Employees - Global Aerospace Industry

Approx. 2 million jobs

Elevated Skills and Wages

Global median hourly wages, sector to sector comparison, select countries (2007 $US)

Labour represents the second largest expense after purchased inputs in terms of industry cost structure.

<table>
<thead>
<tr>
<th>Manufacturing Sector</th>
<th>$ US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum and Coal Products</td>
<td>$46</td>
</tr>
<tr>
<td>Aerospace</td>
<td>$45</td>
</tr>
<tr>
<td>Chemicals</td>
<td>$36</td>
</tr>
<tr>
<td>Automotive</td>
<td>$30</td>
</tr>
<tr>
<td>Paper</td>
<td>$30</td>
</tr>
<tr>
<td>Manufacturing (overall)</td>
<td>$28</td>
</tr>
<tr>
<td>Furniture and Related Products</td>
<td>$22</td>
</tr>
<tr>
<td>Computer and Electronics</td>
<td>$20</td>
</tr>
<tr>
<td>Apparel</td>
<td>$14</td>
</tr>
</tbody>
</table>

Aerospace Employees (thousands)

- United States: 624
- China: 350
- France: 160
- Great Britain: 101
- Germany: 97
- Canada: 87
- Mexico: 43
- Japan: 31
- Brazil: 23
4 main stages for Chihuahua’s Aerospace Cluster

1. **Aerospace Cluster Integration**
2. **Establishment of an Aircraft Maintenance, Repair and Overhaul (MRO) company**
3. **Development of Integral Aviation Services Center**
4. **Establishment of a Technological Road Map for 2023**
Aerospace Cluster Initiatives

**Technology**

**Education**
2. Education curriculum alignment between the industry requirements and the Academia (Theory & Praxis).

**Supply Chain**
3. Project to integrate and develop the aerospace supply chain.

**Certification**
4. Development of a strategy to get the necessary certification capabilities in Chihuahua.

**Infrastructure**
5. Development of the needed infrastructure for the aerospace industry.

**Promotion**
6. Positioning of Chihuahua’s Aerospace Cluster on the international arena.
Aerospace Cluster Organization Chart

Honorary Member
Secretary of Economy
Mr. Manuel Russek Valles

Honorary Member
Secretary of Education
Mr. Pablo Espinoza Flores

Aerospace Cluster Director
Ing. José Luis Rodríguez

Cluster Manager
Lic. Mónica Vega O.

Supply Chain Counselor
C.P. Jesús Mesta

Promotion Counselor
Ing. Conrado Rolón

Academic Entailment Counselor
Ing. Felipe Sandoval

Certifications Counselor
Ing. Luis Carlos Ramírez

Mega Projects Counselor
Lic. Luis Lara

Technical Council
Aerospace Cluster Companies
Chihuahua is one of the most important Aerospace Clusters in Mexico with the following indicators:

- 32 aerospace certified suppliers
- 4,000,000 Sq Ft of industrial floor
- >13,000 direct labor force = >$150M USD in payroll and >$450M USD in indirect jobs (economic spillover)
- > $1,000M USD in local and foreign investment
- > $750M USD annual exports

These indicators are the result of the teamwork of the triple helix: Industry, Academia and Government.
Aerospace Industry in Chihuahua 2013-2014

Stage 1
June - August
Define the technological capacity currently established in Chihuahua and what is being targeted short term.

Stage 2
September - December
Define a Road Map Support of Universities of Wichita and/or Toulouse and External Consultants to define the action plan for 2023.

Stage 3
January - March
Virtual Representation of Road Map in stages.
# Stage 1: Chihuahua’s Aerospace Analysis

<table>
<thead>
<tr>
<th>Subsystems</th>
<th>Components</th>
<th>Systems</th>
<th>Assembly</th>
<th>Other Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Galleys equipment</td>
<td>Interiors</td>
<td>Communication systems and equipment</td>
<td>Assembly for aircraft construction</td>
<td>Special systems and equipment</td>
</tr>
<tr>
<td>Windows and wings</td>
<td>Electronic Components</td>
<td>Fabrication of aircraft engine manufacturing</td>
<td>Aircraft structures subassemblies and aircraft engines</td>
<td>*MRO (Maintenance, repair and overhaul)</td>
</tr>
<tr>
<td>Landing gear</td>
<td>Aerostructures - Fuselage</td>
<td>Aerostructures and forging</td>
<td></td>
<td>Aviation services</td>
</tr>
<tr>
<td>Electrical Wiring - Harness</td>
<td>Aircraft engine components</td>
<td>*Fuel systems</td>
<td></td>
<td>Ground support and equipment to the airfield</td>
</tr>
<tr>
<td>Signal and recording systems</td>
<td>Control systems and equipment</td>
<td>Avionics</td>
<td></td>
<td>Armament and equipment</td>
</tr>
<tr>
<td>Software systems</td>
<td>CNC Machinery</td>
<td>Automatic flight navigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment processes</td>
<td>Security equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* On the radar  
**High participation**  
**Participation**  
**Low participation**  
**No participation**
Main Components

1. NDT Services, Penetrant Inspect
2. Chemical Conversion (Alodine)
3. Chromic Acid Anodize
4. Boric/Sulfuric Acid Anodize
5. Primer Applications
6. Top Coat Applications
7. Fuel Tank
8. Inspection Services
9. Blasting and Polish Services
10. Sulfuric Acid Anodize

- Current capacity in Chihuahua
- Partial capacity

11. Passivation
12. Cadmium Plating
13. Hard Chrome Processing
14. Phosphate Fluoride Processing
15. Nickel Plating
16. Electroless Nickel Plating
17. Zinc Nickel Plating
18. Manganese Phosphate Coating
19. Shot Peening
20. NDT Services
21. Magnetic Particle Inspection
22. Cadmium Plating *2014
23. Passivate *2014
24. Dry Film Lube *2014
## Design Capabilities

<table>
<thead>
<tr>
<th>Products / Processes</th>
<th>High Participation</th>
<th>Participation</th>
<th>Low Participation</th>
<th>No participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Wiring Harness</td>
<td><img src="image" alt="SAFRAN Engineering Services" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seats</td>
<td><img src="image" alt="ZODIAC AEROSPACE" /></td>
<td><img src="image" alt="Soisa Aerospace" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbines</td>
<td><img src="image" alt="Honeywell" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerostructures</td>
<td><img src="image" alt="SAFRAN Engineering Services" /></td>
<td></td>
<td><img src="image" alt="Cessna" /></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td><img src="image" alt="ZODIAC AEROSPACE" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For further information please contact Chihuahua’s Aerospace Cluster.
In Chihuahua, the new frames MRO Center has a potential market of about 10,000 airplanes¹

1. Commercial aircraft only, including turboprops and regional jets

Zone 1: México
- 297 airplanes
- 26 operators

Zone 2: US & Canada
- 8,259 airplanes
- 468 operators

Zone 3: Latin America (except México)
- 851 airplanes
- 166 operators

Zone 4: Southern Cone
- 955 airplanes
- 100 operators
- CUU out of range for most of the regional jets and single isle airplanes.

1. Source: ACAS, Oliver Wyman analysis

CUU Assumed out-of-scope

Extended range narrowbody @ 5,000 NM

Typical narrowbody @ 3,000 NM

Range of Regional jet @ 2,000 NM
MRO Chihuahua

Inversionistas de Chihuahua S.A. de C.V. + International MRO

Local Training Center, Government Incentives

MRO Services Chihuahua S.A de C.V.

Mexican Airlines
Local partners, First Clients

Latin America & US Airlines
Future Targets
Aerospace Industry in Chihuahua

2013 - 2014

Stage 1

Define the technological capacity currently established in Chihuahua and what is being targeted short term.

June - August

Stage 2

Define a Road Map Support of Universities of Wichita and / or Toulouse and External Consultants to define the action plan for 2023.

September - December

Stage 3

Virtual Representation of Road Map in stages.

January - March
1° Workshop

Secretariat of Economy

Presentations

- Delegate Federal Ec.
- Sec. de Economy
- ProMéxico
- Aerospace Cluster
- Tec de Monterrey

Teams integration

Expected Outputs
2º Workshop

**PIT2 – PIT3**

ProMéxico

Presentations
- Interiors
- Design
- Wiring
- Aerostructures
- Various
- Engines

Success Story: Innovation

Tour PIT3

Draft Road Map
3° Workshop

Index
Chihuahua

ProMéxico - TRM
Consolidation
Teams - initiatives
Final Conclusions
Technological Workshops Results Presentation

Last November was held the presentation of results of the technological workshops, attended by members of the Steering Committee, FEMIA, Federal and State Secretariat of Economy, President and Director of Index Chihuahua, ProMéxico, DESEC, local investors, representatives of the Academy, CENALTEC, special guests and participants of the workshops.
Aerospace Industry in Chihuahua

2013 - 2014

Stage 1
June - August
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Stage 2
September - December
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Stage 3
January - March
Virtual Representation of Road Map in stages.
Stage 3 Technology

1. Virtual Representation
   - Champion: JL Rodríguez
   - Leader: Mónica Vega
   - Support Team:
     - Martín Flores
     - Tec de Monterrey - Students

2. Cabin Showroom
   - Champion: JL Rodríguez
   - Leader: Jacobo Mesta
   - Support Team:
     - Aerospace Companies
     - Tec de Monterrey

3. Airplane for exhibition
   - Champion: JL Rodríguez
   - Leader: Martín Flores
   - Support Team:
     - Cenaltec
     - Mónica Vega Clúster
     - Mechanical Engineers

4. Aerospace Integration Forum
   - Champion: JL Rodríguez
   - Leader: Mónica Vega
   - Support Team:
     - Aerospace Companies
     - Government - ProMéxico
     - Soft Landing and Start-Up Facilitators
Stage 3

Champion: JL Rodríguez
Leader: Martin Flores - CAAMEX
Mónica Vega – Cluster

Special Thanks to:
• Levi Talamantes - MFCo.
• Octavio Chacón - Z W&WS.

Produced By:
• Elina Sánchez
• Erick Axel Lamas
• Luis Alberto Corral
• Moisés Armando Cruz
• Sarahí Anguiano

Virtual Representation
Stage 3

Cabin Showroom

Champion: JL Rodríguez
Leader: Jacobo Mesta
Mónica Vega Clúster Aerospace Companies
Stage 3

Champion: JL Rodríguez
Leader: CAAMEX
Mónica Vega  Clúster  Aerospace Companies

Airplane: Piper Cherokee
Champion: JL Rodríguez
Leader: CAAMEX
Mónica Vega  Clúster  Aerospace Companies

Airplane for exhibition
In order to share the vision of growth of the aerospace industry and develop synergy with the academy, we are organizing a series of speaking engagements and panels that will give the students and professors the opportunity to interact with general managers from aerospace companies established in the region.
Activities

- Integration with the Academia
- Integration with the Industry
- B2Bs – Supply Chain
- Conferences
- Lunch
- Aerospace Exhibition
- Videos
- Industrial Tours
- Airplanes Exhibition
Airplanes Exhibition - Base Aérea

Pilatus PC-7

T - 6c

TC - 1000

Cessna 182 Sky Lane
Thank you! ...

Looking for aerospace opportunities? Go to:

www.AerospaceClusterChihuahua.com
Videos

- https://www.youtube.com/watch?v=_ZMy6BoUu0g#t=295
- https://www.youtube.com/watch?v=eDnBM05fbVA
- https://www.youtube.com/watch?v=wXdhaMfYNQo
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American Industries

Mónica Vega Ocaranza
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