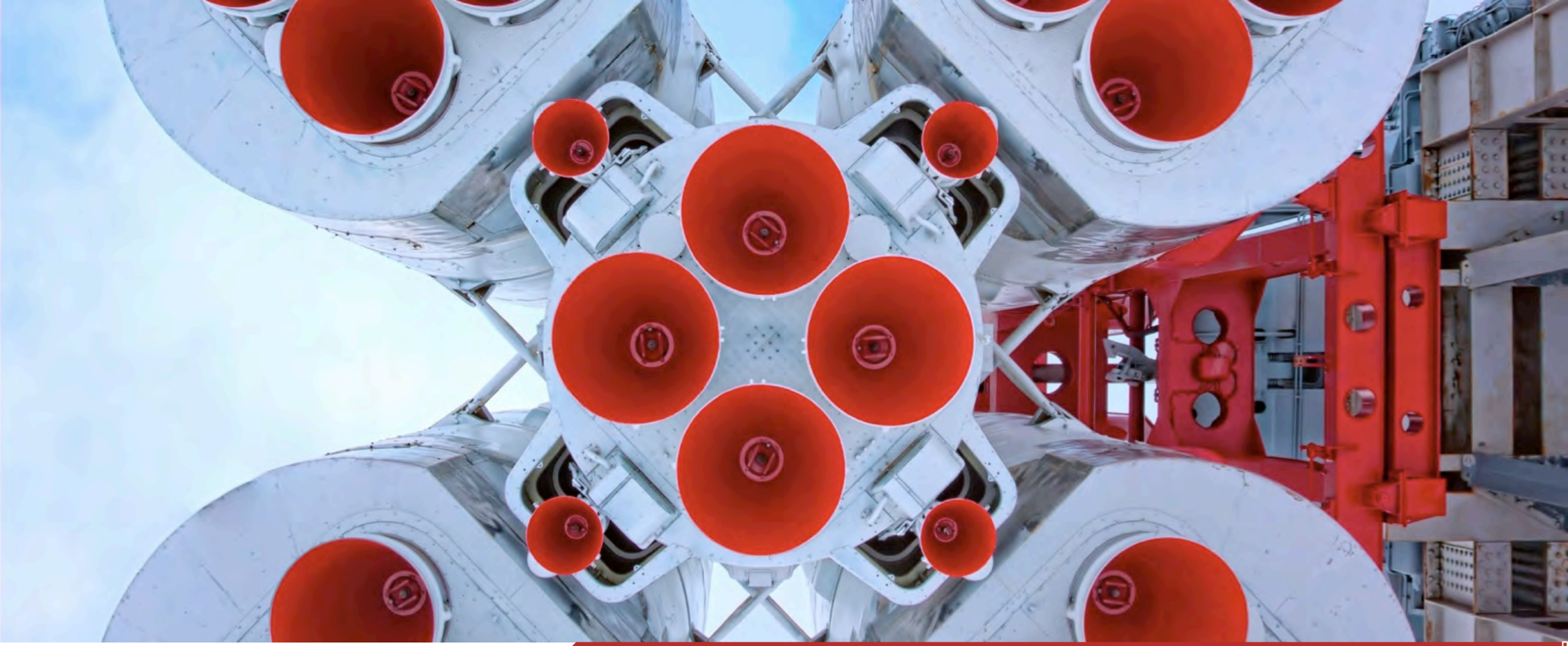

# Ideanco. Aerospace Report 2014

## Aviation and Space

29 September 2014

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# Contents






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# 1 About ideanco.




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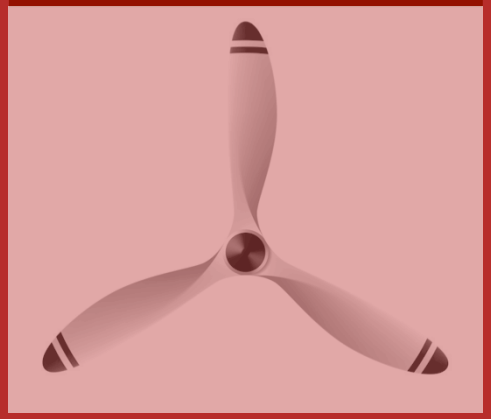
# About ideanco.

Founded in 1999 under the name ‘Creativemode’, Idea and Company FZ LLC (**ideanco.**) is a management consulting firm that prides itself in being an early adopter of crowdsourcing, a major innovation key differentiator. Ideanco – a name born out of the fusion of ‘idea’ and ‘company’ – has used this business model as a means of generating better ideas, superior creative work, and ultimately high performance output for our clients.

We work with clients from Aerospace, Renewable Energy and SMEs to help them identify their highest-value opportunities, address their most critical challenges, and transform their businesses. The ideanco philosophy ensures long-term competitive advantages, which result in building organizations that are more capable and sustainable.

Aerospace



Renewable Energy

SMEs

Ideanco.com

# Author Profile

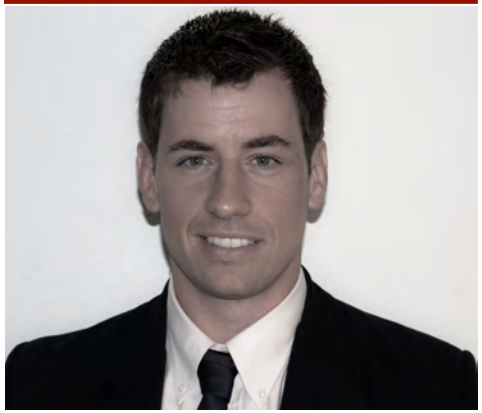
## Professional Experience

| | |
|---|---|
| Present | Aerospace Consultant |
| 2014 | Strategy Analyst at B/E Aerospace |
| 2009 – 2013 | Internal Consultant on Airbus A30X and A5ME programs |
| 2008 – 2009 | Space Systems Engineer<br>Concurrent Design Facility |

## Education

| | |
|---|---|
| 2013 – 2015 | Master in Business Administration<br>Co-President - Student Aerospace Club |
| 2006 – 2008 | M.Sc. Aeronautics and Astronautics<br>Space Systems Engineering |
| 2004 – 2006 | M. Sc. General Engineering |

## Gautier Brunet



# 2 Executive Summary

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# Aerospace report executive summary

An exciting time for an exciting sector!

## Aerospace Trends

- **Aerospace is the healthiest industrial segment of the world economy**. Despite a temporary slow-down in 2010, aircraft deliveries have resumed their long-term growth trend. While the forecast for the military market is relatively flat, the civil market seems ready for significant growth, especially in emerging markets. According to the *Teal Group,* the market for turbine powered aircraft between 2014 and 2023 is $1.9 trillion, including a $500-Billion military component. This corresponds to a healthy 50% growth with respect to the previous decade.
- US primes, including Boeing, are well positioned to gain market share thanks to their successful embrace of globalization. Europe should be able to maintain its market share, thanks to Airbus. However, the defense prospect look weak. “Emerging” producers should be able to prosper through their participation to OEM supply chain. It is likely that a **third actor should appear in the Airbus/Boeing duopoly. COMAC in China** seems well positioned provided it sets an impeccable safety record.
- Aerospace markets across the world should progressively open up to competition. From access to space and UAVs in the US, to the Chinese private aviation market, the tendency is for the **regulatory frameworks throughout the world to allow more commercial use of aerospace markets that will provide numerous business opportunities.**




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# 3 Past




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# History of Aerospace

From the Wright Brothers to the A350 and the 787

## History of Aviation

Aerospace describes the human effort in science, engineering and business to fly within and beyond the Earth's atmosphere. Aerospace organizations research, design, manufacture, operate, or maintain aircraft and/or spacecraft. Aerospace activity is very diverse, with a multitude of commercial, industrial and military applications.

Modern aerospace developed throughout the 19th century, beginning with Sir George Cayley who proposed an aircraft with a "fixed wing and a horizontal and vertical tail," defining characteristics of the modern airplane. Numerous aerospace engineers like Lilienthal, Chanute and Ader came up with innovative designs to beat gravity. The first powered sustained flight was accomplished at Kitty Hawk, North Carolina on December 17, 1903, by the Wright brothers.




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# Recent aviation history

## The start of the jet airplane era

### Development of Airlines

Soon after the first flights of the early pioneers, the first airlines were created and high-value freight started to be transported by air. In 1927, Charles Lindbergh flew non- stop from New York City to Paris. The 1970s saw dramatic increases in costs, particularly increases in fuel prices. The 1980s were marked by the deregulation of the industry – first in the US, and later in Europe - which resulted in the growth of smaller carriers and the mergers of larger carriers. The 1990s saw a dramatic increase in the number of passengers, including first time passengers, as prices were cut and the cities served by airlines increased.

In the last 50 years, the annual Growth Rate has been around 5%, meaning that air traffic has been doubling every 15 years. This growth has shown tremendous resilience to shocks such as the attacks of September 11, skyrocketing prices for fuel and the global financial crisis, proving that people see a lot of value in their ability to visit friends, family and do business. There have been five equipment cycles of constant peak to trough ratios with shorter cycle durations for more recent cycles. Meanwhile, air carriers have fine-tuned their business models to maximize the wedge between customer willingness to pay and operating costs. On the one hand, newer and more efficient airplanes are being used and unprofitable routes have been eliminated. On the other hand, revenues have been increased through a number of ancillary services, some of which had been historically bundled in the price. The contribution of ancillary services has moved from less than 2% in 2005 to more than 8% in 2011.

 

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# History of Space Exploration and travel

The ultimate frontier…

## From Tsiolkovsky to Elon Musk

War and science fiction inspired great minds like Konstantin Tsiolkovsky and Wernher von Braun to achieve flight beyond the atmosphere.

The launch of Sputnik 1 in 1957 started the Space Age, and on July 20, 1969 Apollo 11 achieved the first manned moon landing.In 1981, the Space Shuttle Columbia launched, the start of regular manned access to orbital space. A sustained human presence in orbital space started with "Mir" in 1986 and is continued by the "International Space Station”.




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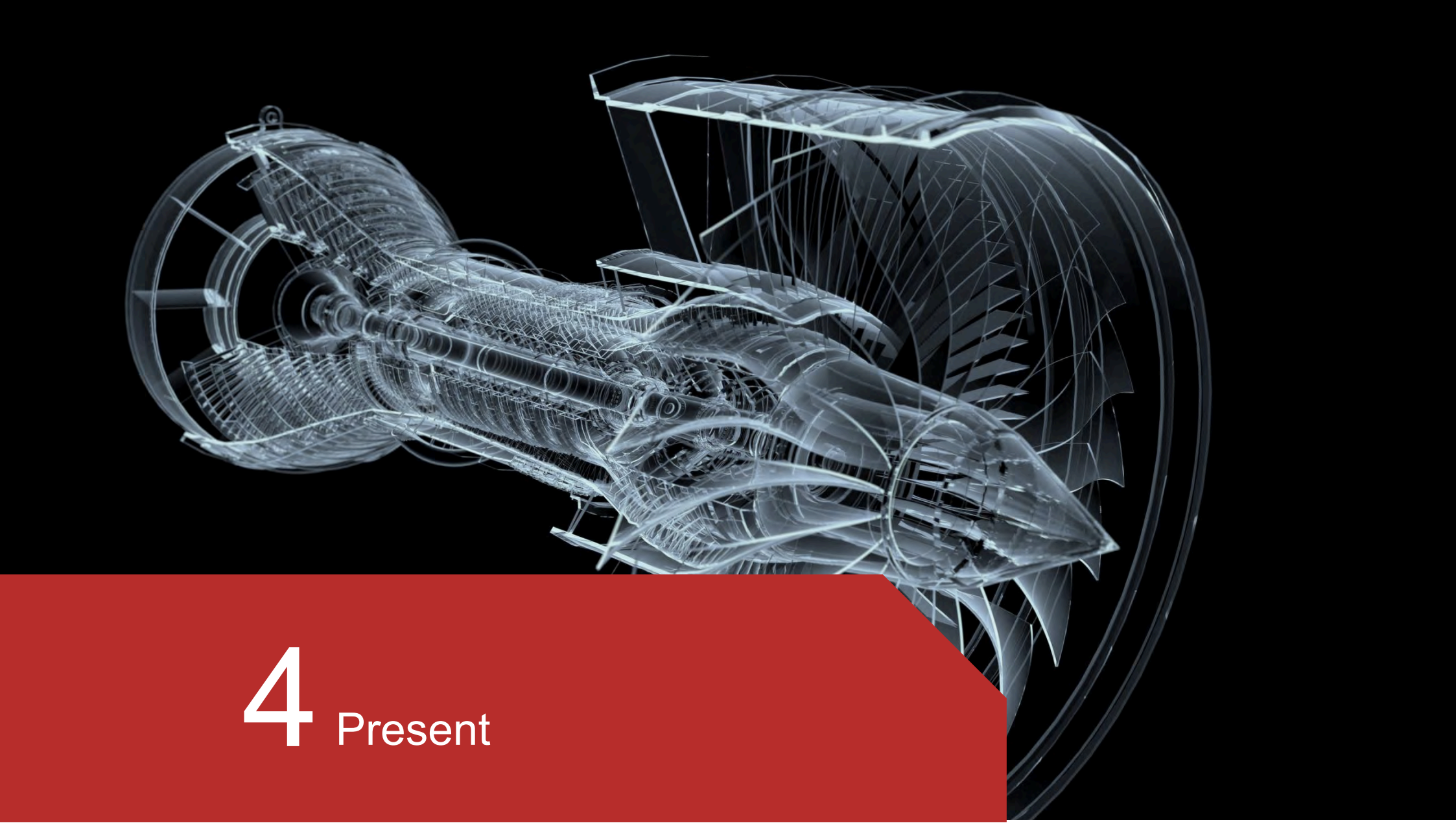

# 4 Present




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# Global aerospace sector overview

A consolidated, cyclical industry with risky developments

## Overview

Commercial aerospace is dominated by four major airframe companies (Airbus, Boeing, Embraer and Bombardier), three aircraft engine companies (GE, Pratt & Whitney, Rolls Royce) and numerous suppliers. Lifecycles tend to be very long – typically between 30 and 40 years. Developing a new product requires significant upfront investments, and the business is very cyclical.

Space and Defense have historically relied on government budgets and are therefore counter-cyclical in nature.

Assembly costs represent between 5-10% of the overall cost of the aircraft. Carbon fiber composites, with their excellent strength to weight and stiffness characteristics, been increasingly used as structural material and now represent around 50% of the airframe by weight for the A350 and the 787.

The global Aerospace and Defense profitability – around 10% in the US in 2012 - is low compared to other sectors such as IT and chemicals with 16% and 18% operating profit margin respectively. The two main initiatives that have had a positive impact on efficiency and productivity are lean six sigma and digital product development.




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# General Aviation

A cyclical industry

## Overview

General Aviation includes all civil aviation operations other than scheduled air services, such as business jets, flight training and agricultural aviation were severely hit by the financial crisis, especially the segment of business jets costing less than $25 million; whose value fell by more than 50% in 2008-2011. Business jet demand is driven by corporate profits. The dichotomy based on size is due to the different forms of financing that the purchase of a jet has, the bigger ones being self-financed by deep-pocketed companies or individuals that can survive the 2-3 year through in profits.

The industry began to recover in 2012, through rotorcraft and agricultural aircraft as well as single-engine piston deliveries. Slow economic recovery and economic uncertainties continue to impact the turbojet and multi-engine piston deliveries.

Student pilots are an important part of general aviation and the aviation industry as a whole. Student pilot numbers have been in decline over the past decade but in the US, the FAA issued a rule that extended the validity of pilot certificates from 36 to 60 months.

Despite these measures, the number of certified pilots should stay stable in the next 20 years.

*Source: 2013 General Aviation Statistical Databook & 2014 Industry Outlook*




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# Civil Transport

## A balanced duopoly

### Airbus and Boeing

Commercial aerospace is a mature industry and a duopoly has emerged as a result of consolidation. Since 1997, Airbus and Boeing have been the only manufacturers of large commercial aircrafts and were able to split the market in roughly equal parts. They can trace back their roots almost 100 year. Bombardier and Embraer are more recent ventures. The evolution of the industry followed a classic pattern of emerging market, shake-out and consolidation.

A number of potential entrants are appearing. Directly competing with Boeing and Airbus' narrow body offering, Bombardier is developing the Cseries and the Commercial Aircraft Corporation of China, Ltd. is developing the Comac 919. Embraer is focused on revamping its regional jet family in the 70-120 seat segment but has indicated that it could stretch its E-195 by the end of the decade. Going forward, it is probable that one entrant will be able to successfully compete in the coming decade or two. Given the incredible Chinese market potential and level of control of the government, is a strong contender.

Entry of a third player would put a significant downward pressure on aircraft prices and would also incentivize OEMs to innovate an find new ways to decrease operating costs. Looking at Airbus' track record and the stringent reliability requirements of the industry, this entry would be a long process with most airlines waiting for several years of reliable service before purchasing.




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# Space

## The state of the world today – Launchers

### Launchers

**Launchers**

In 2011, the American Congress allocated a $10 Billion budget to the development of a manned space program. Detractors of the policy believe that current funding levels are insufficient to get anywhere.

The entrance of low-cost actors such as SpaceX is putting downward pressure on launch price points. Boeing, Airbus and Lockheed now take the Falcon 9, which reaches the ISS for $60 million – about half of what an Ariane 5 costs, very seriously.

On the 16th of June, Airbus Defense and Space and Safran announced that they would create a joint venture in order to develop civil rockets that will be more competitive and fulfill the commercial and institutional needs of the market.




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# Space

## The state of the world today – Satellites

### Satellites

**Satellites**

According to the Union of Concerned Scientists, there are 1085 operational satellites currently in orbit around the Earth, 59% are used for communication purposes (telephone, internet, television), 14% observe the Earth, its atmosphere and weather and 8% are navigation satellites such as GPS.

Most of the military surveillance satellites – which make up 7% of the total satellite population - operate in Low Earth Orbit in order to increase the resolution of the graphic data.




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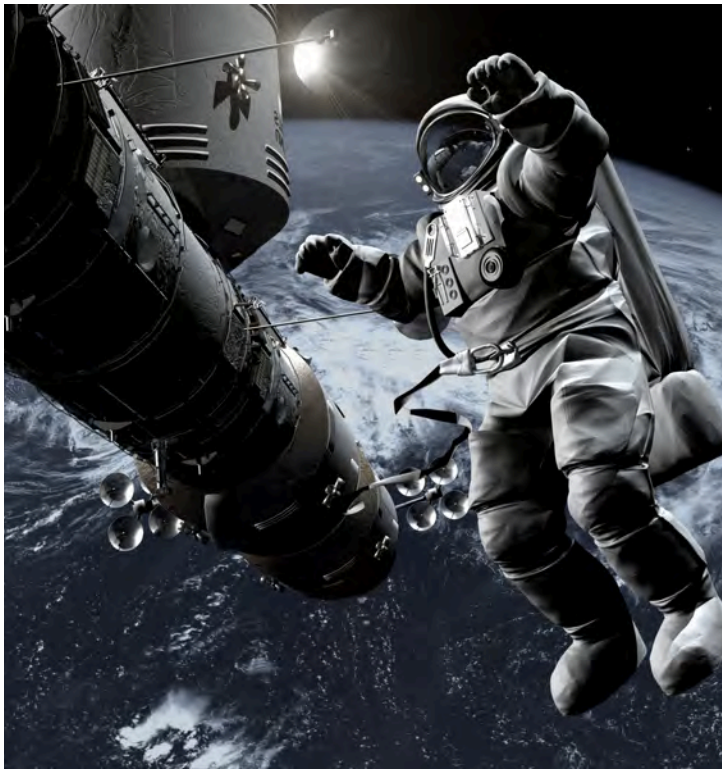
# Space

## The state of the world today – Commercial Space

### Commercial Space

**Commercial Space**

Many other endeavors are currently being considered. Space tourism – though companies such as Richard Branson's Virgin Galactic - propose a few minutes of weightlessness for adrenaline junkies. Asteroid mining and energy collection also have great potential for a private use of space.



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# Global Market Drivers and Demand - Aviation

Demand for aviation is intimately tied to GDP growth…

…but a number of new drivers complicated the picture

## Global Market Drivers

**Economic Activity**
Air traffic is correlated with economic growth and historically, air traffic has grown at a faster rate than GDP. The airline industry has had 2 major crises. The first one happened in 2001 when a recession was amplified by the Sept 11th attacks on the World Trade Center. In 2009, global air traffic fell 3.5% Y/Y after the financial crisis.

**Age of the fleet**
If the fleet of operating aircrafts is very low, the retirement rate will be low for a while and the order levels needed to maintain the fleet should by low as well.

**Fuel costs**
High fuel cost make older airplanes more expensive to operate and incentivize airlines to order new – and more efficient – airplanes.

**Load factors**
Increasing load factors allow airlines to serve an increasing traffic without buying additional aircrafts.

**Aircraft financing**
Interest rates and the cost of debt have a direct impact on an airline's ability to order a plane. Furthermore, Export Credit Agencies (ECAs) often intervene to back airliner transactions and eliminate financial risk. Since the economic crisis in 2008, ECAs have gone from backing 15% to 33% of aircraft transactions.

**Competing investment opportunities**
The returns provided by an airliner purchase will always be compared to the returns generated by other investment opportunities. A striking example is the comeback of cash-rich Japanese banks to aircraft financing despite shrinking returns because of a very limited set of investment options.

**Investor appetite for risk**
The US Federal Reserve Bank's plan for a third Quantitative Easing program is to spend $40 Billion per month in the US mortgage market in an attempt to "crowd out" investors and encourage them to move on to riskier investments - like aircraft financing - that should stimulate the economy.

# **Aerospace Appetite** – Western Europe

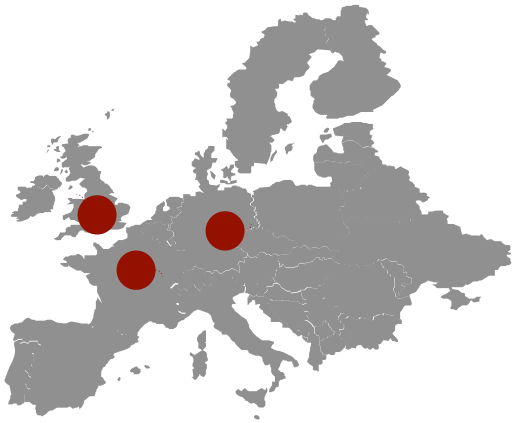
Moderate growth from the historical players, with air traffic expected to increase at a 4% per annum. Traffic numbers have shown resiliency to economic uncertainty. Europe will account for a fifth of 20 years new deliveries

## Western Europe Appetite

### UNITED KINGDOM

**AVIATION:** Through its numerous companies like Rolls-Royce, Airbus UK and QinetiQ, the UK is recognized as a leader in the development and manufacture of some of the most complicated and high tech parts of modern aircraft.

**SPACE:** SSTL is well positioned to take advantage of budgetary pressures and increase its revenue in the low-cost satellite business.
Britain has aggressive plans to capture more than 10% of the world space market by 2030 and will build a spaceport in Scotland to allow Virgin Galactic and Xcor's spaceships to explore space.



### GERMANY

**AVIATION:** The aerospace industry's revenues in 2012 amounted to €28.4 billion – a 10.3 percent increase over the previous year. The field of civil aviation showed the largest share of revenue growth with 69 percent. The number of people employed in the industry also showed an increase of 3.4 percent, amounting to some 100,700 employees. Lufthansa is the biggest airline in Europe.

**SPACE:** Germany has overtaken France as the main contributor to space efforts. The future of Ariane 5ME remains a big unknown as talks of a complete redesign continue.

### FRANCE

**AVIATION:** Toulouse has become an aerospace hub as the Headquarters of the Airbus Group. General aviation is still quite active and important culturally. Dassault is an important player as well. The military side of the business is not growing much, the Rafale for example is struggling to find export clients. On the commercial side, the business is quite successful and will be growing in the coming decade.
Air France is one of the biggest airlines in the world, both from a fleet and revenue passenger kilometer point of view.

**SPACE:** France has historically been very active in aerospace. The first four versions of the Ariane vehicle were developed solely in France before becoming a European product. Kourou in French Guyana is still a very active spaceport for Ariane 5 launches as well as Soyuz. The space branch of the Airbus Group that develops the Ariane 5 launchers also designs and manufactures the French nuclear missile, the M51. France's political independence and space technology developments are thereby intimately linked.
Similarly, the Galileo constellation will enable Europe not to depend on the American GPS system.

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# **Aerospace Appetite** – Middle East

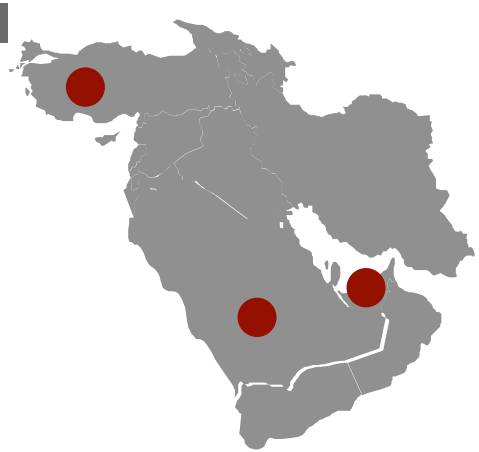
A promising region with Dubai and Ankara as potential world hubs. Almost 6 billion people are within 8 hours of flight to the gulf countries. Region expected to account for 7% of deliveries and airlines will go from an 8% to 12% world market share in the next 20 years

## Middle East Appetite

### TURKEY

**AVIATION:** Turkish airport passenger numbers saw compound average growth of 14% from 2003 to 2012. The success of Turkey's aviation sector has been built on healthy economic growth, a productive and inexpensive workforce and Turkish Airlines' use of its Istanbul hub to attract international transfer traffic. Turkish airport authority DHMI expects passenger growth to average 8.7% p.a. between 2011 and 2015. Eurocontrol forecasts that the number of flights in Turkey will grow at an average annual rate of 7.0% p.a. between 2012 and 2019, the fastest growth of any European country.

**SPACE:** Turkey is projected to expand its launch capability through the UFS project, which includes the creation of a spaceport and small LEO satellite launch capability.



### SAUDI ARABIA

**AVIATION:** 5.5% passenger traffic growth in the next decade i.e. 100 million by 2020.
Since the end of the monopoly of Saudi Arabian Airlines, the aviation market has been increased competition and privatization, especially on international routes. On the infrastructure side, significant investments to enable increased traffic at the 4 major airports and smaller FBOs

**SPACE**: King Abdulaziz City for Science and Technology (KACST), Saudi Arabia has announced today the successful launch of the its thirteenth Satellite (Saudisat-4) from the Russian launch base in Yasny, on board of the Russian-Ukrainian Rocket (Dnepr) provided by Kosmotras launch Agency.

### UNITED ARAB EMIRATES

**AVIATION:** Aviation and aviation-related activities will derive nearly one-third of Dubai's entire gross domestic product (GDP) by 2020, according to the Dubai Civil Aviation Authority (DCAA).

Dubai International Airport is undergoing a $7.8b program to increase capacity to more than 100 million per year by the end of the decade. The airport, one of the world's major transit hubs, could handle over 70 million passengers in 2014,fed by national carrier Emirates Airline, the world's largest user of both the Airbus A380 and Boeing 777.

**SPACE:** In July, the United Arab Emirates declared that it would send a probe to Mars before the 50th anniversary of the creation of the country in 2021. This constitutes an ambitious mission that is the first of its kind for an Arab country and a huge step for UAE. The country has already invested billions of dollars in communication and earth observation satellites (Yahsat, Thuraya and EIAST) but space exploration is a less pragmatic endeavor with unclear and long-term financial returns. This is a clear signal to the world that UAE is climbing the ladder of technological prestige and political influence.

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# **Aerospace Appetite** – Russia

## Still a strong market, expected to account for 4% of 20 year new longer-range aircraft deliveries and 6% of regional airliners

### Russia Appetite

**RUSSIA**

**AVIATION:** Russia's aircraft industry is part of the core of the country's economy. It is one of the most science-intensive hi-tech sectors and employs 360,000 skilled personnel. The production and value of the military aircraft branch far outstrips other defense industry sectors, and aircraft products make up more than half of the country's arms exports.

The UAC, one of the so-called national champions and comparable to EADS in Europe, enjoyed considerable financial support from the Russian government, and injected money to the companies it had acquired to improve their financial standing. The UACs first budget in 2007, was about 2 billion rubles, and next year it increased to 24 billion rubles (about $770 million).

In 1998, the Russian Air Force asked the industry to develop a light multirole frontline aircraft. In 2001, the requirements were upgraded to a multirole frontline aircraft system, which later became the fifth-generation fighter PAK-FA, regarded as Russia's response to the American Joint Strike Fighter. The PAK-FA performed its maiden flight in 2010, breaking America's complete monopoly on the development and production of fifth-generation jets. Moscow Defense Brief hailed it as a major coup for the Russian aerospace industry, saying that:

"while not America's equal militarily, Russia is still a solid second in terms of defense technology, outranking both Western Europe and China and punching well above its economic weight."

The airline industry is relatively fragmented with more than 100 airlines present in the region,. The 10 biggest represent more than 70% of the RPK. Traffic increase has been almost 10% but has not resulted in an increase of orders because of huge operational improvements. Tourism should continue to generate substantial traffic that should favor LCCs in the region.

**SPACE: 2013 reorganization of the Russian space sector**

As a result of a series of reliability problems, and proximate to the failure of a July 2013 Proton M launch, a major reorganization of the Russian space industry was undertaken. The *United Rocket and Space Corporation* was formed as a joint-stock corporation by the government in August 2013 to consolidate the Russian space sector. Deputy Prime Minister Dmitry Rogozin said "the failure-prone space sector is so troubled that it needs state supervision to overcome its problems." Three days following the Proton M launch failure, the Russian government had announced that "extremely harsh measures" would be taken "and spell the end of the [Russian] space industry as we know it."

In 2001, the development of the GLONASS satellite navigation system was made a government priority with the introduction of a new Federal Targeted Program with 1.6 Billion rubbles allocated to the mission.

# **Aerospace Appetite** – Asia

Asia has great potential due to economic performance. The region represents more than a quarter of the economy today and more than a third by 2032. Air traffic is up 13% year-over-year in China. Asia Pacific should account for 40% of overall aircraft deliveries and 50% of Very Large Aircrafts in the next 20 years

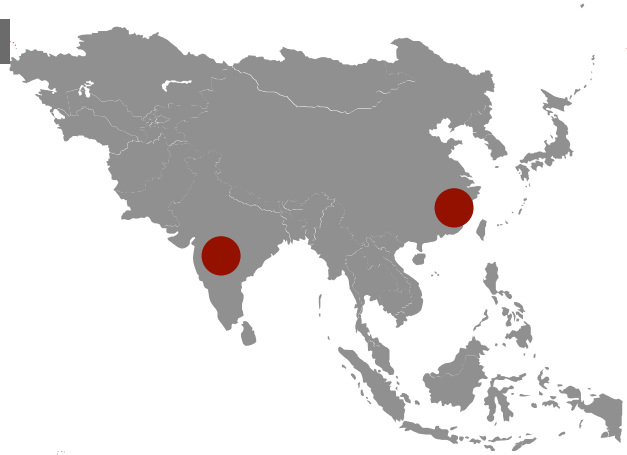
## Asia Appetite

### INDIA

**AVIATION:** Average growth rate of 9.8% will make Domestic India the sixth largest flow by 2032, but will be the fastest growing domestic route. 660 regional airliners are expected to be delivered in the next 20 years according to the Bombardier Market Outlook.

**SPACE:** In September, India will launch its own Mars observation satellite, Mangalyaan, for a tenth of the cost of the American equivalent. If this mission is a success, low cost missions will probably become the norm. Prime Minister Narendra Modi is very proud of this project that should collect photographic and atmospheric data and is "cheaper than the movie *Gravity*". The use of technologies that were tried and tested on the *Chandrayaan* mission to the Moon in 2008 is credited with reducing development risk and cost. Low labor costs and the dedication of the team also contributed to the savings.

For now, the Indian Agency does not plan to commercialize its access to space and views the development of its exploration capabilities as an end in itself.



### CHINA

**AVIATION:** Domestic Chinese traffic will be the largest flown by 2031 with 10.4% of world traffic. Around 2300 new regional jets should be delivered to Greater China according to the Bombardier market forecast. See additional slide about China for more info.

**SPACE:** In the 70s China started sending rudimentary transponders and spy satellites. In 2012, China overtook the US in terms of launches with 19 during that year. On the 14th of December 2013, China became the third nation to land a probe on the Moon. Although this was greeted with general indifference, future accomplishments will undoubtedly generate more interests as they transition from catching up to leading the way.

According to Jonathan MacDowell, from the Harvard-Smithsonian Center for Astrophysics, China will be a major player in 15 years. China is able to develop space missions at a fraction of the cost because the way has been shown the way by Russia and the US and are able to concentrate R&D on the most promising technological increments. For instance, they developed advanced materials for the rover to be resistant to the extremely abrasive dust that is present on the Moon. On the launcher side, they successfully developed a high-performance hydrazine and nitrogen peroxide engine that is very difficult to operate.

The long term goal is to be completely autonomous down the road and cease to rely on foreign systems such as ESA's Deep Space Antenna network that relays messages from lunar probes.

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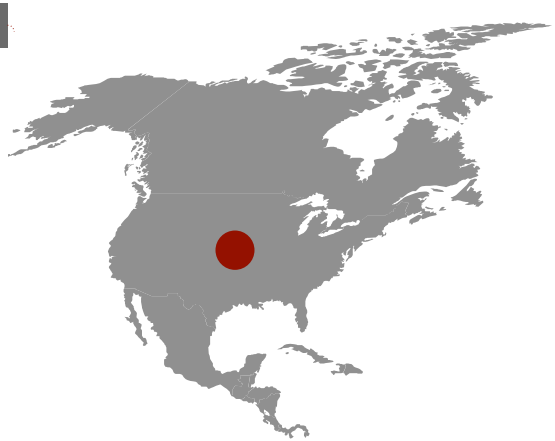
# **Aerospace Appetite** – North America

## The US is the historical powerhouse with 50% of the global industry

### North America Appetite

**USA**



**AVIATION:** Largest single aviation market in the world. Over 100 airlines, 4100aircrafts of more than 100 seats in service today.
The US airlines have had a very competitive history with a number of bankruptcies. This has put an enormous pressure on cost reduction and load factor optimization. The load factor has evolved from 61% in 1993 to 82% today.
This trend has limited the growth of the fleet. The US market is focused on single-aisle due to the size of the US domestic market.
North America will account for 20% of new aircraft deliveries in the next 20 years.
Furthermore, scope clause relaxation in 2012 will open up new opportunities for more regional jets in the near-term. According to the Bombardier market forecast, around 3800 i.e. 25% of regional jet deliveries will be in the US. 9500 out of a total of 24000 business jets should be delivered to the North American market.

**DEFENSE:** The US spends as much as the next 7 countries (China, Russia, France, UK, Saudi Arabia, Germany and Japan) combined on defense with more than $600 billion in 2013. It boasts a significant technological advantage in many sectors of the defense industry. For example, it has been able to replace a lot of its traditional “dumb” bombs by more effective laser or GPS-guided bombs. The 2011 European air campaign over Libya showed that Europe was not able to supply enough guided missiles despite the small scale of the conflict.

**SPACE:** The US is the strongest player in the space domain. During the Cold War, space became an area of competition with the USSR that led to the Apollo Moon landings. NASA’s budget as a share of GDP has been decreasing ever since. Recently, private actors such as SpaceX and Google have invested heavily in space technology.
In the launchers business, the most frequently used vehicles are:

- In the heavy category the Atlas V and Delta IV built by ULA, a Joint Venture between Lockheed Martin and Boeing
- The Falcon 9 built by SpaceX in the intermediate category
- Pegasus and Taurus designed and built by Orbital in the light category.

In the last 20 years, the Department of Transportation/FAA has granted an average of 10 orbital and suborbital launch licenses.

# **Aerospace Appetite** – South America

A vibrant region that will generate significant growth, and account for 8% of 20 year deliveries of regional and longer-range aircrafts

## South America Appetite

### BRASIL

**AVIATION:** Embraer has grown into the world's largest producer of small planes (37-120 seats) and the third-largest manufacturer of aircraft overall, after Boeing and Airbus. Its regional jets form the backbone of commuter airlines worldwide. Most of the Brazilian aerospace industry is linked to the supply chain or MRO operations of Embraer. Embraer invested heavily in Brazil in the 1990s to develop its regional jets, but the cost proved too much for the state-owned company nurtured under a military regime. In 1994, Brazil's democratic government sold Embraer to a private group, which has revamped operations, boosted growth and now lists shares on Wall Street.

Number of Billionaires: 60 Number of private jets: 700

Brazil has a developed helicopter market because of the number of High Net Worth Individuals as well as security concerns when travelling within a city like Sao Paulo for example.

Domestic traffic flow is expected to grow at 7%, to represent 43% of total traffic in Latin America in 2032. Much like in the US, single-aisle will be accounting for most of the deliveries because of the strength of the domestic traffic. Most of the aircraft orders will be generated by this growth since the current fleet is relatively under-developed.

Manpower is one of the main issues which must be dealt with by the Brazilian aerospace industry. There is a lack of qualified work labor in the country As a result, it is not rare to see companies recruiting employees from other countries. Even so, BNDES, the Brazilian National Bank for Economic and Social Development, estimates that the number of employees in this branch will more than double from 35,000 today to 78,000 in 2020.

**SPACE:** In 2012, Brazil invested $200 million on space projects and R&D through the Brazilian Space Agency, AEB. The first Brazilian satellite was launched in 1993 and was named SCD-1. Altogether, there have been fifteen Brazilian missions, ten of which were successful. The most recent mission CBERS-3 was built in cooperation with China and ended up in the failure of the Chinese launcher. Marcos Pontes, a Brazilian astronaut, spent 10 days on the International Space Station, in 2006, a testament to Brazil's belief in human exploration of space.

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# **Aerospace Appetite** – Africa

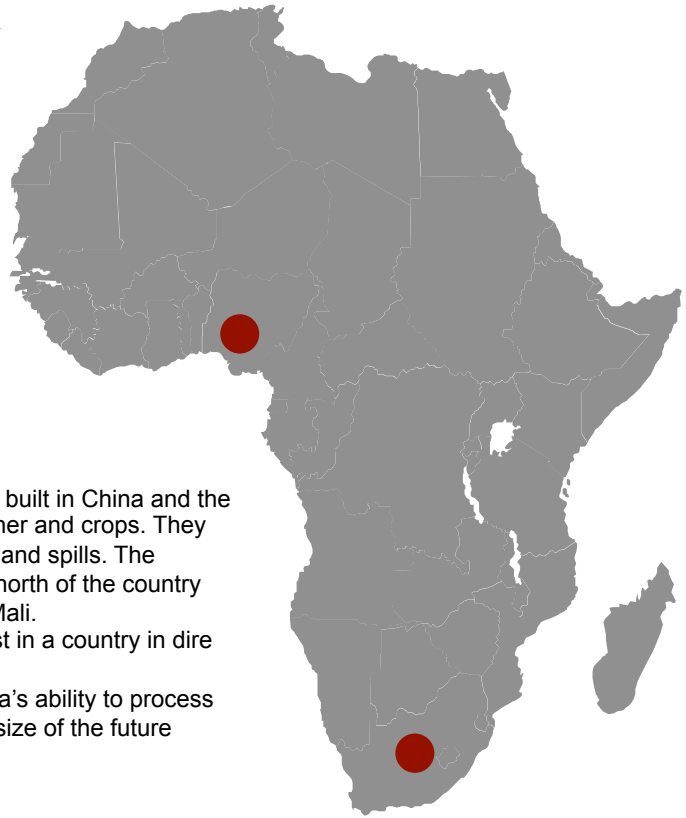
Severe infrastructure and economic limitations prevent the aerospace industry from developing in Africa, with South Africa and Nigeria leading the way.  Africa will account for 3% of 20 year new deliveries, 96% for growth

## Africa Appetite

### NIGERIA

**AVIATION:** Nigeria has experienced high octane growth and it has become the largest market for business jets in Africa. Infrastructure and skills remain an issue. In particular, service centers and maintenance engineers and technicians are in short supply in this expanding sector. There is a strong market for smaller aircrafts in the region with over 50 small airfields that can be used by the turbo prop and light jet community.  The airline business is rapidly evolving and should experience growth if corruption and safety issues disappear. The collapse of Air Nigeria in 2012 and the grounding of Dana Air following the crash of an MD-83 carrying 163 people left the country with an effective duopoly and high fares.

**SPACE:** Nigeria currently has 3 satellites in orbit. They were built in China and the UK (SSTL) and provide valuable information about the weather and crops. They also monitor the oil-rich Niger delta to counter crude oil theft and spills. The satellites can also provide intelligence about militants in the north of the country and peace-keeping strategies in surrounding countries like Mali.
Nigeria's space program has been highly criticized for its cost in a country in dire use of funding for education and healthcare.
The success of the current programs – determined by Nigeria's ability to process all the satellite data and limit corruption – will determine the size of the future market.



### SOUTH AFRICA

**AVIATION:** South African Airways is a major airline with more than $23 Billion in revenues in 2014. South Africa has several aviation manufacturers. Engine development company Adept Airmotive for example displayed its new 320-hp V6 at the Innovation Center of the 2014 Oshkosh airshow.

Boeing said it was working with South African Airways and a Dutch biofuel company to make jet fuel from tobacco seeds. "Initially, oil from the plant's seeds will be converted into jet fuel. In coming years, Boeing expects emerging technologies to increase South Africa's aviation biofuel production from the rest of the plant," added the firms.
Aviation biofuel, made from renewable resources such as plants, can reduce carbon emissions by 50 to 80 percent.

**SPACE:** In 1999, South Africa launched its first satellite, SUNSAT from Vandenberg Air Force Base. A second satellite, SumbandilaSat, was launched from the Baikonur Cosmodrome in Kazakhstan in 2009

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# Aerospace Appetite

## Other countries of interest

### Other Great Countries of Interest

#### QATAR

Qatar Airways – the national flagship carrier based in Doha – is a major airline with a lot of growth potential.

The airline operates a hub-and-spoke network, linking over 125 international destinations across Africa, Central Asia, Europe, Far East, South Asia, Middle East, North America, South America and Oceania from its base in Doha, using a fleet of more than 100 aircraft.

The airline has more than 30,000 staff. In 2013, Qatar launched its first satellite called Es'hail 1 on an Ariane 5 rocket from Kourou in French Guyana.

#### ITALY

Finmeccanica S.p.A. operates in seven sectors: aeronautics, helicopters, space, electronics, defense systems, transportation and construction.

The company has offices in over 100 countries. It is partially owned by the Italian government, which holds about 30% of Finmeccanica's shares.

On the launcher side, Italy spear-headed the Vega development. Vega is a single-body launcher with multi-satellite release capability.

It can take relatively small payloads of up to two tons to Low Earth Orbit.

#### MEXICO

Mexico is an increasingly important player of the aerospace supply chain. According to a study by KPMG, Mexico is 15.7% more cost competitive than the United States.

The country boasts 260 factories everything from electronic panels to partially assembled engines for shipment directly to the world's leading original equipment manufacturers (OEMs), including Bombardier, Boeing and Honeywell. Aerospace exports from Mexico reached $4.3 billion in 2011, a 40 percent increase from 2007.

Optimistic government forecasters now say exports may double again by 2015 and hit $12 billion by 2020.




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# Aerospace Appetite

## Other countries of interest

### Other Great Countries of Interest

#### SINGAPORE

Singapore is currently the sixth busiest airport and the fourth busiest air cargo hub in Asia, the Singaporean aviation industry is also a significant aerospace maintenance, repair and overhaul center.

58,000 direct jobs were available in the industry, rising to 119,000 jobs if the entire supply chain is included. Airlines registered in Singapore were also major contributors to the economy, employing over 15,000 in Singapore and providing a further 11,000 jobs in the supply chain in 2009.

Overall, these airlines contribute over S$5.5 billion to the economy and supported 34,000 jobs. Singapore – as an Asian hub - is also seen as a great place to build a spaceport should the space tourism industry take off.

#### ARGENTINA

Since the 1950s, the Argentine Air Force (FAA) operated a rocket launch site at Chamical Air Base to perform high atmosphere studies.

However after the Falklands War the military approved development of the Condor missile which was later canceled due to political pressure from the United States.

In 2009 they successfully tested the Gradicom rocket, whose booster was entirely developed by Argentine scientists and engineers.

Currently, CONAE, the National Commission for Space Activities, is developing a multistage liquid propellant rocket called Tronador II to be used for satellite launching.

#### CANADA

The Canadian aerospace industry is made up of over 700 companies of all sizes and is responsible for the employment of more than 172,000 Canadians.

Aerospace contributes $28B of GDP to the Canadian economy annually and reached $25.1B in direct revenues in 2013. Canada ranks third in terms of global civil aircraft production activity.

The Canadian aerospace defense sector represents 25% of the total Canadian defense sector and is responsible for close to 60% of the total R&D investment.

A very diversified space systems manufacturing sector with close to 50% of the revenues dedicated to commercial and industrial activities.




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# 5 Future




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# Market Outlook for Aviation

## Worldwide global trends

### Aviation Market Outlook

**Aircraft size is growing**
Average aircraft capacity has grown by more than 25% over the last 20 years. This is driven mainly by the emergence airline hubs and the congestion of a lot of airports. Airlines are also densifying their existing fleets by optimizing the cabin layout. B/E Aerospace for example found a way to design an S-shaped lavatory wall that would allow the last row of seats to recline, thereby adding a row of seats. Increasing capacity is also a way to decrease fuel burn per passenger kilometer.

**Growing middle class**
The middle class should increase from 32% now to 62% of world population in 2032.

**LCCs will support growth**
Low Cost Airlines will grow the fastest and increase their share from 17% to 21% of Revenue Passenger-Kilometer (RPKs) flown by 2032.

**Ticket price is still going down**
In the 40s, flying an intercontinental route meant spending more than a year's salary of the average American. Today, less than a week would be needed to fund the purchase of that same ticket. Nowadays, flying is not a luxury anymore and the emergence of low-cost airlines has opened up this service to far more people.

**Democratization of flying is not finished**
Boeing's Future Market Forecast expects the number of passengers worldwide to reach 6.7 billion in 2032, compared to 2.9 billion in 2012 and the fleet to more than double during that time frame. Around 60% of the orders should be generated by growth and 40% by replacement of the current fleet.

**Emerging markets**
Emerging markets are expected to contribute 70% of economic growth. Asia Pacific region is a strong contributor but not the only one.

**Environmental concerns as constraints and drivers of innovation**
In the last 40 years, the sound levels of airplanes have decreased by 75%. Their CO2 emissions have been cut by 70%. Every new generation of products – such as the latest A350XWB and the A350NEO - typically brings an additional 20% progress in that direction. Global warming and other long-term environmental trends are putting pressure on aerospace manufacturers to innovate. Furthermore, the airframe of the plane will continue to get lighter as the use of more advanced composites progresses. Many technologies, including the use of carbon nanotubes, will improve mechanical performance that will allow significant weight savings. Overall fuel use per passenger kilometer will be further improved by cabin layout optimization and advanced Air Traffic Control software that will limit landing queues.

# China: The growth engine of the 21st century aerospace market

Despite a macro backdrop where GDP slowed to 7.7% after a decade at 10%, China remains the main source of the growth to come with 1 billion passengers expected to fly in 2023

## Why China Matters So Much

**Air traffic is outpacing GDP growth by 1.7X**
Given the resilient macro outlook in the region, the increase in air traffic will likely remain around 13% year over year during the next decade.

**Huge long term potential for private aviation**
The private jet to billionaire ratio is 15 times lower in China than in the US, a clear sign of under-penetration. This is explained mainly by the current regulation and infrastructure limitations. For example, most of the airspace is currently controlled by the military.

**Infrastructure and policy are improving**
The growth rate over the past 4 years of Fixed Based Operators (FBOs) has been 34%. Most secondary hubs as well as China Eastern Airlines (CSA) Guangzhou airport are expanding capacity at CAGR rates close to 20% from 2013 to 2016.

China should open its low-altitude (<3000 feet) airspace by 2015, which should have a positive impact on helicopter demand.

In a gradual process from 2011 to 2020, General Aviation flights only need to submit their flight plans to the Civil Aviation Administration of China (CAAC) and not the military.

**China has plans to send a man to the Moon in 2025**
The China National Space Administration has an ambitious list of short-term and long term goals, including Earth Observation, a satellite communication network, commercial launch services, remote sensing system, a space lab and culminates in the manned exploration of the Moon. To put it bluntly, the People's Republic of China expects to catch up with the US in the next decade.

**It is easier to become a pilot**
The requirements for obtaining a PPL are becoming easier, providing an increasing number of private pilots and boosting General Aviation growth. This also means a more accessible stepping stone to become a commercial pilot.

# Market Outlook for Commercial Aviation

Bubble or no bubble?

## The Sustainability of the Current Forecasts in Question

The peaking backlogs of aircraft OEMS has led many to question whether the current orders are not forming a bubble.

Aircraft production was not much impacted by the recession of 2009 as it had been in 1995 and 2002. Airlines have shown greater capacity discipline and increased load factors. The orders plummeted, but the significant backlog acted as a buffer. This is likely to happen again in the event of a crisis, which means that the supply chain should be able to remain essentially unaffected.

The supply chain will likely continue to consolidate by part family. This provides economies of scale and the investment power to ramp-up production and keep up with the average 5% increase in production over the next decade. The process will result in fewer but stronger competitors in the supply chain. Recent commercial introductions like the 787 and the A350 have been plagued with schedule and cost overruns, partly because of the weak performance of the supply chain. OEMs will likely react by managing the contractors on the critical path of the development more closely.

Fuel prices, which impact aircraft retirements, should remain close to their current levels. The increase of the load factor, which has in the past few years been responsible for a discrepancy between traffic growth and aircraft delivery growth will not be able to increase much more. It therefore seems that deliveries will have to stay significant and the likelihood of a bubble burst is low.

# Commercial Aviation Outlook

The future of the duopoly

## Market Share Evolution

After Airbus announced plans for an A320 NEO, Boeing responded in August 2011 with the 737MAX. On every size and range combination, they compete head-to head. Their strategies differ on the high capacity side of the curve. Airbus is a believer in the Hub-and-Spoke model which is used by a number of airlines. The advent of global networks of airlines has justified the need of larger capacity aircrafts. However, the success of Southwest and JetBlue which operate under a point-to-point system has allowed a comeback of that system, even on international routes.

An average of delivery forecasts of several investment banks (UBS, Bank of America, JP Morgan, Morgan Stanley) and consulting firms (TEAL Group, Airline Monitor) as well as Airbus and Boeing was computed.

The analysis shows an equal market share for single-aisle deliveries with the slight advantage shifting from Airbus to Boeing in the next three years. On the twin-aisle side, Boeing enjoys a 60% market share. The difference should decrease with time and reach a 55/45 split in 2017.




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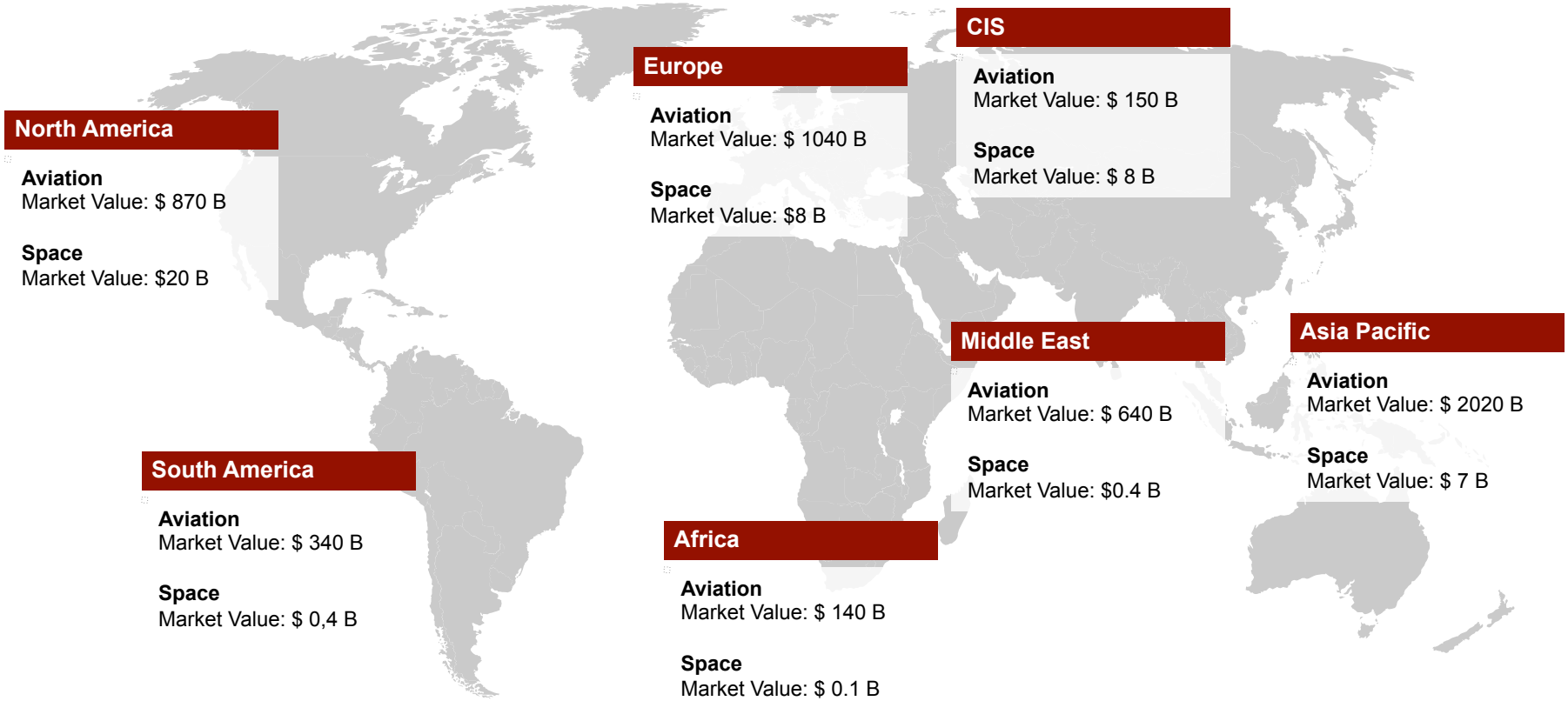
# Global Market Outlooks

Aviation and space annual market sizes in different world regions. The values of the market are not intended to be used as exact measures but rather give a sense of their relative size. The aviation market was based on Boeing forecasts while the space market was estimated using national space agencies

## Key Indicators







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# Long term trends in Aerospace

## An exciting future for an exciting sector

### Aerospace Future Trends

**Commercially driven**
Whether it's the space market in the US, airline industry in Saudi Arabia or the General Aviation market in China, many sectors of aerospace have traditionally been heavily regulated and driven by government orders. Although it will be a progressive multi-decade long process, these markets will open up to competition. This will put a downward pressure on prices that should ultimately benefit consumers. In the launcher market for example, SpaceX should ultimately allow launches at a fraction of the current market price.

**Balanced outsourcing**
The delays of the 787 have revealed that excessive outsourcing can lead to a loss of control from the OEMs and dangerous knowledge transfer to the supply chain. Boeing reversed the trend in 2009 when it regained control of critical aircraft part manufacturing and assembly, for example by buying Alenia's stake in a fuselage assembly plant.

**Unmanned Aerial Vehicles**
UAVs have many advantages that suggest that they might be used widely in the future. In the military world for which most were developed, they allow to perform a range of operations without risking human lives.
One of the most active players that could open up a huge market for them is Amazon. Automated delivery of light parcels could create a need for millions of drones instantly.
Additionally, search and rescue operations as well as border patrol also have potential.
There remains a number of regulatory hurdles that need to be overcome. The FAA is looking into the legal framework that would need to be put in place to allow such operations. What happens when a car crashes into an Amazon drone? How are liabilities established?

**Connectivity**
O3B, which stands for "Other Three Billion" is a project to increase the internet connectivity to pretty much anyone in the world. It is backed by companies like Google who hope to increase their advertising revenues on their platform.

**Pseudo-satellites**
The technical challenges of space exploration have forced some investors to lower their sights in terms of altitude and develop High Altitude Pseudo-Satellites (HAPS).
These come in the form of unmanned, ultralight, solar-powered aircrafts that are designed to hover indefinitely over the same region of the world.
HAPS could fulfill missions such as earth observation and communication.
Airbus has developed a system called *Zephyr* that weighs 50 kilograms and has a 23-meter wingspan.

**Space tourism**
According to the FAA Aerospace forecast years 2013-2033, about 8,000 high net worth individuals from across the globe are sufficiently interested and have a spending pattern likely to result in the purchase of a sub-orbital flight. Assuming a $200K ticket, this would correspond to a $1.6 Billion for the coming two decades.

# 6 References




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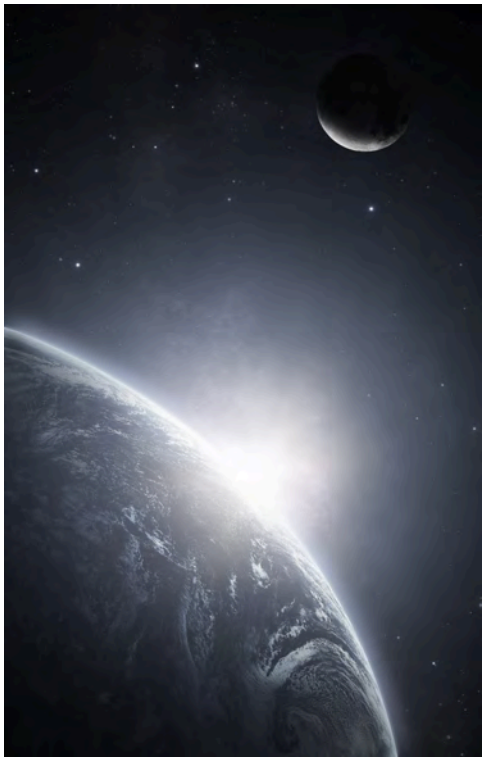
# References

Here is a list of references used to support the arguments presented in this report.

## References


- Global Market Forecast (2013). *Future Journeys 2013 2032*. : Airbus.
- Tinseth, Randy (July 2014). *Current Market Outlook 2014* : Boeing.
- Aboulafia, Richard (January 2014). *World Aircraft Overview,* Teal Group.
- The Airline Monitor (April 204). *A review of trends in the airline and commercial jet aircraft industries,* ESG Aviation Services.
- Poponak, N. et al. (June 2014). *When 1 billion Chinese fly, volume IV*: Goldman Sachs Aerospace and Defense Equity Research
- Federal Aviation Administration (2013). *FAA Aerospace Forecast Fiscal Years 2013- 2033*
- General Aviation Manufacturers Association (2014). *2013 General Aviation Statistical Databook & 2014 Industry Outlook.*
- IATA (2013). *Air Passenger Market Analysis December 2013.*
- Hansman, John (2010). *Airline Industry Trend Update,* MIT ICAT.
- 2014 Global Aerospace and Defense Industry Outlook (2014). *Expect another record year for commercial aerospace and continued declines in defense:* Deloitte.
- Bombardier Aerospace (June 2013). *Market Forecast 2013-2032:* Bombardier.
- Sampathkumar, A (July 2014). *Commercial Spaceflight Industry, Reusable Launch Vehicles & Additive Manufacturing,* Sullivan & Frost
- Colins, P. *The Coming Space Industry Revolution and its potential global Impact.*

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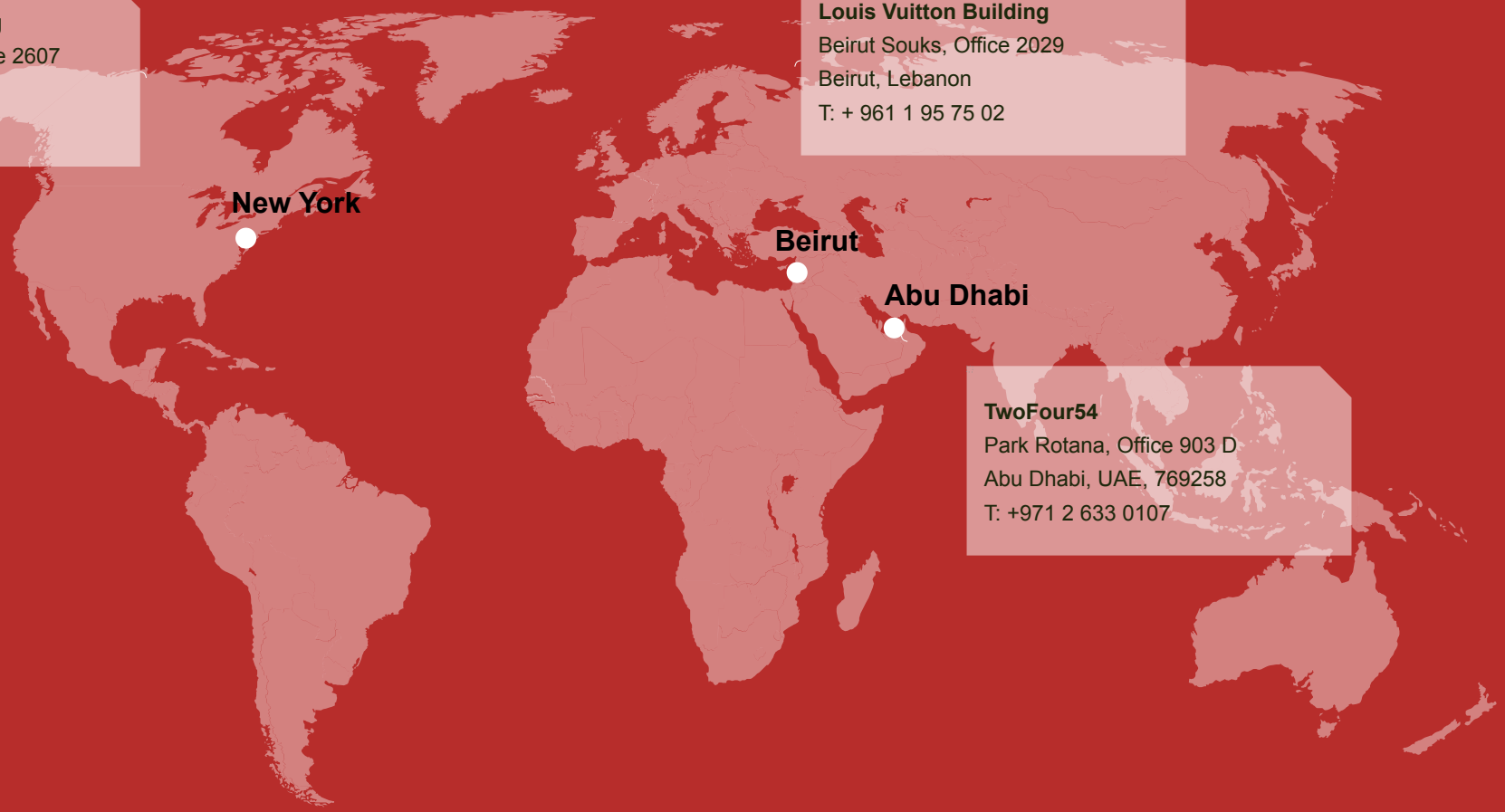


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