



SUPPLIER OF THE FITTEST:
HOW TO MANAGE SIGNIFICANT
INCREASES IN
PRODUCTION EFFECTIVELY

2016 COMMERCIAL
AEROSPACE STUDY
INSIGHT FOR SUPPLIERS



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01 MESSAGE FROM MAZARS



Gaël Lamant, Partner
Paris



Jason Slivka, Manager
New York

We are pleased to present you with Supplier of the Fittest: How to Manage Significant Increases in Production Effectively!

Various macroeconomic factors in today's global economy have led to a significant increase in the demand for new aircraft. As a result, backlogs for Boeing and Airbus, the major OEMs in the aerospace industry, have risen to all-time highs. In response, these OEMs have increased their production rates to help satisfy the world's hunger for single aisle aircraft.

An aircraft is quite a large and expensive object. Won't production rate increases of 25%-40% over just a few years have a significant ripple effect in the industry?

To best address this question, the Mazars Group has embarked on a journey to determine how increases in production rates would affect suppliers throughout the global supply chain. It includes the results from a global survey, independent research, and interviews conducted with industry personnel.

We are excited for you to accompany us on our journey, so please fasten your seatbelts and enjoy the ride!

Sincerely,

Gaël Lamant and Jason Slivka



02 METHODOLOGY



RESEARCH

We have performed independent research on the aerospace industry and the macroeconomic factors therein. This information will serve as a basis for our analysis and help the reader understand all of the macroeconomic factors that currently affect and will potentially affect the industry going forward. Our goal is not just to give a snapshot of the industry as currently presented, but look into the future to help suppliers adapt and respond to the unknown. Our facts and figures come from publicly available information sources that we precise on page 68.



SURVEY

We have gathered responses from over 100 aerospace suppliers from Europe and North America on areas of major concern: main risks and strategies, globalization, financing, and technology and innovation. We have asked various questions under each topic with the hope that the information provided will be robust in helping the readers optimize their strategy for the future. Survey results are presented either in ranking order or in ranked percentages. Respondents are allowed to choose or cite multiple answers if they find them all coherent.



INTERVIEW

We conducted multiple interviews with key leaders in the aerospace industry to add perspective to the outcomes of our research and survey in order to offer complimentary insights into the industry.



03 EXECUTIVE SUMMARY



Confirmation of optimism about long-term growth prospects.

Changes in macroeconomic factors, such as growth of domestic markets in emerging countries (China, India), are projected to result in a significant increase in air travel. According to experts, air traffic doubles every 15 years. To meet this increasing demand, airlines continue to place orders for new aircraft, which pushes OEM backlogs to record highs. Between 35,000 and 40,000 new aircraft are expected to be produced in the next 20 years, (compared with 17,400 deliveries during the previous 20-year period) including 23,000 to 28,000 single-aisle aircraft.

This large order increase means OEMs must raise production rates, for which they have announced multiple rounds of production increases for single-aisle aircraft. Boeing and Airbus, the two largest commercial OEMs, are projected to increase their combined single-aisle aircraft production rates to 117 per month in 2019, from 84 per month in 2015, rise of nearly 40% in less than five years!

In order to achieve these goals, OEMs will rely heavily on their suppliers. As stated by Didier Katzenmayer, Head of industrial Affairs at Airbus Operations: "Our

industrial issues are a reality: ON TIME & QUALITY, and the whole supply chain is aware of this." Rising demand could lead to a large increase in sales for suppliers as long as they can manage production rate increases effectively.

This publication is a guide to the opportunities and risks suppliers face in navigating the complexity of the commercial aerospace supply chain. It also highlights some key differences between suppliers in North America and Europe, where a majority of them are clustered.



The key findings of our publication illustrate the following:

• Price pressure

One main risk suppliers may face, is pressure on prices and delivery rates. One way to view increase in production rates is growing competition in the market place. Airlines put more pressure on the OEMs to deliver high quality at the best price, leading OEMs to drive for efficiency and costs savings. This pricing pressure at the OEM level gets passed along to the suppliers, with dual-sourcing generalized to secure production.

• Restrictions to a fast ramp-up

The main restrictions to a fast ramp-up mentioned by professionals are:

- The limited size of suppliers, mainly in Europe. However, the European supply chains have consolidated in recent years. This consolidation is encouraged by OEMs and will continue especially for rank 2 suppliers onwards. Experts expect to see significant interest in cross border M&A activity, particularly between the US and Europe.
- Limited access to short-term financing, primarily in Europe. This is a concern in the current context of a ramp-up, especially for rank 2 suppliers and up.
- Inadequate human capital (skills shortage).

• Efficiency

In the present context, the highest priority for suppliers is to focus on improving the efficiency of current programs to ensure they can properly meet demand while remaining profitable. The goal is to produce better, lighter and more economical solutions. To do so, suppliers plan to invest in R&D. Broader use of composite materials, well known for their light weight structure, is cited as the most expected evolution. Also, and this might be more disruptive, 3D printing is seen as a financially attractive way to reduce shipping and logistics time. This technology could change the business model; however, new users will have a learning curve in how to use it.

• Diversification

A high number of our respondents intend to diversify into new markets. Suppliers understand the current market and have an interest in exploiting production increases through diversification of their portfolio.

• Globalization

Globalization is another major market evolution. Surprisingly, despite price pressure, reducing production costs was only the third most popular reason why our respondents would invest abroad. Instead, access to new markets and proximity to OEMs were considered more important. Geographical proximity enhances collaboration among OEMs, suppliers and sub-suppliers, which helps to mitigate the potential for production shortage.

As expected, the US is chosen as the first destination for long-term investment. The North-American market offers a lot of opportunities for aerospace companies, which can be secured with a native dollar. However, our respondents also consider China, India, Mexico and Morocco as offering strong opportunities. Morocco offers a highly competitive cost advantage and grants large tax incentives and support for aerospace investments. In Mexico, the aerospace industry has shown an exceptional average growth of 17% for the past years.



04 MARKET CONTEXT & OEM RESPONSES



01.

MARKET CONTEXT AND TRENDS

02.

MAJOR COMMERCIAL OEMS

03.

OEM RESPONSES TO MARKET CONTEXT AND TRENDS

INTERVIEW

DIDIER KATZENMAYER FROM AIRBUS

04.

FROM OEMS/ AIRCRAFT TO SUPPLIERS/ PARTS

05.

OEM : SUPPLIER COLLABORATION

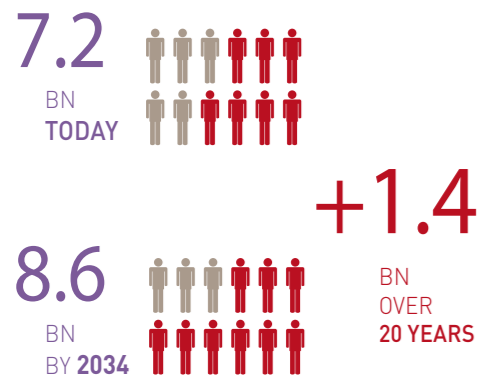
INTERVIEW

RACHID BENDALI FROM LORD CORPORATION

GROWTH FACTORS IN THE AEROSPACE INDUSTRY

SOCIAL-ECONOMIC CONTEXT IN THE NEXT 20 YEARS:

GLOBAL POPULATION:



MIDDLE CLASS:



AIR TRAFFIC:

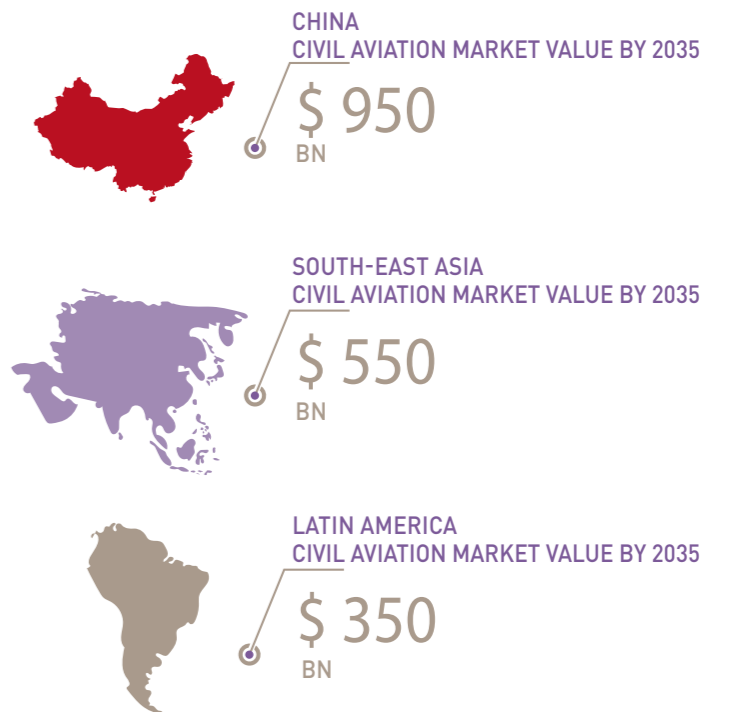


EMERGING MARKETS

TRAFFIC

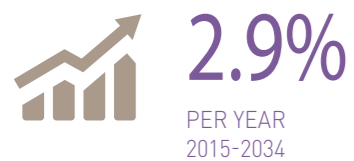
EMERGING ECONOMY WILL ACCOUNT FOR OVER

70% OF WORLD'S AIR TRAFFIC BY 2034



AEROSPACE INDUSTRY GROWTH:

WORLD GDP GROWTH:



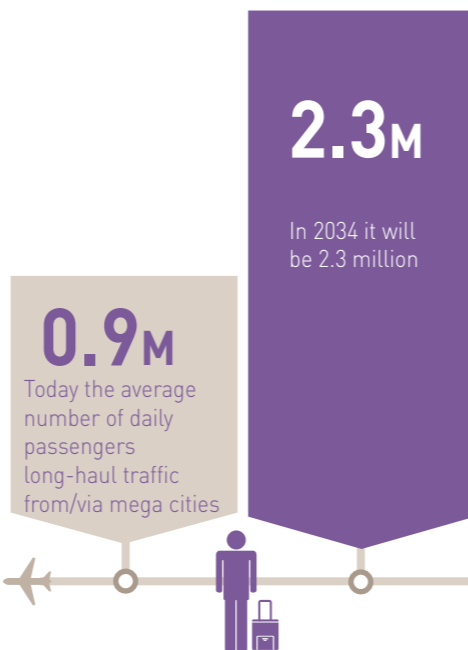
AIR TRAFFIC GROWTH



MEGA AVIATION HUBS:



MEGA HUBS: 10,000 daily international long-haul passengers



ENERGY AND TECHNOLOGY:

More energy efficient aircraft models:

Aircraft today are about **70%** more fuel efficient than those in the 1960s and those in the 2050s will be **40%-50%** more efficient than today

REGULATIONS:



- European carbon emissions curb: ex. EU's clean sky 2 program (reduction of up to **20% -30% emission**)
- New countries opening up restrictions Ex. Iranian sanction lifted and Iran ordered **\$25 BN +** worth of aircraft from both Boeing and Airbus

FLEET RENEWAL:

almost **74%** of the existing fleet will be renewed by 2034



WHERE ARE ALL THE COMMERCIAL AIRLINE MANUFACTURERS LOCATED?

BOMBARDIER

Turnover 2015:

\$ 18BN

Activity: designs, manufactures, and sells commercial airplanes, aero structures, and also provides engineering services and railway construction

Number of Employees: 70,900

HQ: Montréal

BOEING

Turnover 2015:

\$ 96BN

Activity: designs, manufactures, and sells commercial airplanes, military aircraft, space systems, and global services

Number of Employees: 161,400

HQ: Chicago

EMBRAER

Turnover 2015:

\$ 6BN

Activity: design, manufactures and sells airliners, combat aircraft (AMX), business jets (3rd prod. worldwide)

Number of Employees: 20,000

HQ: San José Dos Campos

ATR:

Turnover 2015:

\$ 2BN

Activity: designs, manufactures, and sells turboprop airplanes

Number of Employees: 12,000

HQ: Toulouse

AIRBUS

Turnover 2015:

€ 64BN

Activity: designs, manufactures, and sells commercial airplanes, military aircraft, space systems, and global services

Number of Employees: 136,574

HQ: Toulouse

UNITED AIRCRAFT CORPORATIONS

Turnover 2015:

Rub 352M (€4.8 BN)

Activity: manufactures designs and sells military, civilian, transport and unmanned aircraft

Number of Employees: 100,000

HQ: Moscow

COMAC

Turnover 2015:

Non communicated

Activity: designs, tests and builds of large commercial passenger aircraft

Number of Employees: Non communicated

HQ: Shanghai

MITSUBISHI AIRCRAFT CORPORATION

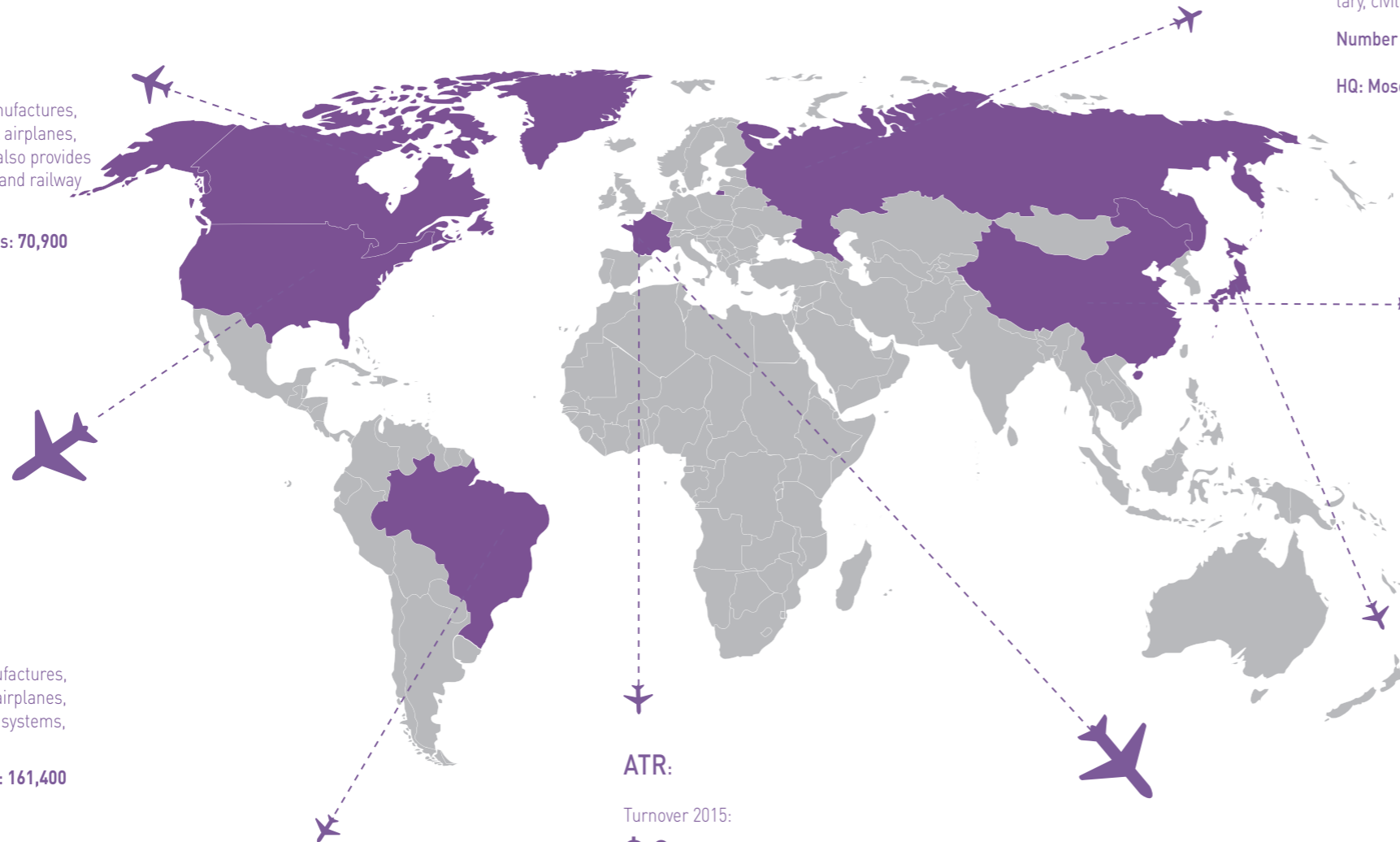
Turnover 2015:

N.A

Activity: designs, manufactures, and sells commercial airplanes

Number of Employees: Non communicated

HQ: Nagoya-Shi



Aside from Boeing and Airbus, there are a handful of aircraft OEMs that compete globally in various segments of the commercial aircraft sector.

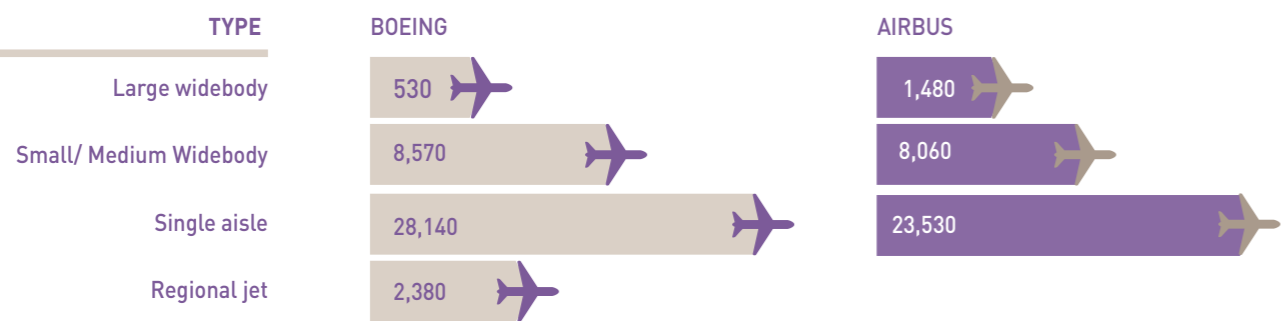
Though none of these companies are close in size to Boeing and Airbus, they all play a role in the industry. Bombardier, Embraer and ATR are recognized companies that sell aircraft to airliners throughout the world. Though previously competed on smaller aircraft, Bombardier recently emerged as a potential duopoly-buster with the completion of its CSeries aircraft, which can seat up to 160 passengers. However, the Canadian group faces financial difficulties, and announced a restructuring earlier this year.

Embraer operates entirely on the regional market in the commercial aerospace sector, in which it has been very successful. However, due to the size of the Brazilian aerospace industry, Embraer looks to international suppliers from North America and Europe for complex tasks, using local suppliers for simple manufacturing. Embraer's website states: "In order to spur the development of the aeronautics industry supply chain in Brazil, [Embraer] extended the Embraer Entrepreneurial Excellence Program (P3E) to its local suppliers."

United Aircraft Corporation (UAC) manufactures the Sukhoi Superjet 130 and the MC-21 (first flight expected in 2018). The supply chain for these aircraft is slightly different from the OEMs previously discussed, as it includes a higher percentage suppliers from Russia, in addition to those from North America and Europe.

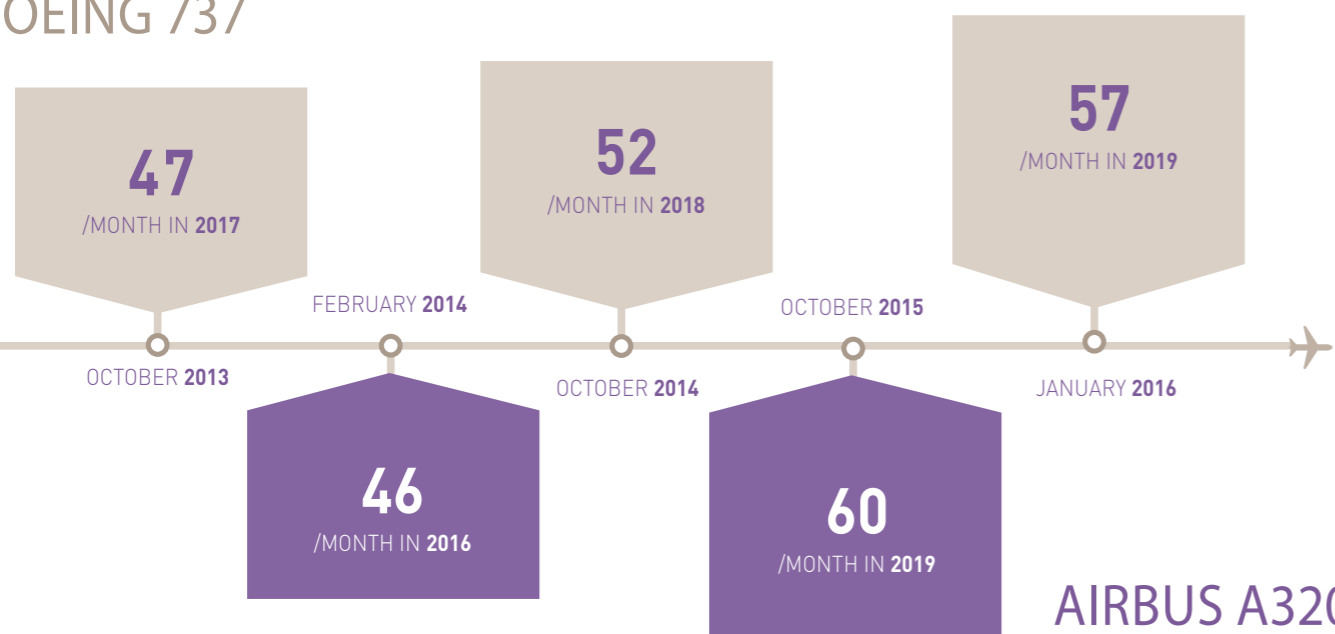
COMAC, the manufacturer of the ARJ21 regional jet (first light in June 2016) and the C919 single aisle aircraft (first delivery expected in 2018), and Mitsubishi, the manufacturer of the MRJ regional jet (first delivery expected in 2018), are both fairly new entrants to the commercial aircraft market.

According to the information published in July 2016, Boeing and Airbus estimate that the demand for new aircraft will amount to 39,620 (According to Boeing) and 33,070 (According to Airbus) in the next 20 years (the Airbus number does not include jets with capacity under 100 people) as detailed below:



As of December 31 2015, Boeing and Airbus have the capacity to produce 42 single-aisle aircraft per month; however, both OEMs have announced increased production level over the next few years as follows:

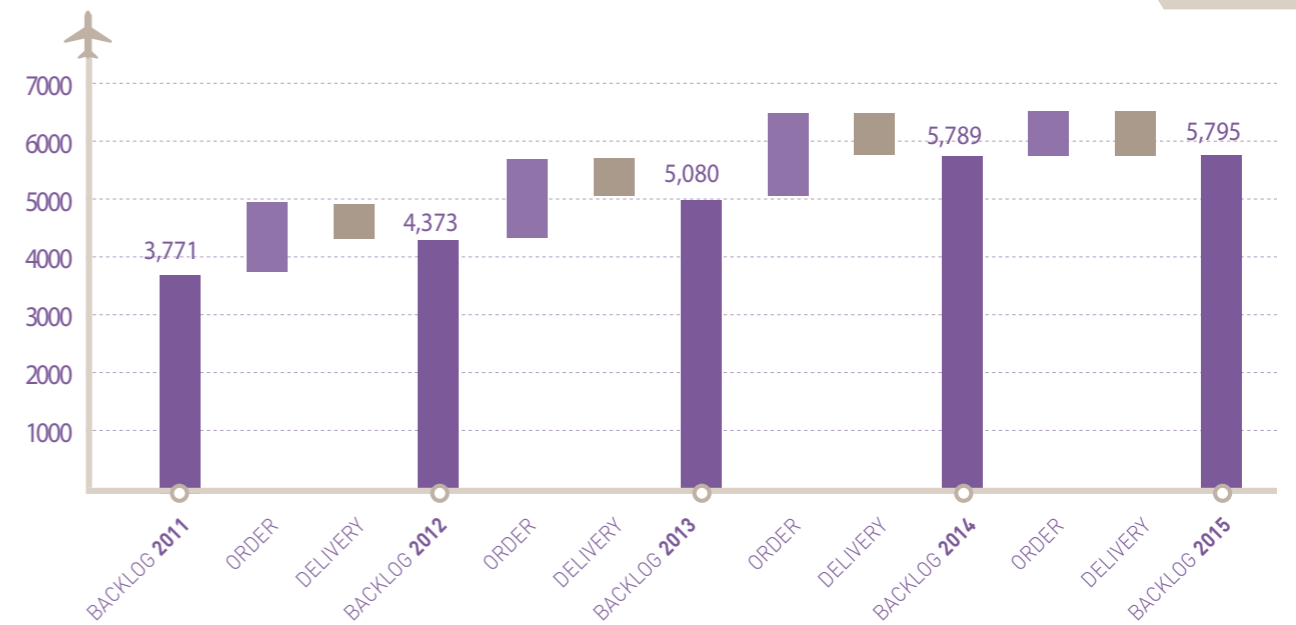
BOEING 737



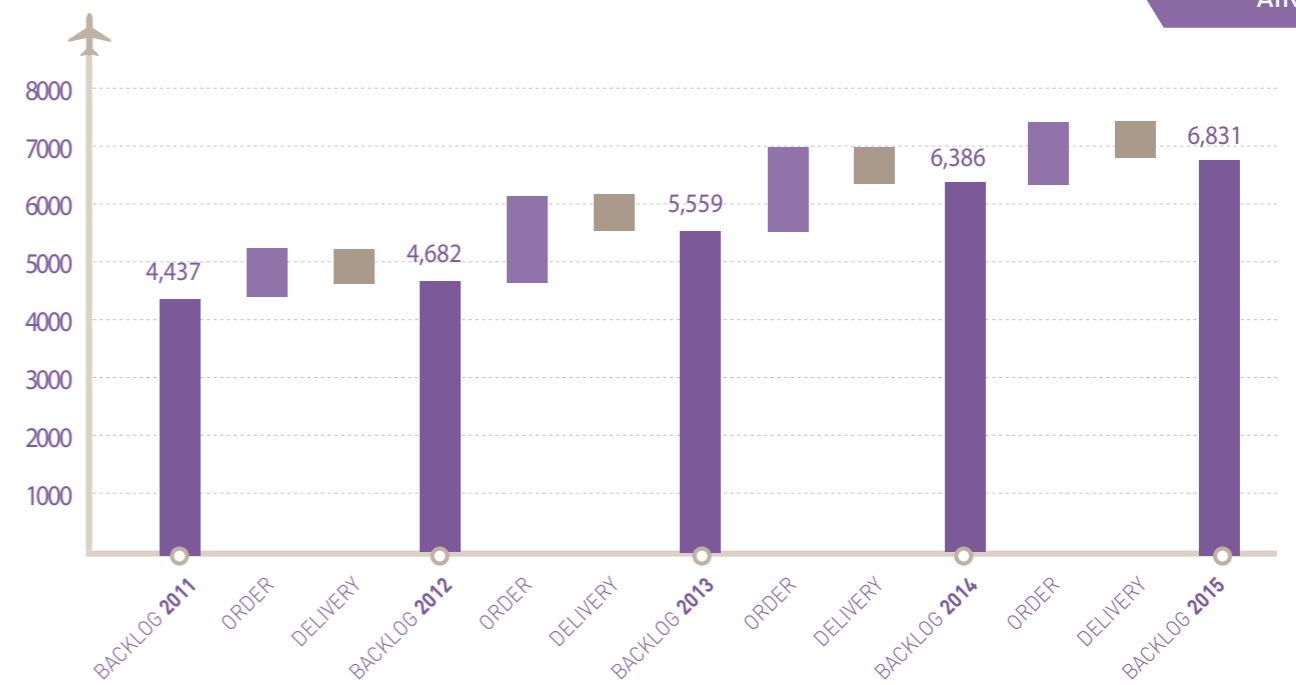
AIRBUS A320

The graphs below illustrate the increases in total order backlog for both Boeing and Airbus from December 2011 to December 2015:

BOEING



AIRBUS





INTERVIEW

WITH DIDIER KATZENMAYER

1. Airbus has announced an increase in its output rates from 42 aircraft per month to 60. What actions have you taken to assure yourself of a good ramp-up in production of your suppliers and your supply chain?

As soon as we announce an increase in production rates, we make sure that our industrial fabric has the ability to keep up with this increase. But faced with such volumes, particularly on the SA (Single Aisle) Family, it was essential to secure our production by introducing dual-sourcing, the idea being to maintain flexibility in order to limit the industrial risks.

2. What are Airbus' main expectations in terms of suppliers in such circumstances?

Deliver a quality product on time. The whole supply chain is involved, from the smallest to largest. It is therefore imperative that our suppliers control their own supply chain efficiently.

3. Among the three main risks they may face, suppliers cite: the pressure on prices, delivery rates and the risk of delays in the schedules. In your opinion, what are the main risks that should be anticipated?

Our industrial challenges are a reality: ON TIME & ON QUALITY and the whole supply chain is aware of this. Concerning the pressure on prices, two elements must be taken into account and mentioned: the first one in relation to the market vs. competitiveness and the second in relation to volume produced and that which could be produced. To achieve this, the industry has rallied on these issues notably through the Industrial Performance project, led by GIFAS (French Aerospace Industries Association), and for which 400 SMEs in the sector (Tier-2 and Sub-tiers) have benefited over 3 years from a plan to improve their performance and increase their maturity. And in view of the benefits of this project to the key players, a second phase is currently under consideration. Finally, on the issue of risks to scheduling, even if an aeronautical program may encounter difficulties, we maintain our delivery objectives.

4. Suppliers also identify a human resources risk. What do you think?

To address this problem, we once again try to anticipate working as far in advance as possible, particularly with the professional bodies (UIMM, Union for the Metallurgical Industry) and our Supply base: identifying skills shortages and launching relevant training courses if necessary.

5. What differences do you observe between the aeronautical industry in Europe and the US? What are the main characteristics of the supply chain on both sides of the Atlantic?

A real technical expertise exists on both sides of the Atlantic. The main characteristics or specificities often originate from the Prime Contractors themselves, whether they are aircraft manufacturers or engine manufacturers. Based on the "Make or Buy" policy of the Prime Contractor (i.e. core business / industrial strategy), willingness to rely on a supply chain that is in close proximity and/or established in certain geographic regions (best cost countries), the suppliers will organize themselves accordingly to respond to the needs of their client. The goal of the aeronautics industry is to provide for their customers this ability to adapt and understand the need in a global context.

6. 34% of aeronautic companies identify the US as the most attractive country in aeronautics. Why?

The American liberal economic model may appear to be an opportunity to gain greater agility and flexibility compared to more conservative models. It must not be forgotten that the North American market alone represents 20% of the potential opportunities over the next twenty years, with a native dollar. It is logical therefore that the



DIDIER KATZENMAYER

Head of Industrial Affairs at Airbus Operations SAS

companies in the sector are interested in this market.

7. Can your suppliers avoid globalization and allow themselves to remain national players?

Globalization is a reality: we are in a global aeronautics market where competition exists. It is essential to seek new customers in worldwide context. The major players in the industry have also taken this on board by expanding internationally in recent years, either through sales teams spread throughout the world or through industrial bases located in different geographical zones. But establishing industrial locations abroad necessitates a strong commitment and involvement from the CEO and its staff in order to support and structure the approach. It must bring real added value to the company and its customers.

8. Will consolidation in the aeronautical sector continue until 2025? Do you encourage it?

Yes, and we strongly support it. Encouraged by the Prime Contractors, the French and European supply chains have been consolidated in recent years to create the famous SMEs, "Entreprises de Taille Intermédiaire" in French, and the movement will continue especially for Tier-2 & Sub-tiers onwards.

9. 31% of aeronautical suppliers intend to diversify into new markets. Should it be less?

The diversification of the customers' portfolio seems to me to be a prerequisite in the sound management of a company, because it is necessary to guard against any reversal of the market. We can see it today, for example, in the business aviation, which is going through a difficult phase. Managers must balance activities by opening other business, such as railway sector and/or medical... (for instance), while preserving sufficient capacity to respond to existing customers.

10. For suppliers, access to credit is a barrier to their investment projects. What do you think?

Access to credit is still a concern, especially in the ramp-up context even though we have tools to finance working capital requirements, such as the reverse factoring applicable to Tier-1 suppliers. The problem with Tier-2 & Sub-tiers remains unchanged. However, the major international banks seem to understand the issue towards the supply chain, and they may start offering their service(s) on relevant cash flow solutions.

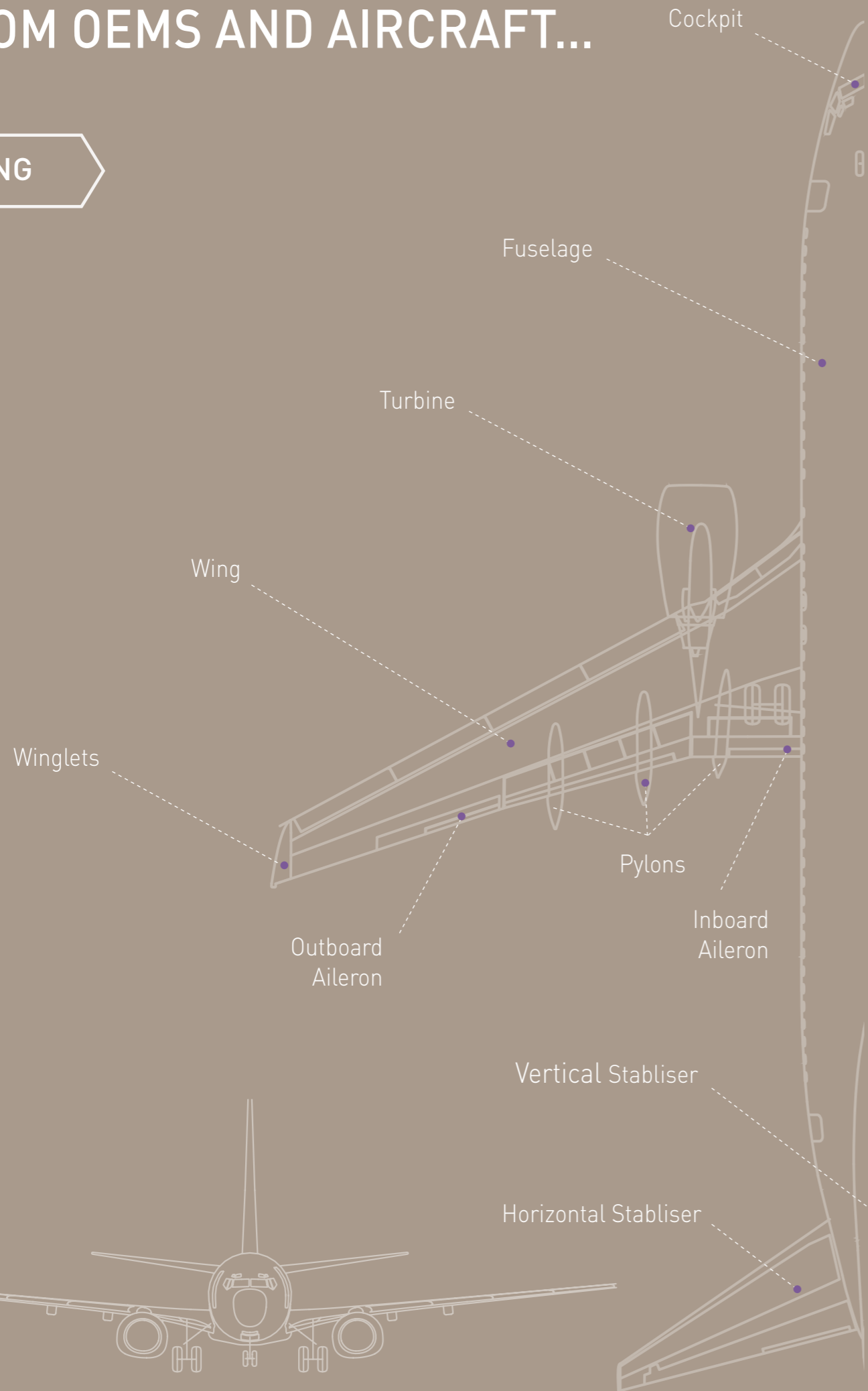
11. Is cyber-security an identified risk in your business?

In the age of social networking, big data, additive layer manufacturing solutions (3D printing), the Digital world plays a strategic role in the exchange of data. Our teams and the supply chain are sensitized as well. As evidence of this, we have launched a project for the development of a "Safe Box" approved by GIFAS which is dedicated to SMEs, enabling them to guarantee reliable and secure transmission of data between industrial players in the Aerospace sector.



FROM OEMS AND AIRCRAFT...

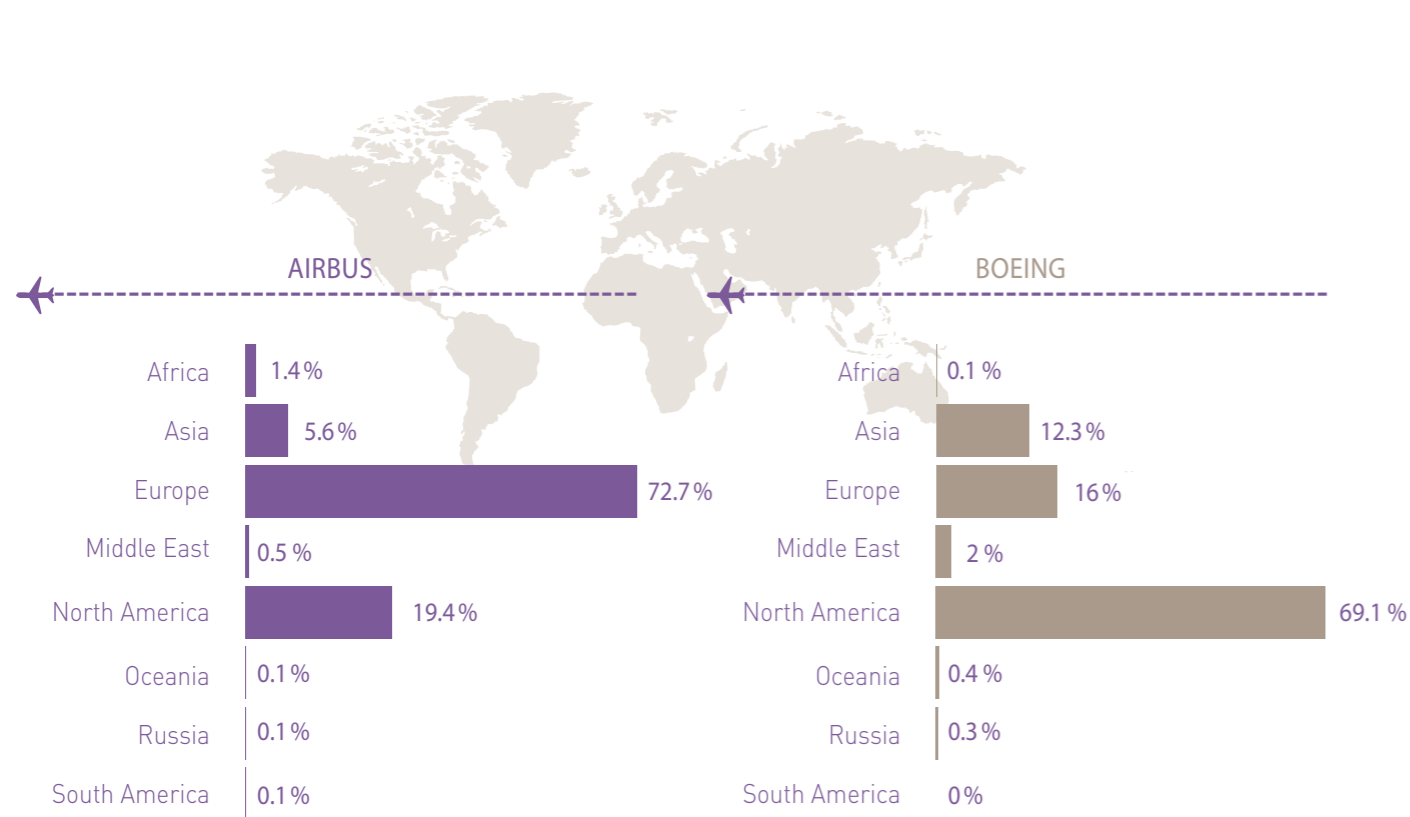
BOEING



AIRBUS

...TO SUPPLIERS AND PARTS

Commercial aircraft suppliers are located throughout the world, with a tendency to migrate closer to the production facilities of the major OEMs. As shown below, Europe and North America accounts for approximately 70% of the supply base for Airbus and Boeing, respectively.



Both Airbus and Boeing understand the importance of working with their suppliers in order to achieve the production demands of its airline customers. Below is a list of some of the initiatives undertaken by the OEMs to display their commitments to the supply chain:

- | ← AIRBUS | ← BOEING |
|---|--|
| <ul style="list-style-type: none"> • Best in Class Partner Award in performance, innovation and support • Airbus Supplier Awards ceremony • Country sourcing offices to identify high-quality and diversity among the suppliers in China, India, Brazil, and the US • A procurement strategy aimed at reducing risk in procurement management, was launched to improve performance in a lean and integrated organization. It increases the harmonization of supplier processes and training • Airbus collaborates with its suppliers to foster risk-sharing partnerships to benefit all parties. To foster this environment, Airbus establishes regular contact with supplier, such as events, suppliers' days, and forums all of which creates room for discussion and sharing of lessons learned • Extended Enterprise, which is aimed at sharing risks and opportunities. In particular, Airbus continues to outsource more parts to suppliers, and award larger contracts to Tier-1 suppliers | <ul style="list-style-type: none"> • Boeing Performance Excellence Award • Supplier of the Year in corporate citizenship, collaboration, global supplier diversity, safety, support & services, production & design, outstanding performance, technology, leaders' choice pathfinder, leaders' choice advantage, leaders' choice innovation and leaders' choice alliance • Exostar program that has strengthened coordination between the manufacturer and its suppliers. Leveraging on these capabilities allowed Boeing to involve more than 20,000 companies in the design and manufacturing processes of its 787 aircraft • Boeing Quality Management System Requirements for Suppliers'3 aimed at aligning the requirements for Boeing's suppliers and incorporating structures that encourage development and progress • Moreover, Boeing established a set of standards that suppliers must meet to do business with Boeing. These include: investment in technology, sharing of lessons learned, and sharing Boeing's values and ethical standards to ensure quality, efficiency, and operational business strategy |

Is Airbus building a new supply chain in America?

In July 2015, Airbus opened its first production facility in the US. Located in Mobile, Alabama, this facility is designed to be an assembly line for the Airbus A320 family. Opening an assembly line in the US gives Airbus additional capacity to increase production and brings it closer to a market with a significant number of customers and suppliers. Creating this assembly line has allowed Airbus to

strengthen its industrial ecosystem in the US. Airbus is already the top customer for US-based aerospace exports, having purchased over \$16B of product from American companies and supporting more than 245,000 jobs during 2014. It also has various other subsidiaries operating in the US, including engineering, spare parts, training, and others.

Adding this new production facility will add to the existing partnership between Airbus and its American suppliers. Completing this production facility in Alabama reflects how Airbus is building stronger ecosystems throughout the world. In 2008, Airbus entered into a joint venture in China to build a production facility in Tianjin, making it the first aerospace OEM with a facility in Asia.

These moves have allowed Airbus to position itself to react efficiently to any future changes in the geographical characteristics of demand.



INTERVIEW

WITH RACHID BENDALI

Reflecting on Changes in the Single Aisle Segment

Production increases in the A320 and B737 models have been met with excitement and trepidation as suppliers look for ways to profitably satisfy the requests of major OEMs. However, not all suppliers are affected similarly. In reviewing the single aisle production announcements, Rachid stated that LORD felt it would not be significantly affected by such large increases in the single-aisle market as has had more success with, twin-aisle aircraft based on its need for more advanced systems and technologies. Despite its preference, LORD continues to supply the single-aisle market, and sees a real opportunity not just in the increased production rates of the A320 and B737 but also with the Bombardier C-series. Delta Airlines' recent order has pumped life into the C-series, which will benefit LORD's business, given its participation throughout the life of the project, especially after the acquisition it made just a few months ago.

An Actionable Strategy

On March 17, LORD announced an agreement to acquire Fly-by-Wire Systems France, continuing one facet of its strategic plan of inorganic growth through acquisitions and strategic agreements with global organizations. According to Rachid, this acquisition "helps LORD become a larger player in the civil fixed wing market while also increasing its engineering footprint within Europe." This acquisition underscores the importance of location in the commercial aerospace industry. As a key participant in Boeing, Airbus and Bombardier's supply chains, LORD understands maintaining a presence near its customers is imperative in supply chain efficiency. A more efficient supply chain allows for faster production cycles of current parts

and also more robust communication of technologies needed to manufacture future products.

More Talent, More Capabilities

Aircraft technologies have continued to improve at exponential levels, and LORD has positioned itself well to not only to provide value to the current technological improvements, but also to participate in the future innovations of the industry. Although engineering talent management is an obstacle for many companies within the industry, LORD is well situated to attract top talent. In addition to its Erie, PA and Geneva, Switzerland technology centers, it has an R&D center at its headquarters in Cary, NC near the Research Triangle Park. This area is a blossoming business area fueled by graduates from surrounding universities.

Providing Value to the Industry and its Stakeholders

One way LORD displays its commitment to developing its engineering presence in Europe is through its participating in the European programs for research and development under the Clean Sky Initiative. According to its website, this initiative was created to "develop breakthrough technologies to significantly increase the environmental performances of airplanes and air transport, resulting in less noisy and more fuel efficient aircraft, hence bringing a key contribution in achieving the Single European Sky environmental objectives." LORD is actively working with Snecma, part of the SAFRAN Group, to develop a state-of-the-art engine attach system for both the open rotor and the ultra-high bypass engines. These types of innovations



RACHID BENDALI

*Director of Global Business Development, Marketing & Strategy
LORD Corporation in Raleigh-Durham, North Carolina.*

are becoming increasingly important as the commercial aerospace sector works to compete against other burgeoning markets.

Innovations Beyond the Commercial Landscape

Commercial aerospace is a large segment of the overall A&D industry; however it is vital that all organizations mitigate their concentrations within a specific segment to ensure future sustainability as technology advances. LORD has done this with its activity within the Unmanned Aerial Vehicle ("UAV") segment. UAVs, also known as drones, have become increasingly popular over the past few years, far

exceeding the usage expected by governmental organizations, like the FAA regulations. LORD will continue to monitor the regulations set forth by the FAA and expects UAV success to be centered on inspection work, off-shore platforms, agricultural monitoring, and other similar uses.

Although dynamic changes in technology and manufacturing capability make it difficult to remain successful suppliers for long, LORD continues to be a leader in the aerospace industry because of its focus on both near and long-term success, while continuing to engage important stakeholders and seek ongoing technological innovations.





5-1
PRIORITIES AND RISKS



01.

AMONG THE DIFFERENT STRATEGIC DRIVERS LISTED BELOW, WHICH ONES ARE YOUR HIGHEST PRIORITIES FOR CASH DEPLOYMENT IN THE UPCOMING YEARS?

02.

HOW DO YOU ASSESS THE IMPACT OF THE FOLLOWING RISKS ON YOUR ORGANIZATION?

01.

AMONG THE DIFFERENT STRATEGIC DRIVERS LISTED BELOW, WHICH ONES ARE YOUR HIGHEST PRIORITIES FOR CASH DEPLOYMENT IN THE UPCOMING YEARS?



- 1 Improving efficiency of current programs
- 2 Diversifying into new markets
- 3 Innovating for already announced next generation products
- 4 Expanding into new countries
- 5 R&D for future advanced technology
- 6 Merger & Acquisition

Suppliers make cash deployment decisions based on future expected returns, and our survey respondents expect the highest return from improving the efficiency of current programs and diversifying into new markets. By reporting backlogs, OEMs provide complete transparency into the buying behavior of their customers, allowing suppliers to plan appropriately and reduce costs of current programs. This transparency also allows suppliers to understand other segments of the market and diversify their current operations to better fit the needs of the OEMs.

INSIGHTS FROM THE EXPERTS:

How have your teams worked to help improve the efficiency of current programs?

"Our engineering and management teams have been working with our partners and their design teams on both the 737 MAX and 777 X for the past 2-3 years to produce better, lighter and more economical solutions for the future aircraft series.

Specific to the Boeing 737, the next build rate increases are significant as a number of the parts and assemblies B & B produces are used in multiples per aircraft shipset. In some cases, we have flight control components that are 8 per shipset times 42 planes, or 336 components per month. An increase to 47 planes per month equates to a 12% increase in demand as we jump from 336 per month to 376 per month. At B & B we began the journey 2 years ago to review, redesign, and modify our manufacturing operations to support these fast-approaching increases.

In many cases we are supporting manufacturing of these complex components in a "lights-out" environment, running unmanned production at night and over the weekends. To support this direction, our attention to process capability has really shifted over the years as we design robust supply chain solutions for our customers."

Jeff Lage

Vice President
B & B Manufacturing



←----- EUROPEAN SUPPLIERS -----→

- 1 Improving efficiency of current programs
- 2 Innovating for already announced next generation products
- 3 Diversifying into new markets
- 4 Expanding into new countries
- 5 R&D for future advanced technology
- 6 Merger & Acquisition



←----- NORTH AMERICAN SUPPLIERS -----→

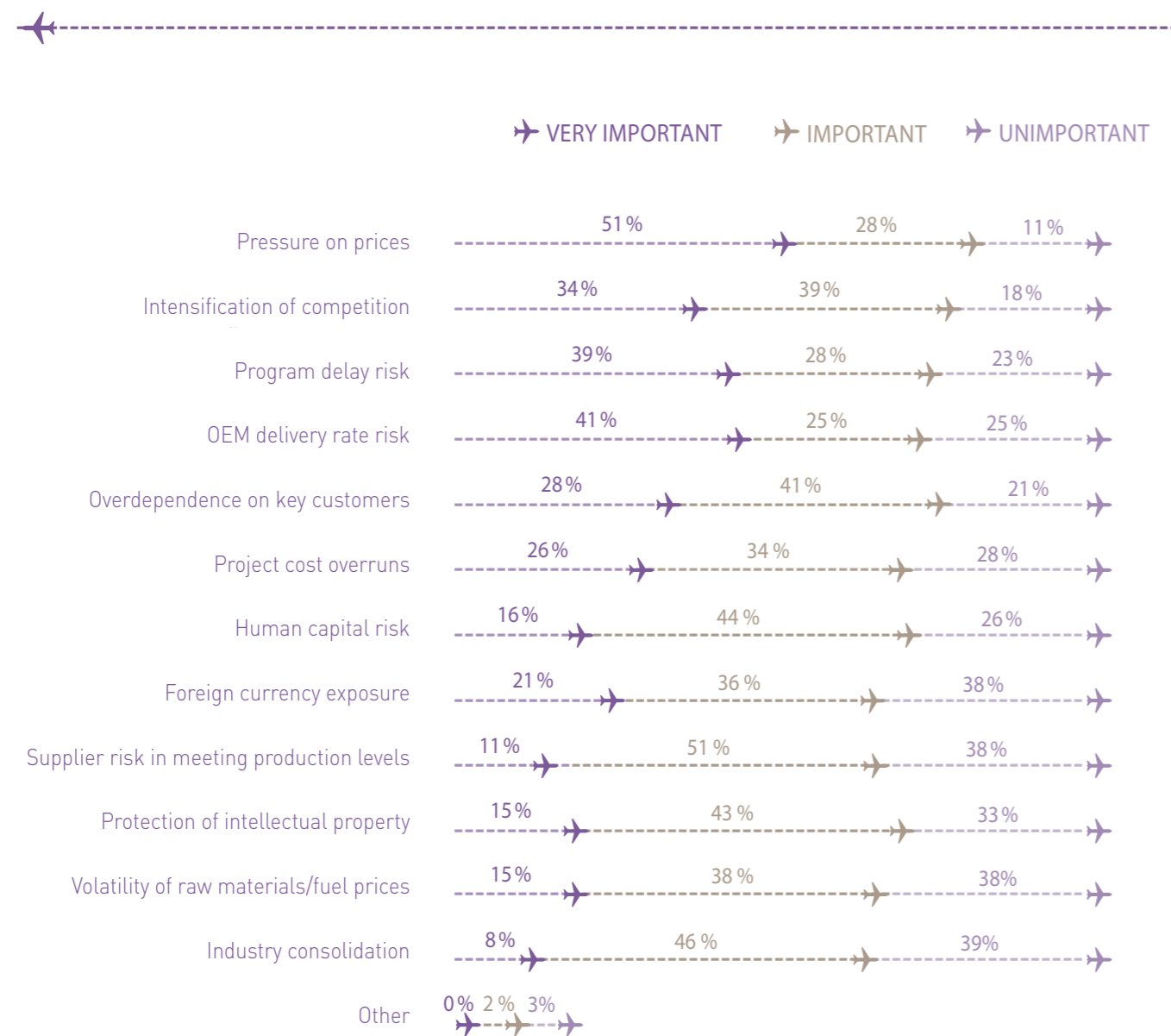
- 1 Diversifying into new markets
- 2 R&D for future advanced technology
- 3 Innovating for already announced next generation products
- 4 Improving efficiency of current programs
- 5 Expanding into new countries
- 6 Merger & Acquisition

Diversification into new market segments is a riskier option than improving current programs because of the capital investment needed. In looking at the data comparison between European and North American suppliers, European suppliers exhibits less risk than their counterparts across the Atlantic.



02.

HOW DO YOU ASSESS THE IMPACT OF THE FOLLOWING RISKS ON YOUR ORGANIZATION?



Pressure on prices is clearly the most important risk to our respondents. One way to view the increase in production rates is, essentially, the addition of more competition into the market place. Airlines can choose from a greater variety of products and put more pressure on the OEMs to delivery high quality at the best price. This pricing pressure at the OEM level gets passed down to the suppliers, and creates a risk of delivering high quality products at the right price.

Another reason for price pressure is the intense competition at the supplier level. With backlogs so easily identifiable, many companies are looking to participate in the commercial aerospace sector. This could include either new entrants or current sector participants that have other specializations.

“ DUE TO RECENT DECREASE OF EURO-DOLLAR EXCHANGE RATE, FOREIGN CURRENCY EXPOSURE IS OF LESS A CONCERN THAN IT WAS STILL A FEW MONTHS AGO, IN CONTRAST TO PRICE PRESSURE WHICH STILL IS CURRENTLY PERCEIVED AS A MAJOR CONCERN BY SUPPLIERS. ”

GAËL LAMANT
Partner
Mazars



INSIGHTS FROM THE EXPERTS:

The price pressure applied on suppliers is the result of a relentless drive for efficiency and cost savings by OEMs. Though a challenge for suppliers of all sizes, small suppliers can sometimes struggle to adapt; however, the size of the company does not necessarily dictate the size of the challenge to overcome. Smaller organizations can both withstand the pricing pressure and also thrive if they invest in infrastructure such as implementing and improving ERP systems, Six Sigma manufacturing processes and other technological advances preferred by larger organizations.

Robert Peterson
Managing Director
KeyBanc Capital Markets

Arye Sapir
Vice President
KeyBanc Capital Markets



5-2
**RESPONSE TO
PRODUCTION INCREASES**



03.

WHAT DO YOU SEE AS THE MAIN RISKS ASSOCIATED WITH SIGNIFICANT INCREASES IN PRODUCTION?

04.

WHAT DRIVES YOUR DECISION TO INVEST ABROAD?

INTERVIEW

WITH DANIEL PARFAIT FROM SAFRAN MEXICO AND CENTRAL AMERICA

05.

IN WHICH COUNTRIES WOULD YOU LIKE TO INVEST IN THE FUTURE?

06.

HOW DO YOU PLAN TO INVEST ABROAD?

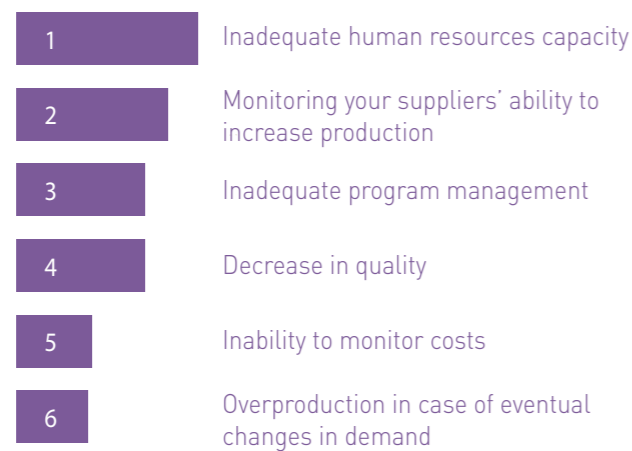
INTERVIEW

WITH HAMID BENBRAHIM EL ANDALOUSSI FROM GIMAS



03.

WHAT DO YOU SEE AS THE MAIN RISKS ASSOCIATED WITH SIGNIFICANT INCREASES IN PRODUCTION?



In evaluating production increases, it is clear suppliers are most concerned with the availability of inputs and the human capital necessary to keep production moving efficiently. Though much of the production process may be automated, significant human capital is needed to increase production, including engineering, supply chain management, client management and manufacturing.

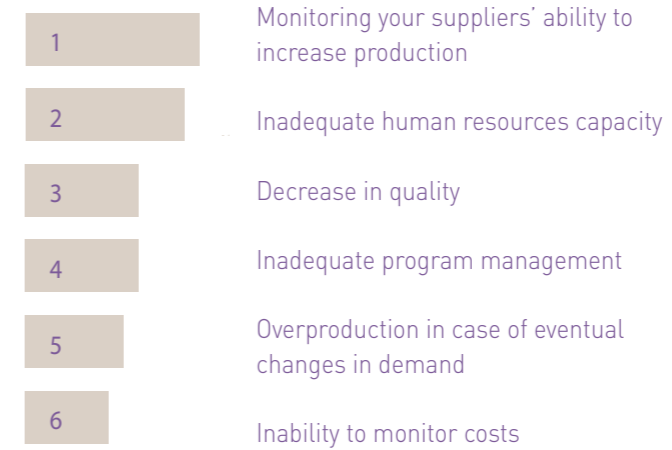
As demand for aircraft increase, suppliers throughout the supply chain must decide to what extent they must increase production. As Tier-1 suppliers make this decision, Tier-2 suppliers must make the same decision, and this process continues all the way down the supply chain. The more suppliers involved, the larger number of forecasts, which can lead to produc-

tion inefficiencies, a phenomenon called the Bullwhip Effect. Suppliers looking to mitigate the Bullwhip Effect by not overproducing may cause a shortage of inputs for suppliers further up the supply chain. Therefore it is especially important for OEMs, suppliers, and sub-suppliers to collaborate and share risks to avoid the potential production shortages.

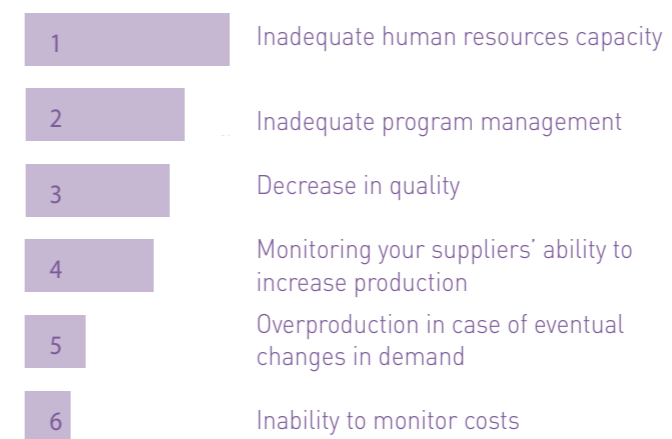
One other risk our respondents considered important is the possibility of a decrease in quality. Clearly, significant production increases, without proper controls in place, can lead to a decrease in product quality as more volume can be more difficult to control. Maintaining strong relationships with customers and sub-suppliers, and hiring competent professionals, are the best ways to mitigate any decreases in quality.



←-----EUROPEAN SUPPLIERS-----→



←-----NORTH AMERICAN SUPPLIERS-----→





04. WHAT DRIVES YOUR DECISION TO INVEST ABROAD?



- 1 Access to new markets
- 2 Ensuring geographic proximity to current prime contractors
- 3 Reducing production costs
- 4 Access to new technology/human capital
- 5 Increasing production in dollar zones to take advantage of foreign exchange rate changes
- 6 Taking advantage of attractive tax regimes

Despite a trend toward cost effectiveness due to price pressure, reducing production costs was only the third most population reason why our respondents would invest abroad. Instead, access to new markets and proximity to OEMs was considered more important.

These two options are quite complimentary. Collaboration with OEMs and transparency into their backlogs allow suppliers to better understand the needs of its customers. As certain suppliers have difficulty meeting the production increases, others can step in and fill the void in adjacent markets. This is easier when a company is located closer to its customers and can collaborate more effectively.

INSIGHTS FROM THE EXPERTS:

We will continue to see significant interest in cross border M&A activity, especially between the US and Europe. However, turning this interest into action is not without its complications. Language barriers, labor laws and the long term nature of aircraft programs can delay or derail potential transactions. That being said, a specific event like the Brexit vote could be a catalyst that leads to more M&A activity between North America, Europe and the UK. The devaluation of the British Pound may have an impact on overall company value and earnings, which could lead to acceleration in the investment environment once there is better visibility on the long-term impact of the Brexit vote.

Robert Peterson
Managing Director
KeyBanc Capital Markets

Arye Sapir
Vice President
KeyBanc Capital Markets



←-----EUROPEAN SUPPLIERS-----→

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←-----NORTH AMERICAN SUPPLIERS-----→

- 1 Access to new markets
- 2 Access to new technology/human capital
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- 4 Ensuring geographic proximity to current prime contractors
- 5 Taking advantage of attractive tax regimes
- 6 Increasing production in dollar zones to take advantage of foreign exchange rate changes





INTERVIEW

WITH DANIEL PARFAIT

1. SAFRAN was one of the first aerospace suppliers to set foot in Mexico. What was the firm's initial objective?

At the beginning, the main objective was to be closer to our clients from the North American market, such as Boeing, our first client in the dollar zone. Our experience in Mexico has been positive, and for that reason we have increased our participation in other markets over the years. We also have always been looking to achieve our goals of providing local support to customers throughout the Americas, increase our market share in the region, and diversify our production zones.

2. Considering that SAFRAN has been operating in Mexico for the last 20 years, what are the main changes you perceive in the aerospace industry in Mexico?

We observe that the aerospace industry in Mexico has shown an amazing average growth of 17% for the past years and has developed its supply chain. Besides, thanks to the opening of schools and universities, such as the Universidad Aeronautica de Querétaro (by its acronym in Spanish UNAQ), adapted to the requirements of these industries, there is today an excellent, young and qualified workforce. We are confident that this growth will continue in the years to come. SAFRAN strongly believes that Mexico will continue to consolidate its position within the global aerospace industry, and will become a key player worldwide. By the way, Mexico is already moving from "maquiladora" manufacturing to design and innovation. For SAFRAN, which dedicates 12% of its turnover to R&D, this aspect is crucial. That is why SAFRAN signed an agreement of cooperation with the COsejo NAcional de Ciencia y Tecnología (by its acronym in Spanish CONACyT) in April 2014.

3. What advice would you give to an aerospace supplier who wishes to establish a footprint in Mexico for the first time?

Advice depends on the company's current activity within the aerospace industry:

A. For current suppliers who want to expand their operations with a Mexico footprint:

- Invest properly in your operations and people. Do not underestimate the time it takes to gain alignment with your own internal company culture, communications, and performance. Spend time and invest up front; it will pay dividends down the road.
- The best thing for the customer is to mitigate any risk to them. Use Mexico first as your own internal supplier: develop your certifications, approvals and processes, and run parts as your own internal dual source before transferring production. This is just one of many possible risk mitigation steps you can take to protect the customer while gaining confidence and demonstrating performance.

B. For new companies who want to enter the aerospace market in Mexico:

- Scale your start. My recommendation is to start as a Tier-2 – do not go directly for the OEM / Tier-1's if you do not have the full scale of resources available... It is better to gain experience and understanding of the challenging requirements of aerospace, while making proper business decisions for your company.
- Certifications/approvals (AS9100, NADCAP) are the entry to market, but they do not guarantee business. That is only the first step in the process.



DANIEL PARFAIT

President of SAFRAN Mexico and Central America

4. What are the main challenges for an aerospace supplier to establish a part of its manufacturing activities in Mexico?

This is not a challenge; it is a success factor: willingness and internal commitment. Most companies appear to be willing to go to Mexico only if and when they have the award packages from their customer. The most successful cases of establishing operations in Mexico begin when the first desire to go to Mexico is because it can supplement the companies' own operations. Additional customer awards will follow.

5. SAFRAN recently opened a new Mexican plant in Queretaro. What does this development tell of the firm's mid- and long-term strategy in Mexico, but also in North America?

Indeed, last February SAFRAN inaugurated its fifth plant in Queretaro, SAFRAN's 10th site in the country. It is dedicated to repairing high-tech CFM56 engine parts, which previously were replaced. This plant will help SAFRAN remain competitive in its repair business and also consolidate its presence in the American market. But SAFRAN also has announced the construction of a 6th plant in Queretaro to produce composite parts for the new LEAP engine, the successor to the CFM56. This new plant will be the third of its type after the two existing SAFRAN/Alba-

ny plants in Rochester, New Hampshire in the United States and Commercy, eastern France. It will help to deal with the record book for this new engine (over 10,000 on order, before its entry into service scheduled in a few months) and the rise in production rates requested by aircraft manufacturers, especially Boeing for the 737 Max. The efficiency of the global supply chain for the LEAP engine thus will be enhanced. Parts produced here are intended for North America (on the Boeing 737 MAX, powered by LEAP engines exclusively), while the Commercy plant will primarily make parts for engines powering Airbus jetliners, mainly in Europe. This is a clear example of why Mexico is strategic for SAFRAN.

6. On the ground, what are the initiatives carried to train present and future employees, and what are their aim?

The growth of the industry demands specific programs to satisfy the human resources demand. In this respect, the federal and states governments have put a great effort to satisfy the demand of the industry by establishing specialized institutions and programs. We have the Aeronautic University at Querétaro (UNAQ) as a perfect example of the latter. SAFRAN is committed to milestone initiatives, such as the French-Mexican Campus for Aerospace, initiated by the UNAQ. SAFRAN has donated a CFM56-3 engine, as well as two landing gears. SAFRAN

actively collaborates with many different educational institutions and governments to foster education in the aerospace industry. SAFRAN also has developed a specific program with the French-Mexican Lyceum of Mexico City. It also has partnerships with many universities across the country, such as the Polytechnic University of Chihuahua and the Technological Institute of Querétaro.

SAFRAN also strongly supports the Mexican youth, through participating in education programs backed by the government, such as "Mexprotec", which complements technical education through one-year programs in France, where Mexican students attend classes and perform hands-on practices at SAFRAN facilities in France.

The engineers are at the heart of SAFRAN and this is why we give a great importance to their formation.

7. SAFRAN also invested in Morocco, a country that tends to play the same role as Mexico for US in Europe. What are the similarities and differences between these two countries?

The geographic situation has indeed been in both cases a crucial aspect for SAFRAN. But my knowledge of the Moroccan context is not sufficiently deep to compare it to Mexico. But what I could say is that Mexico has distinguished itself since our arrival here for its healthy economy, the quality of its workforce, its infrastructure and its good business environment, with the supportive federal and states governments, especially the support of Promexico. Those are the reasons why Mexico is a key player for SAFRAN.

8. Do you see the new assembly line of Airbus in the US as an opportunity for European suppliers to invest in Mexico?

North America remains a critical and significant aerospace region. By having operations in Mexico, a company is prepared to capture opportunity by providing benefits of proximity to customers throughout North America, offer best cost solutions with sustainable long-term cost reductions and control, and meet our needs for expanded capacity.

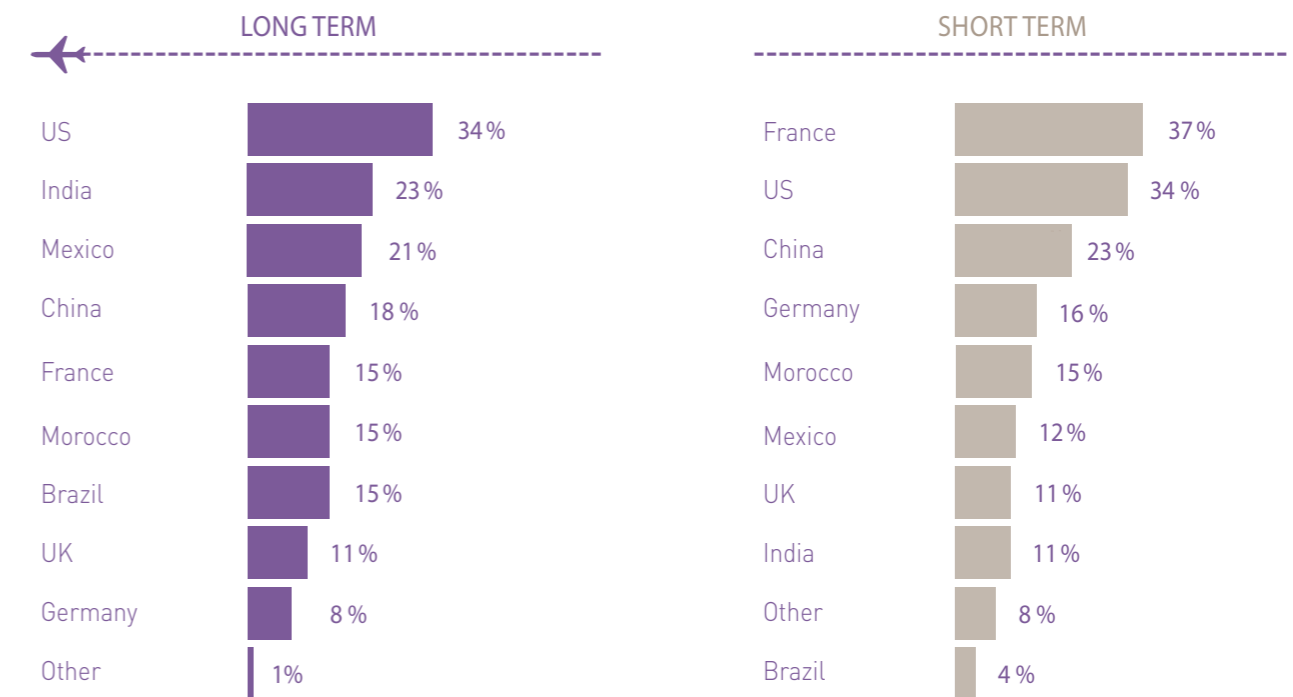
9. Pressure on prices is the most critical risk stated by our panel of suppliers. Do you consider the implementation in a best-cost country is now essential for suppliers to thrive in this environment?

We have significant challenges to reduce costs, and Mexico is a vital aspect of providing a solution to customers in North America. We are open to best cost solutions and innovation to find better ways of working.



05.

IN WHICH COUNTRIES WOULD YOU LIKE TO INVEST IN THE FUTURE?



The data illustrates the idea that suppliers prefer to be closer to OEMs to reduce costs and increase efficiency. France, US, China, and Germany comprise the four countries in which Boeing and Airbus have manufacturing facilities, so it is not unusual to see these countries as the locations in which suppliers are looking to invest in the short term. It is interesting to note that after these four countries, Mexico and Morocco are the most likely destinations for short-term investments. These countries are located nearby the four countries listed above, and have lower labor costs, thus adding some flexibility into the efficiency structure built by supplier management.

The US is seen as the top country for long-term investments. This likely is due to the health of the aerospace industry in the US. Surprisingly, India was selected as the second most likely country for long-term investing. At first glance, this is not necessarily intuitive but the socio-economic situation in India provides a clearer picture. India, with a population in excess of 1.3 billion people is the second largest in the world behind China and is expected to surpass China within the next ten years, according to the United Nations. In addition, the aerospace market is not as developed in India as it is in China, so there is clearly a large opportunity for suppliers looking to invest in India.



INSIGHTS FROM THE EXPERTS:

Air travel growth in China has led to significant investment in the aerospace industry. To best exploit this increase in demand, Chinese companies have used both organic and external means to expand their capabilities and global ambitions.

HNA Group's recent acquisitions in aircraft leasing, MRO and aviation services are excellent examples of this global approach.

Robert Peterson
 Managing Director
 KeyBanc Capital Markets

Arye Sapir
 Vice President
 KeyBanc Capital Markets



2034 Commercial Aviation Market Value: **\$950 BN**

→ WHY?

- Population increase**
 - Chinese population expected to reach 1.4bn by 2030
 - An extremely large market
- Urbanisation**
 - Today: 54% of the Chinese population will live in cities
 - 2050: 70% of Chinese population
 - Travel between megacities will increase
- A growing middle class**
 - Today: 157m consumers, only 12% of the population
 - By 2030: 1bn consumers, 70% of the population
 - This middle class will catalyze the demand for air-travel

→ IMPACT

- Two emerging firms: COMAC and AVIC**
 - Comac C919 narrow-body jet expected to be delivered in 2018
- A foreseen increase in passenger travel**
 - 1bn new passenger expected by 2034
 - China will outpace the United States as first air travel market by 2030
- The industry's new gravity center**
 - China will be the center of an Asia-Pacific region encompassing 42% of world air traffic in 2034



2034 Commercial Aviation Market Value: **\$350 BN**

→ WHY?

- A steadily growing population**
 - Today: 590m inhabitants, 80% urbanisation rate
 - By 2050: plateau at 800m inhabitants, 90% urbanisation rate
- A growth potential**
 - Middle class represents 30% of Latin America's population
 - Regional GDP is expected rise by 80% by 2030
- A very contrasted region**
 - Inequalities between countries: combination of advanced countries (Argentina) and developing countries (Guyana)
 - Inequalities inside countries: average Gini coefficient of 50%, against 31% for the EU

→ IMPACT

- Emergence of two industry players:**
 - Brazil: world-class manufacturer with Embraer, and 4th largest air travel market by 2034
 - Mexico: strategic positioning as the United States low-cost supplier
- Fleet is expected to double by 2034**
 - 2014: 1,470 airplanes
 - 2034: 3,620 airplanes, of which 84% will be narrow-body
- A growing demand for regional travel**
 - A rising passenger traffic
 - Average traffic growth until 2034, 1 point higher than world average rise



2034 Commercial Aviation Market Value: **\$550 BN**

→ WHY?

- A booming population**
 - Today: 600m inhabitants, 42% urbanisation rate
 - by 2030: 720m inhabitant, and a 53% urbanisation rate
- An expanding economy**
 - GDP is set to double in the next 15 years, at a 5% growth rate
 - International tourism supports the region's demand for air travel
- A geographic explanation**
 - South-East Asia is characterised by its insularity
 - Air travel is a necessity for countries such as Malaysia or Indonesia

→ IMPACT

- The largest surge in aircraft fleet**
 - 2014: 1,270 airplanes
 - 2034: 4,120 airplanes, of which 76% will be narrow-body
- The third largest increase in passenger traffic**
 - 6.5% average traffic growth until 2034, 1 point higher than world average rise



MOROCCO:

COMPETITIVE ADVANTAGES

- A unique geographical location with European, Africa and the US
- « booming industry » allowed Morocco to develop expertise in other fields of activities such as automotive, rail industry, renewable energy
- Highly competitive cost advange. The average wage is lower in surrounding countries, such as Tunisia or Turkey. Morocco's aerospace industry also is benefiting large tax incentives and supports for investments
- Major European (and more recently north American) OEMs are located in Morocco
- A large numbers of free trade agreements reaching 55 countries
- The country enjoys political stability and a favorable economic climate

KEY CHALLENGES

- Maintaining macroeconomic stability. A solid environment is necessary for businesses to develop. This accounts for Morocco's public deficit that has been growing since both the crisis in 2008 and the Arab Spring
- Enhancing competitiveness. To increase its competitiveness against several newcomers to the aerospace market, Morocco must continue to work on its investment climate, especially in protecting investors and improving the judicial system
- There is relatively little investment in research and development. To ensure its development in aeronautics, Morocco should encourage and support research institutions and partnerships with foreign companies and universities
- For Morocco to become a significant market player, it is estimated that 20,000 people are needed by 2020 in this sector. It is important that Morocco continue to develop its educational system to meet the growing need for highly skilled personnel



MEXICO:

COMPETITIVE ADVANTAGES

- Its geographical location within the NAFTA offers access to the North American Market
- Its successful experience as a supplier for other sectors, such as the automotive industry
- Quality: Mexico recently joined the Wassenaar Agreement, a benchmark in manufacturing standards. This push for quality is also found in the national effort led by firms to comply with FAA, NADCAP, and ISO standards
- Labour costs are expected to remain low in the short-and medium-to-long run
- A young and educated population with a higher share of engineering, manufacturing, and construction graduates per capita than in the US

KEY CHALLENGES

Education

The main challenge for firms that decide to establish a part of their activities in low cost countries such as Mexico is the qualification of their workforce. The technicality and the 0 failure requirement of the aerospace industry require the workforce to be properly trained. In this regard, new universities have been created to provide foreign and domestic firms with highly qualified Mexican human capital. The three leading universities for the aerospace sector are the UNAQ in Queretaro, the Aerospace Engineering University in Chihuahua, and the School of Aeronautical Engineering at the National Polytechnic Institute in Mexico City. As it is the case for Bombardier, these schools have developed strong ties with the leading foreign firms, with the objective of stimulating a mutual beneficial relationship

Competitiveness

The country's cost competitiveness is both its key advantage and also maybe its biggest challenge. The cost factor is one of the principal investment criteria, and a cost advantage reversal could have a strong negative impact. Therefore, Mexico faces a dual challenge: it must control its labour costs, since it is a key investment decision criteria, but at the same time, it must increase its industry's value added by investing heavily in training and R&D so as not to rely exclusively on the country's cost advantage

International Standards

Once again, the 0 failure standard has made international standards indispensable. In this regard, the Mexican industry must comply if it seeks to rise as a global aerospace player. However, obtaining the OEM's certifications can be an extensive process, and can have the effect of excluding the smallest firms. The combined role of clusters, universities and of the FEMIA is to spread these best practices across the industrial ecosystem



06. HOW DO YOU PLAN TO INVEST ABROAD?



International investment decision making is complex as there are many avenues in which an organization can invest. The decision will be based on expected future profitability calculated by using complex valuation models. However, quantitative factors are not the only ones to be considered, as companies also look at the cultural impact of their investment decisions. It is interesting that organic development and strategic partnership were selected as the top options for investing abroad, as they represent a higher level of control as compared to mergers/acquisitions and joint ventures. Organizations that develop their own presence (like Airbus in the US) or a strategic partnership (like

Boeing and AVIC in China) can determine strategy and manage personnel that best match the organization's overall culture. In contrast, mergers/acquisitions and joint ventures tend to form their own cultures, at least at first. Companies that are acquired have their own existing cultures and values, so the parent company's management philosophy cannot possibly be implemented immediately. This is the same for joint ventures in which partial ownership by multiple parties may lead to some differences in overall culture. Integration takes time and in the current environment in which efficiency is most important, time may not be a valued resource.



INTERVIEW

WITH HAMID BENBRAHIM EL ANDALOUSSI

1. In what job fields occupations has Morocco developed extensive expertise?

Morocco has developed expertise in a variety of different aeronautical activities, categorized in accordance with the new Strategy of the Industrial acceleration Plan by ecosystem, which are: Assembly (aero structures, precision engineering, boiler making, surface treatment, etc.); EWIS - Interconnected Electronic Wiring systems (harnesses, electrical systems); MRO - Maintenance Repair Overhaul (aircraft and engine); and Engineering (design, conception, development, etc).

2. What are the job areas that Morocco soon like to develop/position in?

Just a few years ago, Morocco started to position itself in technologies of the future which are part of the latest programs launched by aircraft manufacturers, especially composites, where leading world players (such as Aircelle Maroc-SAFRAN Group) produce composite parts and assemble the thrust reversers/nacelles for various engine manufacturers. The Stelia Group (a subsidiary of Airbus), has also developed activities in metal and composite aero structure. The same goes for the Daher group. The recent arrival of the Hexcel Group, (a world leader in composite materials and carbon fiber) will allow the establishment of other high-added-value players in this field. Regarding new businesses in the course of development, the Thales Group has located its future 3D printing plant, at Midparc in Nouasseur, the group's center of excellence in this field.

3. Offering an abundant skilled labor force is a key priority for the Moroccan government. According to estimates, the Moroccan aeronautical industry requires nearly 20,000 trained employees for 2020. In your opinion, is this estimate fair, and would it be possible to reach this objective? If so, how can it be achieved?



Hamid Benbrahim El Andaloussi is the President of GIMAS (Groupement des Industries Marocaines Aéronautiques et

This top-down estimate was made at the request of the Ministry of Industry, in partnership with the GIMAS, to develop a 5-year plan entitled, "Contrat-Programme Aéronautique" ("Aeronautics Contract Program") within the framework of the Industrial Acceleration Plan with a top-down estimate. It was made by comparing Mexico relative to the US market, and Morocco relative to Europe. Another comparison was a bottom-up estimate, which considered both the organic growth in business in recent years, and acceleration effect of the plan. It incorporated innovative and tailored measures which have been developed for the industries in the sector. The two estimates agree.

4. Both public and private training institutions are already involved to meet the needs in talents of the aerospace sector. In your opinion, are the synergies between these players optimized, or should further synergies be developed to bring more efficiency?

The synergies are optimized with the maturity that is occurring in the sector. But certain needs cannot wait, such as the need for skilled operators in the various aeronautical trades. This is why within the framework of Industrial Emergence Pact, the state,

in conjunction with GIMAS (Grouping of Moroccan Industries Aeronautics and Space) created the IMA (Institute of Trades Aeronautics) in April 2011, in which professionals manage the training center.

This innovative public-private partnership is a major lever for attracting investors and supporting their growth. The UIMM has provided educational expertise in training program design and trades provided in the form of courses that alternate between a business and the center and which last from 6 to 9 months, depending on the sector. These courses are: CNC machining, electrical wiring, composite operator, assembler and aeronautical boilermaker. Today, other institutions have emerged and synergies with universities have been developed, especially in the field of research. Clusters composed of universities and industry will begin to emerge.

5. Lately, we are seeing a number of North American aeronautical equipment investments in Europe. Does the potential exist to attract these players to Morocco? If so, how can Morocco up its game in order to capture their interest?

North American investors have already started to settle in Morocco in the last 5 years, following a 10-year period of investments made by France. Indeed, the 2000-2010 phase was necessary to develop the local supply chain and make Morocco a credible basis in the eyes of investors who do not have historical connections that are culturally strong as those with France. This means that Morocco is now listed as a base of competitiveness and excellence in the world map of the aeronautics industry. Some examples of American groups recently established are: the United-Technologies Group (Ratier Figeac), Bombardier, Alcoa Fastening Systems, Eaton and Hexcel.

Boeing, which established at the very beginning of the Morocco base in 2000 in a joint venture with SAFRAN Labinal in the MATIS Aerospace company, specializes in assembling complete harnesses, and

develops additional outsourcing projects with players located in Morocco on other ecosystems. We must demonstrate the advantages of Morocco through various organized events such as the Boeing Symposium Summit, where US benchmark players paid visits to Morocco, which is on the world map of aeronautical construction today.

6. The Moroccan government has contributed strongly to the growth of the sector by putting in place a number of measures, such as the Hassan II Fund and P2I platforms. Do you think the government should intervene more and/or implement new measures to stimulate growth? If so, in your opinion, how should the government intervene, and what measures should be put in place?

The government, more particularly the Ministry of Industry, launched the Industrial Acceleration Plan to further boost the industry's development while maintaining the objectives and commitment of the state and the private sector represented by the GIMAS.

The new measures to stimulate growth consist of implementing financing schemes that better meet the needs of investors, on the issues of technology transfer, investment in equipment, land subsidy, reimbursement for training engineers and operators, financing for procedures supporting qualification and certification; and devices dedicated to Moroccan SMEs from traditional trades who wish to join the industry, etc.



\$

5-3
PROJECT FINANCING



07.

HOW DO YOU PLAN TO FINANCE YOUR INVESTMENTS IN THE FUTURE?

INTERVIEW

WITH NEEL MOREY FROM WELLS FARGO

08.

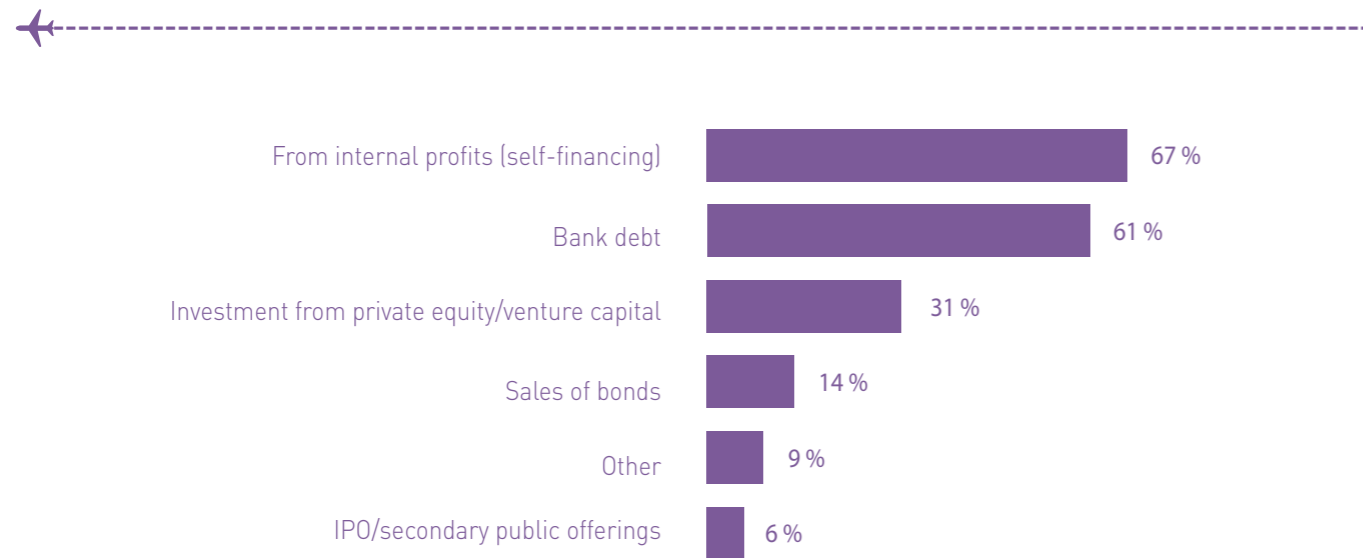
WHAT FINANCING SOURCES DO YOU USE FOR WORKING CAPITAL REQUIREMENTS?

09.

WHAT ARE THE FINANCING RISKS TO WHICH YOUR COMPANY IS EXPOSED?

07.

HOW DO YOU PLAN TO FINANCE YOUR INVESTMENTS IN THE FUTURE?



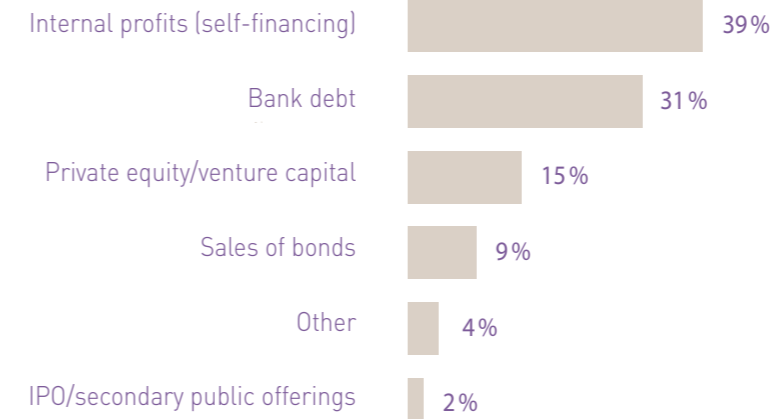
Note: The survey contains 18% respondents who didn't specify their country of origin

Based on the data above, our respondents do not prefer to offer equity in exchange for financing as self-financing and bank debt are the two most popular options. The only draw-back to self-financing is the opportunity cost associated with investing in other projects or distributing dividends. The strategic decision to invest in long-term projects highlights the intent to grow, rather than to act as a fully matured company. Additionally, on a global basis, interest rates continue to stay very low or even negative to help stimulate corporate borrowing and reinvestment into the economy.

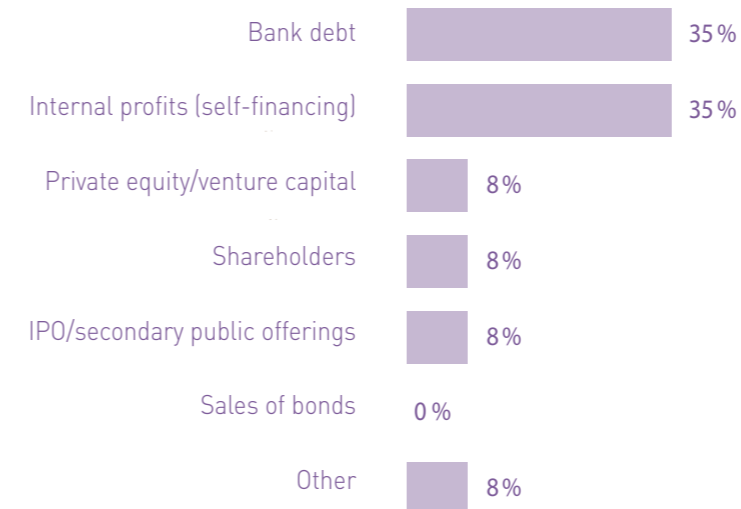
Even though we would expect companies to prefer self-financing and bank debt more than equity offerings, we did not expect self-financing to be equal to, or more popular than, bank debt. The main reason for this difference is the accessibility of bank debt for European suppliers. As the data shows, European suppliers prefer self-financing over bank debt whereas North Americans have no preference between the two. It seems to be more difficult to access bank debt in Europe.



←----- EUROPEAN SUPPLIERS -----→



←----- NORTH AMERICAN SUPPLIERS -----→



“ VISIBILITY INTO THE BACKLOGS OF OEMS IS AN INVALUABLE ASSET IN PLANNING FOR FUTURE INVESTMENTS ”

JASON SLIVKA
Manager
WeiserMazars



INTERVIEW

WITH NEEL MOREY

Clear Skies Immediately Ahead

Low fuel prices, increases in passenger traffic, and better technology all have contributed to booming backlogs for the main OEMs and suppliers within the industry, providing significant transparency for Neel and his team to better evaluate the future financial prowess of A&D companies. According to Neel, this future visibility, as well as the specificity of the product, is the main reason Wells Fargo continues to dedicate approximately twenty-five individuals to provide middle market banking services to companies in the aerospace and defense industry. This unique approach allows Wells Fargo to focus on its current and prospective customers, which is of the utmost importance to Neel and his team.

Focusing on Clients Worldwide

Neel is extremely passionate about the focus his teams place on their customers. Given the complexities and size of the industry, any small change in the economic, social, or political dynamic can have a significant effect on financials throughout the organization's supply chain. For example, a small change in interest rates could have a huge impact on the total cost of capital available for these companies. Additionally, any relocation to other countries needs to be handled with care, given the intellectual property, tax, and country specific differences. Neel and his team work with various companies with international operations on multiple fronts. In the US, Wells Fargo can act as either the primary or secondary lender (secondary

in a situation where the company has an intercompany loan with a foreign parent). The decision to lend is made locally by both Wells Fargo and the subsidiary, with a guarantee from the parent providing crucial support in the transaction. Internationally, Wells Fargo relies on lending licenses rather than a branch network to service its customers.

Double Vision: Looking South and Into the Future

With its close proximity to Boeing and its suppliers in the US, Mexico has become a hot spot for the aerospace industry. Mexico offers cheaper labor, a larger English speaking population, and good engineering expertise as compared to other low cost countries. Wells Fargo has seen multiple clients increase their presence in Mexico to take full advantage of these synergies. Though some may perceive



NEEL MOREY

Group Head – Aerospace & Defense Coverage at Wells Fargo

moving to Mexico as a risk, Neel explains that there are other risks to which his team is more attuned. He often looks to a company's expertise and strategy to determine what the future holds. The risk level of an aerospace company begins to increase as it becomes more commoditized or begins to stray from its core competency.

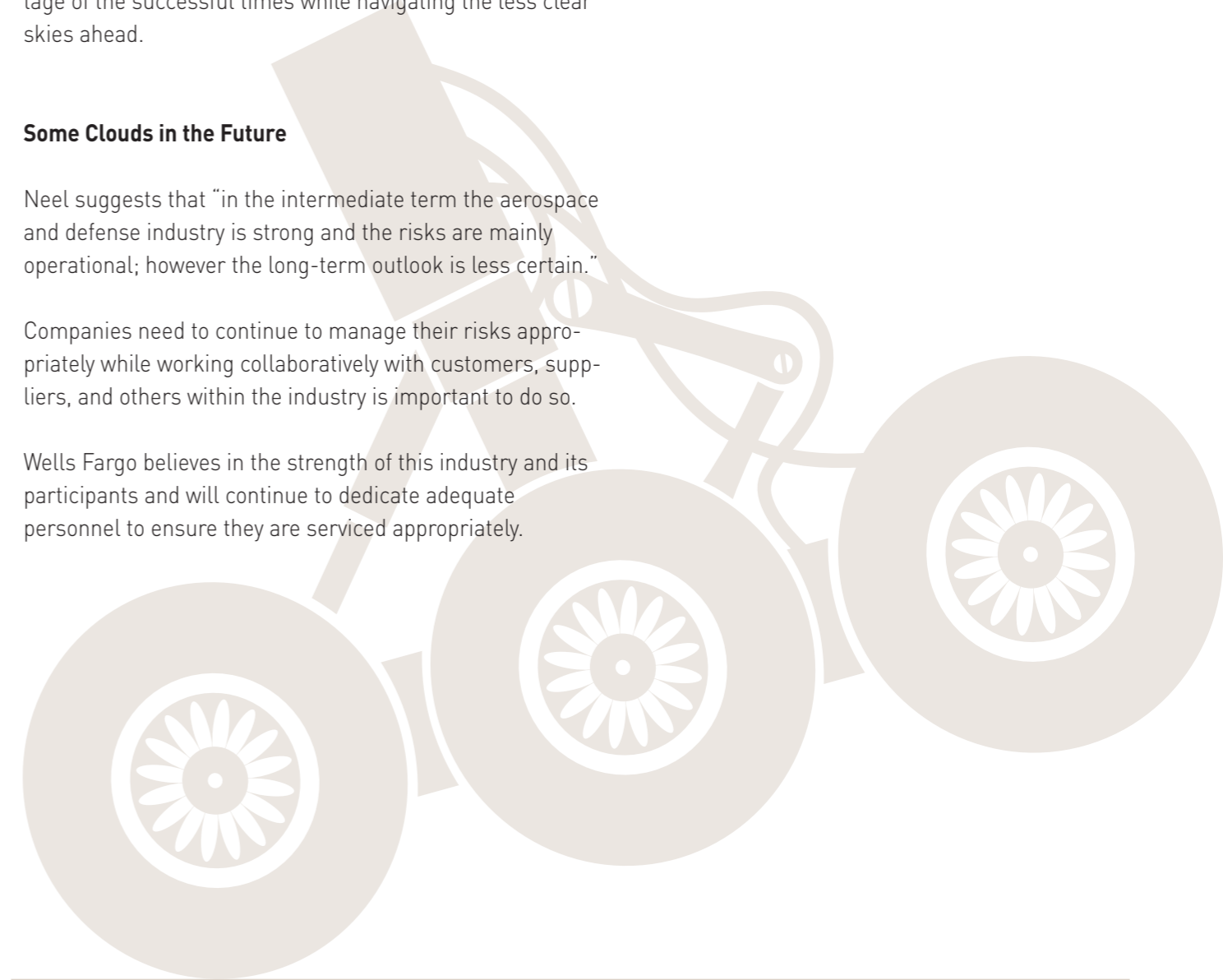
However, Neel was quick to point out that considering tangential industries along with a company's core competency is a great way for the company to innovate. Finding that sweet spot is imperative, as companies seek to take advantage of the successful times while navigating the less clear skies ahead.

Some Clouds in the Future

Neel suggests that "in the intermediate term the aerospace and defense industry is strong and the risks are mainly operational; however the long-term outlook is less certain."

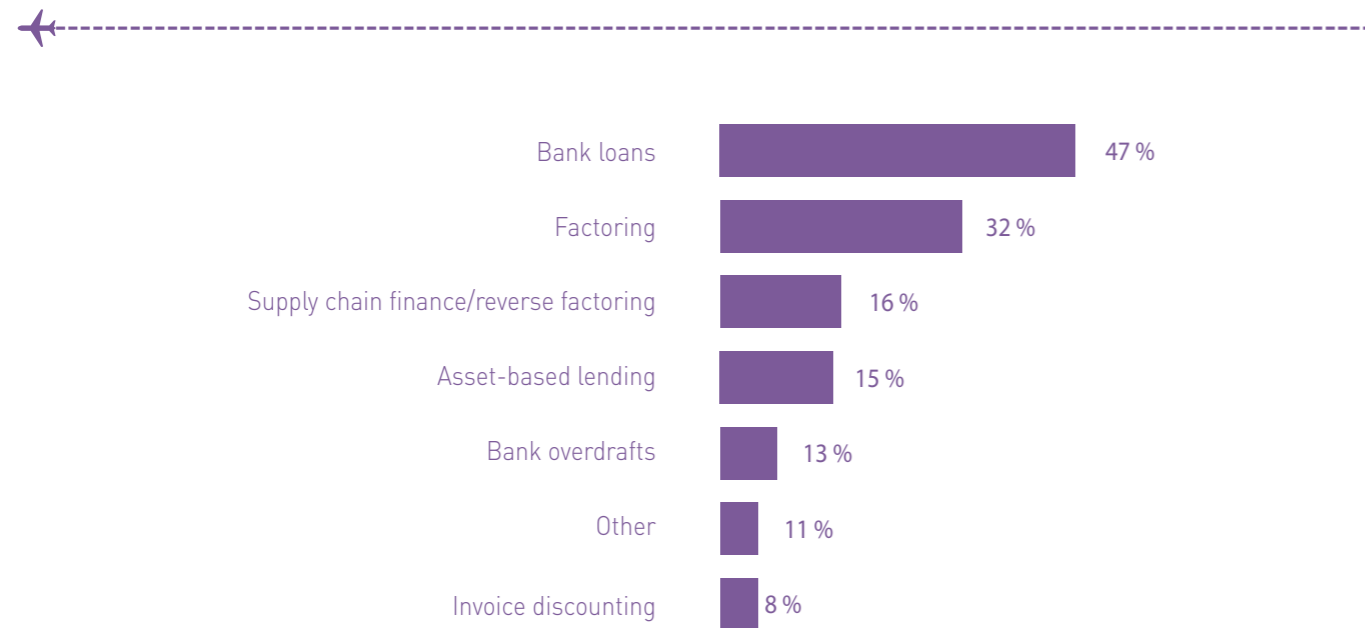
Companies need to continue to manage their risks appropriately while working collaboratively with customers, suppliers, and others within the industry is important to do so.

Wells Fargo believes in the strength of this industry and its participants and will continue to dedicate adequate personnel to ensure they are serviced appropriately.



08.

WHAT FINANCING SOURCES DO YOU USE FOR WORKING CAPITAL REQUIREMENTS?



Note: The survey contains 18% respondents who didn't specify their country of origin

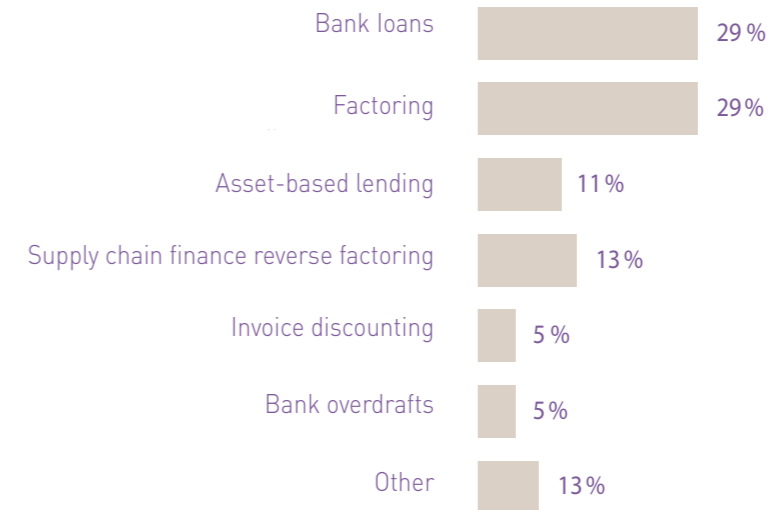
With cash tied up in capital-intensive projects, companies will often look to short term financing to help with operations. Lines of credit and short term loans, as expected, were the most popular choice for working capital financing among our respondents.

As with overall investing strategies, North American companies are more likely to use bank debt than their European counterparts. Lines of credit and

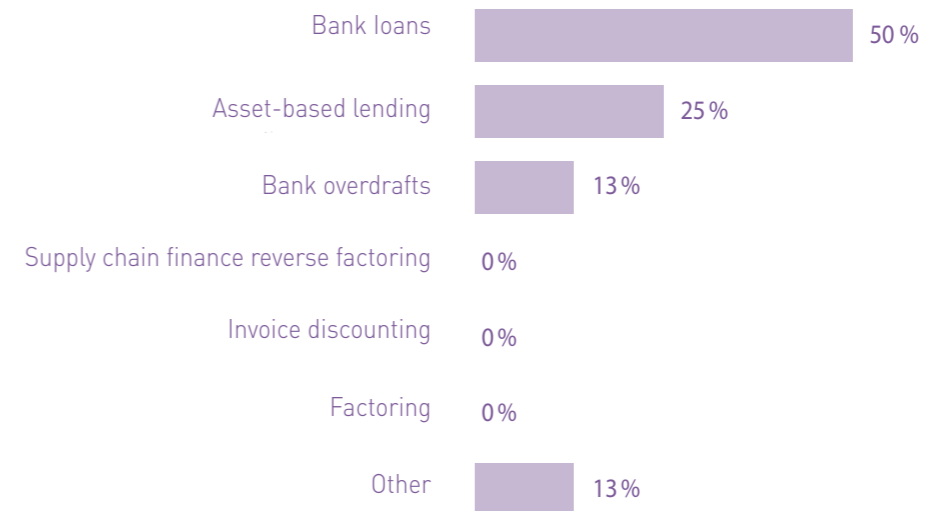
short-term loans are undoubtedly the most popular choices among the North American respondents. Other types of financing, led by factoring, were considered only remotely popular. Conversely, European suppliers were indifferent to lines of credit and short-term loans and factoring, once again illustrating the difficulty in obtaining financing in European countries.



←-----EUROPEAN SUPPLIERS-----→

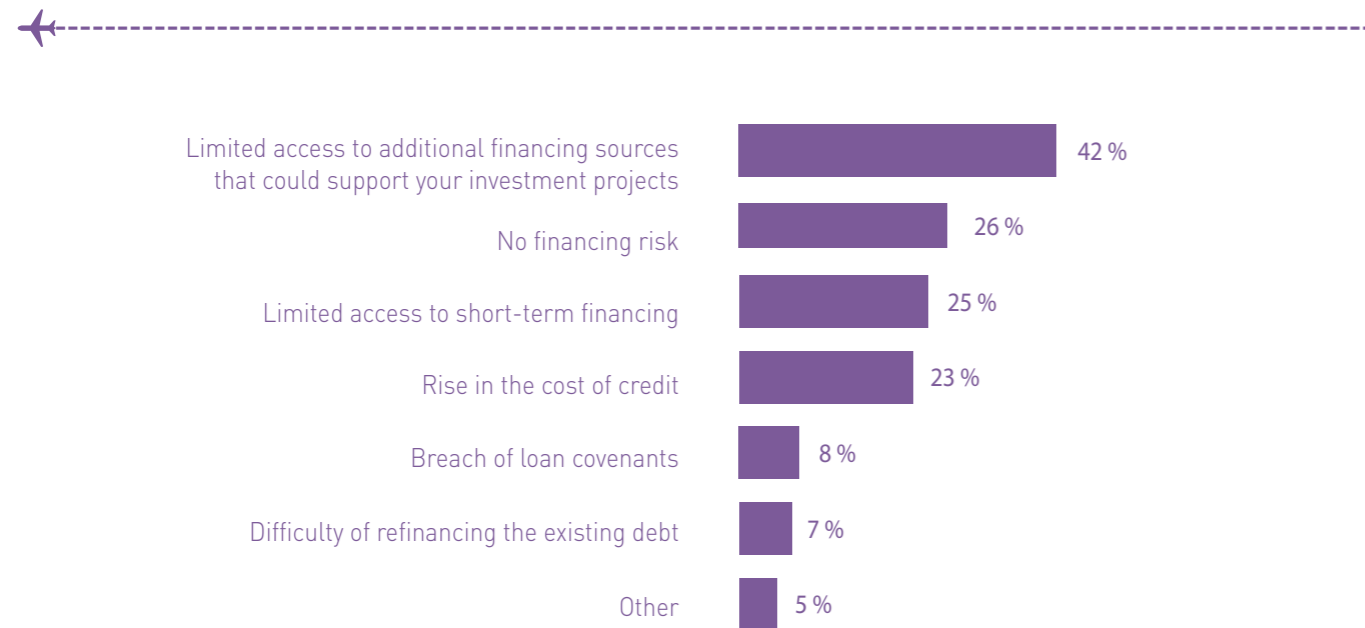


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09.

WHAT ARE THE FINANCING RISKS TO WHICH YOUR COMPANY IS EXPOSED?



Note: The survey contains 18% respondents who didn't specify their country of origin

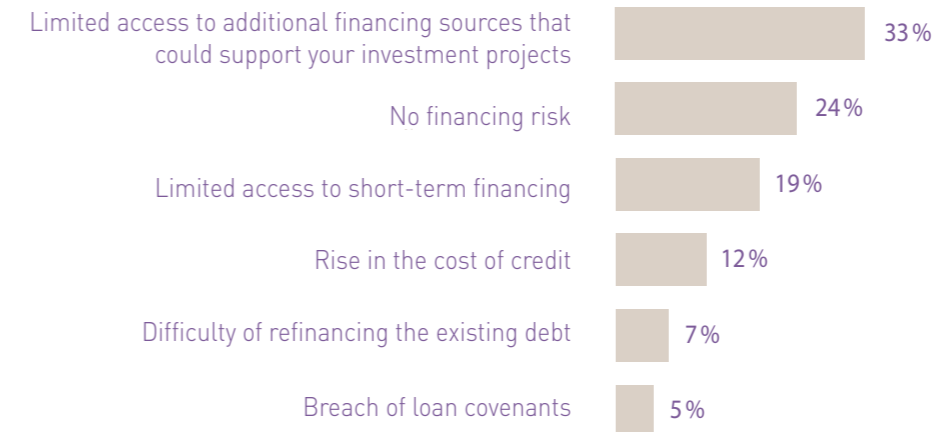
As discussed above, European companies have more difficulty gaining access to financing sources, compared to North American companies. However, suppliers in both regions believe that the accessibility of financing is the largest financing risk.

It is interesting, though, that one-fourth of our respondents believe there is no financing risk. These companies likely are those with defined contracts and ensured profitability and cash flow into the future. Strong profitability and cash flow allow a company to finance its operations and investments internally, and thus it will not be subject to potential financing risks.

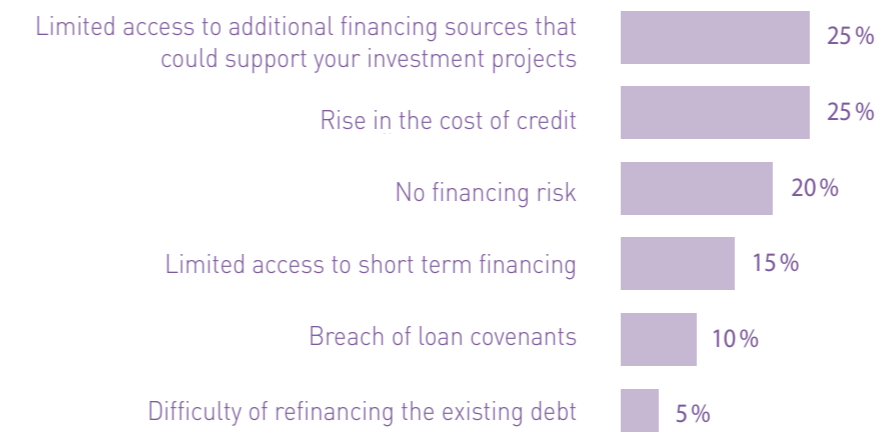
North American suppliers seem to place a larger emphasis on the rise in the cost of credit. Interest rates in the United States have remained low since the last recession, but the Federal Reserve has consistently discussed an increase in the borrowing rate. Though doing so may have a greater positive effect on the entire economy, borrowers may be faced with increased interest rates and thus a higher cost of credit.



←-----EUROPEAN SUPPLIERS-----→



←-----NORTH AMERICAN SUPPLIERS-----→



“THERE ARE RESTRICTIONS TO HOW FAST WE CAN RAMP UP...”

FRANÇOIS BASTIN
Executive Vice President
CFM International



5-4
TECHNOLOGY
AND INNOVATION



10.

WHAT PROCEDURES ARE YOU PLANNING TO INTRODUCE (OR HAVE RECENTLY INTRODUCED) TO IMPROVE PRODUCTION EFFICIENCY?

11.

WHAT TYPES OF TECHNOLOGY DO YOU SEE AS HAVING THE LARGEST IMPACT ON THE AEROSPACE INDUSTRY IN THE INTERMEDIATE FUTURE?

INTERVIEW

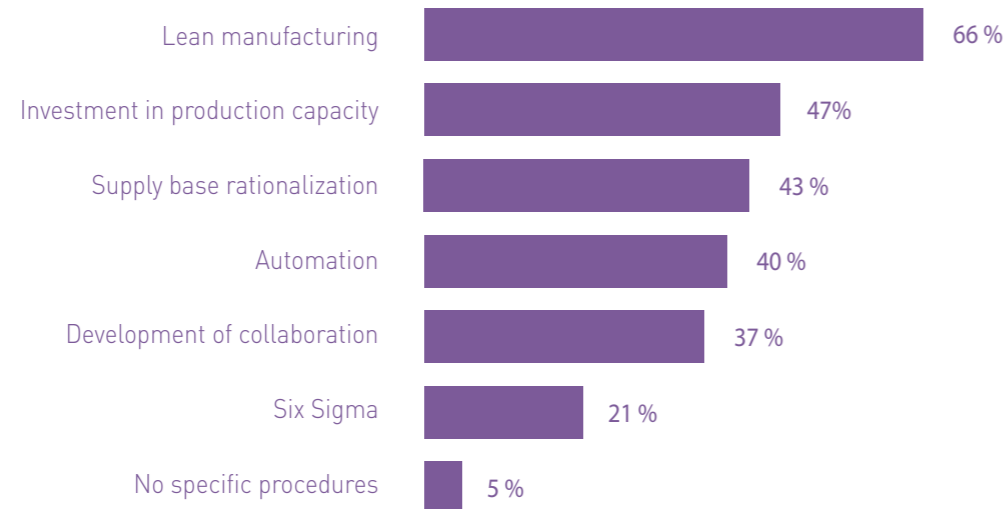
EZEQUIEL JIMENEZ SANCHEZ &
CARLOMAGNO RIVAS FROM GE MEXICO

12.

HOW DOES YOUR COMPANY PLAN TO KEEP PACE WITH CHANGES IN TECHNOLOGY?

10.

10. WHAT PROCEDURES ARE YOU PLANNING TO INTRODUCE (OR HAVE RECENTLY INTRODUCED) TO IMPROVE PRODUCTION EFFICIENCY?



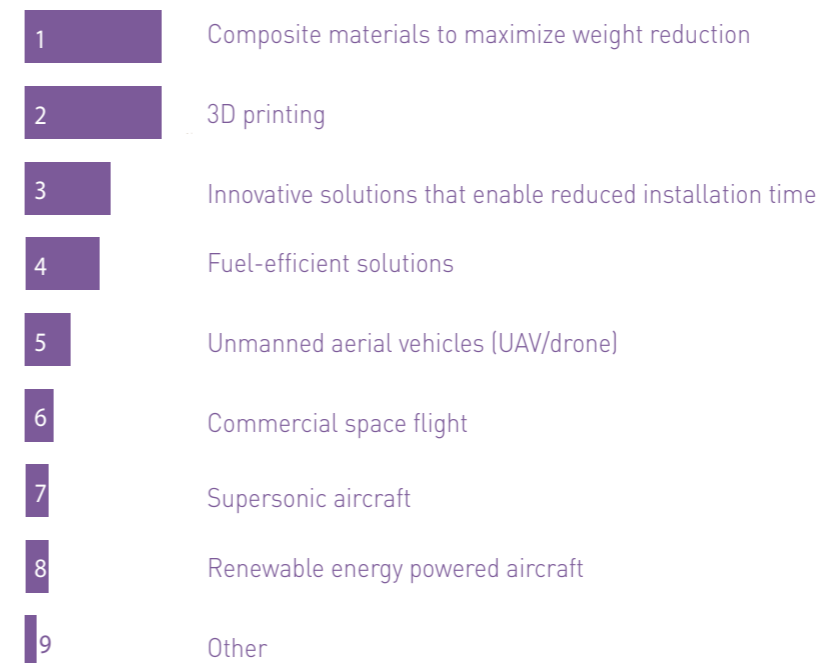
The most popular choice for improving production efficiency was lean manufacturing. The main difference between lean manufacturing and the other choices is the capital expenditure needed to commence the initiative. For example, increases in production capacity and automation lead to significant equipment costs, whereas lean manufacturing is more focused on process

improvement to allow a quicker manufacturing process without compromising quality.

This is consistent with our previous findings in that suppliers may find difficulty accessing financing sources, but need to invest in efficiency measures due to the price pressures applied by customers further up the supply chain.

11.

11. WHAT TYPES OF TECHNOLOGY DO YOU SEE AS HAVING THE LARGEST IMPACT ON THE AEROSPACE INDUSTRY IN THE INTERMEDIATE FUTURE?



Composite materials are best known for their light weight structure, which leads to less fuel burn and thus lower cost. OEMs historically have used a variety of composite materials on their aircraft and continue to produce aircraft with a higher percentage of overall composite material. The main downside to composite materials is their higher cost; however as this technology become more common, economies of scale can be realized to reduce production costs.

Whereas composite materials are seen as a direct improvement in effectiveness over materials

previously used in the manufacturing process, 3D printing has more of a hybrid impact on both effectiveness and efficiency. 3D printing can help with the addition of new product into the supply chain. These products are typically difficult to manufacture otherwise, due to their complexity and cost. Additionally, 3D printing can help improve the efficiency of the manufacturing products by reducing lead time for certain parts. Suppliers can begin to rely less on sub-suppliers for specific material that can be produced internally using a 3D printing machine.



INTERVIEW

WITH EZEQUIEL JIMÉNEZ SANCHEZ
AND CARLOMAGNO RIVAS

1. What are the main advantages that present 3D printing offers to the aerospace industry?

- Cycle time reduction for certain parts
- Allows the capability of manufacturing complex geometrics forms that cannot be manufactured by other processes

2. At what stages of the production process can 3D printing intervene? What parts are involved?

- This process is very useful for complex geometrics forms
- It offers fast-track validation of new designs
- Rapid prototyping

3. What are the prospects for 3D printing in the aerospace industry in the future?

This process will be extended for new and typical manufacturing countries in the next several years.

4. How can 3D printing change your business model? Is it a technology that could replace existing plants/machinery or is it conceived to be used in conjunction with these existing installations?

3D printing will change business model, because will allow different business to produce parts for the customers locally. This will reduce shipping and logistics time.

5. Could it have an impact on the geographic repartitioning of the firm's production capacity?

It may happen, based on customer needs and financial analysis of the business.



EZEQUIEL JIMÉNEZ SÁNCHEZ
*Engineering Manager of Gas Power System
Configuration Management*



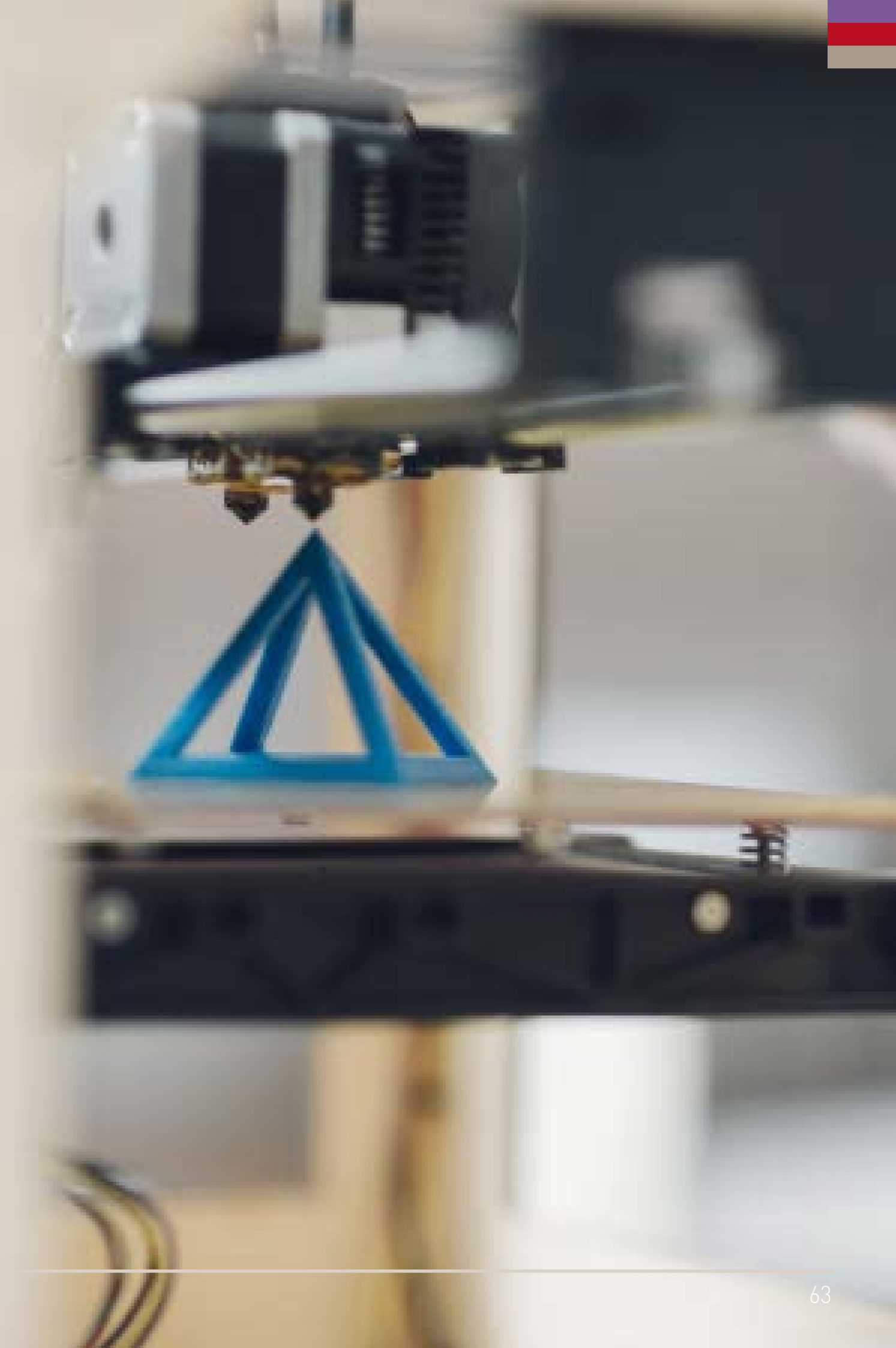
CARLOMAGNO RIVAS
*Aero Engineering Manager for Latino América
GE Power Services*

6. What are the main risks associated with 3D printing, in terms of supply of raw materials and ability to properly train the teams that will use such devices?

- With new technologies like 3D printers, maintenance associate with the machines and spare parts could be a concern
- New users have a learning curve in how to use this technology
- Material will be a roadblock for all the products. Needs must be evaluated before the production demand can be met

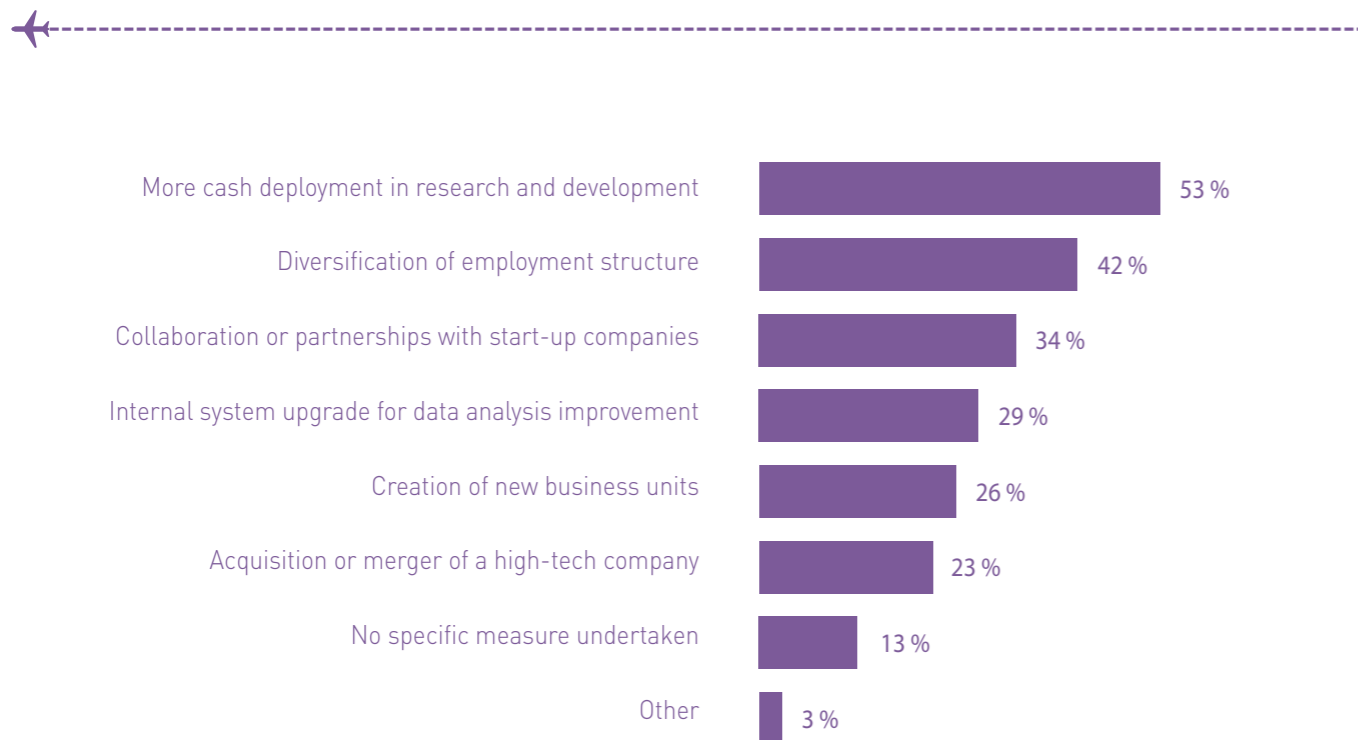
7. Is this technique already financially attractive?

Yes, especially with high volume and complex parts. This new 3D technique reduces several hours from the traditional process of validation and approval.



12.

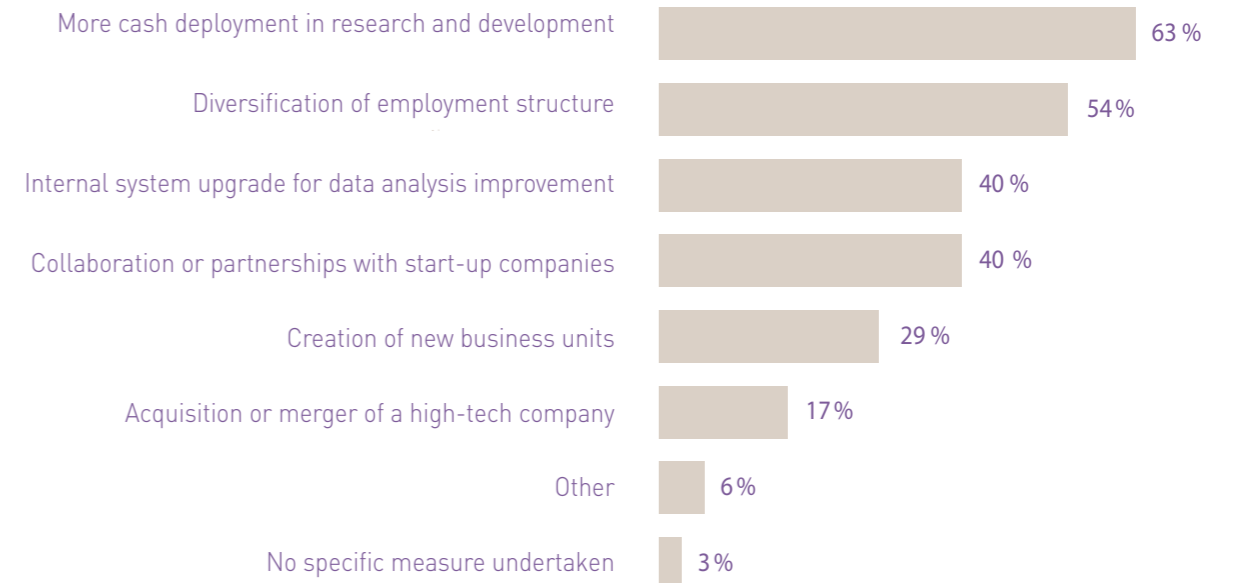
HOW DOES YOUR COMPANY PLAN TO KEEP PACE WITH CHANGES IN TECHNOLOGY?



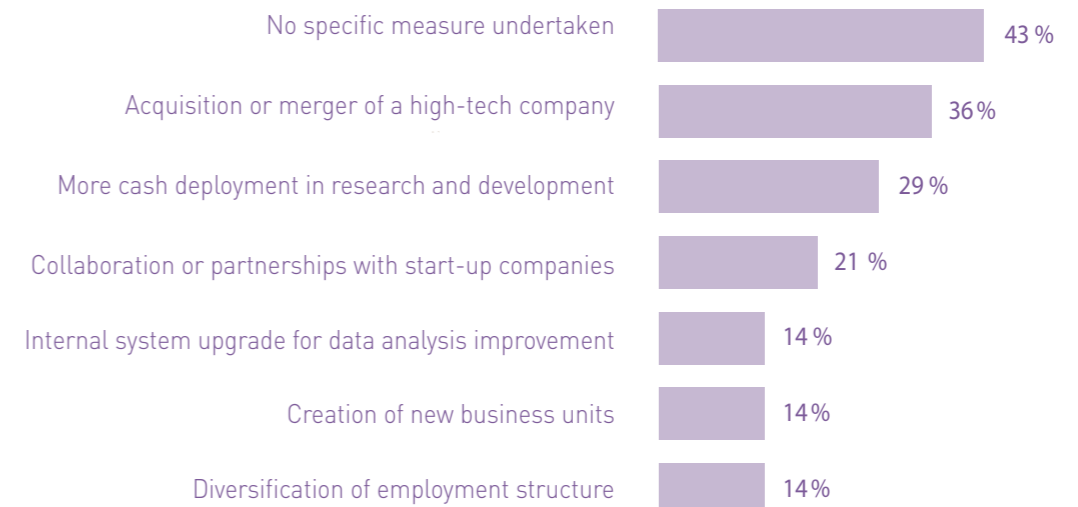
In general, our respondents believe that more cash investment in research and development and diversification of employment structure are the most popular ways in which they can keep pace with technological changes.

However, when reviewing the answers provided by both the European and North American respondents, a significant difference exist in how companies intend to keep pace with technology.

EUROPEAN SUPPLIERS



NORTH AMERICAN SUPPLIERS



06 PERSPECTIVES AND CONCLUSIONS



The announcements of production rate increases of single-aisle aircraft have significantly impacted organizations throughout the aerospace supply chain. Though often seen as an advantage, the rate at which demand is increasing could be a detriment to unprepared suppliers. Pricing pressure is high and OEMs continue to demand the highest quality. To remain successful, suppliers have continued to focus on improving the efficiency of current programs. Innovative manufacturing techniques, better collaboration with other suppliers, global expansion and technological advancements are some of the methods suppliers have used to adapt to the demand structure and mitigate risks.

Although risks related to current production increases have been prioritized, it is important to be perceptive to the future of aviation. As shown by the increase in actual and projected air travel, demand moves quickly. Technology is also constantly being improved, even for projects as long-term as aircraft manufacturing. It was not long ago when very large aircraft like the Boeing 747 and Airbus A380 were extremely popular. Now, both Airbus and Boeing have concluded that the

demand for these aircraft will be much less robust going forward.

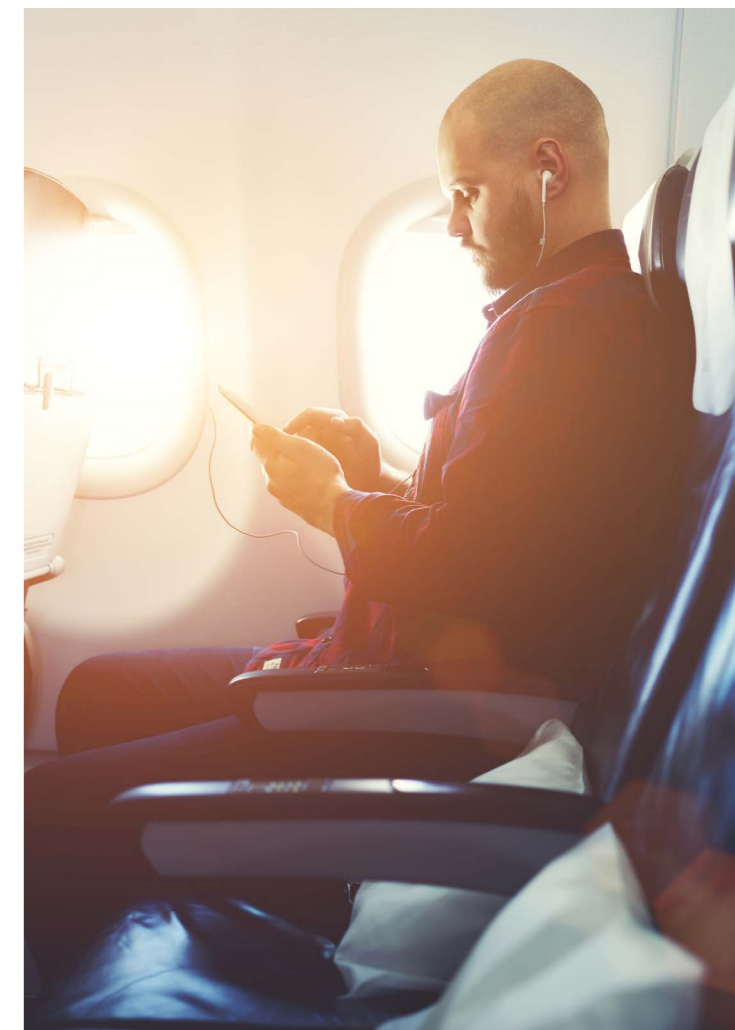
It is clear both OEMs are developing for the future of aviation as there have been discussions about significant changes to future aircraft including engine type, materials, and physical appearance, etc. These changes will continue to trickle down the supply chain, making some products obsolete while creating others that are more modern. Innovation is



crucial to exploit these changes and the suppliers best able to balance efficiency of current programs and future innovation will have great sustainable success.

For 2016-17, we will focus on the following topics:

- Actual increases in monthly production rates from 42 to 47 (Boeing – 2017) and 46 (Airbus – 2016)
- Delivery of the first 737 MAX scheduled for Q3 2017 and ramp-up of A320 NEO
- Bottlenecks in A350 supply chains
- Bombardier CSeries orders and its impact on the commercial aerospace duopoly
- Impact of Brexit on exchange rates and market fundamentals



- New uses for disruptive technologies (IoT, 3D printing, composite materials, etc.)

We are excited to bring you more thoughts leadership on these topics and can provide valuable assistance in your journey to manage both production increases and other market changes effectively.

07 ACKNOWLEDGEMENTS & REFERENCES

We thank our survey respondents and interviewees for the insights they have provided into the current state of the commercial aerospace supply chain. This information is quite important as suppliers look to exploit an increase in customer demand while understanding the risks in doing so too aggressively.

Special thanks to the students of Science Po who greatly contributed to the research stage of this project.

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