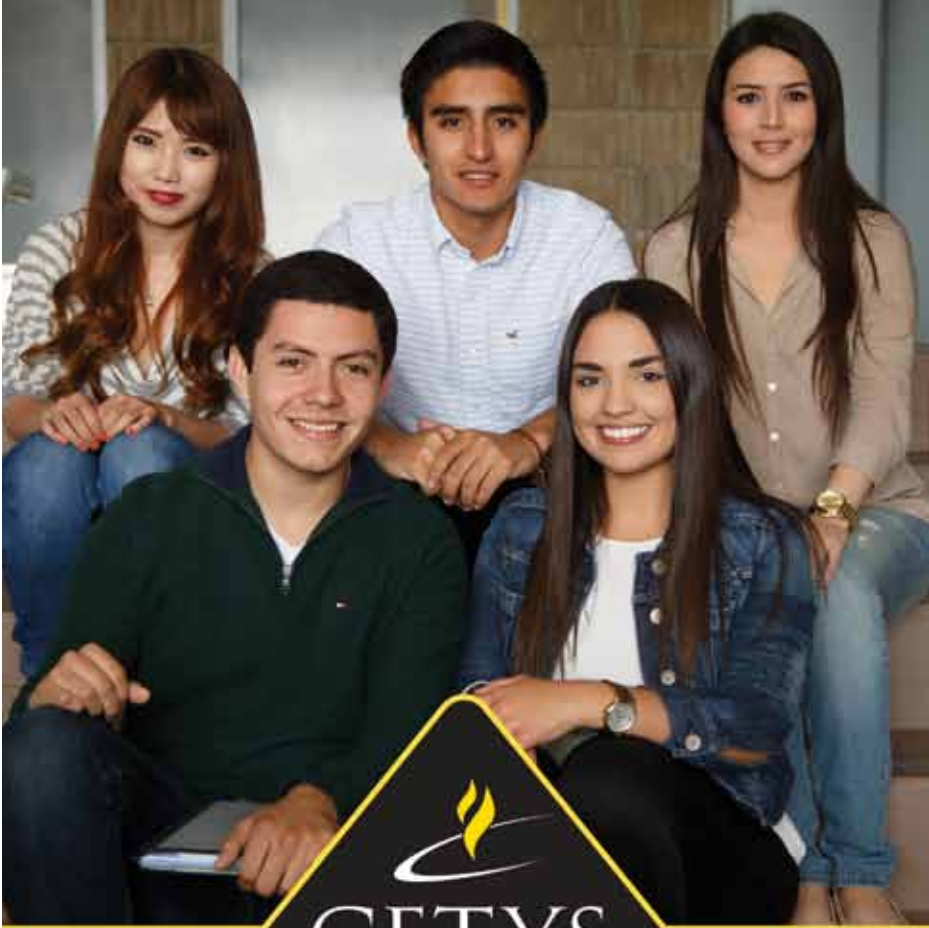
work closely with SEDECO so we can learn first hand what changes may need to be made.

To what extent does this dialogue go both ways and what influence will academia have on the direction of industry?

Through our dialogue with industry we always offer an initial diagnosis as to where we believe they are headed, establish a process by which we can guide them, and identify priority areas to work on. What we have seen is that companies such as Honeywell, Gulfstream, and UTC are looking at either larger more sophisticated operations or enhancing and expanding current operations based on what they see the region can deliver particularly with regards to human capital. The soon-to-be constructed facility for CEID CEID is based on a very intense and close-knit interaction between industry and the university. CEID will have an area to accommodate eight to 12 projects that will be based on and dedicated to solving actual industry problems.

Do you have a final message for our readers?

Based on the recent accreditation in the United States of our first engineering program by the Accreditation Board on Engineering and Technology (ABET), CETYS aims to be by 2021 the best institution in Latin America, offering engineering programs with focus on innovation and design, with the same aspiration for our MBA, with a focus on entrepreneurship. We intend to raise our collaboration with industry in the region to new levels that will support the continued and strategic development of key clusters, in particular the aerospace industry.



CETYS Universidad, driving development through innovation



One of the top private universities in Mexico

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www.cetys.mx +52 (686) 5673700
infocetys@cetys.mx



The Human Capital Factor

Meeting the HR needs of Mexico’s aerospace industry

EXPERT OPINION by José Flores, President, Corporate Recruiters



There is no doubt that Mexico is becoming a key player in the global aerospace manufacturing industry, and the federal government has implemented several measures to assure that will be among the 10 largest providers of this industry before 2020.

In our 30 years of experience supporting the aerospace sector in Mexico, we have witnessed the evolution of the automotive, electronic, and medical sectors from cost centers to a profit centers and from manufacturing plants to a shared-services centers. How ready is the aerospace sector to achieve this level of maturity and what needs of human capital competences are required to achieve this? To answer this question, we must answer three questions: (1) in which stage of competitiveness is Mexico as a country?; (2) what will be the global demands in aerospace for the next 10 years?; and (3) how is the aerospace value-added curve in Mexico?

Mexico’s Competitiveness Stage

According to the World Council Forum 2014 /2015 competitiveness report, Mexico is transitioning from the second stage focused on efficiency to the third stage focused on innovation. In order to achieve this transition, corporations must work together with educational institutions to produce the professionals with the necessary technical and soft skills. Fortunately, in 2007, Mexico founded the Mexico Council for Aerospace Education (COMEAE), which is integrated with universities and technical institutions to meet this need. As reported by COMEA, Mexico has 52 educational programs in 12 states, 50% of which are for engineering careers and 1.6% of which are for post-degree studies at the Master’s and Ph.D. levels, and, as stated by PROMEXICO, each year graduates 90,000 engineers.

Global Aerospace Trends

The CIT 2015 aerospace study conducted by Harris Poll among 100 of the top global airlines executives showed that in the next five years, the major trends in aircrafts manufacturing will be concentrated in: technology innovations (75%), social media (57%) and air safety (55%). Therefore, airframers will launch replacement programs for the single-aisle market before 2030, with a projected demand of over 25,000 commercial aircrafts.

Mexico Aerospace Value-Added Curve

At the moment, 79% of the aerospace plants in Mexico are dedicated to manufacturing and assembly processes, 11% to engineering services R&D, and 10% to MRO. From the 270 suppliers of this sector 23% are Mexican companies, supplying mainly to tier-three companies.

Human Capital Stage and Competencies Required in the Aerospace Sector

As we have seen, Mexico is in the transition from the efficiency stage to the innovation stage, and, according with Harris Poll study, the name of the game in the single-aisle market will also be innovation; nevertheless, only 11% of the aerospace operations in Mexico are concentrated in engineering services and R&D. In research conducted by IDEA and ABT associates about human capital needs in Mexico’s aerospace sector, the main deficiency was the need for soft skills such as interpersonal skills, team working, multicultural exposure, analysis, problem solving and business sense, in order to understand the economic impact of decision making. These skills are also marked as critical in the study conducted by the Institute for Defense Analysis and the Society of Manufacturing Engineers for the aerospace sector in United States. Nevertheless, at Corporate Recruiters, we have found that soft skills are the most hard to define by our clients and there-

fore the most difficult to evaluate. For this reason we have supported them to elaborate solid job descriptions and create a search plan by using our Competencies’ Pyramid (1) system that has been the result of our 30 years of experience in the manufacturing industry.

Our evaluation system contemplates five levels of competence: personal, position-related, manufacturing sector, management, and global competences. For each level it is important to identify the proper competences according with the moment and dimension of the operation, and as well as the challenges and responsibilities of the position. It is also important to assign value to each competence in order to evaluate candidates match accordingly.

The Take Off

Mexico already has a well educated workforce and a proven manufacturing market, but, in order to soar to the next level, educational institutions and corporations must work together to create programs and opportunities to develop soft skills mainly in all positions related to R&D, NPI supply chain and liaison functions among local plant, headquarters and tier-one and tier-two suppliers. Fortunately, global companies such as Bombardier and Honeywell and educational Institutions such as CETYS and Instituto Tecnológico de Monterrey are working together to develop R&D programs with state of the art laboratories.

Companies will have to put in place training and developing programs to foster soft skills such as global awareness, languages, multicultural team working, business sense, IT tools proficiency, information literacy, analysis, decision making and critical thinking. In the market these competences will be highly demanded commodities, therefore companies with the right training programs to develop and recruit professionals with these skills will prevail over their competition.

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Universidad Aeronáutica en Querétaro (UNAQ)
unaq.edu.mx

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(1) The Competencies' Pyramid is a trademark model of Corporate Recruiters for the best assesment and evaluation of executive talent, to consult it visit www.global-recruiters.com/our-services



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