

Flight Plan

# Mexico's Aerospace Industry Road Map

Chihuahua





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Camino a Santa Teresa 1679,  
Col. Jardines del Pedregal,  
Del. Álvaro Obregón,  
C.P. 01900,  
México, D.F.

www.promexico.gob.mx  
promexico@promexico.gob.mx

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## PROMÉXICO

**Carlos Guzmán Bofill**  
CEO

**Ana María Rivas Llamas**  
Head of the Administration and Finance Unit

**Carlos Casas Guerrero**  
Head of the Export Promotion Unit

**Juan Ángel Vargas Plata**  
Head of the Business Intelligence Unit

**Juan Carlos Téllez Girón Barrón**  
Head of the Institutional Support and Relations Unit

**Luis Anthony Olivé Hawley**  
Head of the Investment and International Business Promotion Unit

**Sebastián Escalante Bañuelos**  
Director of Publications and Content

**Natalia Herrero Martínez**  
Editing

**Izrael Mijangos González**  
Design

### Created by:

Manuel Sandoval Ríos  
María Cristina Carreón Sánchez  
Juan Héctor Algrávez Gómez  
Ronald Eduardo Pérez Díaz

### With the support of:

Eduardo Ernesto Villa Maciel  
María Josefa Padilla Monroy  
José Mariano Moreno Blat  
María Luisa Silva Hernández

#### Working Group Members (TRM of the Aerospace and Defense Sector of Chihuahua):

- Advanced Materials Research Center (CIMAV)
- American Industries
- Center for Supply Development (CEDEP)
- Chihuahua's Polytechnic University
- Chihuahua's Technological Institute (ITCH)
- Hawker Beechcraft
- High Technology Training Center (CENALTEC)
- Honeywell
- Kaman Aerospace
- Labinal (Safran Group)
- National Chamber of the Transformation Industry (CANACINTRA)
- Nordam
- Secretariat of Economy, Chihuahua State Government
- SOISA Aerospace
- Technological Development Support Institute (INADET)
- Tecnológico de Monterrey
- Textron
- Under Direction of Operational Linkages on Industrial-Technological Education, Chihuahua State Government (DGETI)
- Zodiac Aerospace

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# Introduction

The development of the aerospace sector in Mexico is considered an international success story because in a five-year period it has reached levels of development that have required decades in other countries. This is the result of an integral development and promotion strategy which, along with the country's comparative advantages, have captured the attention of the global industry. Mexico's competitive poles in this sector, are advanced manufacturing, engineering and design.

The natural evolution of the aerospace sector has reached the potential to develop specialized niches with high commercial and competitive value, such as the defense industry and dual use, and restricted use technology industries. The development of these industries has required public policy frameworks focused in attracting high-tech projects.

Due to the integration of capabilities in aerospace and defense matters, fostered by the public policies implemented by the sector, Mexico has attracted an increasing number of projects for the aerospace industry. These investments represent a huge potential to promote competence nation-wide through technology transfers as active promoters of the social and economic national development with the creation of well-paid jobs for Mexican talent.

Mexico has outgrown the paradigm of exclusive manufacturing industry, by incorporating high technology and engineering into its processes. Today, there is an unprecedented integration of design and advanced manufacturing capabilities.

The future development of the aerospace and defense (A+D) industry depends on the definition of strategies that encompass the vocation of each state. To that end, the existing capabilities, competitive advantages and industrial niches in Mexico's various regions must be taken into consideration.

The state of Chihuahua represents a special case. Its aerospace industry has reached a level of maturity that has enabled it to attract strategic projects by leading companies in dual and restricted use and high-tech goods, especially in manufacturing precision machinery projects.

Chihuahua's vocation and development as an A+D cluster has been boosted by the use of Road map Methodology to develop an integral and dynamic plan that follows the same lines as the National Flight Plan. Chihuahua is one of the first states in the country to establish a local strategy derived from the National Flight Plan. Chihuahua's A+D Road map traces the path that must be followed by the industry, academia and government in order to generate technological advantages, opportunities and strategic alliances. To achieve this goal, a systemic understanding of several factors is needed: the nature of the business environment; business opportunities, external threats, weaknesses and strengths of the industry; and finally, the set of trends that will drive the social, environmental, economic, political-legal and technological markets.

A map, by nature, involves a process of continuous improvements, constant evaluation, and determines the areas of convergence of the players who add value. Therefore, this is a work in progress that requires permanent evaluation and constant updating.



# 1. The Aerospace and Defense Industry in Mexico

During the last seven years, Mexico has been consolidated as one of the leading players for the global aerospace sector. Currently, 249 companies and support entities, including the defense sector, which are established mainly in six states and employ more than 31,000 high-level professionals.<sup>1</sup>

<sup>1</sup> General Directorate of Foreign Trade, Ministry of Economy, 2011

Mexico has established its vocation as an advanced manufacturing, engineering and development center with a high strategic value. The aforementioned, due to the degree of technological sophistication of its exports, its engineering talent (the highest number of engineering graduates in the Americas), the quality and competitiveness of its workforce and, particularly, its respect for industrial property.

As a response to the economic deceleration and the lack of specialized talent the United States is experiencing, Mexico becomes an obvious partner to achieve the strategic goals of the A+D industry. These crossroads put pressure on the companies in the sector, especially those that have contracts with the US Government, searching for more competitive options, such as Mexico.

All this has led to the creation of highly competitive poles that operate within a certified and world-class system. An example is the Bilateral Air Safety Arrangement (BASA) with the United States, which enables companies established in Mexico to validate the certifications they obtain from the national authority (Directorate of Civil Aviation, DGAC) with the U.S. Federal Aviation Administration (FAA), allowing the entry of various Mexican products and goods into the US market.

Mexico's talent, strategic geographic location and nationally developed infrastructure, among other competitive advantages, make it the perfect place to produce dual use goods and restricted technologies. Due to the huge potential of these sectors, a regulatory framework has been created; it ensures the good use, destination and final users of sensitive goods produced nationally.

To that extent, the Mexican government developed an export control system which made Mexico a part of the prestigious group of collaboration, the Wassenaar Arrangement (WA), that avoids the spread of weapons of mass destruction, and at the same time attracts high-tech civil and military projects. Mexico was an outstanding case; its admission to this mechanism was completed in record time, even though no other country had been approved in more than five years.

Mexico's inclusion to the WA shows the international community's interest in the country. Mexico is seen as a reliable destination for sensitive technologies. Its acceptance sets the tone for remaining a safe destination for the production of goods and services that include restricted technologies and dual use goods and services.

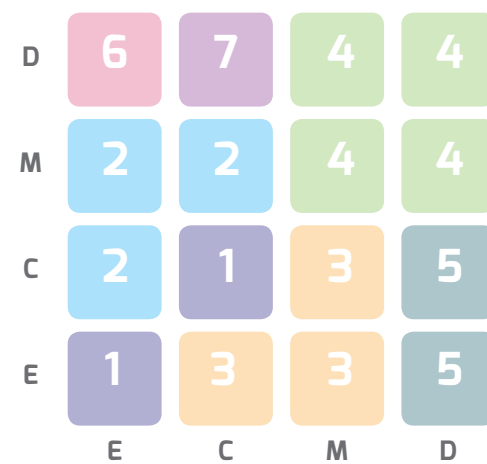
According to conservative estimates, the potential for investment projects in restricted technologies and dual use goods and services in Mexico is valued at seven billion dollars for the next five years, in addition to its capacity to create between 30 to 40 thousand highly-paid jobs.



## 1.1. Maturity profile of the Mexican Aerospace Industry and Government Strategy

The Manufacturing Institute of the University of Cambridge developed the concept of sector development strategies. In this study, the Institute classifies sectors based on their degree of global development and the degree of development of the same sector, nationally. This classification results in seven areas, where each represents a sectorial strategy based on the development of the industry.

**Graph 1. Maturity profile**



**Area 1:** Industrial policies overlap with science and technology policies, while new industries are supported as they emerge.

**Area 2:** The protection of emergent industry, where countries intend to penetrate an existing industry in the world and protect themselves while they advance in the learning and cost curves associated with that industry.

**Area 3:** A country has significant leadership while the industry develops.

**Area 4:** With a mature industry, the focus is on enhancing productivity and competitiveness.

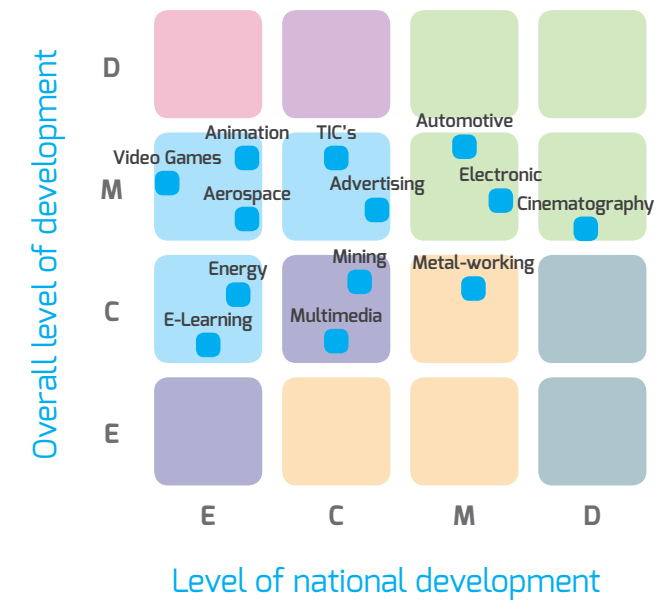
**Area 5:** The national industry is in decline, but it is emerging or growing on a global level.

**Area 6:** it represents a small and relatively stable number of national producers, while the world position deteriorates; it is probable that this industry is in decline, therefore unwise to support.

**Area 7:** If the industry was declining before it was developed in the country, it is clearly an industry that is in decay.

In the case of Mexico, the aerospace industry is located in Area 2 of the chart, and it recommends that the national strategy focuses on protecting an emerging sector.

**Graph 2. Maturity profile of Mexico's industries**



This strategy determines that the Mexican aerospace sector, in an attempt to penetrate the global aerospace market, must develop learning and cost curve through the insertion of national innovation abilities by attracting global innovation projects.

Undoubtedly, the growth of the Mexican aerospace industry can be qualified as exponential and dynamic. However, it is important to point out that this growth will be subject to the industry's capacity to generate endogenous innovation frameworks and, consequently, increase the added value of products manufactured in Mexico.



## 2. The Aerospace and Defense Industry in Chihuahua

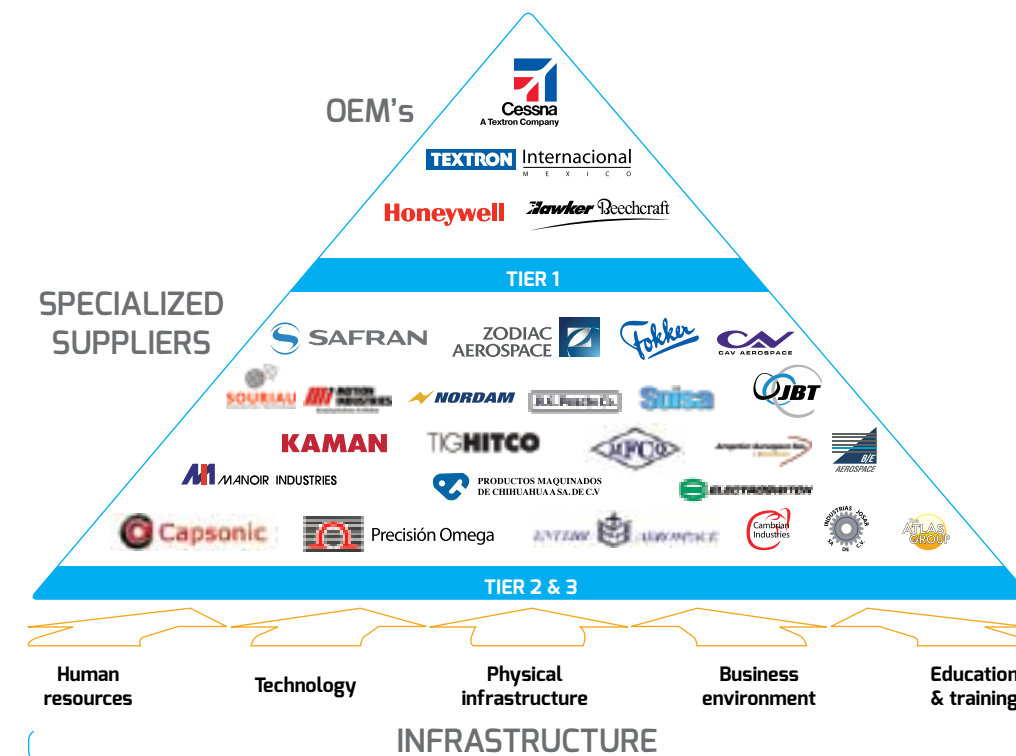
Because of its industrial and advanced manufacturing capacity, Chihuahua is one of the states with the highest development and potential in the country's aerospace and defense sector. Currently, there are more than 30 companies and support entities of the sector in Chihuahua, of which four are original equipment manufacturers (OEM):

- 1) **Cessna:** electrical wiring systems for aircraft.
- 2) **Textron:** helicopter structures and cockpits.
- 3) **Hawker Beechcraft:** metal components for the aerospace industry.
- 4) **Honeywell:** components for jet engines.

In 2011, Chihuahua's exports were almost 455 million dollars annually; this amount is close to 11% of the national exports of the sector. These numbers show mainly to the United States, Germany, France and Canada.

There are 59 universities and technology schools, 65 technical schools and two high-level research and development (R&D) centers in Chihuahua, which provide the talent required by the industry.

Graph 3. Capabilities of Chihuahua's Aerospace Sector

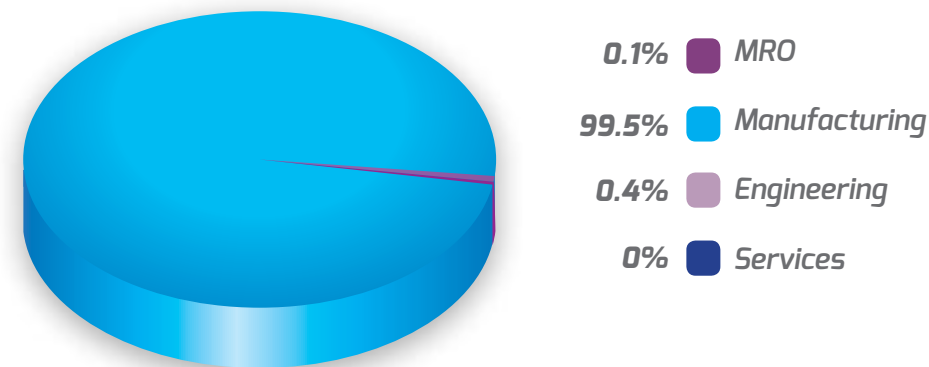


Source: Government of the State of Chihuahua

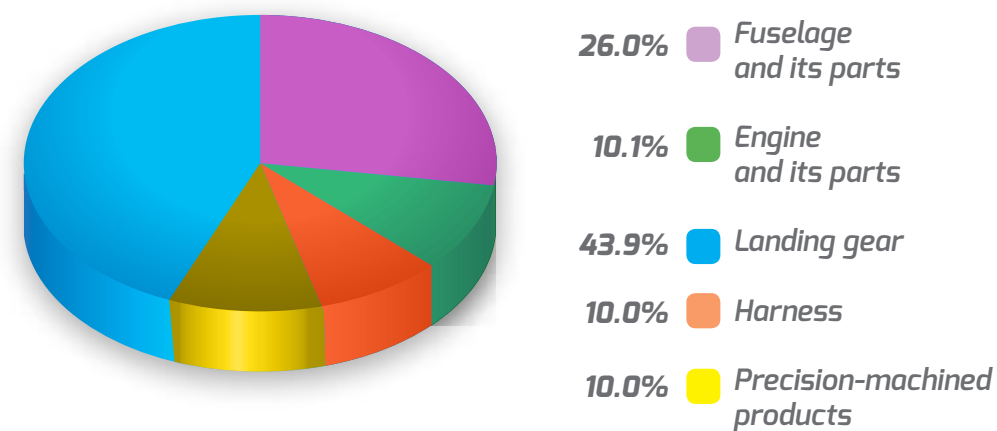


According to the information by the 11 leading export companies in Chihuahua, the vocation required to manufacture fuselages and their parts, engines and their parts, harnesses and precision machined products is present in the state. Furthermore, the existence of companies and their installed capabilities in both manufacturing and engineering for the A+D niche are highly developed in Chihuahua.

Graph 4. Composition of the A+D industry in Chihuahua



Graph 5. Aerospace and defense manufacturing in Chihuahua



## 2.1. SWOT Analysis

The SWOT analysis or matrix is an indication of the current situation of the industry and it helps identify the aspects that must be leveraged and/or improved for Chihuahua in order to reach its highest potential. The results of the regional SWOT for the aerospace and defense sector established by the working group in charge of the Road map are presented below.

### STRENGTHS

- Industrial infrastructure
- Extensive experience and successful companies in the export manufacturing industry
- Supply development and strengthening
- High level of education
- OEM's established
- Skilled labor

### WEAKNESSES

- Lack of coordination and communication in the Triple Helix
- Lack of supplier development
- Lack of infrastructure and worker training

### OPPORTUNITIES

- Location
- Cost and availability of human capital
- Arrangements US/Mexico on military security

### THREATS

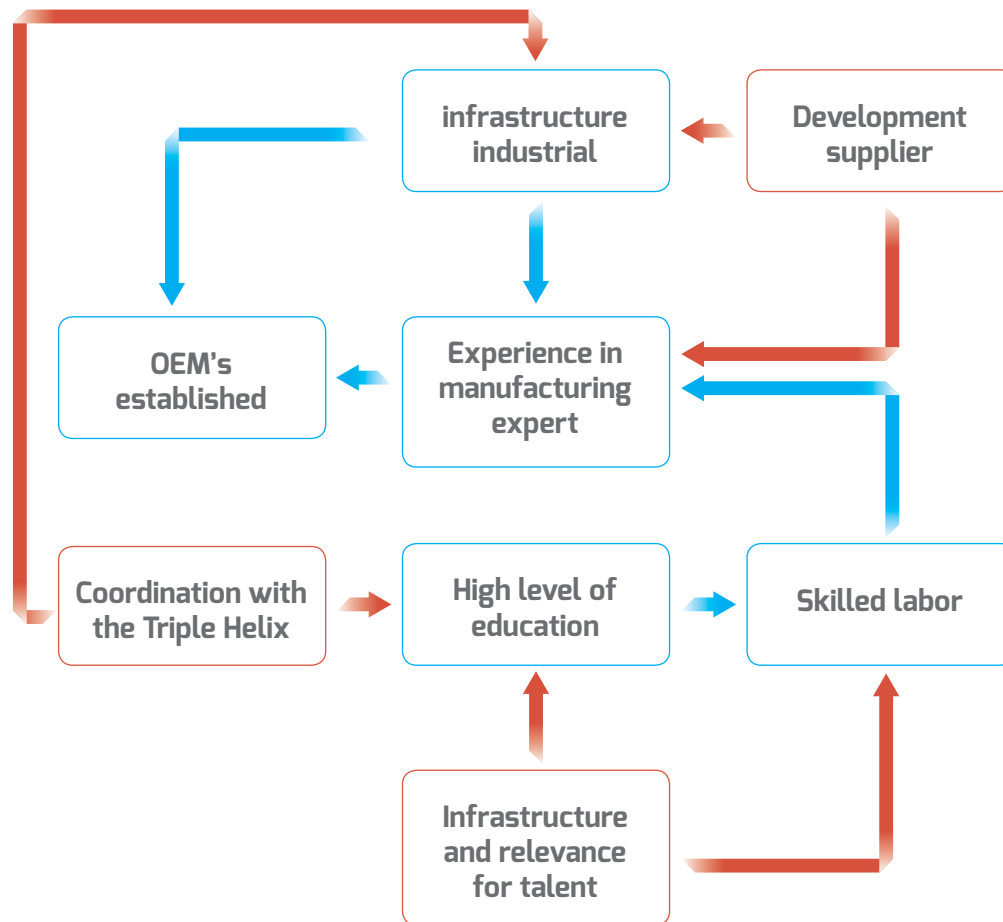
- Economic situation
- Perception of insecurity
- International competition
- Lack of industrial policy

Source: Business Intelligence Unit, 2010.





**Graph 6. Chihuahua's causal map**



The state is considered the most specialized state in the A+D industry, because its companies manufacture their products under permission from the US Department of State and Defense, guaranteeing their penetration into the restricted technology market.

Additionally, from the 775 thousand students enrolled in engineering and technology programs in the country, Chihuahua has 29,702 students enrolled in the same disciplines, with 3,253 have concluded their studies and 3,355 have graduate with degree programs every year, which amounts to 22%, nationwide. These advantages have positioned Chihuahua as a state with high terminal efficiency and one of the top ten states in Mexico with the highest number of engineering and technology students.

According to the Investment Map of Mexico, Chihuahua is the most attractive state for direct foreign investment, considering variables such as high infrastructure, economy and productivity, workforce and geographic location.

Due to Mexico's high technological sophistication, quantity of engineering graduates per capita, and global competitiveness of labor costs, the country is one of the favorite destinations for international aerospace companies. Chihuahua guarantees its presence in the most representative markets by leveraging the vocation of the A+D industry and developing technological fields to supply future trade partners.

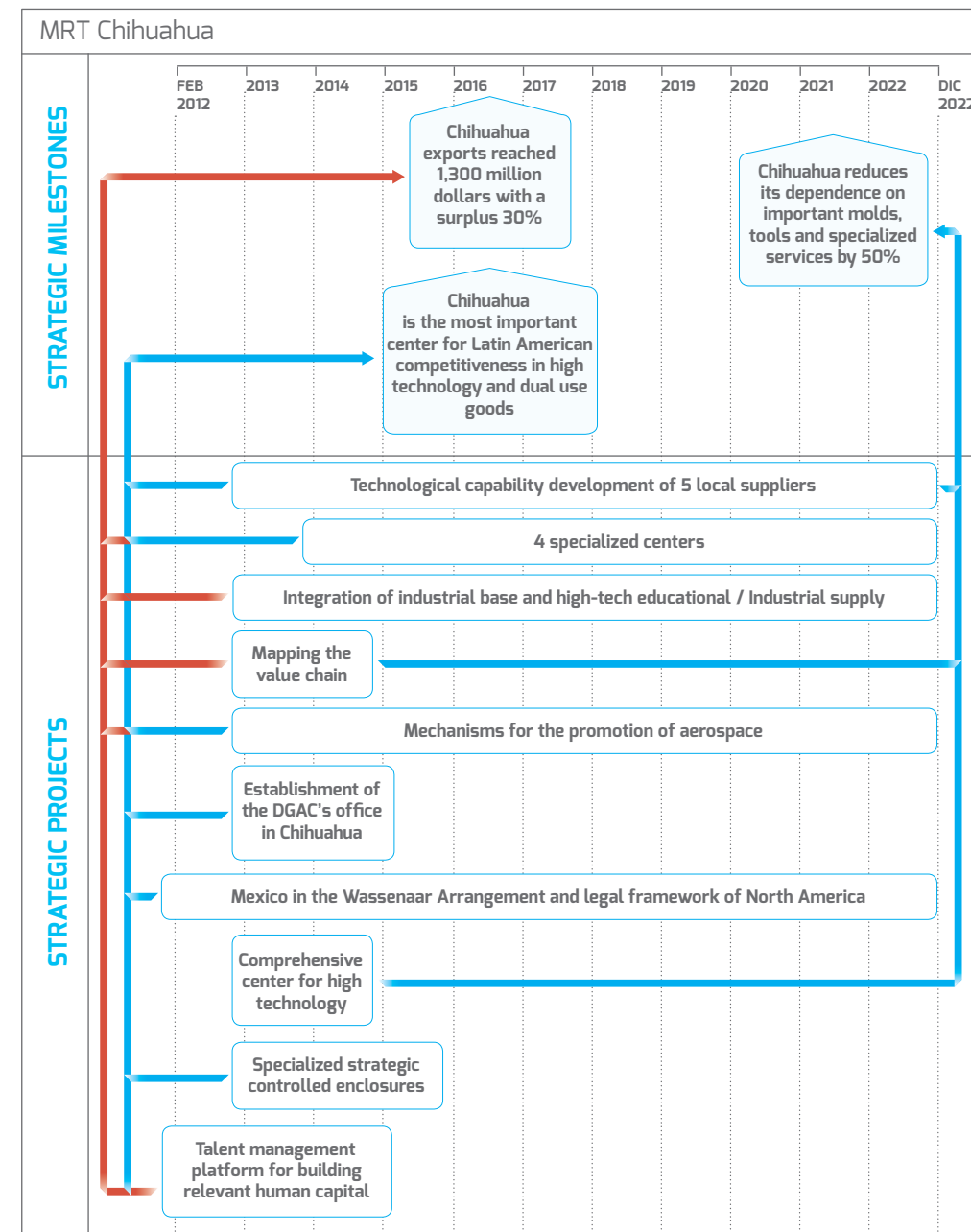
The aforementioned working group, believes that the industrial infrastructure, vast experience and recognition of companies in the export manufacturing industry, openness to developing and strengthening supply, and establishment of large aerospace assemblers, provide Chihuahua with a competitive advantage.

Chihuahua has in its territory globally renowned companies such as Honeywell, Textron, Zodiac Aerospace, Cessna, Cav Aerospace, Kaman, Safran-Labinal, Hawker Beechcraft, Nordam, etc. These firms specialize in fuselage manufacturing and parts, precision machining for engines and their parts and harness manufacturing.



### 3. Road Map of Chihuahua's Aerospace and Defense Sector

Graph 7. Road Map of Chihuahua's aerospace and defense sector





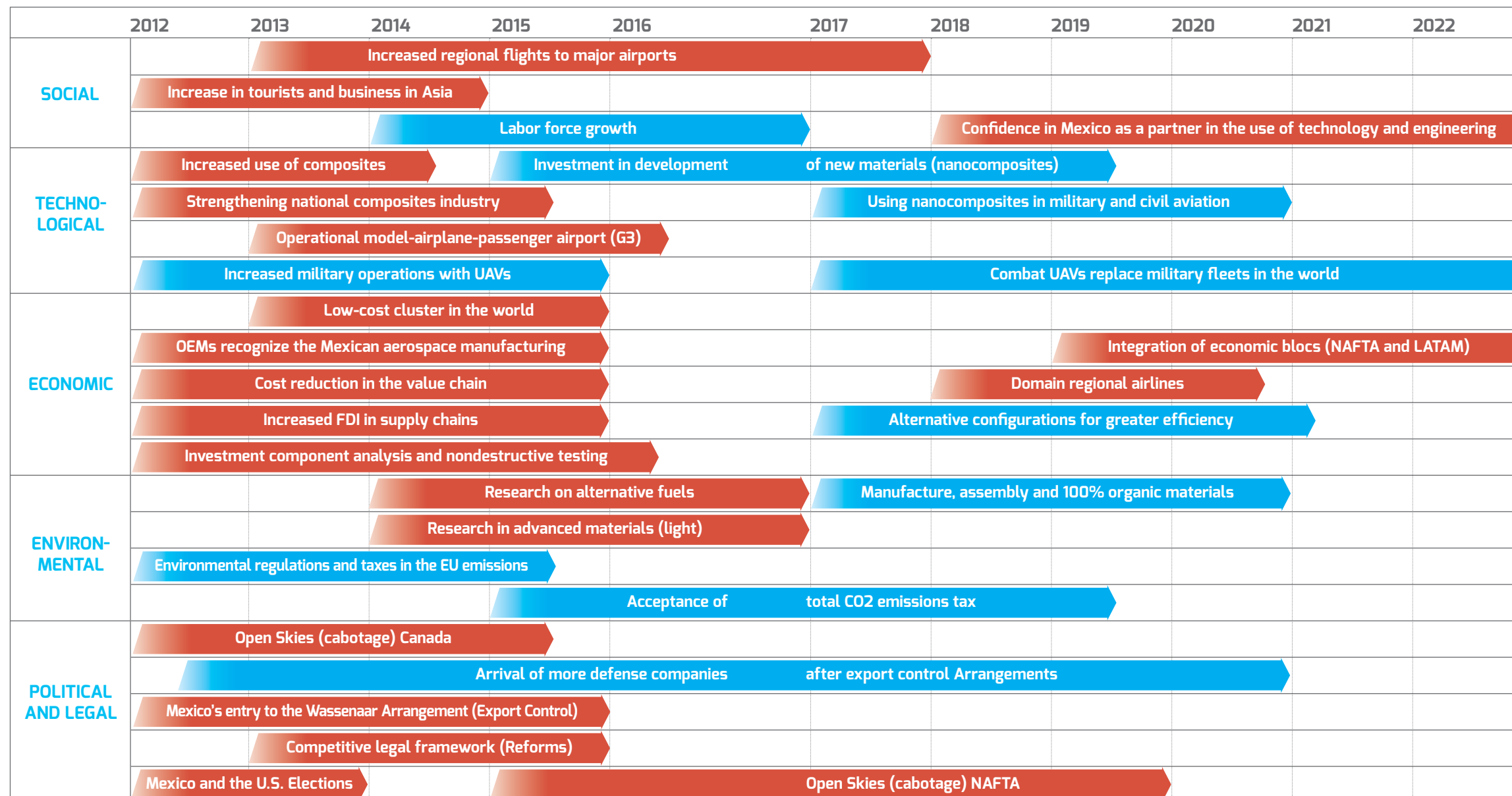


# 4. Trends of the Aerospace and Defense Sector in Chihuahua

The design of an A+D cluster in Chihuahua begins when manufacturing processes and engineering centers are migrating to emerging countries. However, to maximize the potential of this cluster, the working group determined the trends that must lead its vocation.

A trend is understood as a pattern of behavior in specific markets during a time frame which must cover the social, technological, environmental, economic, talent management, and political-legal contexts.

**Graph 8. Global Trends: Chihuahua's A+D cluster**





<sup>2</sup><http://www.wired.com/dangerroom/2009/07/air-force-plans-for-all-drone-future/>

The working group identified a driver related to the aerospace and defense sector market, which is that Unmanned Combat Aerial Vehicles (UCAV) will progressively replace the military fleet of the leading countries.<sup>2</sup> The efficiency of UCAVs in military operations around the world has been proven, and Chihuahua will have the opportunity to generate the conditions required, including restricted technologies to supply this booming industry.

The group has also identified as a driver for a higher investment in the research of third-generation compound materials (nano-composites). This not only will help improve energetic aircraft efficiency, but its reach. This tendency responds to the aviation industry's need to create cleaner, lighter and quieter aircraft.

Research in third-generation compound materials involves an opportunity for Chihuahua to improve their R&D capabilities, and its human capital, so necessary for the aerospace industry and restricted technologies.

<sup>3</sup>[http://www.tax-news.com/asp/story/story\\_aviation.asp?storyname=51459](http://www.tax-news.com/asp/story/story_aviation.asp?storyname=51459)

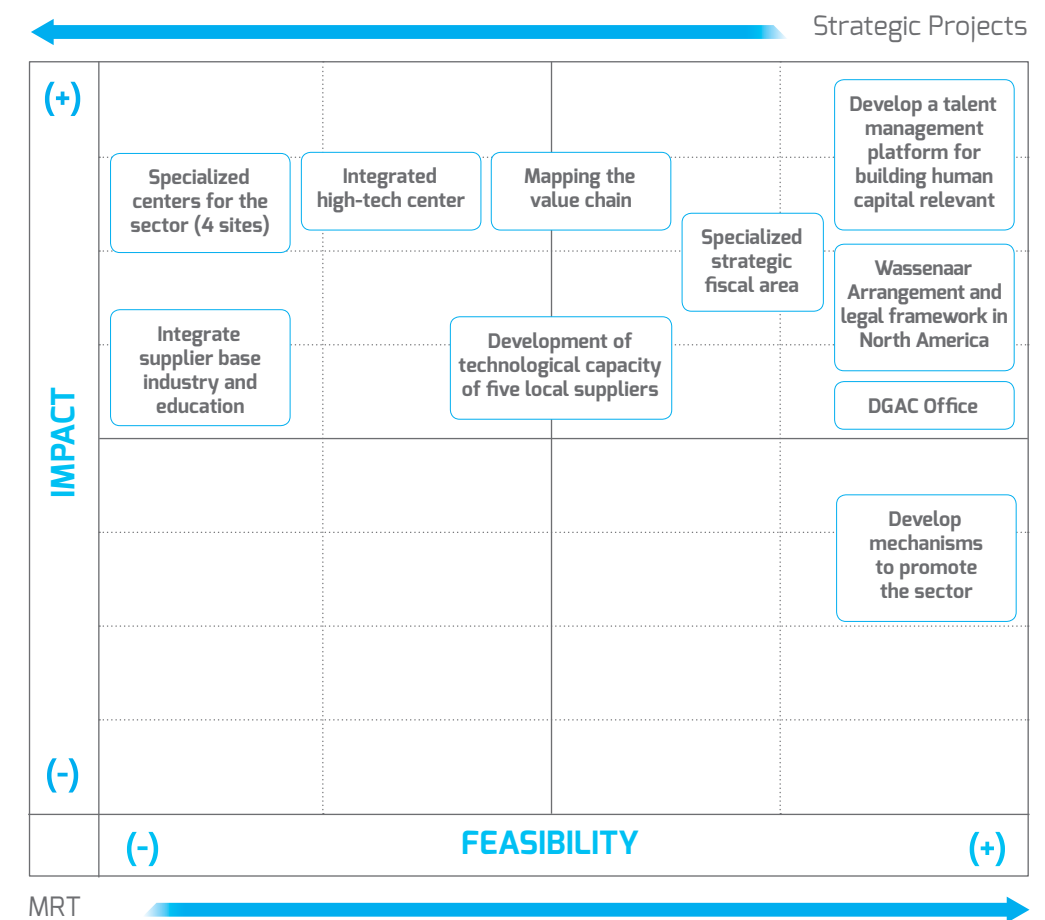
Another tendency forecasts global taxes on CO<sub>2</sub> emissions in the industry; the search for alternative and more energy efficient fuels will be required in order to comply with emission standards used around the world. In Europe alone, from January 2012, airlines will have to comply with emission reduction and those tax schemes agreed upon under the European Union's Emissions Trading Scheme (ETS).<sup>3</sup>

In a search for a cleaner aviation sector, tendency points to alternative fuels such as bio-turbosine, biodiesel, bio-ethanol, hydrogen and electricity to fuel the world's next civil and military aircrafts. The working group identified these tendencies with the highest impact on the sector. However, this strategy will also include what is included in the Road Map.



# 5. Milestones and Strategic Projects

A strategic milestone is a goal or objective based on the prospective analysis of drivers and the ability to articulate key players. For a milestone to be considered strategic, it must meet SMART requirements: Specific, Measurable, Aggressive but Attainable, Relevant and Time-bound.



Below are the three main strategic milestones agreed upon and developed by the Road Map Working Group, and the strategic projects that will support these milestones, measuring their impact and feasibility.

*Milestone: In 2016, the aerospace industry in Chihuahua exports reached 1,300 million dollars, with a surplus of 30% representing a growth of 20% and an increase of 100% of surplus.*



Chihuahua exports approximately 455 million dollars, or close to 11% share in national exports from the sector. Based on the group's proposals, the following projects must be focused on and developed to fulfill the previously mentioned milestone.

## I) Mapping of the Value Chain

In order to analyze the value chains of the A+D industry to identify the areas with the highest potential and economic impact, a study must be made to map the manufacturing and innovation capabilities and production chains of Chihuahua's aerospace industry. The study must cover the complete value chain of the state's A+D industry, manufacturing and special processes, direct and indirect supplies, logistics and services, and structure potential business cases to develop suppliers both locally and regionally.

### Support and Benefits

The benefits of mapping the value chain of Chihuahua's A+D industry include the correct knowledge that will enable companies in the cluster to generate business opportunities; strategic alliances among local and international companies; and the generation of capabilities for local companies.

## II) Establishment in Chihuahua of the offices of the Directorate for Civil Aviation

The goal of this project is for the Directorate of Civil Aviation (DGAC) to establish an office in Chihuahua, to expedite the certification of the A+D industry's processes, enabling the Cluster's companies to save time and costs.

### Support and Benefits

The addition of a DGAC office will be required for the implementation of the BASA, so Chihuahua can harmonize its quality infrastructure to international standards, particularly the United States. This way, companies involved in designing and manufacturing in Chihuahua will have a direct interface to place products and designs more efficiently at more competitive prices.

## III) Promotion Mechanisms for the Aerospace Sector

This project focuses on promoting the competitiveness of Chihuahua's A+D industry by obtaining economic support and promoting the state's industrial capabilities internationally.

### Support and Benefits

Mexico has one of the largest networks of free trade Arrangements in the world (ten Arrangements with 44 countries). Its strategic geographic location is a gateway to other markets. It has a large number of students who graduate from engineering programs, a proportion which exceeds records in countries such as the United States, Brazil and Canada.

For the A+D sector, a new public policy framework will be pushed in order to attract national and foreign investment and manage high technology that leads to an increased competitiveness in the regions, allowing Mexico to leverage the benefits of the Wassenaar Arrangement through the promotion of Arrangements that support the obtaining of more permits and contracts in restricted technologies. As an example of these mechanisms to boost the sector's competitiveness and exports, a process to establish a Memorandum of Understanding (MoU) with the US Department of Defense is being created, so that acquisitions from Mexican manufacturers from the A+D sector are considered local purchases, thereby avoiding restrictions on local content that are imposed by the Buy American Act.<sup>4</sup>

<sup>4</sup>The Buy American Act requires purchases by the US Government to include 51% of local content.

**Milestone:** In 2021, Chihuahua will reduce its dependence on imports of molds tooling and specialized services in 50% of the current.

The goal is to increase national added value through two strategies: promoting engineering and design activities to manufacture products that contain restricted high technology, and developing specialized services such as thermal treatments, metrology centers and other processes required to develop dual-use technologies.

The molding, dying and tooling industry (MTyH, according to its Spanish acronym) is extremely globalized; companies that manufacture molds are located in countries at different levels of industrial development. Because of this, there is a wide range of qualities and functions within the industry which fragments and segments the organization of the industry on a global level.

The complexity of the MtyH industry includes the production of plastics injection molds for simple pieces (such as a glass), to molds for very complex pieces for the aerospace or automotive industries. While Mexico has a domestic production of MtyH, it is not enough to offset the trade deficit caused by the existing dependency on their importation. Mexico's levels of MtyH importation are much more significant than in other countries with the same or lower level of industrialization. Mexico imports molds from the United States, Canada and European and Asian countries. China is one of its most representative MtyH suppliers. The analysis for MtyH imports in Mexico shows that the Mexican market is being supplied from abroad as much from segments with high complexity and quality, as from segments with low complexity and price.

Chihuahua imports MtyH substantially. In 2011, Mexico imported close to 2 billion dollars in MtyH, of which Chihuahua alone imported 183,708 dollars, close to 10% of the national total, making it the fourth MtyH importer state, just behind Baja California, Estado de México and Nuevo León.

## The main imported products.

- Parts and accessories identified exclusively or mainly, for machines in items 84.56 to 84.65, including part and tool carriers, automatic opening threading devices, dividers and other special devices for assembly on tool machines; carriers for any type of hand tools.
- Mandrels or tool carriers.



- Casting boxes; casting plates for molds; models for molds; molds for metal, glass, mineral matter, rubber or plastic.
- Molds or their parts, used to cast car parts.
- Inlay stamping or piercing tools.
- Matrix draft or die outlines that weigh one ton (1,000kg) or more, for metal stamping; and their parts.
- Common metals or their alloys for artificial plastic material injection processes; with maximum size of 700 mm high, 600 mm wide, 700 mm thick, and a maximum weight of 2,000 kg, to be used in injection machines.

The working group identified the following projects to meet the strategic milestone of import substitution:

#### IV) Development of the Technology Capacity of Five Local Suppliers

Chihuahua wants to develop five world-class local suppliers with support from the three levels of government, academia and companies. To do so, it proposed creating a specialized group in the aerospace cluster to identify and select suppliers in order to develop their capabilities and reduce dependency on foreign suppliers and articulate the cluster.

##### Support and Benefits:

There are companies established in Chihuahua with the capacity to manufacture and maintain molds, dyes and tools. However, they must develop their design capabilities, quality infrastructure, advanced manufacturing and certifications.

Through these projects, and the creation of the Integral Center of High Technology in Advanced Manufacturing, which along with CIMAV will reduce imports, we aim to increase added value by including more local suppliers. In addition, a value network will be developed for the aerospace sector to improve its investment attraction capabilities and talent.

#### V) Integral Center of High Technology in Advanced Manufacturing

The Integral Center of High Technology in Advanced Manufacturing will focus on talent training, design, manufacturing and technology innovation of molds, dyes and tools required by Chihuahua's manufacturing, aerospace and defense sector. The center must have capabilities that include:

- Technical training, highly specialized courses, assessment and consulting.
- CAD/CAM Design Services, simulation (material injection, product, manufacturing, effort analysis, finite element analysis simulations).
- Metrology labs, physical hardness tests (hardness, fatigue)

#### Support and Benefits

This specialized center will create a competitive advantage in the state because of its ability to become the national and local supplier of engineering and design of molds, dyes and tools. In addition, key quality infrastructure will be available to obtain the certifications required by the industry and, furthermore, contribute at a high level to the substitution of molds, dyes and tools in Mexico.

*Milestone: In 2016, Chihuahua will be the most important center for Latin American competitiveness in high technology and dual use goods for manufacturing of precision.*

The goal of this milestone is to make Chihuahua the Latin American region that captures the most investment projects for the development of dual-use technologies and goods. This is also more feasible since Mexico's acceptance in the WA.<sup>5</sup>

Mexico was accepted into the Wassenaar Arrangement mainly because its trade partners recognized the national ability to develop and protect sensitive technologies and due to the orchestration of an Export Control System (SCE, as per its abbreviation in Spanish)<sup>6</sup> on June 16, 2011.

Both the SCE and membership in the WA guarantee Mexico's commitment to constantly monitoring the source, destination, end user and use of sensitive and dual-used goods produced in the country.

Mexico's entry to the WA, the application of an export control system, and the Arrangement process for an MU with the US Department of Defense are the three fundamental requirements for Chihuahua's A+D cluster to attract an important amount of direct foreign investment and world-class projects in the area of dual- and restricted-use technologies.

The United States our major commercial partner is going through a talent crisis due to a lack of engineering graduates, added to constant cuts in defense spending, which complicates the upkeep of its current abilities to research, develop and produce defense and high-tech dual-use items.

Mexico has more engineering graduates per capita than the United States and skilled and engineering labor costs are more competitive in Mexico; the technological sophistication of its manufactured goods is above that of BRIC countries such as India and Brazil. These three factors make Mexico the best answer to the issues that affect the United States.

The creation of the SCE and Mexico's acceptance into the WA have laid the foundation to guarantee national surveillance during the export of restricted and dual-use technologies and goods. According to conservative estimates, the WA will enable the national industry to access a potential high-technology export market of close to an additional 11.3 billion dollars per year, added to the potential creation of between 30 and 40 thousand highly paid jobs in the next five years.<sup>7</sup> Chihuahua's advanced manufacturing vocation (landing gears, fuselages, engines, harnesses and precision machining) make it the ideal destination for projects in the A+D cluster.

<sup>5</sup> The goal of the Wassenaar Arrangement (WA) is to promote transparency and information exchange during the manufacture and transfer of dual use technologies, preventing the spread of conventional weapons after promoting a safe environment for the trade of restricted and dual use technologies and goods among its more than 40 member countries.

<sup>6</sup> The SCE is currently operated through the Directorate of Export Control of the Ministry of Economy, and its task is to grant permissions to produce dual-use and defense goods on a national level.

<sup>7</sup> General Directorate of Foreign Trade, Ministry of Economy, 2011.





Furthermore, the Federal Government is in negotiations with the US Department of Defense to develop a regional aerospace and defense manufacturing block focused on Buy NAFTA. This could be completed with the signing of a MoU between the US Department of State and the Ministry of National Defense (SEDENA).

Chihuahua will become the first restricted technologies cluster to benefit from these new opportunities based on the cooperation of multiple trade partners. This window of opportunity will enable Chihuahua to export more than 1.3 billion dollars by 2016, making it the most important high-tech and dual-use technologies and goods state in Latin America.

## VI) Integration of the High-Tech Industrial and Educational Base

Turning Chihuahua into the most important state in dual-use technologies and defense for precision manufacturers of the A+D industry, requires strategic alliances between the industry and academia to align human capital training, R&D and innovation processes, and other services with the needs of productive vocations and Chihuahua's supply chain.

For that purpose, a competitiveness committee is proposed to include the industrial, academic and government sectors (triple helix) that enables it to promote a partnership similar to the Strategic Alliances and Innovation Networks for Competitiveness (AERI-CO-NACYT) which articulates resources from federal, local and international governments.

### Support and Benefits

After a general evaluation of the potential benefits of constituting a high-tech industrial and educational base for the more than 30 companies that operate in Chihuahua's A+D industry, it was determined that after the creation of a committee among academia, government and industry it will be possible to see the needs of this industry throughout the mapping and analysis of value chains. The benefits of this practice are the identification of the gaps and weaknesses faced by the industry and an area for negotiations which leads to the creation of projects to promote the competitiveness and talent of local companies.

The direct benefit of this project is the creation of a network that also acts as a technology and tendency observatory, resource manager, (thus the benefit of generating a strategy through prospective triple helix analysis) and opportunities promoter of Chihuahua's industry.

The following are a few examples of the vocation to leverage the aerospace and defense sector in this state:

- **Honeywell:** Tank transmission, aerospace equipment and turbine design. The company estimated that its exports would be at least five times higher, requiring two new plants.
- **Safran:** F16, UH-60 Black Hawk and P8-A wiring.
- **Zodiac:** Design and manufacturing of fuel tanks for military aircraft, design of compound material parts.
- **Hawker Beechcraft:** Manufacturing of parts for military aircraft.

## VII) Human Capital Training Platform

With the purpose of leveraging opportunities and eliminating talent weaknesses in Chihuahua, the Road Map Working Group is seeking to develop and support a talent management platform in restricted and high technologies to tackle identified staffing and practices issues.

This program covers developing and using a technological platform, as well as using advanced talent management and business intelligence practices that enable the identification of profiles and competences required for the positions in highest demand in terms of restricted technologies and the aerospace industry in Chihuahua.

### Support and Benefits

One of Chihuahua's main windows of opportunity is based on talent. Mexico is experiencing a boom in the training of engineers, technicians and industrial design specialists, compared to other countries. In the United States alone, there are fewer engineers per capita than in Mexico, and this driver has decreased since the 90s since there are not enough professionals to replace retiring engineers.

The situation becomes relevant by considering the issue of national security and industrial property in the US A+D industry, which restricts the subcontracting of specialists from countries with no common interests or those who are in direct economic competition with the US and its allies (China, India, among other). This situation has made Mexico a strategic trade partner for the United States and opened various opportunities for Chihuahua to attract aerospace engineering and restricted technology projects.

However, the creation of the talent management platform is a requirement to catalyze Mexico's talent potential. The three main benefits of creating this project will be:

1. Identify among professionals oriented towards aerospace disciplines, engineering, design, restricted technologies and sciences in general, those with the potential to successfully join the sector, and manage their insertion and support their permanence and development within it.
2. Analyze the future staffing drivers and requirements, facilitating the planning of abilities that must be found or developed based on milestones and projects outlined by the sector's strategic maps.
3. Guide and support professionals, providing them with professional development routes based on their area of specialization and level, clarifying their growth outlook in aerospace disciplines and restricted high technologies.

## VIII) Strategic Special Economic Zones

The working group estimated that a Strategic Special Economic Zone would particularly benefit the A+D industry by reducing existing delays in its supply chain. Streamlining customs procedures will facilitate the integration of production chains and create cooperation conditions for certain manufacturing or service exporting activities. This would increase Chihuahua's competitiveness and image in the A+D industry and facilitate the attraction of new capital, technologies and processes, and the expansion of activities as well as access to new markets.



### ***Support and Benefits***

The implementation of an Strategic Special Economic Zone will improve supply times by streamlining customs procedures. With the goal of becoming an efficient platform for the export and import of dual-use and defense products and components, this type of platform must have physical and perimeter security controls and a technical and IT support center (safety and sustainability are essential).

An Strategic Special Economic Zone will be attractive, in terms of efficient infrastructure. It will offer a simple regulation system, as well as skilled labor, tax and financial incentives, and a strategic location, among other factors.



# Conclusions

In the last decade, Mexico has proven that it has the capabilities and talent in advanced manufacturing to supply the international market of the aerospace industry.

The integration of design and advanced manufacturing capabilities on a national level prove that the Mexican industry has included high technology and engineering in its processes.

Through the projects identified in this Road Map, which involves the efforts of academia, industry and government, Chihuahua will become the leading A+D cluster in Latin America in precision manufacturing for the high-tech industry and dual-use goods.

This exercise identified projects and factors that will promote Chihuahua's ability to attract future high technology investments for the aerospace and defense sector by as well as creating the capabilities to optimize the sector's industrial competitiveness in the region, such as: the creation of a talent management platform; reducing dependency on the importation of molds, dyes and tooling in the sector; and making better use of future investments that have been encouraged by Mexico's acceptance in the WA.

Chihuahua has been able to determine the right path to reach its maximum potential and become one of Mexico's most competitive regions in the aerospace sector with a medium- and long-term vision. The road to success has been forged, and the coming years will be bursting with opportunities and new challenges for Chihuahua.



# Action Plan

## Project to Map the Value Chain

The working group appointed the president of Chihuahua's Aerospace Cluster, to properly monitor the following activities and bring the project to completion.

### Below are specific actions that must be taken to complete the project:

- 1. The creation of a committee comprising two companies (INDEX Chihuahua, ProMéxico and the Cluster) that will be responsible for reviewing existing studies and establishing the terms of reference will be set to select the consultant to perform a study of the value chain.*
- 2. The aerospace cluster, through INDEX Chihuahua as intermediary, will apply for economic support from ProMéxico to carry out the study of the value chain for companies in Chihuahua's aerospace cluster, and begin the trackability of dual parts, products and services as indicated in the WA. To that end, INDEX Chihuahua will consult with ProMéxico's state office to start the application process and fulfill the requirements.*
- 3. The review of the draft of the document (value chain) for its approval. The study will be launched with partial reviews (monthly, if possible), to verify that the document contains everything established in the terms of reference and follow up on companies' contributions to the document.*
- 4. The generation of a progress report of the document and the deadline for its completion, as well as a review by managers to enable the release and publication of the final document in collaboration with ProMéxico and INDEX Chihuahua.*
- 5. Publication and implementation of the document, according to the project's execution schedule, as a promotion instrument to leverage the opportunities resulting from strategic planning and threat minimization.*
- 6. Follow-up on the document that will bring benefits to the cluster and each company to strengthen operational and promotional activities and to expand lines and/or new plants for the development of each one.*
- 7. A meeting to review lessons learned and set a new project for the years following the first fiscal year.*



## Establishment in Chihuahua of the offices of the Directorate for Civil Aviation

A representative of INDEX Chihuahua and Honeywell were appointed to follow up on the project. Below are actions to follow for this project:

1. Meet with the Ministry of Economy of Chihuahua to establish the strategy to attract the DGAC Office. Subsequently, the relevant documents will be drawn up to enlist the support of the State Governor in the negotiation. Lastly, the presentation will be made in collaboration with CODECH, local customs offices, relevant federal delegates and the private sector.
2. Presentation to the DGAC, in coordination with the Ministry of Economy of Chihuahua, INDEX Chihuahua, and companies related to the aerospace cluster and relevant federal delegates. During this presentation, the conditions under which the DGAC may establish an office in the state are shown.
3. Negotiate the requirements for establishing the DGAC office in Chihuahua, the staff required, the company requirements program and their follow-up schedule.
4. Signing of the Arrangement between the government of Chihuahua, the DGAC and, if required, INDEX Chihuahua to begin the establishment of the office in Chihuahua.
5. Monitor the installation and operation of the office and coordination with companies of the aviation cluster.

## Promotion Mechanisms for the Aerospace Sector

A representative of Honeywell was appointed to follow up on the fulfillment of this project. The following was agreed:

1. Consult with cluster companies on what their promotion needs. Create a list of all the aerospace companies in Chihuahua (whether or not they participate in the cluster) to estimate their global strengths and obtain their basic data to establish a core program with the three levels of government.
2. In coordination with the three levels of government and private organizations, present the promotion program to establish synergies or joint investments and validate the strategy. This way, the schemes will be leveraged and their publication sought in natural markets in the cluster, such as the United States, Canada, Europe, Japan and other countries.  
  
*This strategy will coordinate joint visits (companies and the three levels of government) and promotions aimed at strengthening expansions or new projects of already established companies in Chihuahua.*
3. Determine the visits to be made to corporations or events in order to prepare the strategy, documents, brochures and other products, and search for a symbol or strategic emblem to strengthen the state's competitive image in this priority sector. In addition, search for a relevance strategy within the state to advertise the cluster's advantages and achievements in the Aerospace Sector.
4. Develop an electronic platform that enables the identification of additional and/or complementary business opportunities and anchor it with the three levels of government.

5. The coordination with the Government of Chihuahua and ProMéxico to attend national and/or international events to advertise Chihuahua's Aerospace Sector's leadership and set Chihuahua on the path towards leadership of the sector in Latin America.

## Development of the Technology Capacity of Five Local Suppliers

The group decided to appoint an individual in charge of following up on and completing the project. Below are the activities to complete:

1. Create a committee that will specify the types of molds and dyes required by companies in the cluster to identify the situation of current suppliers, and how to establish a specific project to generate local investments to satisfy this demand. This committee will develop a strategy to attract current suppliers and evaluate how to provide a demand that enables the large market for this activity to be visualized.
2. Create two strategies resulting from the review of maintenance and development needs for new molds and dyes. The first will be aimed at developing local investors who establish this business and are able to integrate other companies to the supplier chain. The second is a strategy to attract current suppliers so that they provide this service locally, thereby saving time and money (increase their efficiency). In addition, coordination will be established with education institutions (Chihuahua and regional technology institutes, CENALTEC, technology universities, polytechnic, etc.) in order to establish an additional strategy that launches the training process of companies' staff to increase their performance and have additional workforce for new projects resulting from local capital or new investments by current suppliers located outside Chihuahua and/or the country.
3. Identify the first five prospects to attract molds and dyes to the state and launch promotion strategies to do so and to quantify the local demand for the service and construction of molds and dyes (and their maintenance). The short-term goal is for at least two suppliers to establish or be attracted to the state.
4. Determine the education institution that will begin the staff training process as well as the potential support by state or federal resources to finance the strategy. It may be developed with staff from education institutions or companies to reduce waiting times to obtain this staff.
5. Begin training company staff and continue with the strategy to attract or develop local suppliers based on companies' demand and their requirements. This will be done in coordination with the three levels of government.
6. Follow up on the strategy to attract and/or development of local suppliers and the staff training program. A meeting will be developed in December to review lessons learned from this strategy and schedule actions for 2013, continuing with the strategy in the long term.



## Integral High Technology Center

Representatives from the Monterrey TECH are in charge of this project. They are committed to follow up on the following specific actions:

1. In the first stage, development and NADCAP certification. This stage is fundamental for the certification of parts with Thermal, Chemical and Surface Treatments (special processes), so that high precision parts and specifications can be certified in Chihuahua, saving time and money; instead of shipping them out of Chihuahua and then bringing them back for final assembly, they will be sent directly to assembly plants.

The goal of this stage is to have at least four companies start the certification process together with the Monterrey TECH. By the end of the training period companies and academia will have highly trained staff to complement the transfer of these techniques to other companies that require them.

2. The next step is to train staff with higher technical abilities. Companies and academia will implement at least ten courses with highly specialized staff from the companies to accelerate knowledge among company employees of the aerospace cluster and facilitate the operation and development of activities in each company. The first training lecture will be done with Honeywell's technical staff to begin specific training supported by the companies and academia.
3. Search for alliances with institutions that have specific material to develop molds and dyes, such as CENALTEC Juárez, CEMYT (MANESA) and staff from some of the companies that have employees specialized in mold and die maintenance, repair and design, who can contribute with material to train and certify the staff of companies which require this development.

Finally, two additional courses (second and third) will be scheduled with support from companies' staff.

4. Define the investment required to establish the program (curriculum and technical material) for the academic training of the staff that will take this technology and initiate support to companies that require the aforementioned technified staff. Two additional courses (fourth and fifth) will be added with predetermined topics, in coordination with the Tecnológico de Monterrey.
5. Continue with an additional course (sixth) and follow up on the initiative to develop highly technified staff with a focus on molds and dyes, in coordination with the Monterrey TECH. This will begin staff training in mold and die development with a program according to interested and involved companies.
6. Give the four predetermined courses to company staff to give continuity to the special training, with their staff and academic employees from participating institutions, such as the Monterrey TECH, UACH (or the Faculty of Engineering) in its aerospace division, Universidad Tecnológica y Politécnica, among others.
7. Hold a meeting to analyze advances and areas of improvement of the actions undertaken. Discuss the program for 2013 and the resources that must be requested from the three levels of government, in addition to investments by companies of the aerospace cluster.

## Talent Management Platform to Train Relevant Human Capital

A government representative from Chihuahua will monitor the following specific actions:

1. Establish coordination with the relevant department of the Ministry of Economy of Chihuahua, to restart the Academic Productive Liaison Council (COVAP), which will coordinate with middle, middle-high and higher education institutions the curriculum changes to properly train and educate staff in the state's aerospace companies, and to produce highly-skilled staff who will enable the attraction and operation of new and existing companies.
2. Define the scope of COVAP and operation of the EPEX Program, which will enable skilled students to do internships in companies' overseas offices and receive training so they can be incorporated into their sponsoring companies, particularly, on their return to Mexico, based on their performance abroad. It is estimated that at least 15 students will be able to benefit from this support in 2012 (the program has been running for six years and close to 180 students have been benefited with a hiring rate of 90%).
3. Hold the first meeting of 2012 in coordination with the Ministry of Economy of Chihuahua, education institutions, directors of the aerospace cluster and ProMéxico, to leverage the existing relation with education institutions. This way, training will continue for staff joining the companies in the future and the existing training in these companies will be guaranteed.
4. Create a program to fulfill companies' needs so that through COVAP they can train company staff. The program will establish how to link support from other institutions such as CONACYT, STPS, federal and local ministries of economy in Mexico, among other.
5. Promote the human talent training program required by companies and its implementation with higher education institutions in the state, both public and private, such as UACH, UACJ, the Monterrey TECH, ULSA, Universidad Politécnica, Tecnológico de Chihuahua and regional technology schools, CIMAV, etc., and to seek economic support for the initiative.
6. Monitor the program and begin visits to education institutions involved in training human capital, to get to know them completely (facilities, academic staff, strengths and opportunities), and establish their involvement with companies to improve the liaison process and increase the efficiency of companies' staff training processes.
7. Carry out a second COVAP meeting to follow up on the Arrangements established in the first meeting, review the advances of the EPEX program and continue monitoring Arrangements (as well as the initiatives and actions undertaken), reviewing their issues and possible solutions.
8. Follow up on the established program and hold a meeting on lessons learned to create a schedule for 2013.



## Strategic Special Economic Zone

Due to the complexity of the allocation of concurrent resources (both from the private sector and from the three levels of government), as well as the search for an ideal location, strategy will be carried out during 24 months. The working group determined that a representative of INDEX Chihuahua and Honeywell will be responsible for following up on these activities:

- 1. Create a group integrated by staff from the aerospace cluster, INDEX Chihuahua, the state government, ProMéxico, and a representative of the Ministry of Economy from the federal level and the General Directorate of Customs, to identify the technical and economic requirements and begin their search.*
- 2. Submit a report to the cluster on developments and estimated times to project completion. In addition, determine the demand for services that companies will be able to provide once the project is completed and measure the potential profitability of the operation of the facilities and the savings in time and resources that the companies would have as a result of the project.*
- 3. In coordination with INDEX Chihuahua's customs committee, review the proposal and its potential operation of the special economic zone, and review the existing customs regulations to communicate the threats and opportunities that will arise with changes to regulations and their impact on companies.*
- 4. Monitor issues that result from the implementation of the initiative and define investment amounts, the potential location of the Customs bonded warehouse and the negotiations to obtain the resources and prepare the executive project.*
- 5. Continue the negotiations to create an executive project and search for resources to pay for the executive project.*
- 6. Define the location of the project and obtain the land for it.*
- 7. Follow up on the obtaining of the land and constituting the legal entity that will have to be created in compliance with standards from the Ministry of Finance and Public Credit (SHCP) and the Directorate of Customs and all stakeholders in the initiative. Review the strategy to determine the budget for the construction of the buildings required for the installation of the Strategic Specialized Customs Bonded Warehouse and propose the calendar for monitoring the initiative from 2013 to the conclusion of the project.*







## Business Directory

### **Arnprior Aerospace**

*John Wilbur, CEO.*

Parque Industrial Chihuahua Sur, Ave. Tabalaopa No. 8901, Chihuahua.

01 (613) 597 9897

<http://arnprioraerospace.com/>

[john.wilbur@arnprior-rmsi.com](mailto:john.wilbur@arnprior-rmsi.com)

### **A.E. Petsche Co. (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representatives.*

Av. Washington No. 3701, Edificio No. 13-B, Col. Panamericana,

Parque Industrial Las Américas, 31200, Chihuahua.

01(614) 439 3638 / 461 9473

[www.aiig.com](http://www.aiig.com)

[crolon@aiig.com](mailto:crolon@aiig.com)

### **Cambrian Industries**

*Fernando Cadena, President of the Council.*

Antonio J. Bermúdez No. 1550, Parque Industrial Bermúdez, 32470, Ciudad Juárez.

01(915) 771 61 00 / 892 06 66

[www.cambrianind.net](http://www.cambrianind.net)

[fernando\\_cadena@cambrianind.net](mailto:fernando_cadena@cambrianind.net)

### **Capsonic Automotive & Aerospace**

*Francisco Delgadillo, General Manager.*

Hermanos Escobar No. 6551, Parque Industrial Magnaplex, 32320, Ciudad Juárez.

01(656) 627 0011 / 627 0535 / (616) 627 0536

[www.capsonic.com/Auto/Market/Aero/](http://www.capsonic.com/Auto/Market/Aero/)

[fdelgadi@capsonic.com](mailto:fdelgadi@capsonic.com)

### **CAV Aerospace**

*Gabriel Peschard; Francisco Meza, Manager Plant.*

Av. Alejandro Dumas No. 11321 Int. 2, Complejo Industrial Chihuahua, 31136, Chihuahua.

01(614) 158 6600

[www.cav-aerospace.net](http://www.cav-aerospace.net)

[c.peschard@cav-aerospace.net](mailto:c.peschard@cav-aerospace.net)

### **Cessna Aircraft Chihuahua / Textron Aerospace de México.**

*Laura Morales.*

Av. Washington No. 3701, Edificios No. 28, 34 y 35, Col. Panamericana, Parque Industrial

Las Américas, 31200, Chihuahua.

01(614) 426 1221 Ext. 2000, 2001

[www.cessna.com](http://www.cessna.com)

[jmercerc@cessna.textron.com](mailto:jmercerc@cessna.textron.com)

[lmorale@cessna.textron.com](mailto:lmorale@cessna.textron.com)

**Croni, S.A. de C.V.**

*Jorge Campos, Manager plant and Representative.*

Santos Dumont No. 6450, Parque Industrial Panamericano, 32690, Ciudad Juárez.

01(656) 633 1731 / 34

www.croni.com

jcampos@croni.com

**Forges de Bologne México****Manoir Aerospace/Intermex Manufactura de Chihuahua, S.A. de C.V.**

*Frederic Mathieu, Director General / Nicolas Maillard, Manager Plant /*

*Fernando Siqueiros Falomir, Legal Representative.*

Calle Oscar Wilde No. 11390, Complejo Industrial Norte, 31109, Chihuahua.

01(614) 481 2680 / 439 4020 / 483 2366 Ext. 105

www.manoir-industries.com

frederic.mathieu@g-mind.com

fsiqueiros@intermex.com,

nicolas.maillard@g-mind.com

**Fokker Aerostructures**

*Hans Buthker, Head of the Fokker Aerostructures.*

Av. Tabalaopa S N Fracción C, De Lote 2, Manzana 1, Parque Industrial Chihuahua Sur,

Primera Etapa.

www.fokker.com/frb-Contact

**Hawker Beechcraft Corp. (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa, Director General /*

*Rosa Ma. Blanco Fabela, Legal Representative.*

Blvd. José Fuentes Mares No. 9003, Col. Ranchería Juárez, 31090, Chihuahua.

01(614) 439 3638

www.aiig.com

croton@aiig.com

rblanco@aiig.com

**Honeywell Aerospace de México, S.A. de C.V.**

*Felipe de Jesús Sandoval Ramírez, Director General y Representative Legal Planta*

*Chihuahua; James Bedon, Gerente General; Aldo Romero Moreno, Director de Planta.*

Vialidad Tabalaopa No. 8507, Col. Ejido Ávalos, 31065, Chihuahua.

01(614) 429 5410

www.honeywell.com

james.bedon@honeywell.com

aldo.romero@honeywell.com

felipe.sandoval@honeywell.com

**JBT AeroTech**

Av. De la Industria No. 720, Parque Industrial Antonio J. Bermúdez, 32470, Ciudad Juárez

01(656) 207 36 90

www.jbtaerotech.com

**Kaman Aerostructures México**

*Robert Kanaskie, Presidente de Kaman Aerostructures.*

José Fuentes Mares Boulevard, Complejo Industrial, número 9403, Chihuahua.

01 (904) 485 1421

www.kaman.com/aerospace/aerostructures/

robert.kanaskie@kaman.com

**Labinal de México, S.A. de C.V.**

*Jorge Ortega Rodríguez, Presidente; Denis Schaeffer, Gerente General /*

*César Díaz de León, Legal Representative.*

Calle Nicolás Gogol No. 11322, Complejo Industrial Chihuahua, 31109, Chihuahua.

01(614) 439 2168 / 439 2000 / 442 5900

www.labinal.com

jorge.ortega@mx.labinal.com

maricarmen.dominguez@mx.labinal.com

cesar.diaz@mx.labinal.com

**Manoir Aerospace México**

*Alain-Jory Barthe, presidente de la división Aeroespacial.*

Calle Oscar Wilde No. 11390 Complejo Industrial Norte, 31109, Chihuahua.

01(614) 481 2680

www.manoir-industries.com

information@g-mind.com

**Safran Engineering Services**

C/o Labinal - Etablissement 3 - MEXICO Av. Homero y Nicolás Gogol No. 11322 Complejo Industrial Chihuahua, 31109, Chihuahua.

01 (614) 442 7221

www.safran-na.com

**Servicios y Operaciones Integrales (SOISA), S.A. de C.V.**

*Jesús Mesta.*

Calle Melchor Guaspe 3800-3, Colonia Dale, 31050, Chihuahua.

01(614) 492 3333

www.soisa.com.mx

**SGL de México, S.A. de C.V.**

*Germán Coss, Gerente General.*

Av. Fuentes Norte No. 7250, Parque Industrial Fuentes, 32437, Ciudad Juárez.

01(656) 618 0580 / (686) 618 2626

www.electro-nc.com

rmolina@electros witch.com

**Sippican de México, S. de R. L. de C. V.**

*Víctor Méndez de León, Gerente General.*

Av. Teófilo Borunda No. 6683, Partido Iglesias, 32650, Ciudad Juárez.

01(656) 227 6600

www.sippican.com

victor.m.mendez@lmco.com

**Textron International Mexico/  
Intermex Manufactura de Chihuahua, S.A. de C.V.**

*Jesús Antonio Fierro Arzola, Legal Representative.*

Av. Víctor Hugo No. 330-C, Complejo Industrial Chihuahua, 31109, Chihuahua.

01(614) 439 4020 / 483 2366 Ext. 105

jfierro@intermex.c

**The Metal Finishing, LLC**

*Robert H. Babsr Jr, Presidente.*

Av. Nicolas Gogol 11332, 31136, Chihuahua.

01 (614) 483 1559

rbabst@metalfinishingco.com

**The Nordam Group**

*Ken Lackey, Presidente y Director Ejecutivo; Steve Pack, Vicepresidente; José Luis Enríquez.*

Calle Taguchi No. 18901, Parque Industrial Supra III Etapa, 31183, Chihuahua.

01(614) 158 0100 / 158 0140

www.nordam.com

jenriquez@nordam.com

**Tighetco Latinoamérica, S.A. de C.V. (Planta Chihuahua)**

*Peter Nicholas, Presidente; Humberto Santiago Martens, Vicepresidente.*

Calle Aeroespacial s/n, Lote 1 Manzana 2 Parque Industrial Chihuahua Sur,  
31074, Chihuahua.

01(614) 420 8007

www.tighetco.com

humberto.santiago@tighetco.com.mx

**Zodiac/Air Cruisier (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representative.*

Av. Ishikawa No. 1200, Zona A Parque Industrial Supra, 31170, Chihuahua.

01(614) 439 3638

www.aircruisers.com

croton@aiig.com

rblanco@aiig.com

**Zodiac/Amfuel (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representative.*

Av. Ishikawa No. 1200, Zona B Parque Industrial Supra, 31170, Chihuahua.

01(614) 439 3638

www.amfuel.com

croton@aiig.com

rblanco@aiig.com

**Zodiac/Icon International (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representative.*

Av. Ishikawa No. 1200, Zona D Parque Industrial Supra, 31170, Chihuahua.

01(614) 439 3638

www.icoregroup.com

croton@aiig.com

rblanco@aiig.com

**Zodiac/IDD Aerospace (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representative.*

Av. Ishikawa No. 1200, Zona E Parque Industrial Supra, 31170, Chihuahua.

01(614) 439 3638

www.iddaerospacecorp.com

croton@aiig.com;

rblanco@aiig.com

**Zodiac/Weber Aircraft (Grupo American Industries, S.A. de C.V.)**

*Conrado Rolón Hinojosa; Rosa Ma. Blanco Fabela, Legal Representative.*

Av. Ishikawa No. 1200, Zona C Parque Industrial Supra, 31170, Chihuahua.

01(614) 439 3638

www.weberair.com

croton@aiig.com

rblanco@aiig.com





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