

AVIATION BENEFITS BEYOND BORDERS



POWERING GLOBAL ECONOMIC GROWTH,
EMPLOYMENT, TRADE LINKS, TOURISM AND
SUPPORT FOR SUSTAINABLE DEVELOPMENT
THROUGH AIR TRANSPORT



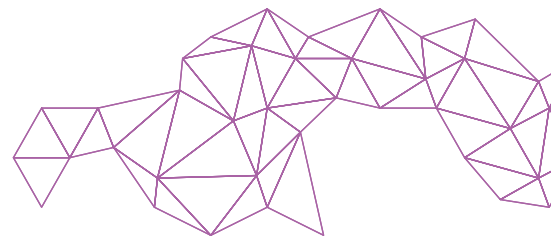
The air transport industry is the global network of commercial aircraft operators, airports, air navigation service providers and the manufacturers of aircraft and their components. It is responsible for connecting the global economy, providing millions of jobs and making the modern globally-connected quality of life possible. The Air Transport Action Group (ATAG), based in Geneva, Switzerland, represents the full spectrum of this global business. ATAG brings the industry together to form a strategic perspective on commercial aviation's sustainable development and the role that air transport can play in supporting the sustainability of other sectors of the economy.

ATAG's Funding Members include: Airports Council International (ACI), Airbus, ATR, Boeing, Bombardier, Civil Air Navigation Services Organisation (CANSO), CFM International, Embraer, GE Aviation, Honeywell Aerospace, International Air Transport Association (IATA), Pratt & Whitney, Rolls-Royce and Safran.

www.atag.org

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CONTENTS



Introduction	2
Executive summary and key facts	3
A global industry: Aviation's economic, social and environmental impacts in 2014	11
Regional and group analysis	39
Africa	40
Asia-Pacific	42
Europe	44
Latin America and the Caribbean	46
Middle East	48
North America	50
APEC economies	52
European Union	53
Small island states	54
Developing countries	55
OECD countries	56
Special case study: Making it in India: How the commercial aerospace sector is helping invigorate the Indian economy	57
National analysis: A country-by-country look at aviation's benefits	61
A growth industry: An assessment of the next 20 years of aviation	65
Essay: Shaping the millennials. How access to democratised air transport has shaped a generation by Peter Jordan	69
References	72
Methodology	76



INTRODUCTION

Finding our balance



Michael Gill
Executive Director, ATAG
Geneva, July 2016

The year 2015 was momentous for multilateral policymaking in the sustainable development field. Two international agreements – one on sustainable development and the other on climate change – were debated, negotiated and adopted. Both agreements provide a long-term vision of how the world can unite to solve some of its greatest challenges: poverty, health, education and environmental considerations all taking a positive and, in many cases, interdependent path.

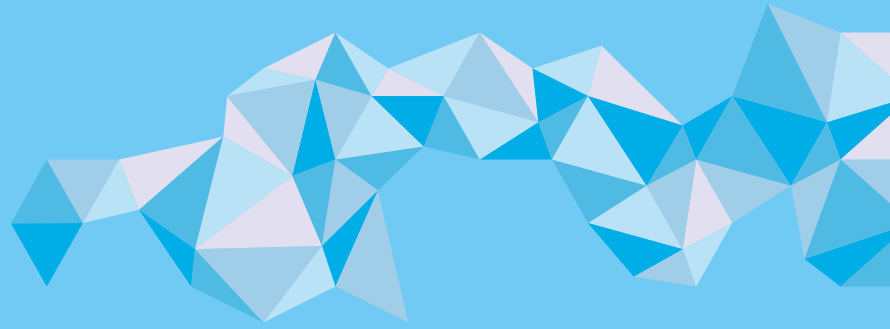
Sometimes it is hard to see how these lofty and all-encompassing frameworks truly influence individual citizens' lives or how we can each contribute to their success. In this 2016 edition of *Aviation: Benefits Beyond Borders*, we look at the role that can be played by a sector such as aviation, which is such a vital conduit for bringing the citizens and businesses of the world together. This report explores the role modern air transport plays in supporting the global economy and connectivity through the prism of the sustainable development goals.

It is a role that the women and men across the industry play in helping to achieve some of the objectives that governments have set out through these United Nations processes. In doing so, we are always mindful of the key

issue of our time: balance. We must balance the need to grow the service we provide, connecting more people and more places, more often – particularly in emerging and developing economies – with the need to reduce our environmental impact. It's a challenging task, but history has shown that it is a task to which our colleagues throughout the industry are committed... and they are already achieving a great deal.

If 2015 was for the Sustainable Development Goals and the Paris Agreement, 2016 is 'our' year for multilateral action. Two significant decisions at the International Civil Aviation Organization (ICAO) will help drive our climate plan forward and prove that collaborative action, done with respect for the differences inherent in the global community, does pay off.

It is noteworthy that the aviation industry has played a major role in making the CO₂ Standard and the global market-based measure at ICAO a reality. We are a sector that likes to think long-term and work together on challenges. We provide a responsible and balanced outlook and the ten million people who work in aviation can be proud of what we achieve, daily, annually, and what we will achieve for decades to come.



Executive Summary

Key facts and figures from
the world of air transport



EXECUTIVE SUMMARY

Key facts and figures from the world of air transport

All figures are for 2014, unless otherwise stated, to give a single set of data for one year. Where available, the latest figures are also noted. These should be viewed as a snapshot of the aviation sector in 2014 and not as part of a trend. Although previous *Aviation: Benefits Beyond Borders* reports have used the same economic impact technique, differences in data sources available between years mean many of the annual reports are not directly comparable.

62.7 MILLION

Jobs supported by aviation worldwide¹

DIRECT JOBS

450,000

Airport operators³
(work for the airport operator)

5.5 MILLION

Other on-airport⁴
(retail, car rental, government agencies such as customs and immigration, freight forwarders and some catering)

2.7 MILLION

Airlines⁵
(flight and cabin crews, executives, ground services, check-in, training, maintenance staff)

1.1 MILLION

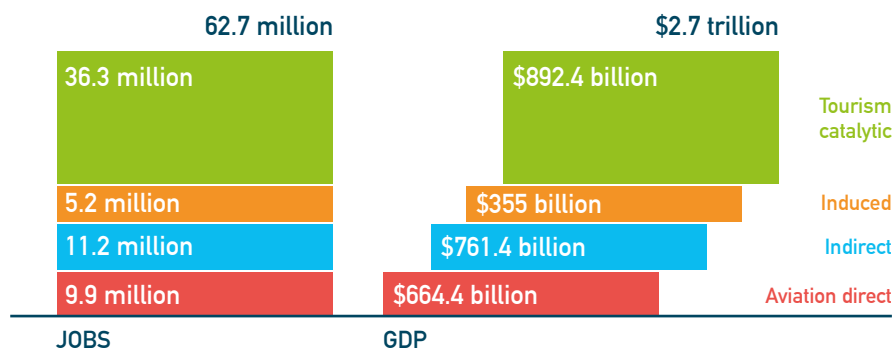
Civil aerospace⁶
(engineers and designers of civil aircraft, engines and components)

220,000

Air navigation service providers⁷
(air traffic controllers, executives)

Beyond the industry

Aviation's global employment and GDP impact, 2014²



\$2.7 TRILLION

Aviation's global economic impact (including direct, indirect, induced and tourism catalytic)⁸

3.5%

of global GDP supported by aviation⁹

21st

If aviation were a country, it would rank 21st in size by GDP (similar in size to Sweden or Switzerland)¹¹

3.8x

Aviation jobs are, on average, 3.8 times more productive than other jobs¹². By opening markets, enabling knowledge transfer and other catalytic effects, aviation also makes jobs in other sectors more productive

These figures represent a snapshot of the benefits that aviation activities deliver to the global economy. They do not include other economic benefits of aviation, such as the jobs or economic activity generated when companies or whole industries exist because air travel makes them possible. Neither do they include the intrinsic value that the speed and connectivity of air travel provides, nor domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold¹⁰.

51,554

Routes served globally in 2014¹³
(in 2015 the number was 52,964).
Of these, 17,370 unique city-pairs
are served

5,500+

Number of commercial flights
made using sustainable alternative fuel
expected by the end of 2016

3.3 BILLION

Passengers carried by airlines¹⁴
(in 2015, 3.57 billion passengers
were carried)

6.2 TRILLION

Kilometres flown by passengers
(in 2015, it was 6.7 trillion)¹⁷

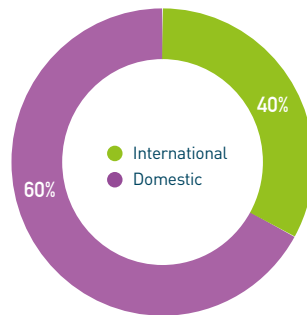
69.2 MILLION

Hours flown by all operations in 2014¹⁸

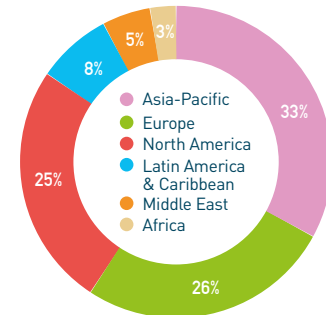
32.8 MILLION

Scheduled commercial flights worldwide¹⁵
(in 2015, there were 34.8 million flights).
Including non-scheduled and business
operations, there were 38 million aircraft
movements in 2014¹⁶

Going places
Global passenger split,
international / domestic, millions¹⁹



Asia-Pacific in front
Regional passenger traffic split²⁰



This report provides a global view of a truly global industry. Oxford Economics analysed the economic and social benefits of aviation at a national level in 60 countries and used the results of that assessment to build the most comprehensive global picture of air transport's many benefits. Working with partners across the industry, the Air Transport Action Group (ATAG) has expanded the analysis to build a unique view of the air transport system that provides jobs, trade, connectivity, tourism, vital lifelines for many remote communities and rapid disaster response.

Every day...

- » **9.8 million** passengers
- » **104,000** flights
- » **\$17.5 billion** worth of goods carried⁴³

Air transport is a major contributor to global economic prosperity

Aviation provides the only rapid worldwide transportation network, which makes it essential for global business and tourism. It plays a vital role in facilitating economic growth, particularly in developing countries.

Airlines transport around three and a half billion passengers annually with revenue passenger kilometres totalling over six trillion in 2014.

Over 50 million tonnes of freight were carried by air in 2014, amounting to just under 786 billion freight tonne kilometres.

Air transport facilitates world trade, helping countries contribute to the global economy by increasing access to international markets and allowing globalisation of production. The total

value of goods transported by air, \$6.4 trillion, represents 35% of all international trade.

Aviation is indispensable for tourism, a major engine of economic growth, particularly in developing economies. Globally, 54% of international tourists travel by air⁴⁴.

Connectivity contributes to improved productivity by encouraging investment and innovation; improving business operations and efficiency; and allowing companies to attract high quality employees.

Aviation's global economic impact (direct, indirect, induced and tourism catalytic) is estimated at \$2.7 trillion, equivalent to 3.5% of world gross domestic product (GDP)⁴⁵.

These figures do not include other economic benefits of aviation, such as the



1,402

Commercial airlines²¹

173

Air navigation service providers²⁴

3,883

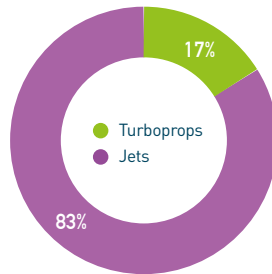
Airports with scheduled commercial flights²²

(there are 41,788 airfields in the world, including military and general aviation²³)

26,065

Commercial aircraft in service²⁵

Jetting-off
Aircraft in commercial service, by type 2014²⁶



jobs or economic activity that occur when companies or industries exist because air travel makes them possible, the intrinsic value that the speed and connectivity of air travel provides, or domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold.

Around 1,400 airlines operate a total fleet of over 26,000 aircraft. They serve almost 4,000 airports through a route network of several million kilometres managed by 173 air navigation service providers.

Air transport is a major global employer

The air transport industry supports a total of 62.7 million jobs globally⁴⁶.

It provides 9.9 million direct jobs: airlines, air navigation service providers and airports directly employ over three million people and the civil aerospace sector (the manufacture of aircraft systems, frames and engines) employs

1.1 million people. A further 5.5 million work in other on-airport positions.

There are 11.2 million indirect jobs generated through purchases of goods and services from companies in its supply chain.

Industry employees support 5.2 million induced jobs through spending of wages. Aviation-enabled tourism generates around 36.3 million jobs globally.

Air transport invests substantially in vital infrastructure

Unlike other transport modes, the air transport industry pays for a vast majority of its own infrastructure costs (runways, airport terminals, air traffic control), rather than being financed through taxation and public investment or subsidy (as is typically the case for road and railways).

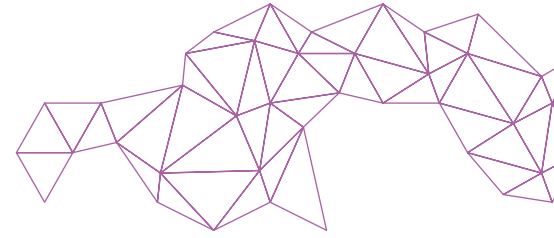
In 2014, airports invested \$37 billion in construction projects, creating jobs and building new infrastructure.

The benefits to society of research and development spending by the aerospace industry are estimated to be much higher than in manufacturing as a whole. Every \$100 million of spending on research eventually generates additional GDP benefits of \$70 million, year after year.

Air transport provides significant social benefits

Air transport contributes to sustainable development. By facilitating tourism and trade, it generates economic growth, provides jobs, improves living standards, alleviates poverty and increases revenues from taxes.

The increase in cross-border travel is a reflection of the closer relationships developing between countries, both between individuals and at state level. In the same way, eased restrictions on the movement of goods and people across borders facilitate the development of social and economic networks that will have long-lasting effects.



739 MILLION

Tonnes of carbon dioxide (CO₂) emitted by airlines

(in 2015, it was 781 million tonnes²⁹. This is 2% of the global human emissions of 36 billion tonnes. Around 80% of aviation CO₂ is emitted from flights over 1,500 kilometres in length, for which there is no practical alternative form of transport

\$226 BILLION

Amount the world's airlines paid for fuel

(in 2015, it was \$181 billion)²⁸

278 BILLION

Litres of jet fuel used by commercial operators

This equates to 73.4 billion gallons, or around 222.4 million tonnes of Jet A-1²⁷ (in 2015, 294 billion litres was used)

This improved flow of people and goods benefits both the host and the originating countries, encouraging increased social and economic integration.

Air transport offers a vital lifeline to communities that lack adequate road or rail networks. In many remote communities and small islands, access to the rest of the world and to essential services such as health care is often only possible by air.

Aviation's speed and reliability are perhaps most immediately apparent in the delivery of urgently needed assistance during emergencies caused by natural disaster, famine and war. Air services are particularly important in situations where physical access is problematic.

Air transport is working to mitigate its environmental impact

Airline operations produced 739 million tonnes of carbon dioxide (CO₂) in 2014 (and 781 million tonnes in 2015), just under 2% of

CLIMATE TARGETS

Improve 1.5%

Aviation will improve its fleet fuel efficiency by an average of 1.5% per annum between 2009 and 2020, a figure the industry is currently exceeding

Stabilise

From 2020, net carbon emissions from aviation will be capped through carbon-neutral growth

Reduce 50%

By 2050, net aviation carbon emissions will be half of what they were in 2005

the total human carbon emissions of over 36 billion tonnes.

The aviation industry agreed in 2008 to the world's first set of sector-specific climate change targets. The industry is already delivering on the first target to continue to improve fleet fuel efficiency by 1.5% per year until 2020. From 2020, aviation will cap its net carbon emissions while continuing to grow to meet the needs of passengers and economies.

By 2050, the industry has committed to reduce its net carbon footprint to half of what it was in 2005.

Companies across the sector are collaborating to reduce emissions using a four-pillar strategy of new technology, efficient operations, improved infrastructure and a global market-based measure to fill the remaining emissions gap.

Modern jet aircraft are 75% quieter than the models that first entered into service and each new generation of aircraft continues this downward trend.

30%

Percentage of global airspace covered by automatic dependence surveillance - broadcast (ADS-B),

which is a satellite-based navigation system allowing tracking of aircraft using a network of stations on the ground, working in conjunction with orbiting satellites. Coverage continues to grow and the technology fosters increased efficiency of aircraft operations³²

By the end of 2016, it is expected that 5,500 passenger flights operating partially on sustainable aviation biofuels will have taken place. It is also expected that shifting to alternative aviation fuels could reduce CO₂ by as much as 80%, compared with traditional jet fuel.

Air transport will continue to provide jobs

Forecasts suggest that, in 2034, there will be over 5.8 billion passengers⁴⁷ and aviation will support 99 million jobs and \$5.9 trillion in economic activity (a 122% increase on 2014 figures)⁴⁸.

However, if growth were to slow by just 1%, the total number of jobs supported by the air transport sector (including air transport supported tourism) would be more than 10.5 million lower than the base forecasts and the contribution of the air transport sector to world GDP would be \$690 billion (2014 prices) lower, with an additional \$350 billion lost through lower tourism activity.

ENVIRONMENTAL PROGRESS

The air transport industry has made significant progress in reducing its environmental impact:

CO₂ emissions per seat kilometre

▼ 80%+ since first jet aircraft

Perceived noise

▼ 75%+ since first jets

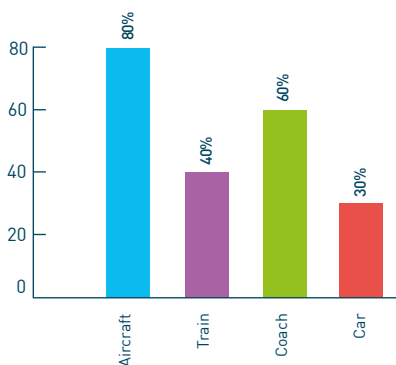
- » Currently surpassing the first goal, with an average annual fuel efficiency of 2.4% achieved across the fleet between 2009 and 2014
- » Over nine billion tonnes of CO₂ avoided since 1990 through a combination of new technology, operational efficiencies and infrastructural improvements, including airlines spending \$3 trillion on over 25,000 new aircraft³⁰
- » The industry has invested in new technology, better operations and infrastructure improvements
- » Civil aerospace spends \$15 billion per year on efficiency-related R&D
- » Sustainable aviation fuels could reduce the sector's CO₂ footprint by as much as 80%. It is expected that 5,500 commercial flights will have taken place using a blend of alternative fuel by the end of 2016³¹
- » Air traffic management modernisation could save millions of tonnes of CO₂

80%

Average aircraft occupancy³³, much higher than other forms of transport

High occupancy

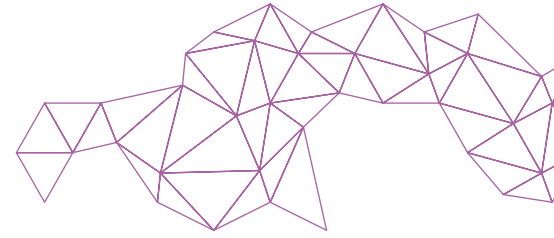
Airlines utilise more of their seats than other modes³⁴



Landing zone

Top 10 airports by passenger movements, millions, 2014⁴¹

RANK	AIRPORT	PASSENGERS	CHANGE
1	Hartsfield-Jackson Atlanta International Airport	96.2	▲ 1.9%
2	Beijing Capital International Airport	86.1	▲ 2.9%
3	Heathrow Airport	73.4	▲ 1.4%
4	Haneda Airport	72.8	▲ 5.7%
5	Los Angeles International Airport	70.6	▲ 6.0%
6	Dubai International Airport	70.4	▲ 6.1%
7	O'Hare International Airport	69.9	▲ 4.5%
8	Charles de Gaulle Airport	63.8	▲ 2.8%
9	Dallas Fort Worth International Airport	63.5	▲ 5.1%
10	Hong Kong International Airport	63.1	▲ 5.9%



35%

Air transport carries around 35% of world trade by value and less than 1% by volume³⁵

\$6.4 TRILLION

Value of cargo handled by air in 2014³⁸

786 BILLION

Scheduled freight tonne kilometres³⁹

High value, time sensitive

Proportion of global trade transported by air³⁶

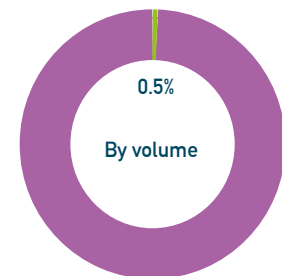
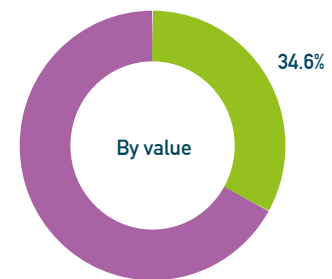


54%

of international tourists travel by air⁴⁰

50.4 MILLION

Tonnes of freight handled by air in 2014 (in 2015, it was 51.2 million tonnes)³⁷



Long haulage

Top 10 airports by cargo tonnes, 2014⁴²



RANK	AIRPORT	TOTAL CARGO	CHANGE
1	Hong Kong International Airport	4,415,983	▲ 6.0%
2	Memphis International Airport	4,258,531	▲ 2.9%
3	Shanghai Pudong International Airport	3,181,654	▲ 8.6%
4	Incheon International Airport	2,557,681	▲ 3.8%
5	Ted Stevens Anchorage International Airport	2,492,754	▲ 3.0%
6	Dubai International Airport	2,367,574	▼ -3.1%
7	Louisville International Airport	2,293,231	▲ 3.5%
8	Narita Airport	2,133,542	▲ 5.6%
9	Frankfurt Airport	2,131,976	▲ 1.8%
10	Taoyuan International Airport (Taipei)	2,088,727	▲ 6.2%

Aviation and the Sustainable Development Goals

Some of the ways in which aviation helps achieve the Sustainable Development Goals



1. NO POVERTY

Aviation directly creates jobs in the industry, as well as other sectors indirectly, providing 62.7 million people worldwide with their livelihoods.



2. ZERO HUNGER

Aviation supports the delivery of vital humanitarian aid to areas devastated by natural disasters and war, both through the World Food Programme and other charities. In 2014, more than 70,000 tonnes of food and commodities were delivered by air to relieve victims of floods, conflict and disease.



3. GOOD HEALTH AND WELL-BEING

Aviation assists with providing vital medical care through the use of air ambulances in remote communities and transporting time-sensitive medical supplies, such as vaccines. Aviation also plays a major role in disaster relief.



4. QUALITY EDUCATION

Aviation enables the movement of students worldwide, providing access to educational opportunities. The industry itself also champions quality education for its own employees in areas such as engineering, air traffic management and pilot training. The manufacturing sector, in particular is also working hard to promote education in science, technology, engineering and maths.



5. GENDER EQUALITY

Aviation is working to achieve gender balance in all sectors. In Europe, aviation is the most gender-balanced of all transport sectors. Work is still needed to encourage balance in technical areas such as engineering and flight crew.



7. AFFORDABLE AND CLEAN ENERGY

The aviation industry is working to develop cleaner sustainable alternative fuels, as well as deploying renewable energy at airports. By the end of 2016, it is expected that 5,500 flights will have taken place using sustainable alternative fuels.



8. DECENT WORK AND ECONOMIC GROWTH

As well as providing employment opportunities, aviation contributes \$2.7 trillion to global GDP, 3.5% of the global total. In 2014, \$6.4 trillion worth of cargo was transported by air.



9. INDUSTRY, INNOVATION AND INFRASTRUCTURE

Aviation is one of the most innovative industries in the world. The manufacturing sector is continually developing new technology and creates significant urban infrastructure through the building of airports, as well as navigational infrastructure. In 2014, airports invested \$37 billion in construction projects, creating jobs and building new infrastructure.



10. REDUCED INEQUALITIES

The connectivity provided by air transport reduces inequality by creating trade links and providing access to goods and services for those in remote communities. The democratisation of air travel has also meant air services are available to more people than ever. Since 1970, the real cost of air travel has been reduced by over 60%.



11. SUSTAINABLE CITIES AND COMMUNITIES

Aviation-related infrastructure is a major part of urban and rural communities worldwide and contributes to the connectivity of populations through integrated transport links. More work is needed on multimodal transport development.



12. RESPONSIBLE CONSUMPTION AND PRODUCTION

Airlines and manufacturers work closely together to dispose of aircraft at their end-of-life responsibly. In recent years, the industry has also been working to develop sustainable alternative fuel feedstocks that avoid some of the issues present in previous bioenergy projects.



13. CLIMATE ACTION

All sectors of the aviation industry have agreed on a four-pillar strategy for reducing CO₂ emissions and are making excellent progress working towards three global climate goals.



15. LIFE ON LAND

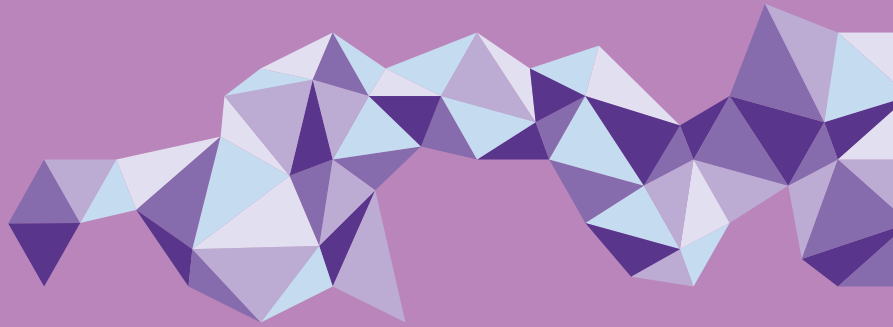
Aviation is working with partners in government and conservation organisations to combat the illegal wildlife trade.



17. PARTNERSHIPS FOR THE GOALS

Partnerships between all sectors of the aviation industry enable the global air transport industry to operate: airports, airlines, air traffic management, manufacturers and suppliers. The industry also partners with the United Nations (mainly through the International Civil Aviation Organization) and governments to cooperate on climate action.

To find out more about the Sustainable Development Goals, visit: sustainabledevelopment.un.org
The SDGs listed above are those that are pertinent to aviation.



A global industry, supporting the Sustainable Development Goals

Aviation's global economic, social
and environmental profile in 2014



A GLOBAL INDUSTRY

Aviation's global economic, social and environmental profile in 2014

THE GLOBAL AIR TRANSPORT INDUSTRY SUPPORTS NEARLY 63 MILLION JOBS WORLDWIDE AND CONTRIBUTES \$2.7 TRILLION (3.5%) TO GLOBAL GDP

In September 2015, world leaders gathered at the United Nations to adopt the 2030 Agenda for Sustainable Development. This Agenda set a number of goals that the world should aim to achieve by 2030. These Sustainable Development Goals (SDGs) supersede the Millennium Development Goals and are intended to address the root causes of poverty and the universal need for development. A number of the 17 SDGs are based on improving the living conditions and economic prosperity of people all over the globe. The SDGs are backed up by around 170 statistical indicators.

To realise these ambitious goals, the international community must work towards shared economic growth, creating jobs and boosting economic activity worldwide. Aviation, as a global transport sector, can play an instrumental role in supporting this task.

Throughout this document you will see a number of icons which relate to the SDGs shown here. This shows how aviation can help achieve the goals.



ENABLING ECONOMIC GROWTH

Direct impacts

The industry itself is a source of considerable economic activity, creating jobs that directly serve passengers at airlines, airports and air navigation service providers (ANSPs). These include check-in, baggage handling, on-site retail, cargo and catering facilities. However, aviation also directly enables jobs in the manufacturing sector, those companies that produce aircraft, engines and other vital technologies.

The world's 1,402 airlines collectively transported 3.3 billion passengers to destinations all over the globe in 2014 and carried 50.4 million tonnes worth of freight. To enable this activity, the industry generated 9.9 million direct jobs and added \$664.4 trillion to global gross domestic product (GDP) (3.4% of the total). This is larger than the automotive industry, which accounts for 1.2% of global GDP and chemicals manufacturing (2.1%). It is more than half the size of the global financial services industry, which accounts for 6.2% of GDP⁴⁹.

In 2014, the air transport industry supported an estimated 9.9 million jobs worldwide:

- » 2.7 million of these jobs (27% of the total) were provided by airlines (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » The airport sector accounted for 5.95 million jobs (60% of the total). Of these, 450,000 positions were with airport operators (such as airport management, maintenance and operations). On-site employment (for example at retail outlets, restaurants, hotels, government agencies) created an extra 5.5 million jobs or 55% of the total.
- » In the manufacturing sector, 1.1 million jobs (11%) were supported, employing people in the building of civil aircraft and their associated parts, such as engines, electronic systems or components.

» Air navigation service providers employed an additional 220,000 people (2%).

Growth in traffic at airports also brings growth in the direct jobs generated. It has long been estimated that each million passenger movements at an airport generate around 1,000 jobs and recent analysis seems to support this theory. In Europe, the direct employment generated by increased traffic was studied in different bands of airport size and found that, for airports with fewer than one million passengers, each increase of 1,000 passenger movements increases direct employment by 1.2 jobs⁵¹. This impact reduces slightly as airports grow (presumably due to efficiencies of scale). It is important to note that this only relates to direct jobs at an airport and not the wider employment and economic benefits of connectivity growth across the economy (or even in indirect and induced employment).



Mexican waves



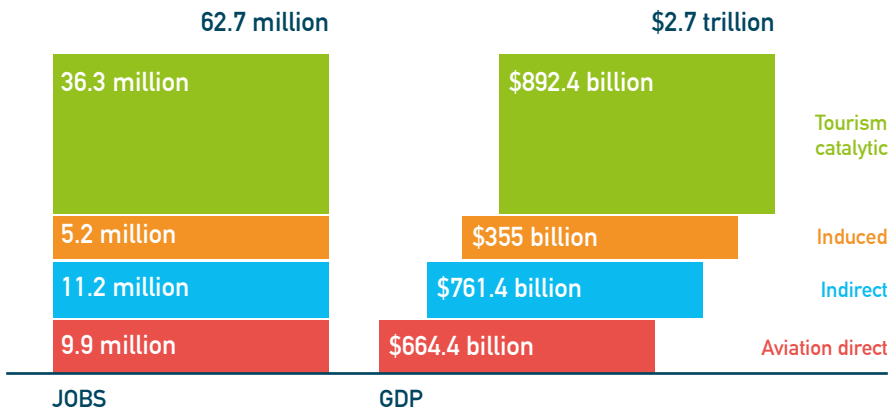
French aerospace manufacturer, Safran, has been operating in Mexico for over 20 years. Historically, the aim of its operations in the country has been to provide local support for customers in the region and to engage in the market. Today, Safran has ten industrial facilities in Mexico, with close to 6,000 employees, making it the country's leading aerospace employer. Over the last decade, Safran has invested more than \$1 billion in Mexico.

To accommodate its manufacturing activities through CFM International, a joint undertaking of the French company (via its subsidiary Safran Aircraft Engines) alongside the American GE Aviation, Safran announced in February 2016 the creation of a new facility in Querétaro. This facility will employ nearly 500 people and be dedicated to the production of composite parts for the LEAP engine, which will power the Boeing 737MAX, the Airbus A320neo and the Comac C919.

At the plant, Safran employees will begin producing fan blades made of 3D woven composites towards the end of 2017. Production volumes are forecast to rise sharply the following year, reaching an annual rate of over 20,000 blades in 2021.

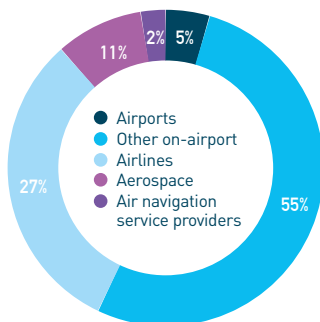
Beyond the industry

Aviation's global employment and GDP impact, 2014²



What we do

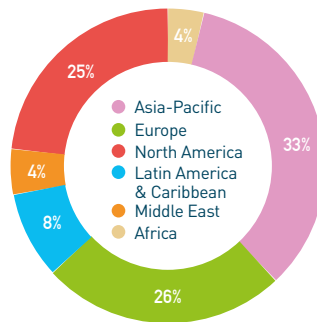
Direct employment by air transport by segment, 2014⁵⁰



The economic impact of the aviation industry does, however, go further than just its direct impacts. The consequential economic benefits of both additional jobs and GDP should also be considered. These benefits demonstrate at least partially the breadth of air transport's economic reach.

Where we work

Direct employment by air transport by region, 2014⁵⁴



Growing in tandem

How a growth in passenger numbers helps support a growth in direct employment⁵²

Airport size	Each 1,000 passenger movements generates
0 – 1 million passengers	+1.2 jobs
1 – 10 million passengers	+0.95 jobs
Over 10 million passengers	+0.85 jobs



Investing in R&D in Canada



Pratt & Whitney, the US-based technology company specialising in jet engine manufacturing, has been branching out its operations abroad, bringing with it significant investment and job creation benefits. As well as ventures in India and Singapore, Pratt & Whitney has recently made a substantial investment in Canada.

An arm of the United Technologies Corporation, Pratt & Whitney is known for innovation. Its recent jet engine, the Geared Turbofan, uses a novel gear system design and contains state-of-the-art composite materials.

At the end of 2014, Pratt & Whitney announced a major investment of \$1 billion in research and development at its Longueuil (Quebec) and Mississauga (Ontario) facilities over four and a half years, which will be mainly directed towards work on the company's next generation 'PurePower' engine family, to which the Geared Turbofan belongs.

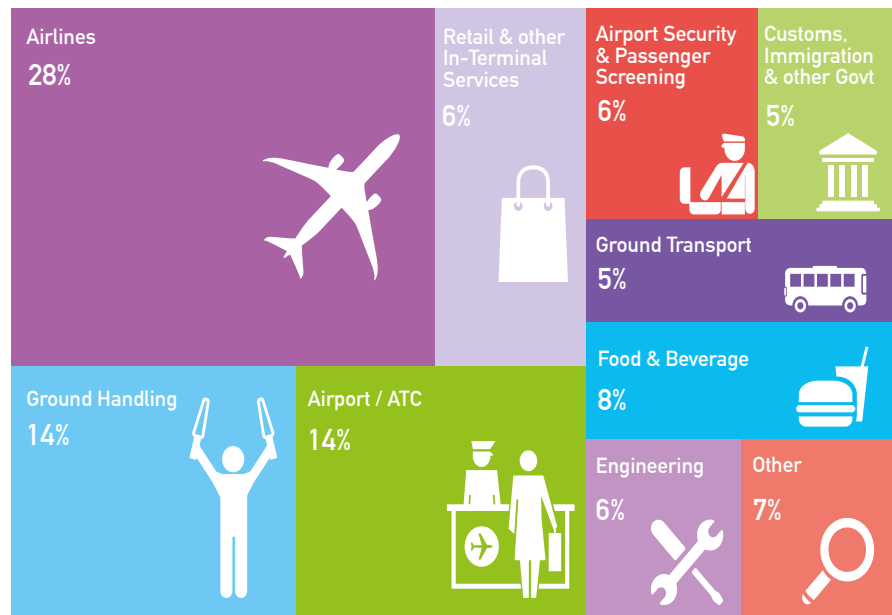
The Canadian government saw the value in scaling up Pratt & Whitney's R&D activities in the country and committed to supplement its investment with a \$300 million repayable contribution. Not only will the deal result in 6,000 high-quality direct jobs, but it will also have consequential economic benefits for the areas surrounding the R&D sites.

Pratt & Whitney's Canada branch also focuses on developing skills through its partnership with 20 Canadian universities, which funds over 200 research projects.

This investment is a prime example of the global nature of the aviation industry, and shows why increased investment is a crucial aspect of the SDGs.

On the ground

A quick look at the types of jobs at a typical European airport⁵³



Indirect impacts

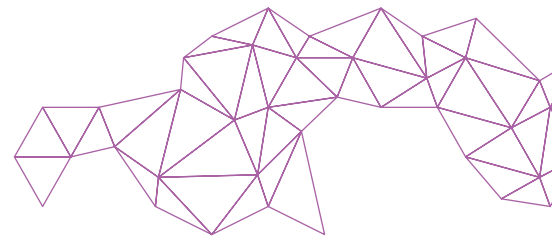
These include employment and activities of suppliers to the air transport industry - for example, aviation fuel suppliers; construction companies that build airport facilities; suppliers of sub-components used in aircraft; manufacturers of goods sold in airport retail outlets; and a wide variety of activities in the business services sector (such as call centres, information technology and accountancy).

Over 11 million indirect jobs globally are supported through the purchase of goods and services by companies in the air transport industry. These indirect jobs contributed approximately \$761 billion to global economic activity in 2014.

Induced impacts

The spending of those directly or indirectly employed in the air transport sector supports additional jobs in industries such as retail outlets, companies producing consumer goods and a range of service industries (such as banks, telecommunication providers and restaurants). Worldwide, over five million induced jobs globally are supported through employees in the air transport industry (whether direct or indirect) using their income to purchase goods and services for their own consumption.

The induced contribution to global economic activity is estimated at \$355 billion in 2014.



Supporting wider economic development



Whilst this report has explored the direct, indirect and induced impacts of the global aviation industry, there is far more to air transport's economic impact. Many other industries rely on effective air links to function.

- » One of the industries that relies most heavily on aviation is tourism. Without the connectivity provided by flight, many countries that rely on a steady influx of tourists (particularly developing countries in regions remote from their source tourism markets) would not be able to enjoy the same level of economic growth.
- » World trade in a vast range of commodities and services is facilitated by air travel, increasing countries' access to international markets and allowing globalisation of production.
- » In the modern globalised world, countries need connectivity to fully participate in the worldwide economy, encouraging higher productivity, investment and innovation. It helps businesses operate more efficiently and attract high-quality employees.
- » Air transport plays an especially pivotal role in 'just-in-time' global manufacturing production and in speeding fresh produce from agricultural communities in developing economies to markets in the industrialised world.

The exact economic impact of these wider benefits is difficult to define, considering the complexity of the global economy. However, tourism effects are more easily assessed.

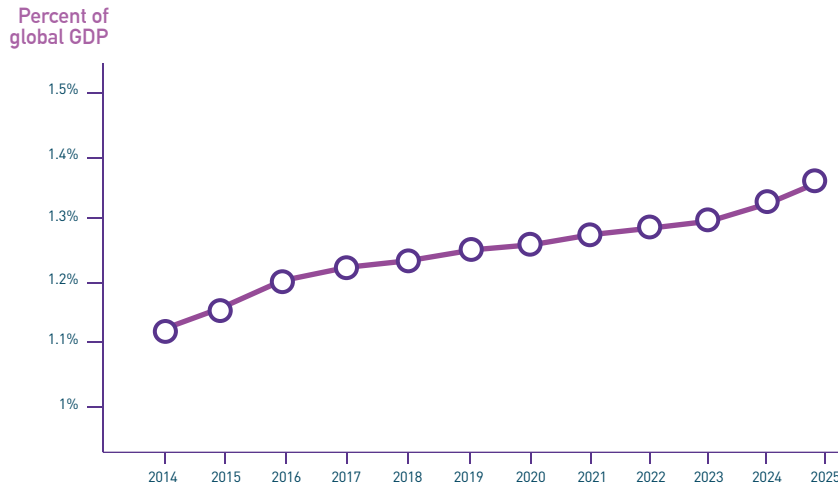
Since reliable data exists, the flow-on impacts and these economic links between the two industries are explored overleaf.



Onwards and upwards



Projected growth in tourism facilitated by aviation, contribution to global GDP, 2014-2025⁵⁸



Aviation supports tourism

Tourism represents a significant contribution to the worldwide economy, providing employment and boosting global economic activity. In 2014, tourism supported 277 million jobs and made up 9.8% of world GDP, a total of \$7.6 trillion⁵⁵. For example, these employment figures include the people who work for the world's 90,000 accredited travel agencies⁵⁶.

According to the World Travel & Tourism Council, the sector's recent strong short-term growth will continue into the future, with an average annual 3.7% growth expected up until 2025⁵⁷. If these predictions prove correct, by 2025 tourism should account for \$11.3 trillion in global GDP and provide 355 million jobs globally.

⊖ Tourism's growth, which is above the average of wider economic growth, is dependent on travel, particularly air transport. In 2014, 54% of international tourists travelled to their destination by air. For developing countries in particular, air links provide a vital economic lifeline to communities. In Africa, an estimated 5.8 million people are employed in areas

supported by the steady influx of overseas visitors, most of whom arrive in the region by air, and contributed \$46 billion to GDP in African economies in 2014⁶⁰.

For small island states, the economic input provided by international tourists is invaluable. These countries, many of which are in remote parts of the world, enjoy tourism-induced economic boosts which would not be available without air links.

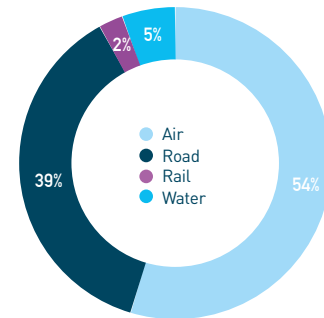
The contribution of air transport to tourism employment and GDP:

- » **Direct:** an estimated 15.9 million direct jobs in tourism globally are supported by the spending of foreign visitors arriving by air. This includes jobs in industries such as hotels, restaurants, visitor attractions, local transport and car rental, but it excludes air transport industry jobs.
- » **Indirect:** a further 13.4 million indirect jobs in industries supplying the tourism industry are supported by visitors arriving by air.

Getting you there



The travel modes of international tourists, 2014⁶¹



- » **Induced:** these direct and indirect tourism jobs supported by air transport generate a further seven million jobs in other parts of the economy, through employees spending their earnings on other goods and services.

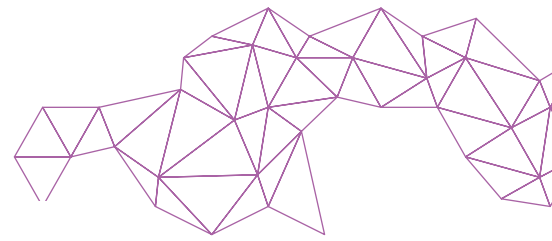
When these factors are viewed together, air transport supports over 36 million jobs within the tourism sector, contributing roughly \$892 billion a year to global GDP⁶².

A driver of global trade



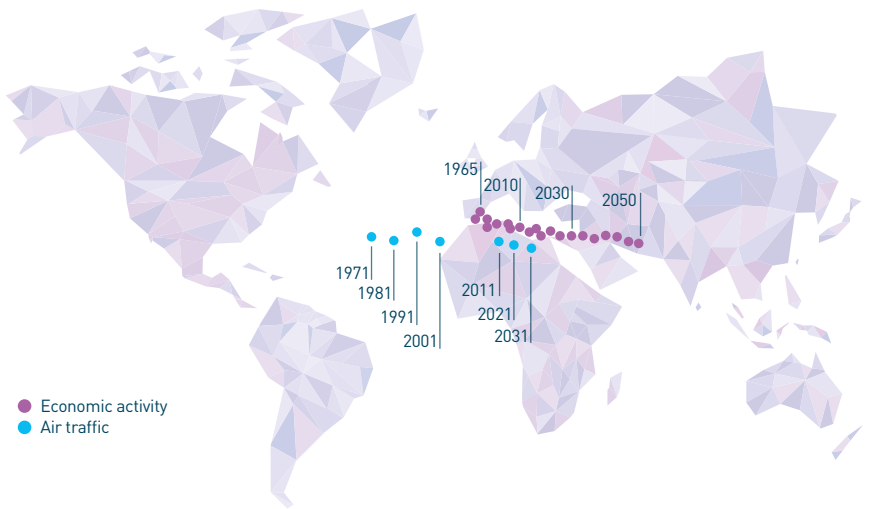
The international trade of goods and services is one of the key drivers of global economic growth and development. The ability of people and businesses to trade with others all over the world is one of the key features of our modern, globalised society. Alongside the internet and other transport modes, air transport is a vital enabler of the global economy.

While the last three years has seen an unusual slowing in the growth of world merchandise trade volume (since 2012, there has been an average growth in trade volume of 2.4%)⁶³,



Re-balance

Shift in geographic centre of gravity for economy and air transport¹⁸



**\$6.4 TRILLION
WORTH OF
GOODS WERE
TRANSPORTED
INTERNATIONALLY
BY AIR IN 2014**

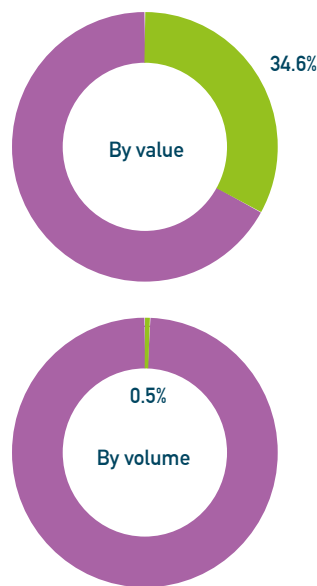
the longer-term picture of global trade has been markedly positive. Forecasts suggest that the volume of global trade will increase with greater, more widespread prosperity, as new markets open in the rapidly-developing economies of the world.

So-called 'south-south' connections in migration and trade are becoming increasingly important. In 2013, south-south migration made up 37% of the global movement of people, higher than south-north migration, which stood at 35%⁶⁴.

Air transport facilitates south-south trade. China-Africa, for example, is one of the world's fastest growing markets. China now represents roughly a quarter of Sub-Saharan Africa's trade, up from only 2.3% in 1985⁶⁵. This potential is recognised by Ethiopian Airlines, which has, in the last few years, been increasing traffic between its Addis Ababa hub and its four Chinese destinations and other Asian cities⁶⁶. The east African airline, by opening these routes, is well-placed to facilitate the growing investment partnerships between the two continents, based on the sharing of Asian agricultural expertise and Africa's untapped mineral resources⁶⁷.

Small volumes, big values

Air freight, as a proportion of global trade, by volume and by value, 2014⁷²



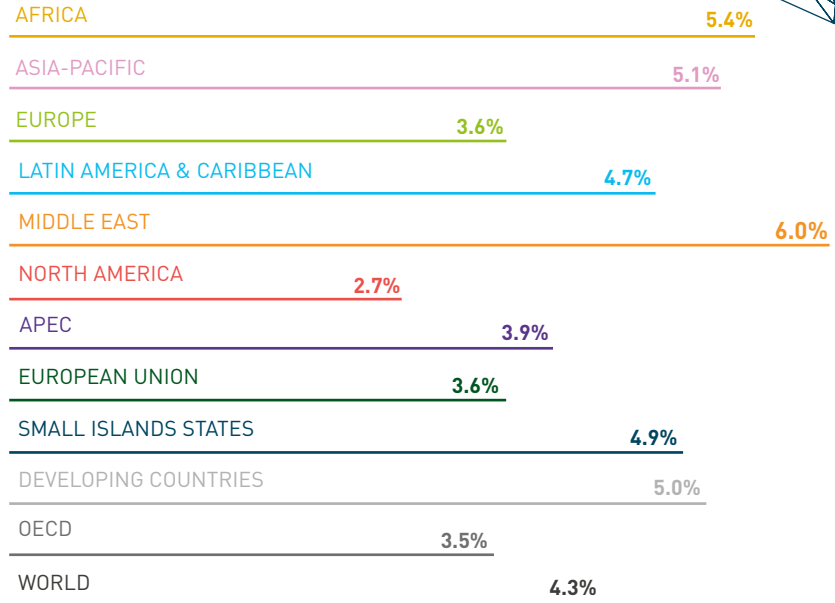
⊖ In December 2015, Qatar Airways opened a new route between Durban and Doha, flying between the cities four times a week. As one of South Africa's largest trading partners, Qatar's move makes commercial sense for both countries. According to Qatar Airways, trade between South Africa and Qatar stands at around \$500 million per year and the airline transports more than 5,000 tonnes of air cargo from South Africa each year.

The World Trade Organization (WTO) has, since 2005, been working towards the goals of the SDGs through supporting trade links in developing countries via the 'Aid for Trade' initiative. This programme, which works along the 'teach a man to fish' strategy of international development, has made good progress over the last decade. A joint OECD-WTO study indicated that \$1 invested in aid for trade is, on average, associated with an increase of nearly \$8 in exports from developing countries⁶⁸. To truly realise the potential of this initiative, research suggests that recipients and donor countries need to ease often restrictive regulatory arrangements in air transport⁶⁹.



Sustaining growth

Projected average annual growth rate for international traffic by region, 2014-2034⁷³



Air transport is, of course, not the only means of transporting goods over long distances, with shipping and road making up a larger proportion. The advantage of air freight is that it is fast and reliable, although it can be a more costly mode of transport, meaning that the majority of goods transported by air are light, compact, perishable and have a high unit value (see the case study on 'fast fashion', page 21, for one of the exceptions to this rule).

For time-sensitive global industries, such as those that require components produced in multiple parts of the world, air freight is the best way to ensure that their production lines run smoothly and efficiently.

In the last few years, driven by advances in internet commerce, a whole new sector of rapid delivery 'e-commerce' businesses have been established and have thrived, entirely based on the ability to move goods to consumers safely and quickly. Cargo carriers, such as DHL, UPS and FedEx, have benefited from the rise of e-commerce and the value of air transport in this sector was once again highlighted in 2016, when online retailer, Amazon, branched out its business by leasing 20 Boeing 767 freighters⁷⁰.



The pharmaceutical industry is one sector that relies heavily on air transport to move drugs and vaccines across long distances under strictly regulated storage conditions. In some cases, it is the perishable nature of the goods that requires swift transportation. In other situations, such as vaccines, it is the necessity of getting the products to the people who need them as quickly as possible⁷¹.

The specialist nature of air freight is highlighted by comparison to other modes of transport. While air freight accounts for less than 1% of the tonnage, it makes up around 35% of the value of international trade.

Bringing business partners together



The sharp increase in the level of telecommunication technology available has made meetings between business partners easier to undertake without travelling long distances in person. However, while these types of virtual meeting are useful in some situations, in many cases professionals feel that face-to-face meetings are far more productive. And of course, larger-scale

conferences are almost impossible without physically gathering in one place.

The personal relationships built up between representatives of companies are often considered to be an important part of business ties. A 2014 survey of 609 business leaders found that 56% of respondents were taking the same number of business trips as they had done five years previously⁷⁴. Another survey of 2,000 business people worldwide in 2013⁷⁵ found that nearly half of those who took part felt that they had lost a contract or client due to not having enough face-to-face meetings. It also found that 81% said face-to-face meetings are better for building long-term trust and ensuring strong client relationships⁷⁶.

This overwhelming preference was attributed to a number of factors, such as the perception that they built longer, more meaningful relationships and the ability to 'read' another person.



Boeing partners in the Middle East



The United Arab Emirates' aerospace sector has enjoyed significant growth in the past decade due to its favourable geographic location and, recently, through partnerships with leading aircraft manufacturers.

Strata is one such UAE-based company that has built partnerships in the aerospace sector. In the past two years, Strata has begun delivering advanced composite components for the Boeing 777 and Boeing 787 Dreamliner. In June 2015, Boeing delivered the first 787 Dreamliner that had incorporated advanced composite parts made by Strata.

Strata was the first major company to open in the Nibras Al Ain Aerospace Park, a joint venture between Mubadala Development Company and Abu Dhabi Airports Company. The aerospace hub, which covers an area of five square kilometres, was developed in line with the Abu Dhabi Economic Vision 2030 (a plan by the UAE government to work towards diversification) to support sustainable aviation and aerospace sectors. Nibras has helped to increase industrial and economic activity in Al Ain, and by 2030 business in Nibras is expected to create 10,000 new jobs.

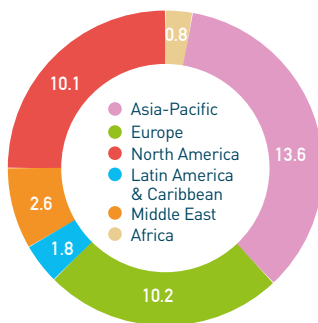
To help local Emiratis develop skills in aerospace and attract untapped talent, Strata set up the Learning, Training, and Development Department. This initiative has an open-door policy for all Emiratis seeking employment in the aerospace industry and provides technical training for all Emiratis, regardless of their age. Strata, in conjunction with Boeing, has also set up a specialised training programme for Emirati engineers.

Strata aims to achieve 'Emiratisation' by helping the local population to develop skills that benefit not only Strata itself, but the wider community as a whole.

Building the future



Airport infrastructure investment by region (billions), 2014⁷⁸



or subsidies. This is in stark contrast to other modes of transport, such as rail and road.

The investments made by the industry in developing its infrastructure, particularly on-airport, lead to further benefits for local communities, often providing the skilled labour for construction. Nearly \$37 billion was invested in airport infrastructure in 2014, with most of the investment taking place in Asia-Pacific⁷⁷.

Operational costs in aviation are funded through user charges (passengers and airlines) and airport commercial revenue. User charges are generally included in the price of the airline ticket or paid by passengers.

One criticism sometimes levelled at aviation is that it does not pay tax on international jet fuel and that this equates to a 'subsidy'. However, when you consider the costs of airport and air traffic management infrastructure, paid for by the industry, this is not a representative comparison with other modes of transport. In fact, when you consider the very real subsidies that other transport modes receive, often coupled with high fares, air transport is a cost-effective sector.

Fronting up the cash



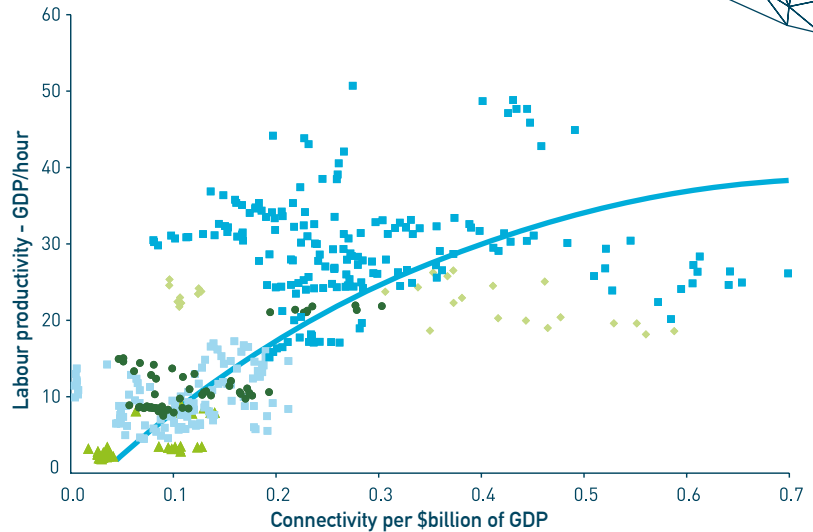
When you look at the array of air transport infrastructure around the world, such as airport terminals, runways and air traffic control, it is easy to forget that the vast majority is financed through its users. The aviation industry, on the whole, pays for this infrastructure itself, rather than relying on government investment



Working connections

Connectivity and labour productivity (excludes Cyprus, Hong Kong, Malta, Singapore), 2012⁸³

- ◆ Developed Asia
- North America and Western Europe
- ▲ Developing Asia and Africa
- Emerging Europe
- Transitioning Asia and South America



The road sector enjoys a high level of public investment in its infrastructure, even though road users in many locations pay fuel duties, vehicle excise charges and, in some cases, congestion charges and tolls. The rail sector, too, is often a beneficiary of high levels of public investment by national or regional governments. In Europe, for example, rail is heavily subsidised. According to the European Commission, rail subsidies in Europe totalled roughly \$30.5 (€25) billion in 2014⁷⁹. Meanwhile, aviation subsidies (primarily for public service obligation routes to remote communities and small islands) were in the order of \$556.5 (€455) million in the EU⁸⁰.

Stimulus for greater productivity

E Arguably, the largest economic benefit of increased connectivity comes through its impact on the long-term performance of the wider economy by enhancing the overall level of productivity. A rise in productivity in firms outside the aviation sector comes through two main channels: the effects on domestic firms of increased access to foreign markets and increased foreign competition in the home

market; and the freer movement of investment capital and workers between countries.

Improved connectivity:

- » opens up new markets, boosts exports and at the same time increases competition and choice in the home market from foreign-based producers, encouraging firms to specialise in areas where they possess a comparative advantage;
- » can drive down costs and prices for firms that have a comparative advantage (such as innovative products and services), benefiting domestic consumers in the process;
- » opens domestic markets to foreign competitors, which can also be an important driver for reducing unit production costs, either by forcing domestic firms to adopt best international practices in production and management methods or by encouraging innovation;
- » can benefit domestic customers through competition by reducing the mark-

up over cost that firms charge their customers, especially where domestic firms have hitherto enjoyed some shelter from competition.

Improved connectivity can further enhance an economy's performance by making it easier for firms to invest outside their home country, which is known as foreign direct investment. This necessarily entails some movement of staff: whether for technical know-how, management oversight, or servicing and meeting customers. Increased connectivity also allows firms to exploit the speed and reliability of air transport to ship components between plants in distant locations, without the need to hold expensive stocks of inventory as a buffer.

Less tangibly, but just as important, improved connectivity increases passenger traffic and trade. This, in turn, can lead to a more favourable environment in which foreign firms can operate – greater links to the outside world often drive a more conducive global business environment.



Fast fashion



In the world of fashion, trends can move quickly. More quickly than some people can keep up with! In such a competitive industry, having a high turnover of stock is essential. In the last few years, a new business model has developed in the fashion world, known as 'fast fashion'.

For most non-time-sensitive goods like fabric, transporting by air is often not economical. Typically, air freight is 4-5 times more expensive than road transport, and 12-16 times more than sea transport.

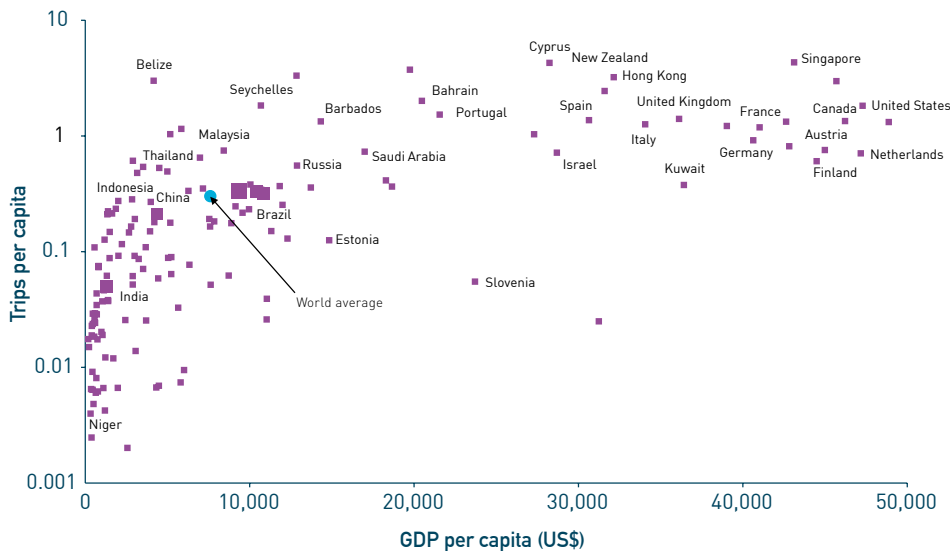
However, high street brands like H&M, Gap and Topshop are increasingly opting for air freight to ensure that they have the right items available on the shelves at the right time. In general, fast-fashion brands aim to renew their collections almost every week, making other forms of freight impossible. Crucially for the brands in question, the garments also arrive at stores in better condition than they otherwise would, and delivery using air cargo is far more reliable.

The ability to have a high turnover of stock allows retailers to gather data on what particular trend is in mode and use that information to inform decisions as to what style to buy the next time.

Some freight forwarders have now begun to specialise in fashion delivery. Companies such as Logwin provide retailers with services and even packaging solutions tailored for the fashion industry. This way, big retailers can design, manufacture and get clothing onto store shelves in a month. If they decide to go for sea freight, the whole process would last two or three weeks more.

Who's travelling?

The global propensity to travel, 2012⁹²



How aviation affects productivity

Quantifying the impact that improved air links have on a country's GDP is a difficult task. There are many factors to this calculation and the complexity makes any assertion, at best, an estimate. However, there are some broad indicators that can be used to make an informed determination.

The International Air Transport Association has developed a connectivity indicator, which measures the degree of integration a nation has within the global air transport network. Using this, IATA has linked connectivity to economic performance to make a conservative estimate as to the value of the sector to national economies.



The most recent research suggests that a 10% improvement in global connectivity (relative to GDP) results in a 0.5% increase in long-run GDP per capita. Oxford Economics estimates that rapidly rising global connectivity over the past two decades boosted global GDP by \$200 billion in 2014, a number that continues to grow⁸¹.

Analysis shows a strong positive relationship between higher connectivity to the global network – as a proportion of GDP – and labour productivity. Developing and transitional economies typically have low connectivity relative to their GDP and also relatively low labour productivity. At the top right of the chart opposite (page 20) are the developed Asian, North American and European economies with high levels of connectivity and labour productivity⁸².

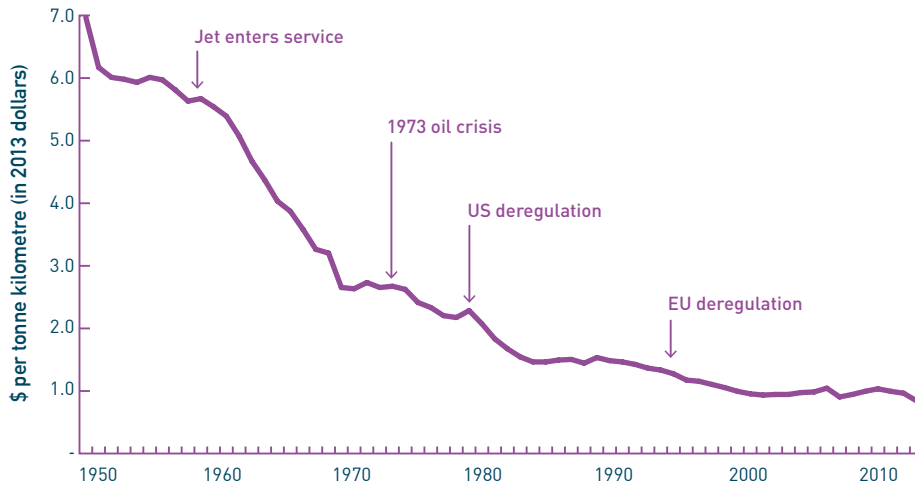
A driver of innovation

Since the dawn of air travel, aviation has been at the forefront of technological innovation, researching and developing disruptive, ground-breaking technology with each new generation of aircraft. There are many motivations for this drive in technological advancement. Not only do more efficient aircraft and engines have a positive environmental impact through reduced fuel burn and associated emissions, but they also lower fuel costs for airlines in the long term, making air travel more affordable.



A good deal

Evolution of average price of air travel (\$ per RTK), in real terms⁹⁰



 Aviation's focus on technological innovation has other consequential benefits on wider society. This encourages research capacity at universities and also results in a highly skilled section of a country's workforce. The benefits to society of research and development spending by the aerospace industry are estimated to be much higher than in manufacturing as a whole – every \$100 million of investment into research eventually generates an additional \$70 million in GDP per year after year⁸⁴.


Aerospace also drives the development of technologies that can be used in other sectors. The aviation sector was one of the pioneers in the use of additive layer manufacturing (also known as 3D printing). Many components of next generation aircraft will be made using this technique. Composite materials, such as carbon fibre and ceramic composites, also owe much of their development to aviation research and development – and make up significant proportions of the finished product of modern lightweight aircraft such as the Boeing 787 and Airbus' A350 XWB.

In terms of economic impact, the aerospace sector plays a substantial role in the regions where it is based. According to the Aerospace and Defence Industries Association of Europe, civil aeronautics in Europe created a \$104.2 (€85.2) billion turnover, with \$7.5 (€6.1) billion invested directly by the industry in 2014⁸⁵.

In the United States, total civil aerospace exports amounted to a \$111 billion contribution to the national economy⁸⁶.

For an example of how valuable aerospace manufacturers can be to a national economy, see page 57 on the contribution of the sector to the 'Make in India' campaign.

Affordability of air travel

 A key driver in the growth of passenger traffic has been the steady decrease in the real cost of air travel. Since 1970, the real cost of air travel has been reduced by over 60%, through deregulation of the aviation market in the 1980s, the development of more fuel-efficient aerospace technologies and the introduction of low cost carriers. It is now more affordable for more of the population to travel by air.

In the United States, for example, the cost of a return flight from Boston to Los Angeles fell by 89% between 1941 and 2012, whilst the flight time is nine hours (and 11 stops) shorter⁸⁷.

This decrease in cost has led to an increase in accessibility of air travel – the democratisation away from a pursuit of the wealthy to a part of normal middle-class lives, especially in the developed world. It is estimated that 81% of Americans have flown

at least once in their lives⁸⁸, with around half flying at least once per year. Statistics in the United Kingdom show similar results⁸⁹. But flying is also becoming increasingly accessible in the developing world, with low cost carriers opening up business and leisure travel to more and more citizens.

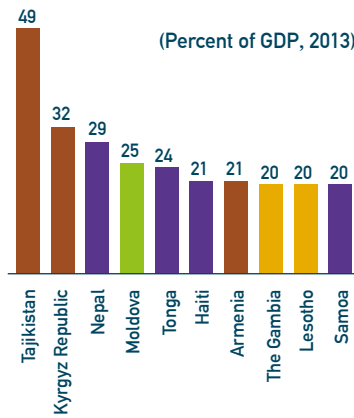
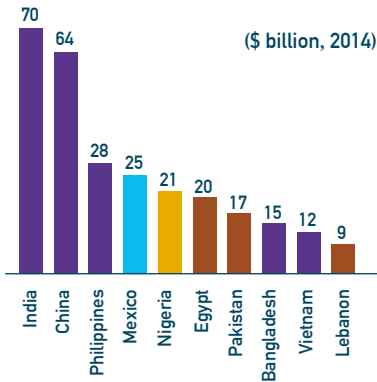
SUPPORTING SOCIAL DEVELOPMENT

Sustainable development is not just about working towards economic progress in an environmentally sustainable way. A significant aspect of this concept is improving the lives of people in ways other than financial prosperity. These socially-based ambitions are an important part of the Sustainable Development Goals and are in many ways supported by civil aviation.

For many people all over the globe, the ability to travel to any other country is an invaluable asset, relied on to visit friends and relatives, move abroad for work and study or, of course, go on holiday. Without air transport, being able to travel and experience new countries and cultures would be far more difficult – and certainly impossible in as short a time.

Supporting those at home

Top remittance-receiving countries⁹⁵



Ensuring well-being: visiting friends and relatives



The third Sustainable Development Goal, which relates to well-being, is about more than just physical health. Families in the 21st Century are a prime example of how globalisation has changed the modern world. Many families are now spread all over the world, as people move for employment opportunities, university education or simply for lifestyle reasons. This has resulted in far greater cross-border ties between individuals, as well as states.

According to the UN's International Labour Organization, there were 150.3 million migrant workers globally in 2013⁹¹. Almost half of these (48.5%) were concentrated in North America and north, south and west Europe. It is estimated that migrant workers make up 4.4% of all workers globally. One in six workers in high-income countries travelled there from another country.



Many of the host countries of migrant workers, particularly in Europe, have ageing populations, making the international labour market essential for their long-term economic well-being, supporting those of pensionable age.

A prime example of how cross-border ties have strengthened is the geopolitics of the

European Union, where the free movement of people and goods has been enabled by the Schengen Agreement of 1985. While recent political developments have dented some confidence in this arrangement, it remains one of the cornerstones of European integration. Naturally, many of the EU's citizens are able to travel across national borders by modes of transport other than air travel, such as rail, road, or even by foot. However, in many cases, flying is the quickest, most secure and most cost-efficient means of travelling between European nations. Almost every intra-European flight can be completed in less than three hours, allowing individuals and businesses to connect seamlessly, consolidating personal ties and business relationships.

Supporting families back home

According to the World Bank, there were an estimated 247 million international migrants in 2013 (for 2015, it is estimated that this number will have surpassed 250 million). These international migrants are estimated to have collectively contributed \$436 billion in remittances in 2014⁹³.



Remittances, where someone working abroad sends part of his or her earnings to family back home, are sometimes viewed negatively, signalling weakness in a national economy and leading



Fly your ideas



Innovation is key to aerospace manufacturing, so naturally, new ideas are seen as extremely valuable and don't always come from established, experienced engineers.

To try and tap into some of the well of talent out there, Airbus has, since 2009, been running a biennial competition called 'Fly Your Ideas'. The competition is open to teams of university students, who are challenged to come up with new ideas on the future of aviation. The competition is supported by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and comes with the chance of winning \$34,000 (€30,000) and a week touring the facilities at Airbus.

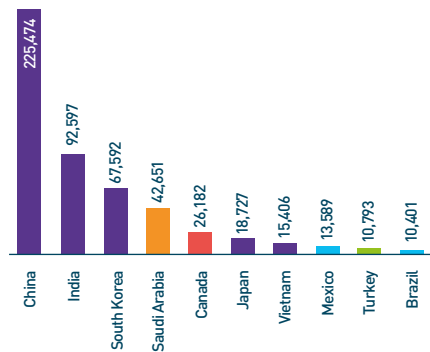
In the last outing of the competition, a total of 518 teams, representing 3,700 students from 104 countries, submitted projects, and these were gradually whittled down to five finalists. Over the course of the competition, each team selected for round two is appointed Airbus mentors, who help develop the team's idea.

The projects submitted to Airbus cover all sorts of categories. Although only one team can win the competition each time, the ideas put forward by the finalists are all worthy of attention. In the last competition in 2015, Team Multifan, from Delft University of Technology, were worthy winners with their concept of dressing an aircraft's wings in a composite skin that harvests energy from the natural vibrations of the wings during flight. They fought off stiff competition from teams proposing wireless transfer technology during taxiing, an innovative cabin trolley design and an infrared guidance system for the taxi phase.

Airbus's work on 'Fly Your Ideas' shows the company's commitment to fostering young talent, with quality education that can help drive sustainable development forward beyond the aviation sector itself.

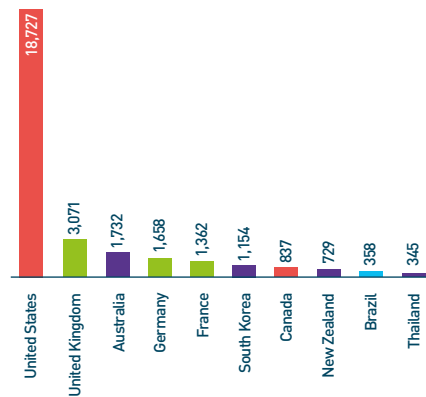
Howdy, students

The top ten origin countries for international students in the United States, 2013⁹⁸



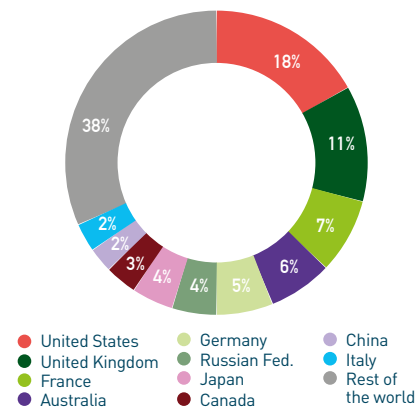
Kon'nichiwa, America

The top ten destinations for Japanese students studying abroad, 2013⁹⁹



Soft power, hard learning

The global top ten destinations for international students, 2013¹⁰⁰



to a 'brain drain' in talent. However, the system of remittances can have a positive impact, and plays a crucial role in some economies. They form a much more stable revenue source than overseas development aid, and the continuity of remittances is supported by the maintenance of family and cultural ties aided by air transport links. This source of overseas income can play a fairly significant role in some nations. For example, remittances account for roughly 49% of Tajikistan's GDP and around 24% of Tongan GDP.

By 2017, the World Bank estimates that, after a slowdown in 2015, global remittances will amount to \$479 billion. Not only do these funds help alleviate poverty in less-developed countries, but they also help achieve the SDGs more widely, fulfilling a number of the indicators developed by the Global Migration Group (a United Nations task force) in 2014⁹⁶.

Quality education

Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all is a stand-alone Sustainable Development Goal. To access higher quality education, for many, means travelling to another country, sometimes in another region of the globe. Without air transport, these opportunities

simply would not be feasible, particularly for shorter-term university exchange programmes like the European Erasmus system.

Sub-goals of the SDG include the aim of expanding global scholarships and, by 2030, substantially increasing the number of youth and adults who have relevant skills, including technical and vocational skills, for employment and entrepreneurship. Air transport connectivity can make these ambitions far more likely to be realised.

For students from developing countries, the opportunity to travel to established universities for higher education is invaluable. Not only does this help the individual's personal improvement, but it also creates consequential benefits for their home country as students return armed with knowledge and skills to contribute to their home economy⁹⁷.

Highly skilled workforce

Jobs in air transport cover a wide range of activities and skills. These include:

- » skilled work by technicians building and maintaining aircraft;
- » a diversity of technical engineering jobs from aircraft and engine design to component production;

- » air traffic control and airspace design planning;
- » logistics for airlines and airports;
- » complex information technology systems on board aircraft and in areas such as baggage handling systems design;
- » service industry supported jobs such as chefs in catering companies;
- » creative positions in design and marketing;
- » customer services occupations in airline ticketing, check-in, cabin crew and retail;
- » manual labour on airfields;
- » air traffic controllers and pilots;
- » emergency response personnel at airports;
- » leadership, management and executive roles.


As this list indicates, many roles in the air transport sector require a highly qualified workforce and a significant amount of training. Value-added per employee in the air transport sector (direct employees, excluding non-airside activity at airports) generates 3.8 times

Working abroad

The top five destinations for international migrant workers, 2014⁹⁴

Rank	Destination
1	United States
2	Saudi Arabia
3	Germany
4	Russian Federation
5	United Arab Emirates

as much value-added per employee than the economy as a whole indicating a more productive workforce. This is particularly true for the large populations of Asia-Pacific, Africa and Latin America.

 In addition, growth in the aerospace sector is helping to drive innovation and skills development in countries that have not normally been associated with aircraft manufacturing (see Making it in India, page 57). This is just one of many examples of companies investing in developing countries.

Engine manufacturer, Rolls-Royce, for instance, spreads its operations across a number of different countries. The company has had a presence in Singapore since the 1950s and currently employs over 1,400 people at its strategic business hub there. It also has locations in, among other places, Chinese Taipei and Hong Kong.

American aerospace company, Pratt & Whitney, has also made significant investment in Singapore. In February 2016, the manufacturer officially opened its first manufacturing facility there to produce fan blades and other key components for the Geared Turbofan engine. As part of Pratt & Whitney's \$1 billion global investment, the new Singapore facility contributes to the 2,000+ jobs created by the company in technical areas in Singapore¹⁰².

Flying in to study

Global top ten countries of origin for international students, 2013¹⁰¹

	No. of students
China	712,157
India	181,872
Germany	119,123
Republic of Korea	116,942
France	84,059
Saudi Arabia	73,548
United States	60,292
Malaysia	56,260
Vietnam	53,546
Iran	50,053

Canadian manufacturer, Bombardier, has also been investing abroad. In 2013, Bombardier started operations in Casablanca with a \$200 million investment, which will create 850 jobs by 2020. Already, Bombardier is producing components for the C Series, the Q-Series and the CRJ Series aircraft in Morocco¹⁰³.

Boeing first established an office in Brazil in 2011 and, in 2012, the company built a research centre in the South American country. More recently, Boeing announced the opening of a sustainable aviation biofuel research centre in São José dos Campos, in partnership with Brazilian aircraft manufacturer, Embraer¹⁰⁴.

European aircraft maker, Airbus, has had a presence in China since 1994 and it opened its first assembly line outside Europe in Tianjin in 2008. More than 1,300 people work for Airbus in China, across multiple locations¹⁰⁵. Airbus has also had operations in India since 2007, when it opened an engineering centre in Bengaluru, employing 350 engineers.

It is not just the manufacturing sector which is helping to promote skills around the world. Swiss International Airlines has boosted its customer service ability by training a team in Fiji to enable a 24-hour call centre service. And, wherever the aviation sector employs people, a number of jobs are generated which have relatively high incomes.



Taking the stress out of flying



For people with autism, especially children, flying can be a stressful experience. Many people with the condition find the whole process of air transport distressing, as they are confronted with large crowds, loud noises and unfamiliar surroundings.

Any break in a person with autism's routine can cause alarm, so to ensure that they can travel with the minimum level of stress, many airports have now issued advice for parents which can prepare them for the experience.

Vancouver Airport, for example, has issued a handbook for children with autism that not only prepares them in advance for their journey, but also guides them through the entire process with a check-list, detailing each stage of the airport experience, from arriving at the airport to landing at destination. Security screening, for example, is often a very scary experience, but with the proper preparation, parents can ensure that their child's anxiety is kept to a minimum.

Other airports, in partnership with airlines and autism charities, have also been running 'dry run' schemes, where children can practise the airport experience before the day of the actual journey. One such scheme, run by JetBlue and the Autism Tree Project Foundation, called Blue Horizons for Autism, has been met with enthusiastic support. The scheme allows children to interact with airline staff at the ticket counter, undertake a security screening, a walk through the terminal and eventually the boarding of an empty aircraft for a mock flight, followed by a short taxi journey around the airport. The first event at JFK International Airport welcomed 100 families.



Integrated transport at Heathrow



An airport is always a major piece of infrastructure in any city and plays an instrumental role in connecting people and businesses to the rest of the world. However, to really address the issue of sustainability, as well as connectivity, major international airports need to be linked to the cities they serve with additional, integrated transport infrastructure.

One of the largest international hubs in Europe, London Heathrow is a prime example of how to approach integrated transport. The 'Responsible Heathrow 2020' plan is aimed at ensuring that transport links to the airport are as sustainable as possible; cutting congestion and the consequential environmental impact is a key driver of sustainability, which is why Heathrow has been encouraging visitors and workers to travel there by public transport as much as possible.

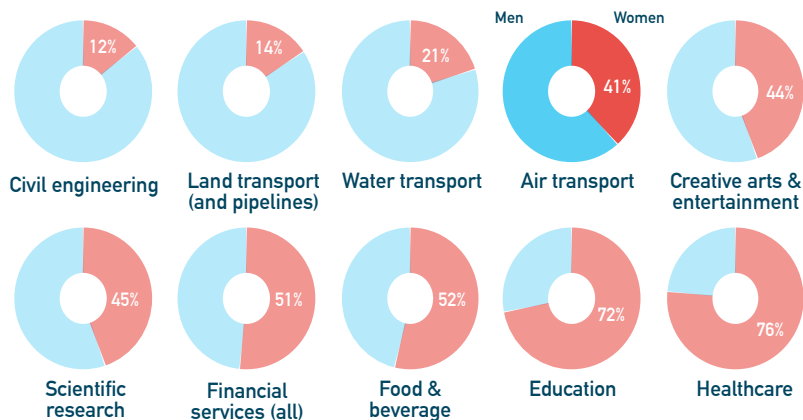
Through its updated Sustainable Transport Plan, the airport is enhancing surface access, allowing passengers, staff and freight to travel to, from and through the airport with maximum ease, as well as putting in place frequent rail and bus links for passengers and staff alike. More than 40% of passengers now use public transport and over 40% of employees commute using sustainable travel modes.

For people working at Heathrow, the cycle hub has proved particularly successful in encouraging active travel. Cycle parking is available at all five terminals and 2,300 members of the cycling scheme can enjoy discounted cycles and equipment as well as free maintenance.

By 2020, Heathrow aims to build on the progress already made by further reducing single occupancy cars to at most 45% and growing the share of sustainable travel.


Gender, balanced?

Air transport has more work to do getting women into the business, EU28, 2014¹⁰⁹



According to a recent analysis for ACI Europe, the total direct employment of almost 1.7 million people at European airports received an estimated \$76.8 billion (€68.5 billion) in income (wages, salaries, bonuses and other remuneration), or an average of \$45,310 (€40,400) per job¹⁰⁶. This figure is considerably higher than the average income in the overall economy. In all countries, the average income of direct airport employment was higher than the national average. This reflects the large number of highly skilled positions that are supported by airport activity.

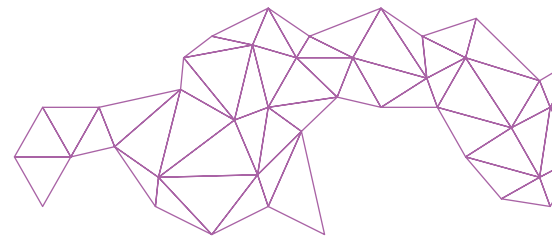
And in the United States, the average wage for an airline employee is roughly \$67,000 per year, which is significantly higher than the average national private-sector wage of \$45,000¹⁰⁷.

 Global statistics on gender equality within the air transport sector are scarce; however, anecdotal evidence suggests that aviation still tends to be a male-dominated industry. Statistics for Europe show that women make up 41% of employees, although technical positions will likely skew towards men. A global survey of gender equality in flight crews shows that, despite the first commercial pilot's licence being granted to a woman in 1934¹⁰⁸, in 2014 women still only made up 5.44% of pilots worldwide.

Some countries are showing signs of a move in the right direction: Iceland, Finland, Thailand, Sri Lanka and Slovenia all have greater than 10% female pilots. But perhaps the most promising sign is in the next generation. Female student pilots now make up more than 10% of their classes in the USA, the Netherlands, Japan, Belgium, Switzerland, India, Canada, Norway, the United Arab Emirates, Spain, Panama, Indonesia and Sweden. Standing out of the crowd is Singapore, where 23.3% of student pilots are women.

On the manufacturing side of the industry, women tend to have a slightly higher representation, making up 23.5% of the workforce in the United States (this includes defence manufacturing, whereas most of the statistics in this report are limited to civil aviation). Within this group, women make up 14.6% of engineering jobs, 10.5% of engineering executive roles and 19.4% of executive positions¹¹⁰.

In airport operational roles and ground handling in Europe, women make up 25.8% of employees, although in the lower age bracket (those under 30), over 32% of staff are women¹¹¹.



Good health and well-being



The United Nations' third SDG, 'good health and well-being', is a crucial element of sustainable development. Whilst not directly linked to improving physical health, air transport, with its ability to provide speedy and safe transport of people and cargo to places that are often in remote areas of the world, has a part to play.

French-Italian turboprop manufacturer, ATR, is able to use its distinct aircraft to connect many remote regions of the world, in many cases small island states. Indonesia is a prime example of how ATR's turboprop aircraft can be used to connect such remote communities, many of which can only support the arrival of small, versatile aircraft like turboprops.

The Asia-Pacific state of Indonesia is made up of over 17,000 islands, many of which are uninhabited. At least ten Indonesian airlines operate ATR turboprops and the company's aircraft are used on 70% of the country's local routes. With passenger numbers in Indonesia projected to grow by 10-15% in 2016¹¹², and the Indonesian Transport Ministry opening 11 new airports and 230 new routes, adaptable turboprop aircraft are well-placed to serve the needs of the population.

A prime example of how aviation plays a role in public health is the ability to transport vaccinations. Not only are these vital medical supplies time-sensitive, making other modes of transport unviable over long distances, but their temperatures must also be carefully regulated, something in which cargo airlines are very experienced. In 2012, for example, UPS transported over 375,000 influenza vaccines in prefilled syringes over 15,000 kilometres from Kentucky to Laos, across the borders of five countries, the whole time maintaining a steady 3-7°C temperature¹¹³.

Aviation also has a crucial role to play in pandemic response. When a viral outbreak occurs in some part of the world, it is vital that the air transport sector acts quickly to work with governments and international institutions to ensure that it does not travel further. Recent examples of this collaborative effort would be the Ebola and Zika outbreaks in West Africa and South America, respectively.

In cases like these, IATA and Airports Council International, alongside other partners, participate in the World Health Organization Travel and Transport Task Force, which is chaired by the UN aviation agency, ICAO, in order to provide information and global coordination to the travel and tourism sector. IATA and ACI work with their

networks of regional and area managers to monitor pandemic-related restrictions in countries around the world, ensuring their member airlines and airports are aware of the situation and avoid any risky activities. The IATA Medical Advisor also cooperates with a number of influential national public health authorities to help them make their recommendations compatible with aviation industry operations¹¹⁴.



Biofuel on demand at Oslo Airport



The beginning of 2016 saw a landmark day for the development and commercialisation of sustainable alternative fuels with the announcement from Norway that Oslo Airport, operated by Avinor, has become the first international hub to offer sustainable alternative fuel to all airlines flying out of the Norwegian capital.

Increasing the uptake of sustainable alternative fuels is a key factor in aviation's plan to become more sustainable in the long term, as these fuels can be as much as 80% less carbon-intensive than traditional jet fuel over the course of their life cycle. The challenge now, and one that is being taken head-on at Oslo, is to provide enough of these fuels (at a cost-effective price) to as many airlines as possible around the world.

On 22 January 2016, Avinor stocked up the airport's hydrant system with a blend of biofuel made from the camelina plant, and Lufthansa Group, SAS and KLM have already signed agreements to purchase the fuel. The incorporation of the fuel into the normal supply mechanism is a landmark event and major step towards normalising the use of sustainable alternative fuels. In previous commercial flights using biofuel, the aircraft needed to be fuelled up in a specialised manner.

So far, Avinor and its supply partners, Air BP and SkyNRG, have agreed to an initial delivery of 1.25 million litres of the fuel, with the goal being to gradually increase the amount in the coming years. In the long term, Avinor plans to take advantage of the abundant natural resource of forestry residue, a sustainable by-product of the Norwegian forestry industry, to use as a feedstock for their fuel supply.



Providing vital aid



One of the more ambitious of the UN's SDGs is the campaign to achieve 'zero hunger'. To truly achieve this goal requires the creation of the conditions for food security across the world. This is a long-term challenge and, in the meantime, some parts of the world will continue to need support from the international community.

The World Food Programme (WFP), in partnership with the UN Humanitarian Air Service, is tasked with getting food to those in the midst of war, civil conflict and natural disasters. As many of these areas are inaccessible by road, air transport is the only option. In 2014, more WFP food was transported by air than at any time in almost a decade. More than 70,000 tonnes of food and non-food commodities were delivered by air to relieve victims of floods, conflict and disease. In South Sudan, for example, air transport was the only viable method of humanitarian assistance due to heavy fighting in this, the world's youngest country¹⁵.

ENVIRONMENTAL RESPONSIBILITY



The undoubted economic and social benefits of aviation are clear, with the growth of the sector being important for all countries, both developed and developing. However, these benefits also come with an environmental cost. For aviation to grow sustainably, it is vital that the industry balances the advantages of air travel with the responsibility to act on climate change.

This responsibility is something that the global aviation sector takes very seriously and it ties in with a number of the SDGs. Aviation accounts for roughly 2% of man-made CO₂ emissions, through the burning of 278 billion litres of jet fuel, producing 739 million tonnes of CO₂. These emissions are equivalent to the annual emissions of a country such as Iran or Mexico¹⁶.

Around 80% of aviation emissions are produced from long distance flights, journeys where there is no other practical alternative to flying. The challenge for aviation is to reduce these emissions, while retaining the benefits of air transport.



To meet this challenge, industry leaders joined together in 2008 to announce a plan, based around three global goals, which the entire sector has committed to. These are:

1. to achieve a 1.5% average annual fuel efficiency improvement from 2009 to 2020 (a goal which is already being surpassed, with an average improvement of 2.4% per year);
2. stabilise net CO₂ emissions at 2020 levels through carbon-neutral growth;
3. reduce net emissions to 50% of what they were in 2005 by 2050.



To meet these goals, the industry has put in place a collective four-pillar strategy, which takes account of all means of reducing emissions.

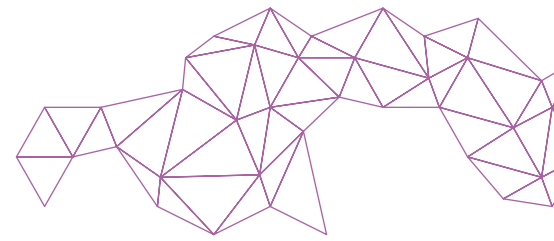
Technology

The first pillar of the strategy relates to technological development. Aviation has always had a focus on efficiency. Fuel makes up the main operating cost for airlines, so in this sense, economic and environmental motivations are intertwined. Since the first jets began flying, technology-driven efficiency has improved by 80%, with the introduction

of new models of aircraft and engines. Aircraft and engine manufacturers spend an estimated \$15 billion each year on research and development, representing a major investment in the sustainable future of air travel¹⁷.

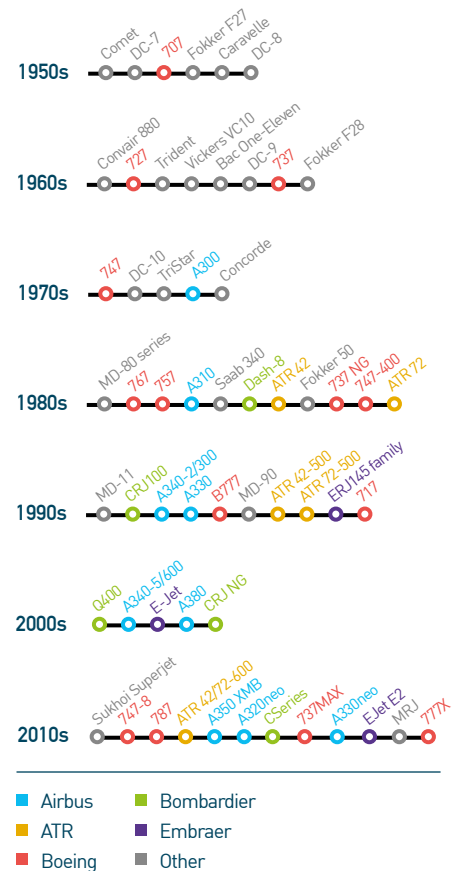
For example, thanks to the introduction of new aircraft, absolute emissions from US airlines dropped by 8% between 2000 and 2014, while traffic rose by 20%. On average, each new generation of aircraft is roughly 20% more efficient than the previous generation. However, technology is only one part of the efficiency equation. Taking into account operational procedures can bring about larger efficiency improvements. In fact, a flight taken today will produce around half of the CO₂ that the same flight would have in 1990.

Recent years have seen the development or introduction of entirely new aircraft types, such as the Airbus A350 XWB, the Boeing 787 Dreamliner and the Bombardier C Series, but also re-modelled versions of existing aircraft such as the A320neo and the Boeing 747-8. These are powered by the latest next-generation jet engines made by manufacturers such as CFM International, Pratt & Whitney, GE Aviation and Rolls-Royce, all of which have produced impressive fuel savings.



All at once

We are currently in the middle of a large wave of new, more efficient, aircraft models¹⁹

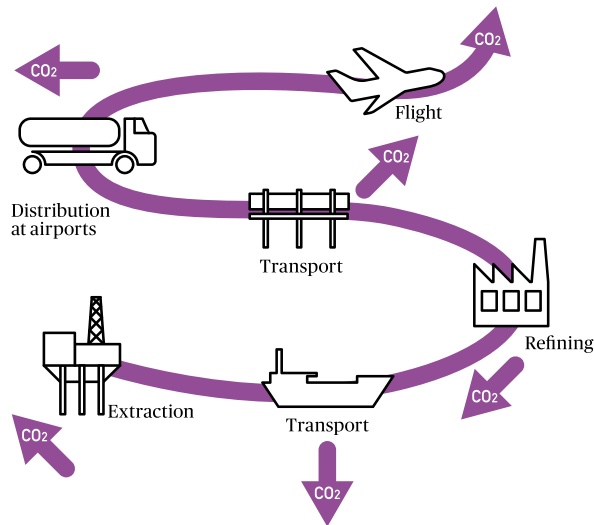




The circle of life

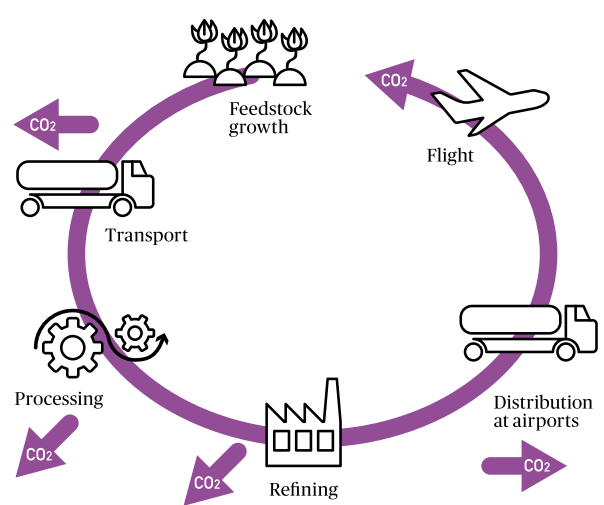
Traditional fuels emit CO₂ from the burning of fossil energy buried for millennia underground, whereas biofuels ingest CO₂ from the atmosphere as they grow. Aviation is looking at next-generation non-food biofuel sources and waste as feedstock¹²⁰

Carbon lifecycle diagram: fossil fuels



At each stage in the distribution chain, carbon dioxide is emitted through energy use by extraction, transport, etc.

Carbon lifecycle diagram: biofuels



Carbon dioxide will be reabsorbed as the next generation of biofuel feedstock is grown.

By 2020, it is expected that other, fuel-efficient aircraft types will enter into service, with the Embraer E2, Airbus A330neo and Boeing's 777X and 737MAX joining the fleet.

In addition to the latest propulsion technology, additional technological features have been included to maximise fuel efficiency. Improved aerodynamics, new manufacturing techniques and composite materials play a prominent role in determining how much fuel is burned on any given flight.

Carbon fibre composites are being increasingly used to build parts of aircraft, particularly the wings, which improves fuel efficiency through decreasing weight. Some engine manufacturers have taken advantage of another new material, ceramic-matrix composites used in jet engines, which allow the engine to operate at a higher temperature, resulting in better fuel efficiency. Like the composite materials used to make wings, this material is also lighter than traditional metal alloys, which further cuts fuel burn.

Sustainable alternative fuels

 Also included within the technology pillar of the industry's strategy is the development of sustainable alternative fuels, which represents considerable potential for securing the sustainable development of air travel. Sustainable alternative fuels (sometimes referred to as 'biofuels') are almost chemically identical to traditional jet fuel, but rather than being made from fossil fuels, they are synthesised from other, more sustainable 'feedstocks'. These feedstocks can take the form of plant matter, municipal waste or even used cooking oil.

To qualify as truly 'sustainable' alternative fuels, the feedstock must fulfil certain criteria, meaning that the feedstock used should not compete with food crops or other agriculturally sensitive produce. This is why many recent innovative alternative fuels have been produced using sources such as waste, microalgae, saltwater tolerant plants that

grow where food crops cannot, and nicotine-free tobacco. One of the main advantages of sustainable alternative fuels is their diversity. Whilst they all end up more or less chemically identical following the production process, producers are able to utilise feedstocks that are abundant in particular regions of the world, be that forestry in Norway or municipal waste in the US.

Sustainability criteria are key to aviation's position on alternative fuels. The industry took careful note of the negative impacts that came about when the first generation of biofuels were deployed in road transport and is determined not to repeat those mistakes.

Sustainable alternative fuels can be up to 80% less carbon intensive over their life cycle when compared to fossil-based fuels. The challenge for this new energy industry now is to produce these fuels to a sufficient quantity, making them commercially viable. This requires significant investment from

Operating everywhere

Just some of the operational efficiency measures being deployed across the world



LIGHTWEIGHT CABIN EQUIPMENT



SLIMLINE SEATS -LOWER WEIGHT



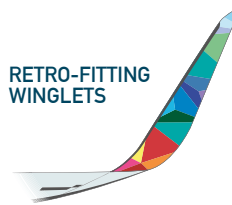
TABLET COMPUTERS REPLACING PILOT MANUALS



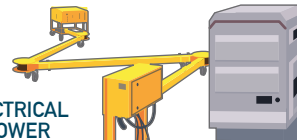
TAXIING ON ONE ENGINE



CONTINUOUS DESCENT AND CLIMB OPERATIONS



RETRO-FITTING WINGLETS



FIXED ELECTRICAL GROUND POWER

industry and governments alike. However, impressive progress has already been made in the fledgling sector, particularly in the last three years.

Since the use of sustainable alternative fuels was first approved in 2011, over 2,500 flights have taken place with an alternative-traditional fuel blend. By the end of 2016, this number is expected to increase to 5,500. The beginning of 2016 saw a landmark event on the road to normalising the use of sustainable alternative fuels, with Oslo Airport becoming the first international hub in the world to offer the fuel to all airlines serving the airport. This is also a particularly significant step, so far as the supply method is concerned, with the fuel being incorporated into the airport's hydrant system, which means that airlines do not need to alter their normal re-fuelling process. United Airlines, too, has become the first US airline to regularly fly (out of its Los Angeles Airport base) using a blend of sustainable alternative fuel.

Operations

The operations pillar of the industry's strategy deals with how aircraft are run once they are in service, ensuring that all flights maximise fuel efficiency. Many of these efficiency gains come from cutting all unnecessary, non-flight critical weight. Many airlines have invested heavily in features such as lightweight seats and cabin trolleys or Kevlar cargo containers, which have the added benefit of being stronger, as well as lighter¹²¹. It has also become increasingly common for flight crews to be issued with tablet computers in place of paper-based flight manuals, which can weigh up to 20 kilograms¹²². While on their own these savings are not huge, when added together they account for significant CO₂ savings. By installing lighter, but stronger, seats, one airline reduced CO₂ across its fleet by 21,000 tonnes.



A Standard for CO₂



The beginning of 2016 saw a historic milestone passed in the field of aviation climate action, with the UN's International Civil Aviation Organization (ICAO) concluding technical requirements that set a CO₂ emissions standard for new aircraft. This is the first such technical standard for aircraft CO₂ emissions, coming into line with similar global standards for safety, noise and NO_x emissions.

Aviation has always been focused on increasing efficiency, but the new standard will complement and support this market-driven progression. It will apply to all new aircraft models entering service after 2020 and will also be phased in for all existing aircraft types rolling off the production line from 2023, even if they were designed and launched prior to 2020. A production cut-off date of 2028 has been recommended for any aircraft that does not comply with the CO₂ Standard.

Like many other certification standards, it is likely that this one dealing with CO₂ will be reviewed in the future, to take into account further technological developments. The fact that a standard is in place means that the biggest step has already been made, allowing for enhancement in future years.

The standard ensures that older aircraft models end production in an appropriate time frame and that manufacturers invest in technology to improve their efficiency. The standard also ensures that new designs go beyond the highest fuel efficiency of today's aircraft.

Smoother and more efficient

An example of how performance based navigation can help cut flight time, CO₂ emissions and noise impact



Wingtip technology is another operational improvement that has led to major fuel and emissions savings for airlines. Most new aircraft have these features included at the point of production, and many airlines have invested heavily in having them retro-fitted to existing aircraft. These additional parts on the tips of the wings reduce drag and fuel consumption, reducing the level of CO₂ produced fleet-wide by over 56 million tonnes since the year 2000²³.

Modifying how an aircraft climbs to cruising altitude and descends on approach can also reduce emissions. Through continuous descent and climb operations, airlines all over the world have been cutting fuel burn and the associated emissions. Rather than following the traditional 'staggered' or 'stepped' procedure, aircraft are now climbing and approaching more smoothly, dispensing with the need to use additional engine power to level off at multiple altitudes during these phases of the flight. By introducing continuous descent techniques across 15 airports in the United Kingdom, airlines were able to cut CO₂ emissions by 20,000 tonnes in nine years²⁴.

Through a process called airport collaborative decision-making (A-CDM), airports, ANSPs, and airlines can work together to optimise flights by sharing information on potential

inefficiencies and delays on the runway, which can force airlines to waste additional time in the air²⁵. By working together to flag up such delays early, all parties get all-important arrival and departure information at the same time, allowing the different organisations involved in a flight to adjust their schedules and resourcing as the latest information comes to hand.

Taxiing is also a prime opportunity for cutting emissions. Many ways in which an airline can avoid using the aircraft's engines on the ground have been explored. The most common of these is the use of fixed electrical ground power at airports, plugging the aircraft into the airport's electricity to run pre-flight systems²⁶. Many airlines have also begun to only use one engine during taxiing. Taking this concept further, new technologies have been developed that power the aircraft entirely while it taxis to the runway²⁷.

Infrastructure

The infrastructure pillar of the strategy relates mainly to improving navigational systems and procedures, ensuring that aircraft are guided through the air as efficiently as possible. In many regions of the world, mid-20th Century technology is still being used

to direct air traffic, with aircraft needing to zig-zag between ground-based radar posts throughout their journey. However, this situation is rapidly changing.

By using an array of new navigational technologies and procedures, which are collectively referred to as 'performance-based navigation', aircraft can now follow an optimised, more direct route. Through cutting out unnecessary travel time, airlines can save fuel and emit less CO₂ than they would have using older systems. Rather than being 'controlled' between radar stations, aircraft can now fly to their destination far more efficiently.



 For the potential of new navigational technology to be truly realised, the industry needs the engagement and cooperation of governments and international institutions. Airspace is governed by sovereign states, meaning that any root-and-branch reform needs governmental buy-in.

In Europe a collaborative project is underway called Single European Sky ATM Research (SESAR), which is part of the vision to consolidate European airspace into a single zone. Once fully in place, the Single European Sky will enable far more efficient routing for civil aircraft. The €2.1 billion investment in the SESAR programme is being put forward by the European Union, Eurocontrol and the industry itself. It is hoped that the project will deliver a 12% reduction in environmental impact alone through savings of between 8 and 14 minutes of flight time, 300-500 kilograms of fuel, and 948-1,575 kilograms of CO₂ per flight¹²⁸.

A similar upgrade is underway in the United States. Once fully implemented, the Next Generation Air Transportation System (NextGen), like SESAR, will result in significant emissions reductions. The NextGen project is being undertaken by the US Federal Aviation Administration (FAA) and aims to simplify US airspace by rolling out PBN and other, satellite-based technologies known

as Automatic Dependent Surveillance - Broadcast (ADS-B) and collaborative air traffic management technologies¹²⁹.

Reacting to changing weather conditions is another way in which flights can be made more efficient. In the US, a new NASA weather software programme is helping US airlines improve efficiency by allowing flexible routing. This allows pilots to react to changing weather conditions and alter their routes accordingly, rather than simply following a pre-determined flight path¹³⁰.

Airports, too, are playing their part in improving infrastructure. The Airport Carbon Accreditation Programme, launched by ACI Europe in 2009, but later expanded to other regions, accredits participating airports with one of four levels: mapping, reduction, optimisation and neutrality. There are currently 157 airports worldwide accredited to one of these levels. Between June 2009 and June 2013, CO₂ reductions achieved in Europe through the scheme totalled over 1.7 million tonnes¹³¹.

These energy efficiency gains have been made via a number of means, such as LED lighting, electrical ground vehicles and solar energy. Over 100 airports worldwide now utilise solar power¹³².



Follow the greens

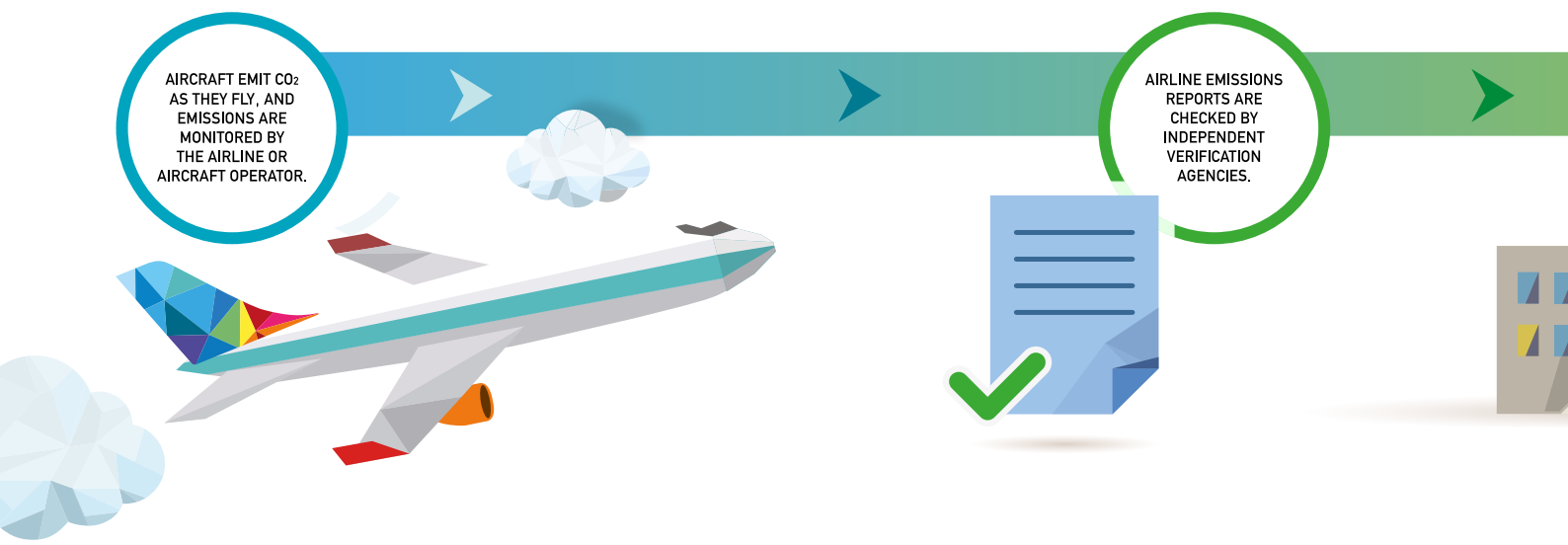


At some of the world's busiest airports, congestion can be a real problem. With too many aircraft on the apron and taxiway, the result is flight delays and higher fuel consumption. For short-haul aircraft, fuel burn during the ground phase can account for up to 4% of the fuel used in the entire journey.

Operational efficiencies to solve issues like congestion, both on the ground and in the air, are a major focus for airports and airlines alike. However, technology companies can also play a role. Honeywell Aerospace has developed an innovative way to boost airport traffic efficiency, replacing the traditional method of pilots finding their way to the gate or runway using paper-based maps and directions from air traffic controllers. Often, the amount of ground-based traffic needing to be managed from the control towers leads to delays, especially in poor visibility conditions.

Honeywell's 'follow the greens' system removes the obstacles that get in the way of the smooth running of airport traffic by using a series of lights on the tarmac. The system assesses all aircraft traffic on the ground and identifies the optimum route for pilots to take. Instead of fussing about with maps and waiting for guidance from the control tower, pilots can simply follow a set of green lights, which will lead them to their destination.

In March 2016, the system was put in place at Dubai International Airport, the sixth busiest airport in the world for both passengers and cargo. The traffic at Dubai is forecast only to increase, so by following the greens, the Middle Eastern hub will be able to manage its already huge aircraft numbers and be prepared for the future, cutting delays for passengers and fuel use for airlines.



DEMONSTRATING HOW A GLOBAL CARBON OFFSETTING SCHEME FOR AVIATION WOULD WORK

Market-based measures



Encouraging progress has been made on the first three pillars of the strategy. However, to achieve the goal of carbon-neutral growth from 2020, other measures need to be taken. This is why the industry has called on the world's governments, represented at the International Civil Aviation Organization (ICAO), to put in place a global market-based measure for aviation.

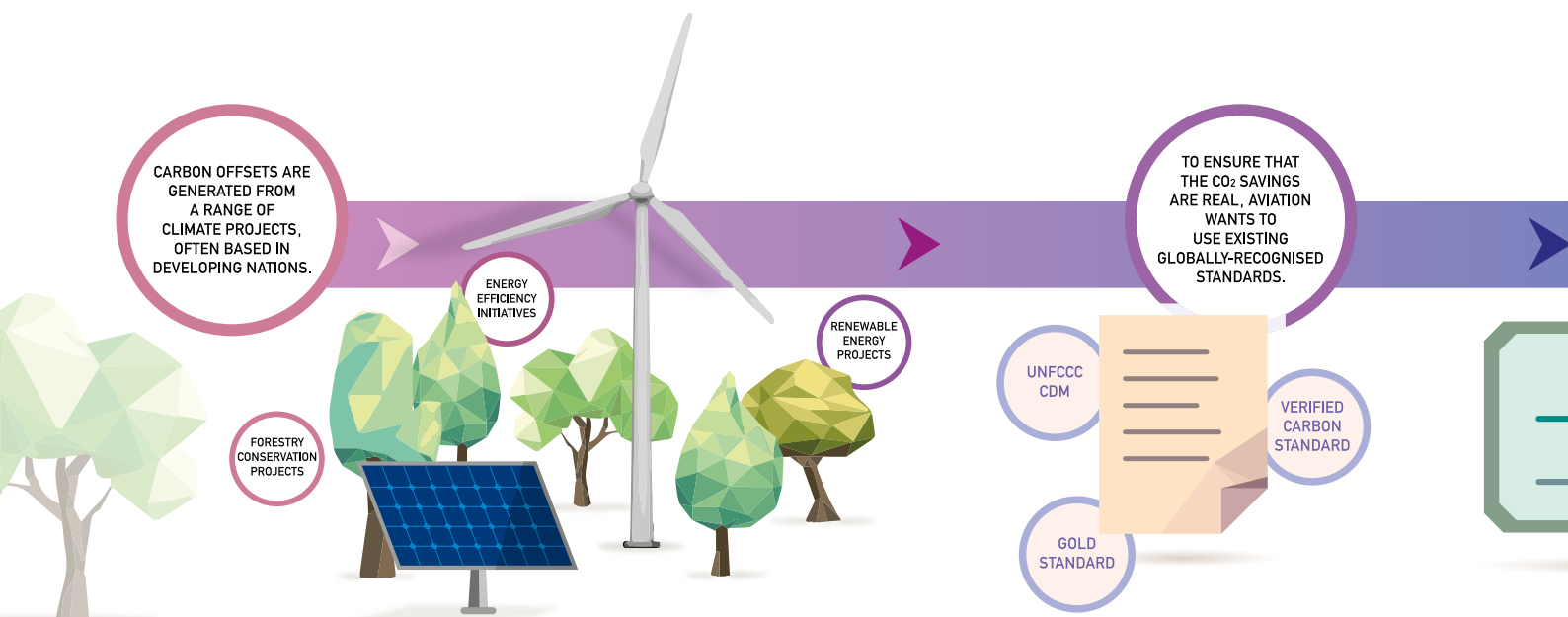
At the 2013 meeting of ICAO's triennial Assembly, the organisation agreed to begin work on developing the measure, which would be put to states at the 2016 Assembly. Over the last three years, ICAO, with valuable input from industry experts, has been working to develop the technical

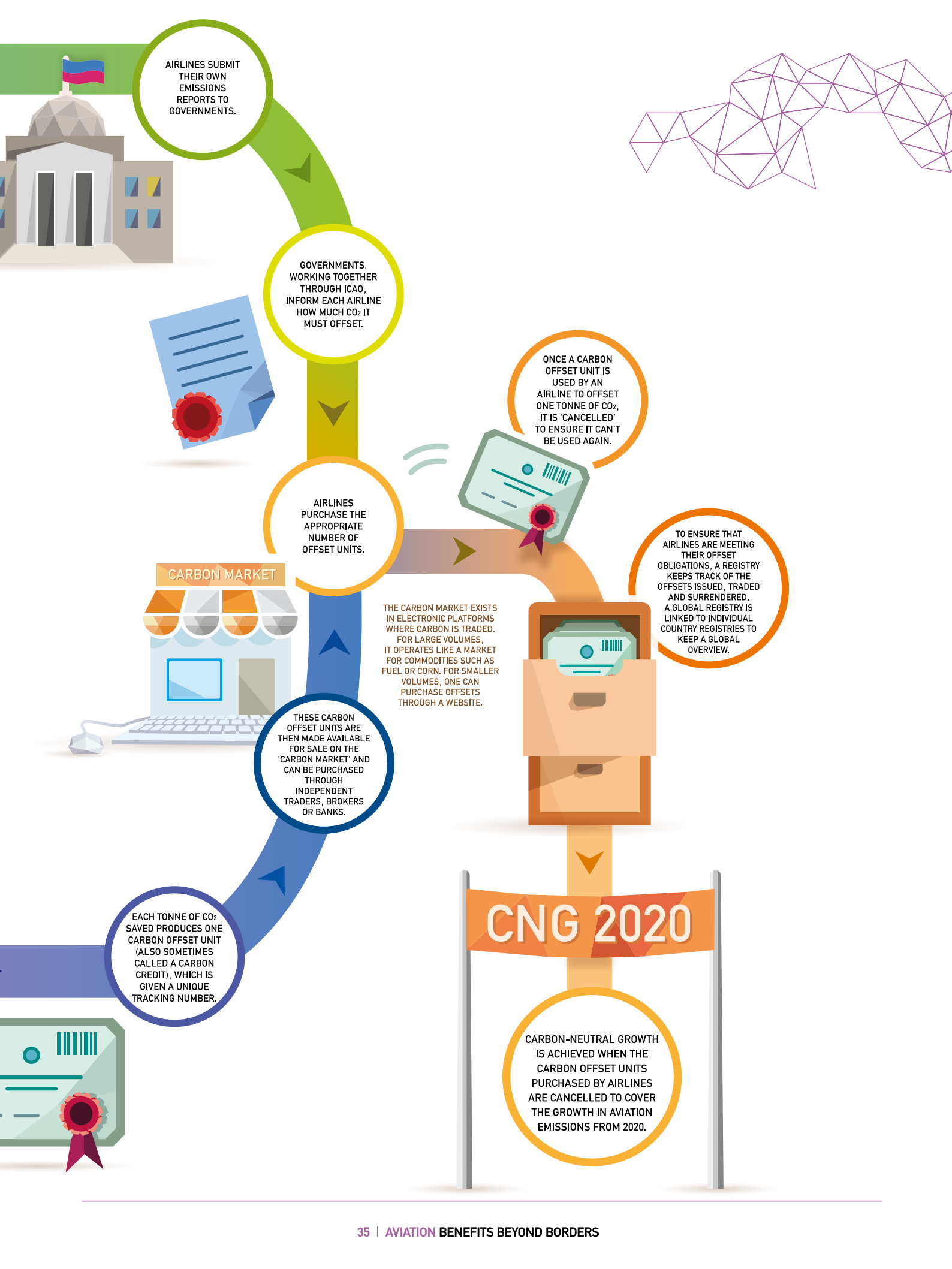
details of the proposed global offsetting scheme. If the scheme is approved at the 2016 Assembly, as the industry has been urging governments to do, the last remaining steps will be capacity building, followed by implementation ahead of 2020.

At the time of this report's publication, negotiations are continuing towards the ICAO Assembly, which takes place in September / October 2016. For the latest developments, check www.enviro.aero.

The global aviation industry has been working hard to develop all four pillars of this strategy. Encouraging progress has already been made, but more needs to be done. To make real efficiency gains, the

industry needs political commitment and financial support from governments. In September 2015, aviation industry leaders joined together to write an open letter to the world's governments¹³³. In the letter, the industry made five key requests, which, if accepted, would go a long way to supporting the sector's sustainable development. These were to: undertake air traffic management investment and reform; continue support for research into new technology, operations and sustainable alternative fuels; improve intermodal transport planning; and put in place the right policy framework to help accelerate the availability of sustainable alternative fuels for aviation.





AIRLINES SUBMIT THEIR OWN EMISSIONS REPORTS TO GOVERNMENTS.

GOVERNMENTS, WORKING TOGETHER THROUGH ICAO, INFORM EACH AIRLINE HOW MUCH CO₂ IT MUST OFFSET.

ONCE A CARBON OFFSET UNIT IS USED BY AN AIRLINE TO OFFSET ONE TONNE OF CO₂, IT IS 'CANCELLED' TO ENSURE IT CAN'T BE USED AGAIN.

AIRLINES PURCHASE THE APPROPRIATE NUMBER OF OFFSET UNITS.

TO ENSURE THAT AIRLINES ARE MEETING THEIR OFFSET OBLIGATIONS, A REGISTRY KEEPS TRACK OF THE OFFSETS ISSUED, TRADED AND SURRENDERED. A GLOBAL REGISTRY IS LINKED TO INDIVIDUAL COUNTRY REGISTRIES TO KEEP A GLOBAL OVERVIEW.



THE CARBON MARKET EXISTS IN ELECTRONIC PLATFORMS WHERE CARBON IS TRADED. FOR LARGE VOLUMES, IT OPERATES LIKE A MARKET FOR COMMODITIES SUCH AS FUEL OR CORN. FOR SMALLER VOLUMES, ONE CAN PURCHASE OFFSETS THROUGH A WEBSITE.

THESE CARBON OFFSET UNITS ARE THEN MADE AVAILABLE FOR SALE ON THE 'CARBON MARKET' AND CAN BE PURCHASED THROUGH INDEPENDENT TRADERS, BROKERS OR BANKS.

EACH TONNE OF CO₂ SAVED PRODUCES ONE CARBON OFFSET UNIT (ALSO SOMETIMES CALLED A CARBON CREDIT), WHICH IS GIVEN A UNIQUE TRACKING NUMBER.



CARBON-NEUTRAL GROWTH IS ACHIEVED WHEN THE CARBON OFFSET UNITS PURCHASED BY AIRLINES ARE CANCELLED TO COVER THE GROWTH IN AVIATION EMISSIONS FROM 2020.



End-of-life

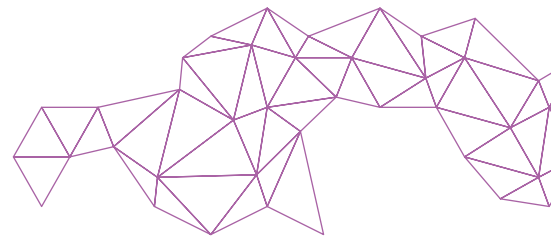
An aircraft will typically remain in service for around 20-25 years. During that time, it will fly on average 40,274,144 kilometres – over 1,000 times around the world – with some long-haul aircraft flying over 100 million kilometres, for several airlines¹³⁴. Once it reaches the end of its useful life, an aircraft can be recycled not only to ensure safe disposal but also to take advantage of the many high-quality components and materials of which it is made.



All airframe and engine manufacturers support the responsible management of aircraft and engines after their end of service. Some of these, including Boeing, Bombardier and Rolls-Royce are members of the Aircraft Fleet Recycling Association (AFRA)¹³⁵, which is an association of 72 companies that collaborate to establish best practice guidelines for environmental management in the disposal and recycling of aircraft. These organisations recycle over 150 aircraft and 30,000 tonnes of aluminium a year, while putting serviceable spare parts back into service. Manufacturers are also ensuring that new aircraft are designed not only for a long, safe and efficient life, but also for end-of-life opportunities.

The Airbus PAMELA project¹³⁶, begun in 2005, led to the creation of Tarmac Aerosave with partners including Safran. This company specialises in recycling aircraft and is now able to re-use and recover materials making up over 90% of an aircraft's weight.

New materials such as carbon fibre present new challenges for aircraft designers to find ways of dealing with the materials once the product leaves service. Processes are being developed to allow these new materials to be recovered and potentially recycled once the aircraft reaches the end of its useful lifespan.



Planes, trains and automobiles

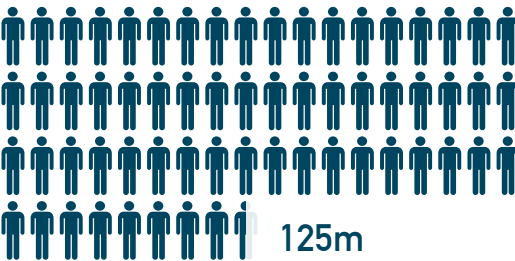


Population exposed to noise above 55dB in Europe (in millions)¹³⁸

Airport

Rail

Road



3m

8m

125m



Noise

Modern jet aircraft are 75% quieter than the first models and each new generation continues this downward trend. While each new model has reduced its noise footprint significantly, the number of aircraft movements has grown and the sensitivity of people living under flight paths to perceived noise has also increased.

However, in the US, statistics show that between 1975 and 2014 the number of people exposed to significant noise levels fell 95%, while enplanements rose by 270%¹³⁷. This trend is being replicated around the world: not only do aircraft get quieter, but airports and air traffic controllers work to provide operational noise mitigation measures and local governments work with the aviation industry to more appropriately zone areas around airports.

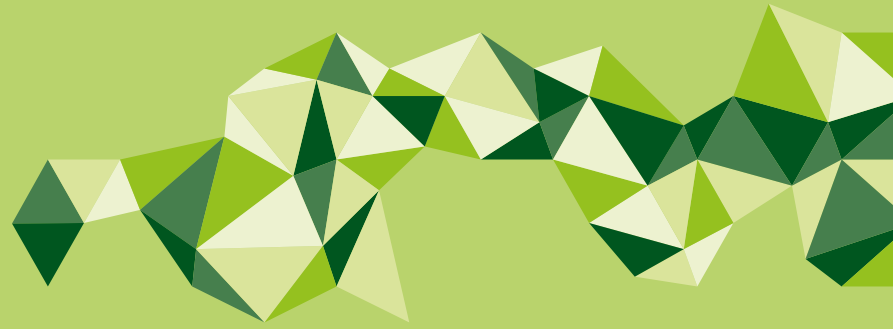
Counter-intuitively, efforts to improve airspace efficiency can also lead to a higher number of noise complaints. The implementation of performance-based navigation has, in some cases, led to an increased perception of noise

by communities. In cases like these, it is important for governments and the industry to engage with communities on issues of noise.

It is also important to note that aviation is not the only source of noise in the transport sector and, in many cases, negative noise impacts on communities stem far more regularly from the road and rail sectors. A report by the European Environment Agency shows that road traffic is responsible for the vast majority of noise in Europe, exposing more than 125 million people to levels above 55dB. Rail is the second highest cause of noise, with nearly eight million people exposed, and airport noise comes in a distant third with less than three million people affected¹³⁸.

THE AVIATION SECTOR HAS A PLAN
FOR COLLABORATIVE CLIMATE
ACTION AND IS MAKING PROGRESS
IN ACHIEVING ITS GOALS





Regional and group analysis

Africa

Asia-Pacific

Europe

Latin America

Middle East

North America

APEC economies

European Union

Small island states

Developing countries

OECD



AFRICA¹³⁹

Air transport supports 6.8 million jobs and \$72.5 billion in GDP in Africa



76.6
million passengers¹⁴⁰

1,033,398
flights¹⁴¹

143.4
billion RPKs¹⁴²

369
commercial airports¹⁴³

244
airlines¹⁴⁴

1,305
aircraft in service¹⁴⁵

38
air navigation service providers¹⁴⁶

69%
Average regional load factor¹⁴⁷

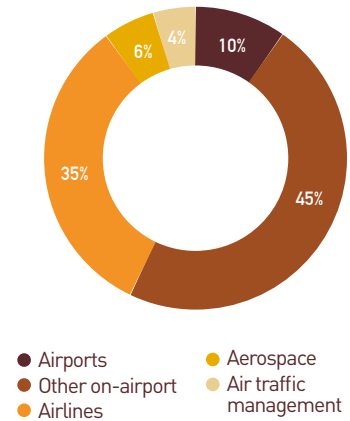
The air transport industry in Africa directly generated an estimated 381,000 jobs in 2014.

- » 133,600 of those people (35% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 37,000 people (10% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 170,300 jobs (45%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 24,700 people (6%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 15,300 people (4%).

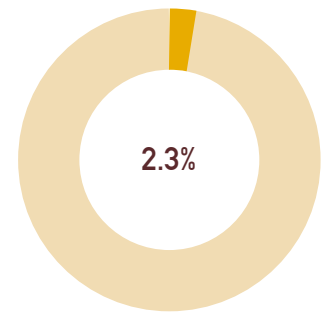
As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through African economies. Including direct impacts, as well as the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported one million jobs and contributed \$26 billion to GDP in Africa in 2014.

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated 5.8 million jobs and contributed \$46 billion to GDP in Africa's economies in 2014¹⁴⁹.

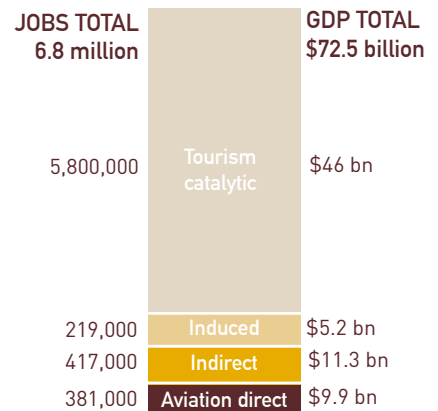
Direct jobs generated by air transport in Africa, 2014



Africa's share of global passenger traffic, 2014



Total jobs and GDP generated by air transport in Africa, 2014





Investing in ATC skills in South Africa

Projected annual growth rate for international traffic by region, 2014 - 2034⁴⁸

AFRICA	5.4%
ASIA-PACIFIC	5.1%
EUROPE	3.6%
LATIN AMERICA & CARIBBEAN	4.7%
MIDDLE EAST	6.0%
NORTH AMERICA	2.7%
APEC	3.9%
EUROPEAN UNION	3.6%
SMALL ISLANDS STATES	4.9%
DEVELOPING COUNTRIES	5.0%
OECD	3.5%
WORLD	4.3%

In total, the industry supported 6.8 million jobs and made a \$72.5 billion contribution to GDP in Africa. This accounted for 11% of the jobs and 3% of the GDP supported by the air transport industry worldwide.

The African aviation market is perhaps one that has the most potential for growth out of the global regions, due to it being a comparatively young industry and servicing a large and rapidly developing population. Overall, intercontinental air traffic to and from Africa has been growing at roughly 8% per annum over the last decade, with regional and domestic traffic growing even more. This has been due to greater economic activity in the continent. However, the performance of the industry itself is still catching up with other regions of the world⁵⁰.

The future outlook appears to be promising. Analysis from Oxford Economics suggests that the industry as a whole is expected to grow by around 5.4% per annum, a higher pace than most regions of the world⁵¹.

The economic potential of the African aviation industry could be further realised if efforts to liberalise the continent's airspace finally bear fruit. African skies are subject to some of the most economically restrictive regimes in the world, with a host of individual

bilateral agreements between states defining the regulatory environment. This system has been recognised as being a barrier for decades, with African states coming together to put forward the Yamoussoukro Declaration in 1988, which had the ambition of opening African skies and working towards air services liberalisation. This Declaration was followed by the Yamoussoukro Decision in 1999, which worked towards the same principles. However, progress has stalled. Industry associations, including IATA, AFCAC and AFRAA have long argued for the implementation of open African skies⁵².

The restrictive regulatory environment is further compounded by some non-physical barriers such as visa requirements and inefficiencies in customs clearance procedures for goods. Industry costs in Africa, including passenger fees, are also among the highest in the world. The region also has prevalent monopoly service providers in areas such as ground handling, fuel supply and catering which do not make sense in an increasingly liberalised global operating environment.

Governments now need to act to address these issues and ensure the African industry can reach its potential.



Air traffic controllers play an instrumental role in the running of the aviation system. Not only are they essential in ensuring air traffic is managed safely, but they also make an invaluable contribution to the overall efficiency of air transport, overseeing the air travel of millions of passengers each year.

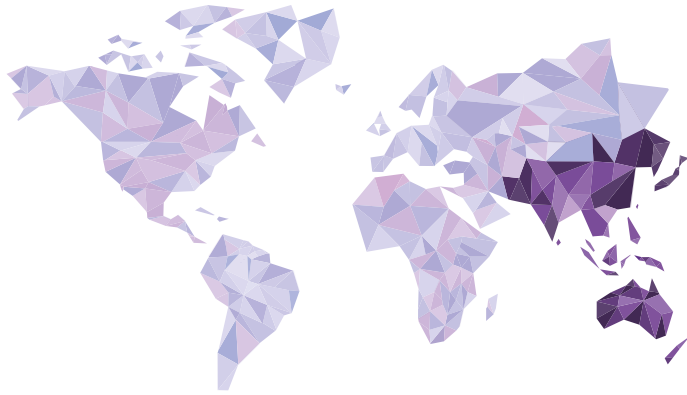
It takes a certain type of person with innate visualisation skills to be able to become an air traffic controller and, for such an important job, air traffic management organisations need to ensure that they can attract the best and brightest, and not only those fortunate enough to be able to fund their own education. That is why South Africa's Air Traffic & Navigation Services (ATNS) has established an air traffic control officer trainee bursary programme.

This scheme is open to all South African citizens, as long as they are at least 18 years old, have high school level maths and English qualifications and are medically fit. The bursary programme allows those with the raw ability to become professional air traffic controllers to be funded through their training without the need for additional financial backing. For the duration of the training course, the bursary pays for tuition, accommodation at ATNS's own guest lodge, transport, meals and a monthly allowance.

The training programme consists of three phases: the Bursary Scheme, air traffic control officer learnership and, finally, full qualification as an air traffic controller. Over 100 students from South Africa, Zambia, Swaziland and Namibia were conferred with various aviation qualifications in November 2015.

ASIA-PACIFIC¹⁵³

Air transport supports 28.8 million jobs and \$626 billion in GDP in Asia-Pacific



1.1

billion passengers

9,925,268

flights

1,949

billion RPKs

1,197

commercial airports

359

airlines

6,957

aircraft in service

44

air navigation service providers

78%

Average regional load factor

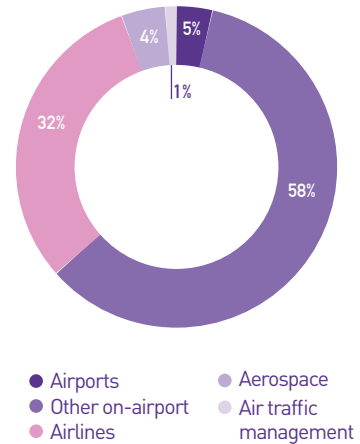
The air transport industry in Asia-Pacific directly generated an estimated 3.3 million jobs in 2014.

- » 1 million people (32% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 149,000 people (5% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 1.9 million jobs (58%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 147,000 people (4%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 45,000 people (1%).

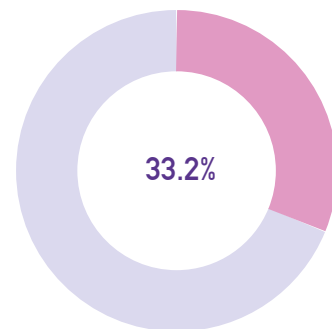
As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the Asia-Pacific region economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 8.9 million jobs and contributed \$364 billion to GDP in the Asia-Pacific region in 2014.

In addition, the spending of foreign tourists – most of whom arrive by air – supported an

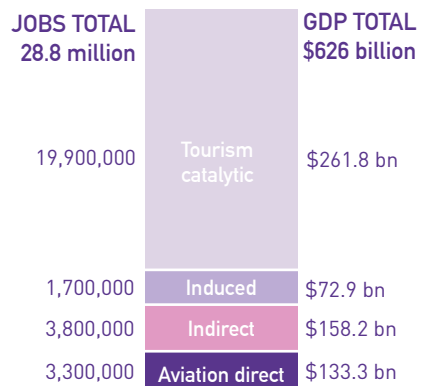
Direct jobs generated by air transport in Asia-Pacific, 2014



Asia-Pacific share of global passenger traffic, 2014



Total jobs and GDP generated by air transport in Asia-Pacific, 2014





Bombardier in Singapore



To become a qualified aerospace engineer, receiving hands-on training is invaluable, and for the manufacturer, a steady stream of able recruits is just as important. To nurture this sort of talent, the Canadian aircraft manufacturer, Bombardier, has set up a partnership with Singapore Polytechnic at the AeroHub, which opened in Singapore in January 2016.

Following the signing of a memorandum of understanding (MOU) between the aerospace company and the polytechnic in February 2014, work began on developing the AeroHub, which is designed to support scheduled and unscheduled maintenance for Bombardier's Learjet, Challenger and Global aircraft. It will, however, serve a dual purpose as a teaching facility for students studying for a Diploma in Aeronautical Engineering and Diploma Aerospace Electronics.

This 'real-world' training, working alongside Bombardier's highly skilled aeronautical engineers, will play an instrumental role in preparing students for the rigours of professional life.

The MOU was the first of its kind and shows how seriously Bombardier, and the aviation industry in general, is committed to supporting educational development, not only in the 'home base' countries, but all over the world.

Singapore Polytechnic students were given the opportunity to complete internships at Bombardier Business Aircraft's Singapore Service Centre. Third-year students from Singapore Polytechnic's courses completed a semester-long industrial project internship at the centre within its new aircraft interior workshop.

Projected annual growth rate for international traffic by region, 2014 - 2034⁴⁸

AFRICA	5.4%
ASIA-PACIFIC	5.1%
EUROPE	3.6%
LATIN AMERICA & CARIBBEAN	4.7%
MIDDLE EAST	6.0%
NORTH AMERICA	2.7%
APEC	3.9%
EUROPEAN UNION	3.6%
SMALL ISLANDS STATES	4.9%
DEVELOPING COUNTRIES	5.0%
OECD	3.5%
WORLD	4.3%

estimated 19.9 million jobs and contributed \$262 billion to GDP in the Asia-Pacific region's economies in 2014.

In total, the industry supported 28.8 million jobs and made a \$626 billion contribution to GDP in the Asia-Pacific region. This accounted for 46% of the jobs and 23% of the GDP supported by the air transport industry worldwide.

The aviation industry in the Asia-Pacific region has in recent decades been a success story, with an impressive level of growth being enjoyed. This is in no small part down to political commitment to the liberalisation of air services.

On 1 January 2015, the ASEAN Single Aviation Market came into effect, based on a policy which is intended to increase regional and domestic connectivity and enhance regional trade. With this new single air transport market, airlines from ASEAN member states will be able to compete more effectively on routes throughout the region, instead of having to navigate a patchwork quilt of regulatory zones⁵⁴.

The wider trend of liberalisation is likely to provide a further boost to the region's expanding tourism industry and trade

connections. Asia-Pacific boasts some of the busiest airports in the world. Eight of the top 20 airports in terms of passenger movements are in the region. For cargo, Asia-Pacific also contributes eight airports to the top 20 in terms of volume of cargo passing through.

Air links have allowed many countries in Asia-Pacific to generate millions of jobs in the tourism industry. According to the World Travel & Tourism Council, five of the top ten countries in terms of tourism-based direct employment are in the region, the top two in the world being India and China.

Significant investments are planned to meet this projected growth in demand, including fleet expansion using newer, more fuel-efficient aircraft, as well as corresponding investments in building the necessary aviation infrastructure, including modern airports and air traffic management systems to support long-term sustainable development of the region.

For the industry itself, employment in the region is expected to grow by roughly 2% each year, further contributing to economic growth.



EUROPE¹⁵⁵

Air transport supports 11.9 million jobs and \$860 (€707.5) billion in GDP in Europe



873.4
million passengers

7,560,360
flights

1,682
billion RPKs

667
commercial airports

387
airlines

6,586
aircraft in service

46
air navigation service providers

81%
Average regional load factor

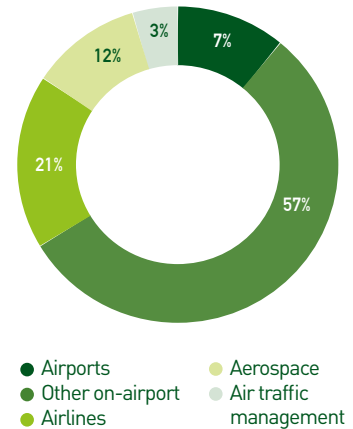
The air transport industry in Europe directly generated an estimated 2.5 million jobs in 2014.

- » 533,000 of those people (21% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 174,000 people (7% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 1.4 million jobs (57%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 311,000 people (12%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 84,000 people (3%).

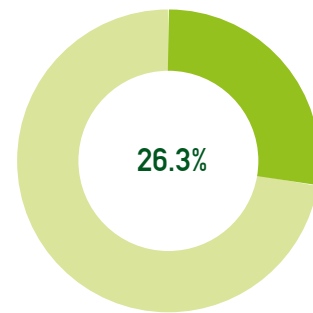
As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through European economies. Including direct impacts, as well as the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, in total the air transport sector supported 6.9 million jobs and contributed \$531 billion to GDP in Europe in 2014.

In addition, the spending of foreign tourists – many of whom arrive by air – supported an estimated five million jobs and contributed \$328 billion to GDP in Europe's economies in 2014.

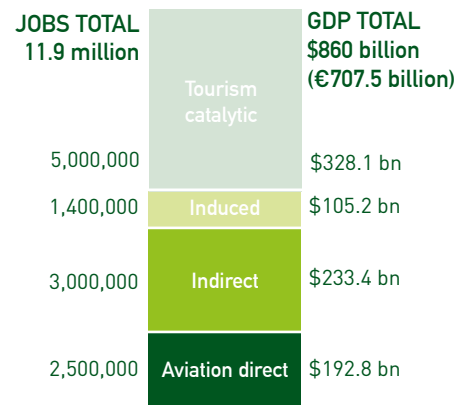
Direct jobs generated by air transport in Europe, 2014



Europe's share of global passenger traffic, 2014



Total jobs and GDP generated by air transport in Europe, 2014



Projected annual growth rate for international traffic by region, 2014 - 2034⁴⁴⁸

AFRICA	5.4%
ASIA-PACIFIC	5.1%
EUROPE	3.6%
LATIN AMERICA & CARIBBEAN	4.7%
MIDDLE EAST	6.0%
NORTH AMERICA	2.7%
APEC	3.9%
EUROPEAN UNION	3.6%
SMALL ISLANDS STATES	4.9%
DEVELOPING COUNTRIES	5.0%
OECD	3.5%
WORLD	4.3%

In total, the industry supported 11.9 million jobs and made an \$860 billion (€707 billion) contribution to GDP in Europe. This accounted for 19% of the jobs and 32% of the GDP supported by the air transport industry worldwide.

The past five years have seen marked growth in passenger traffic in Europe. The number of revenue passenger kilometres flown has increased by 30% between 2010 and 2014, or an average of 6% per year¹⁵⁶. The continent's air travel expansion is expected to continue, albeit more modestly, at a rate of 3.6% per annum on average over the next two decades¹⁵⁷.

This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry on the continent in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in Europe will have grown to support 17 million jobs (41% more than in 2014) and a \$1.6 trillion (€1.2 trillion) contribution to GDP (an 86% increase).

Europe is one of the most established regions of the world in terms of air transport activity, particularly Western Europe.

However, emerging economies in the east are contributing to the overall growth in the region, with employment in the European aviation industry expected to grow by 2% per annum up to 2034. This growth, and the restrictions of development across much of Europe, are leading to capacity shortfalls.

As part of its *Challenges of Growth* series, in 2013 Eurocontrol released a report forecasting air traffic in Europe in 2035 and the difficulty for the sector to meet that projected demand¹⁵⁸. The foregone economic impact associated with this unmet demand is estimated to be two million jobs and \$132 billion (€96.7 billion) in GDP, including direct activity at the airport, indirect and induced impacts, and the lost tourism, trade and investment due to low connectivity growth. Furthermore, the majority of this loss is in the general economy, not the airports or aviation sector.

The European industry is one of the most heavily regulated in the world in terms of social rights, consumer protection and the environment.



Air ambulances in Norway



Living in a remote area can be challenging in any number of ways, be it shopping for food or simply finding ways of socialising. However, one of the main obstacles that many living in these regions need to overcome is accessing healthcare, which can, of course, be a matter of life and death.

For residents of rural Norway this is a particular problem, not only due to their distance from hospitals, but also because of the harsh climatic conditions that can make travelling by road difficult. To address this important issue and serve its citizens living in the High North (among other places), the Norwegian government has, since 1988, been running the National Air Ambulance Service. This service provides an essential lifeline for citizens who need urgent access to healthcare.

The annual budget of the service is almost 800 million Norwegian kroner (\$91 million) and each year around 20,000 patients are helped by the service. Roughly half of these patients are transported by ambulance aircraft, while others are flown by helicopter. In total, the service flies around 18,000 flight hours every year.

The aircraft are usually dispatched for more serious cases and are equipped with state-of-the-art medical equipment, with two pilots and a specially trained nurse. If necessary, a doctor will also travel on board.

Without air links, people living in remote areas of Norway simply would not be able to access healthcare in an emergency, making some regions almost uninhabitable.

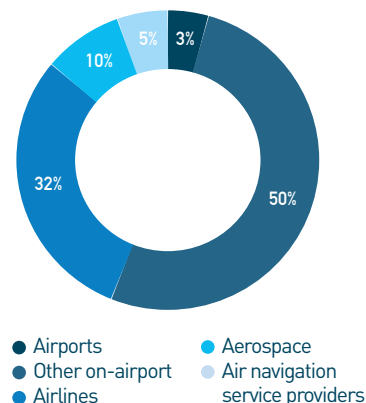


LATIN AMERICA AND THE CARIBBEAN ¹⁵⁹

Air transport supports 5.2 million jobs and \$167 billion in GDP in Latin America and the Caribbean



Direct jobs generated by air transport in Latin America and the Caribbean, 2014



255.8
million passengers

2,599,944
flights

326.8
billion RPKs

370
commercial airports

178
airlines

2,036
aircraft in service

29
air navigation service providers

78%
Average regional load factor

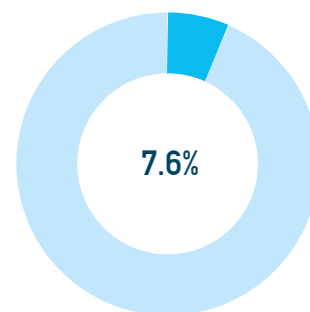
The air transport industry in Latin America and the Caribbean directly generated an estimated 806,000 jobs in 2014.

- » 261,000 of those people (32% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 24,800 people (3% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 405,000 jobs (50%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 80,000 people (10%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 35,000 people (5%).

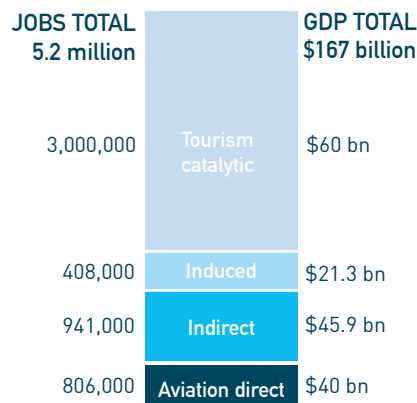
As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through Latin America and the Caribbean economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 2.2 million jobs and contributed \$107 billion to GDP in Latin America and the Caribbean in 2014.

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated three million jobs and contributed

Latin America and the Caribbean's share of global passenger traffic, 2014



Total jobs and GDP generated by air transport in Latin America and the Caribbean, 2014



Projected annual growth rate for international traffic by region, 2014 - 2034⁴⁸

AFRICA	5.4%
ASIA-PACIFIC	5.1%
EUROPE	3.6%
LATIN AMERICA & CARIBBEAN	4.7%
MIDDLE EAST	6.0%
NORTH AMERICA	2.7%
APEC	3.9%
EUROPEAN UNION	3.6%
SMALL ISLANDS STATES	4.9%
DEVELOPING COUNTRIES	5.0%
OECD	3.5%
WORLD	4.3%

\$60 billion to GDP in Latin America and the Caribbean's economies in 2014.

In total, the industry supported 5.2 million jobs and made a \$167 billion contribution to GDP in Latin America and the Caribbean. This accounted for 8% of the jobs and 6% of the GDP supported by the air transport industry worldwide.

The past five years have seen marked growth in passenger traffic in Latin America and the Caribbean. The number of revenue passenger kilometres flown has increased by 56% between 2010 and 2014, or an average of 11% per year. The region's air travel expansion is expected to continue, albeit more modestly, at a rate of 4.7% per annum on average over the next two decades.

This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the region in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in Latin America and the Caribbean will have grown to support 9.7 million jobs (88% more than in 2014) and a \$430 billion contribution to GDP (a 157% increase).

The Latin America and the Caribbean region is, however, in need of further development of infrastructure. IATA forecasts suggest a regional demand in 2034 of 525 million passengers per annum, roughly double the current number⁶⁰. The region also suffers from unreasonable tax arrangements and charges that have a negative impact on economic development. For example, Brazil's airlines pay some of the highest fuel charges in the world, hurting their competitiveness. Brazil ranks 112th in the quality of its air transport infrastructure among 141 economies. Mexico ranks 63rd, which is highest among the region's largest economies. Colombia is at 78, Chile is at 45 and Argentina is at 106⁶¹.



The World Cup



International sports tournaments have the ability to bring the world together like no other occasion, as people from all over the globe gather in one place to cheer their team on. Football's World Cup is one of these special occasions. The 2014 tournament, held throughout Brazil in 12 stadiums in 12 cities, attracted almost 3.5 million spectators over the course of the tournament. Of that, over a million were international visitors (enough to fill nearly 2,500 jumbo jets!).

Without the vital air links provided, this simply would not be possible. During the event, Brazil experienced 16.7 million passenger movements, which was an 11.2% increase from the same time frame the previous year.

Brazil is a large country, so for the most dedicated fans, getting from one venue to another meant that flying was the only option. The teams also relied on air travel to get to the venues. Together, the squads flew 280,000 kilometres, which is equal to seven laps around the world.

In terms of air transport investment, the arrival of the World Cup allowed Brazil to invest heavily in its aviation infrastructure, with a total of \$3.92 billion put forward by the government, resulting in a 52% increase in capacity that will serve Brazil well in years to come.

Having so many visitors fly in for such a major global event, of course, means a big boost for the local economy, with new job opportunities arising to cope with the influx. According to FIFA, 14 million jobs were created in the four years leading up to the tournament.

Brazilian airline, GOL, also took advantage of the country being under the spotlight to showcase their environmental action. During the tournament, GOL contributed to the 'Green Cup' initiative by running 200 flights between host cities on sustainable alternative fuel.

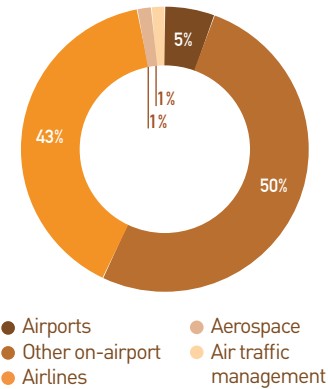


MIDDLE EAST¹⁶²

Air transport supports 2.4 million jobs and \$157.2 billion in GDP in the Middle East



Direct jobs generated by air transport in Middle East, 2014



173
million passengers

1,009,133
flights

555.2
billion RPKs

118
commercial airports

59
airlines

1,210
aircraft in service

14
air navigation service providers

78%
Average regional load factor

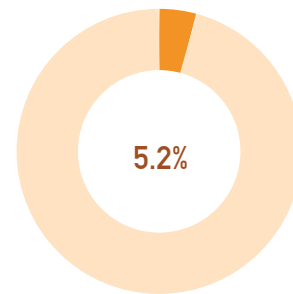
The air transport industry in the Middle East directly generated an estimated 430,000 jobs in 2014.

- » 181,000 of those people (43% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 22,000 people (5% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 215,000 jobs (50%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 3,700 people (1%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 5,000 people (1%).

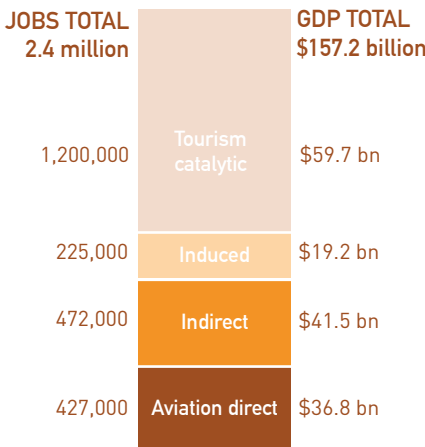
As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the Middle Eastern economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 1.1 million jobs and contributed \$97 billion to GDP in the Middle East in 2014.

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated 1.2 million jobs and contributed \$60 billion to GDP in the region in 2014.

Middle East's share of global passenger traffic, 2014



Total jobs and GDP generated by air transport in Middle East, 2014



Projected annual growth rate for international traffic by region, 2014 - 2034¹⁴⁸

AFRICA		5.4%
ASIA-PACIFIC		5.1%
EUROPE	3.6%	
LATIN AMERICA & CARIBBEAN		4.7%
MIDDLE EAST		6.0%
NORTH AMERICA	2.7%	
APEC	3.9%	
EUROPEAN UNION	3.6%	
SMALL ISLANDS STATES		4.9%
DEVELOPING COUNTRIES		5.0%
OECD	3.5%	
WORLD		4.3%

In total, the industry supported 2.4 million jobs and made a \$157 billion contribution to GDP in the Middle East. This accounted for 4% of the jobs and 6% of the GDP supported by the air transport industry worldwide.

The past five years have seen marked growth in passenger traffic in the Middle East. The number of revenue passenger kilometres flown has increased by 86% between 2010 and 2014, or an average of 13% per year. The region's air travel expansion is expected to continue, albeit more modestly, at a rate of 6% per annum on average over the next two decades.

This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the region in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in the Middle East will have grown to support 5.2 million jobs (119% more than in 2014) and a \$489 billion contribution to GDP (a 211% increase).

The Middle East continues to consolidate its position as a hub region, connecting the European and Asia-Pacific markets.

Airlines from this region are some of the most ambitious in the world, with the likes of Emirates, Etihad and Qatar boasting modern

fleets. However, significant investment is still required in infrastructure, as well as political commitment to market liberalisation. Although the Middle East is home to some of the world's largest hub airports, with traffic expected to increase dramatically in the coming decades, capacity, both in the air and on the ground, urgently needs further addressing.

According to a 2015 assessment, the average flight in the region is currently delayed by 29 minutes (and this could reach 59 minutes by 2025 without action), due to air traffic control capacity and staffing issues. It also concludes that the benefits of proper investment in air traffic management could be over \$16 billion over the next ten years¹⁶³.



Fish 'n' fuel



The Masdar Institute of Science and Technology, alongside partners Boeing and Etihad Airways, has launched an innovative project to support the development of both sustainable alternative fuel and local aquaculture.

In March 2016, the facility officially opened in a two hectare site in Abu Dhabi's Masdar City. The system works by integrating the local aquaculture industry with saltwater-tolerant plants (salicornia and mangrove), from which the biofuel is made. The waste water from the fish farming operation is used to fertilise the crops, thus cleaning up the waste water by-products of the aquaculture operations.

While the production of sustainable alternative fuel is naturally good for the aviation industry, the connected benefit of the integrated system is the sustainable production of food for Abu Dhabi. Aquaculture in the United Arab Emirates is one of the world's fastest growing food sectors, currently growing at roughly 6% per annum. Producing seafood in this manner can greatly increase food security, something of value to all states, not just the UAE.

However, industrial fish farming on this level also has associated environmental costs, as contaminated water is often left to seep into the sea. With the Masdar system, these problems are avoided, as the plants extract the nutrients leaving behind clean water that does not cause contamination.

The fuel produced from the oil-rich seeds of the halophyte plants will be used to synthesise biojet fuel for use in aviation. While this facility is still fairly small-scale, the hope is that the concept will provide the basis for larger-scale operations in the future.

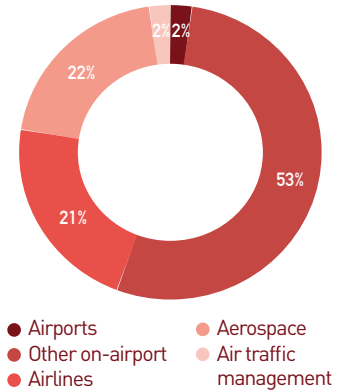


NORTH AMERICA¹⁶⁴

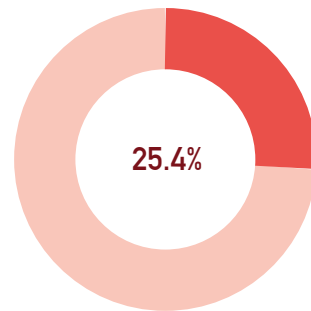
Air transport supports 7.6 million jobs and \$791 billion in GDP in North America



Direct jobs generated by air transport, 2014



North America's share of global passenger traffic, 2014



Total jobs and GDP generated by air transport, 2014

JOB TOTAL	Tourism catalytic	GDP TOTAL
7.6 million		\$791 billion
1,400,000		\$136.8 bn
1,200,000	Induced	\$131 bn
2,500,000	Indirect	\$271.1 bn
2,400,000	Aviation direct	\$252 bn

841.8
million passengers

10,660,954
flights

1.5
trillion RPKs

1,080
commercial airports

175
airlines

7,971
aircraft in service

2
air navigation service providers

83%
Average regional load factor

The air transport industry in North America directly generated an estimated 2.4 million jobs in 2014.

- » 517,000 of those people (21% of the total) were in jobs for airlines or handling agents (for example, flight crew, check-in staff, maintenance crew, reservations and head office staff).
- » Another 41,000 people (2% of the total) worked for airport operators (for example, in airport management, maintenance, security and operations).
- » 1.3 million jobs (53%) were on-site in airports, at retail outlets, restaurants, hotels, etc.
- » A further 534,000 people (22%) were employed in the manufacture of civil aircraft (including systems, components, airframes and engines).
- » Air navigation service providers employed an additional 40,000 people (2%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through North American economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 6.2 million jobs and contributed \$654 billion to GDP in North America in 2014.

Projected annual growth rate for international traffic by region, 2014 - 2034⁴⁸

AFRICA	5.4%
ASIA-PACIFIC	5.1%
EUROPE	3.6%
LATIN AMERICA & CARIBBEAN	4.7%
MIDDLE EAST	6.0%
NORTH AMERICA	2.7%
APEC	3.9%
EUROPEAN UNION	3.6%
SMALL ISLANDS STATES	4.9%
DEVELOPING COUNTRIES	5.0%
OECD	3.5%
WORLD	4.3%

In addition, the spending by foreign tourists – most of whom arrive by air – supported an estimated 1.4 million jobs and contributed \$137 billion to GDP in North America's economies in 2014.

In total, the industry supported 7.6 million jobs and made a \$791 billion contribution to GDP in North America. This accounted for 12% of the jobs and 30% of the GDP supported by the air transport industry worldwide.

The past five years have seen growth in passenger traffic in North America. The number of revenue passenger kilometres flown has increased by 14% between 2010 and 2014, or an average of 3% per year. The continent's air travel expansion is expected to continue at the same rate over the next two decades.

This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry on the continent in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in North America will have grown to support 11 million jobs (43% more than in 2014) and a \$1.5 trillion contribution to GDP (a 91% increase). Much of this growth is likely to

be attributed to North America's status as a manufacturing powerhouse.

For North America, the focus needs to be on the implementation of the NextGen air traffic control system, which will move air traffic management in some of the busiest skies in the world from ground-based radar to satellite navigation. Some of the planned programmes are already in place, but more needs to be done. Once fully implemented, the Federal Aviation Administration (FAA) expects NextGen to deliver \$134 billion in direct airline, industry, and passenger benefits by 2030. The efficiency savings, especially, could be vast. CO₂ emissions are forecast to be reduced by 52.6 million tonnes by 2030.

**Note: In the United States, the FAA also collects economic impact data, with which these numbers are aligned. The FAA assessment further evaluates the much wider economic activity that is supported by air transport (including general aviation and the domestic tourism markets that this report does not include). Accordingly, with these wider catalytic impacts included, the total number of jobs supported by civil aviation in the USA alone is around 11.3 million, with a contribution to GDP of around \$807 billion⁶⁵.*



Investing in the fuel of the future



How to dispose of the vast amounts of municipal waste generated in towns and cities across the world is without doubt an environmental challenge of its own. At present, much of this non-recyclable waste is simply sent straight to landfill sites, a process which comes with a significant environmental cost.

However, change is on the horizon following a landmark partnership between United Airlines and Fulcrum BioEnergy. In June 2015, United announced a \$30 million equity investment in the fuels developer.

Fulcrum specialises in converting household waste into sustainable alternative jet fuel through a thermochemical process that converts normal waste into a synthesis gas, which is in turn converted into jet fuel through the 'Fischer-Tropsch' process.

The sustainability credentials of the Fulcrum process are impressive. Rather than burying the waste in landfill sites, allowing it to gradually emit greenhouse gases such as methane, it can be used to power a flight instead, avoiding 'doubling-up' of emissions. The Fulcrum process also tackles the land-use issues associated with non-sustainable alternative fuels and in actual fact improves land availability due to the decrease in the size of landfill sites.

United and Fulcrum's deal seeks to jointly develop up to five projects located near United's hubs, providing employment opportunities, and has the potential to produce 680 million litres of fuel per year. To ensure that momentum on this project is maintained, United has also negotiated a long-term supply agreement with Fulcrum and, subject to availability, will have the opportunity to purchase at least 90 million gallons of sustainable aviation fuel a year for a minimum of ten years.

APEC ECONOMIES¹⁶⁶

Air transport supports 29.1 million jobs and \$1.5 trillion in GDP in the APEC Economies



The air transport industry in the APEC economies directly generated an estimated 5.9 million jobs in 2014:

- » Airlines: 1.6 million (27% of the total).
- » Airport operators: 203,000 (3%).
- » Other on-airport: 3.2 million (55%).
- » Civil aerospace: 742,000 (13%).
- » Air navigation service providers: 109,300 (2%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the APEC economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 15.7 million jobs and contributed \$1.1 trillion to GDP in the APEC economies in 2014.

1.9

billion passengers¹⁶⁷

58%

APEC share of global passenger traffic, 2014

514

airlines

15,553

aircraft in service

In addition, the spending by foreign tourists – many of whom arrive by air – supported an estimated 13.3 million jobs and contributed \$384 billion to GDP in the APEC economies in 2014.

In total, the industry supported 29.1 million jobs and made a \$1.5 trillion contribution to GDP in the APEC economies. This accounted for 46% of the jobs and 56% of the GDP supported by the air transport industry worldwide.

The number of revenue passenger kilometres flown in the APEC economies is expected to grow by 3.9% per annum over the next two decades. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the economies in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in the APEC economies will have grown to support 46 million jobs (57% more than in 2014) and a \$3.3 trillion contribution to GDP (a 124% increase).

Total jobs and GDP generated by air transport in the APEC economies, 2014

JOB TOTAL		GDP TOTAL
29.1 million		\$1.5 trillion
13,300,000	Tourism catalytic	\$384.4 bn
3,200,000	Induced	\$220 bn
6,700,000	Indirect	\$469.2 bn
5,900,000	Aviation direct	\$410.1 bn



Combating the illegal wildlife trade



As the nations of the world gathered to agree on the set of 17 Sustainable Development Goals, protecting life on land was rightly seen as a crucial goal. A major obstacle to achieving this aim is the burgeoning illegal trade in wildlife, which is estimated to be worth up to \$10 billion per year.

Transnational criminal gangs are exploiting the modern air transport system to traffic protected plants and animals (both living and dead), then selling them on through the black market.

To help combat this illegal trade, the International Air Transport Association (IATA) is working with its airline members, as well as other sectors of the aviation industry, to raise awareness on the issue and assist where they can. While the duty for apprehending and prosecuting these criminals lies with national enforcement authorities, airline staff can be a valuable asset in providing information to the authorities, leading to greater intelligence.

In June 2015, IATA signed a memorandum of understanding with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), signalling their strong cooperation. Since then, IATA has been helping to organise awareness training for airline staff and has set up a Wildlife Task Force, which is responsible for identifying and reviewing emerging wildlife conservation issues and developing an appropriate response.

The response from airlines has been commendable, with Kenya Airways hosting a training workshop in Nairobi and Emirates adorning one of its A380s with wildlife livery to raise awareness. Now that this issue is firmly on the table, airlines will be better equipped to deal with this sort of criminal activity.

Airports, too, have signalled their commitment to protecting wildlife. In March 2016, Airports Council International, alongside IATA, signed the United for Wildlife declaration. This agreement sets out real steps to close the routes exploited by traffickers of the illegal wildlife trade as they move their products from killing field to marketplace.

EUROPEAN UNION¹⁶⁸

Air transport supports 8.8 million jobs and \$708 billion (€621 billion) in GDP in the EU28



The air transport industry in the EU28 directly generated an estimated 1.9 million jobs in 2014:

- » Airlines: 377,900 (20% of the total).
- » Airport operators: 108,300 (6%).
- » Other on-airport: 1.1 million (59%).
- » Civil aerospace: 251,800 (13%).
- » Air navigation service providers: 45,000 (2%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the EU28 economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 5.2 million jobs and contributed \$441 billion to GDP in the EU28 in 2014.

In addition, the spending of foreign tourists – many of whom arrive by air – supported an estimated 3.6 million jobs and contributed \$267 billion to GDP in the EU28's economies in 2014.

In total, the industry supported 8.8 million jobs and made a \$708 billion contribution to GDP in the EU28. This accounted for 14% of the jobs and 26% of the GDP supported by the air transport industry worldwide.

The number of revenue passenger kilometres flown in the EU is expected to grow by about 3.6% per annum over the next two decades. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the EU in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in the EU28 will have grown to support 12 million jobs (39% more than in 2014) and a \$1.3 trillion contribution to GDP (an 83% increase).

649

million passengers¹⁶⁹

19%

EU share of global passenger traffic, 2014

214

airlines

4,490

aircraft in service¹⁷⁰

Total jobs and GDP generated by air transport in the EU, 2014

JOB TOTAL		GDP TOTAL
8.8 million		\$708 billion (€621 bn)
3,600,000	Tourism catalytic	\$267 bn (€218.3 bn)
1,000,000	Induced	\$87.3 bn (€71.4 bn)
2,200,000	Indirect	\$193.7 bn (€158.4 bn)
1,900,000	Aviation direct	\$160 bn (€131 bn)



Benefits of the Single European Sky



Following the liberalisation of the European air transport market in the 1990s, connectivity has grown significantly. However, the potential for efficient connectivity on the continent is still not being fulfilled.

To cope efficiently with the expected increase in traffic, Europe's airspace needs modernisation. The European air traffic management system currently handles around 26,000 flights per day, but the manner in which they are managed is inefficient, with each individual ANSP responsible for the airspace over its territory.

The European Union set up the SESAR Joint Undertaking to help develop the tools necessary for a transition towards a shared airspace. While the initiative has successfully developed a number of technical and operational efficiency measures, achieving a degree of integration, overall progress towards achieving a Single European Sky (SES) has been slower than initially hoped for.

The aviation industry is firmly behind efforts to achieve a fully integrated airspace, not only for the benefit of airlines, but also for the sake of passengers and the environment. Due to inefficiencies in European ATM, travellers are enduring unnecessary delays and aircraft are producing more CO2 emissions than they would under a modern, streamlined system.

The value of SES was shown by a report, published in April 2016, that compares the scenarios of 'do nothing' and full implementation of SES. And the results are striking. It concludes that airspace modernisation could deliver European consumers an additional \$36 billion (€32 billion) of welfare benefits in the year 2035, compared to a 'do nothing' scenario (in which no further airspace modernisation takes place). The total present value of airspace modernisation over the 2015-2035 period comes to \$143.5 (€126) billion.

SMALL ISLAND STATES¹⁷¹

Air transport supports 1.4 million jobs and \$25.3 billion in GDP in small island states



The air transport industry in the small island states directly generated an estimated 74,000 jobs in 2014:

- » Airlines: 12,200 (16% of the total).
- » Airport operators: 9,200 (13%).
- » Other on-airport: 50,800 (68%).
- » Air navigation service providers: 2,300 (3%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the small island states' economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 180,000 jobs and contributed \$4.4 billion to GDP in the small island states in 2014.

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated 1.2 million jobs and contributed \$21 billion to GDP in the small island states' economies in 2014.

In total, the industry supported 1.4 million jobs and made a \$25.3 billion contribution to GDP in the small island states. This accounted for 2% of the jobs and 1% of the GDP supported by the air transport industry worldwide.

The number of revenue passenger kilometres flown in small island states is expected to grow by about 4.9% per annum over the next two decades. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the economies in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in the small island states will have grown to support 2.3 million jobs (66% more than in 2014) and a \$51.6 billion contribution to GDP (a 104% increase).

89

million passengers

1%

Small island states share of global passenger traffic, 2014

59

airlines

368

aircraft in service

Total jobs and GDP generated by air transport in small island states, 2014

JOB TOTAL		GDP TOTAL
1.4 million		\$25.3 billion
1,200,000	Tourism catalytic	\$20.9 bn
54,000	Induced	\$1.1 bn
54,000	Indirect	\$1.1 bn
74,000	Aviation direct	\$2.3 bn



Supporting tourism in the Maldives



For many small island states, particularly those far from the mainland, tourism often plays a central role in the national economy. In the case of the Maldives, a small tropical nation situated in the Indian Ocean, this is especially true.

The Maldives is made up of 1,192 coral islands, joined together in a chain of 26 atolls, and has a population of fewer than 400,000 people. According to the World Travel & Tourism Council, the direct contribution of tourism to the Maldives economy was a staggering 41.5% of total GDP in 2014. If you include tourism's indirect contribution, the proportion of GDP jumps to 78.1%. This ranked the Maldives as second in the world in 2014 when it comes to travel and tourism's direct importance to the economy.

Naturally, for a country situated 430 kilometres from the closest mainland in India (and that's only the northernmost of this vast set of islands) air links are invaluable to its economy. The main international airport in the Maldives is situated in the capital, Malé, although there are domestic airports, such as the one on the southern island of Gan.

According to the Maldives Ministry of Tourism, a total of 1.5 million tourists arrived in the country in 2014, all of these by air. That equates to over three times the population of the islands passing through in one year! In February 2015 alone, the Maldives welcomed a record 120,468 tourists to the islands.

To travel to the numerous holiday resorts scattered around the archipelagos, aviation also plays a major role, with two charter seaplane companies transporting visitors to their destinations. Seaplanes are vital connectors of people in the Maldives, where in 2011, 44 seaplanes recorded more than 100,000 operations, connecting 66 locations. Due to their versatility, and, of course, ability to land on water, seaplanes are an ideal form of aircraft for a country like the Maldives.

DEVELOPING COUNTRIES¹⁷²

Air transport supports 38 million jobs and \$561 billion in GDP in developing countries



The air transport industry in developing countries directly generated an estimated 3.8 million jobs in 2014:

- » Airlines: 1,300,000 (35% of the total).
- » Airport operators: 209,400 (6%).
- » Other on-airport: 2 million (53%).
- » Civil aerospace: 145,300 (4%).
- » Air navigation service providers: 93,400 (2%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the developing countries' economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 10.1 million jobs and contributed \$287 billion to GDP in developing countries in 2014.

1.2

billion passengers

36%

Developing country share of global passenger traffic, 2014

832

airlines

10,011

aircraft in service

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated 27.9 million jobs and contributed \$274 billion to GDP in developing countries in 2014.

In total, the industry supported 38 million jobs and made a \$561 billion contribution to GDP in developing countries. This accounted for 61% of the jobs and 21% of the GDP supported by the air transport industry worldwide.

The number of revenue passenger kilometres flown in developing countries' economies is expected to grow by about 5% per annum over the next two decades. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the developing countries' economies in the next 20 years.

By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in developing countries will have grown to support 61 million jobs (59% more than in 2014) and a \$1.6 trillion contribution to GDP (a 178% increase).

Total jobs and GDP generated by air transport in developing countries, 2014

JOB TOTAL		GDP TOTAL
38 million		\$561 billion
28,000,000	Tourism catalytic	\$273.9 bn
2,300,000	Induced	\$74.5 bn
4,100,000	Indirect	\$106.9 bn
3,800,000	Aviation direct	\$105.6 bn



The first fully solar-powered airport



Solar panels being used at an airport is not an entirely new concept. Airports make an ideal location for solar panels, with wide open spaces on the ground and large terminal buildings on which to build them. Over 100 airports worldwide make use of solar panels to produce clean energy for powering the terminal and sometimes even to contribute to the wider grid.

August 2015, however, saw a landmark event. Cochin International Airport in the Indian state of Kerala became the first in the world to be entirely powered by solar energy, making the airport completely energy self-sufficient. The 46,000 solar panels at the airport produce 12 megawatts of power, more than enough to run the airport's operations.

The journey towards the fully solar-powered airport was a remarkably short one. Cochin Airport, which has always had a focus on sustainability, began work on solar power in March 2013, when the operator installed a solar plant on the roof of the Arrival Terminal Block. Two subsequent plants were then commissioned, allowing the airport to avoid more than 550 tonnes of CO₂.

Following the success of this first foray into renewable energy, the airport ramped up its construction to produce a plant covering 45 acres near its cargo complex.

With the Indian Government's recent solar energy drive, perhaps Cochin will not remain the only fully solar-powered airport for long.

OECD COUNTRIES¹⁷³

Air transport supports 21.9 million jobs and \$1.9 trillion in GDP in the OECD



The air transport industry in the OECD directly generated an estimated 5.5 million jobs in 2014:

- » Airlines: 1.2 million (22% of the total).
- » Airport operators: 172,500 (3%).
- » Other on-airport: 3.1 million (57%).
- » Civil aerospace: 859,000 (16%).
- » Air navigation service providers: 106,000 (2%).

As well as this direct employment in the operations of the air transport sector itself, the sector's impact reaches further through the OECD economies. Including direct impacts, the effect of the sector's procurement of goods and services through its supply chain, and the benefits that arise when employees in the industry and its supply chain spend their wages in the local consumer economy, the air transport sector supported 14.4 million jobs and contributed \$1.4 trillion to GDP in the OECD in 2014.

1.9

billion passengers

57%

OECD share of global passenger traffic, 2014

477

airlines

14,961

aircraft in service

In addition, the spending of foreign tourists – most of whom arrive by air – supported an estimated 7.5 million jobs and contributed \$555 billion to GDP in the OECD's economies in 2014.

In total, the industry supported 21.9 million jobs and made a \$1.9 trillion contribution to GDP in the OECD. This accounted for 35% of the jobs and 71% of the GDP supported by the air transport industry worldwide.

The number of revenue passenger kilometres flown in the economies is expected to grow by about 3.5% per annum over the next two decades. This increase will, in turn, drive growth in the economic output and jobs that are supported by the air transport industry in the OECD economies in the next 20 years. By 2034, Oxford Economics forecasts that the impact of air transport and the tourism it facilitates in the OECD will have grown to support 33 million jobs (50% more than in 2014) and a \$3.8 trillion contribution to GDP (a 99% increase).

Total jobs and GDP generated by air transport in the OECD, 2014

JOB TOTAL		GDP TOTAL
21.9 million		\$1.9 trillion
7,500,000	Tourism catalytic	\$555 bn
2,900,000	Induced	\$269.4 bn
6,100,000	Indirect	\$579.4 bn
5,500,000	Aviation direct	\$503 bn



GE Aviation's US expansion means jobs and investment



To meet the growing demand for jet engines, GE Aviation (which is a partner in CFM International with Safran Aircraft Engines) has expanded its operations significantly. The company has opened eight new US manufacturing facilities in the last eight years all focused on producing new technologies to improve fuel efficiency and lower emissions.

The jet engine order book for GE Aviation and CFM International exceeds 15,000. Much of this backlog involves new engine designs, such as CFM's LEAP engine for narrow-body aircraft and the new GE9X under development for the Boeing 777X.

To deal with this backlog, GE has built new facilities, upgraded existing plants and launched new joint ventures and acquisitions. These new facilities are creating jobs and enable the construction of next-generation engines, which require manufacturing through new processes, such as additive manufacturing. Since 2012, GE's drive to ramp up its facilities included:

- » Opening an additive manufacturing facility in Auburn, Alabama, to mass produce LEAP engine's fuel nozzle tip.
- » Creating a \$51 million research centre in Dayton, Ohio, focused on advanced power starter/generation, conversion and distribution technologies.
- » Investing \$56 million in a second advanced composite component facility in Mississippi, with 100+ staff.
- » Opening the world's first facility to mass produce parts for commercial and military engines in Asheville, North Carolina, with over 300 employees.
- » Constructing a LEAP engine assembly factory in Indiana, that will employ more than 200 people.
- » Investing \$200 million in Huntsville, Alabama, to mass-produce silicon carbide material for CMC components.

And this is only GE's operations in the company's home country of the United States. Worldwide, GE's investment in research and production is far greater.

MAKING IT IN INDIA

Launched in September 2014 by Prime Minister Narendra Modi, the 'Make in India' programme aims to transform India into a global design and manufacturing hub



“India is one of the most important strategic growth markets for Rolls-Royce and we continue to build on our distinguished legacy and long-standing partnership. We are already leveraging the vast engineering talent pool and playing a leading role in the government’s ‘Make in India’ initiative.”

**- KISHORE JAYARAMAN,
ROLLS-ROYCE, PRESIDENT
(INDIA AND SOUTH ASIA)**

The aim of the initiative is to boost manufacturing in India to 25% of GDP by 2022 and create 100 million new jobs, contributing to the alleviation of poverty. The arguments in favour of investing in India are convincing. As the world’s largest democracy with a huge human resource base of 1.2 billion citizens, India’s potential is obvious. ‘Make in India’ is intended not only to stimulate economic growth, but also to foster higher levels of education among young Indians. In December 2015, the Indian Government and the World Bank announced a \$50 million investment in the ‘Nai Manzil: Education and Skills Training for Minorities Project’, which aims to help young people from minority communities complete their education and gain from market-driven training programmes with the aim of improving their employment outcomes¹⁷⁴.

Aerospace is one of the sectors to take advantage of this investment push from India. Leading manufacturers Pratt & Whitney, GE Aviation, Rolls-Royce and Honeywell all run operations in India. The reasons for their confidence in India are numerous, not only based on workforce availability.

The Asia-Pacific region is undoubtedly an aviation hub, meaning that investing in facilities in India allows engineering R&D providers to collaborate with manufacturers on the ground and provide local engineering support. However, the willingness of the Indian government to host foreign companies is certainly a major consideration and is, indeed, the central principle of the ‘Make in India’ campaign. The financial incentives provided in India benefit not only the manufacturers, but Indian engineers and the wider community too.



Rolls-Royce

British technology company Rolls-Royce has a rich history in India. Having operated in the country for over 80 years, Rolls-Royce has an established presence in a number of manufacturing fields, with the first aircraft for both the Indian Air Force and the Navy being powered by Rolls-Royce engines.

The company has been investing heavily in India in recent years: economically through their civil aerospace wing, but also, more widely, in social terms, as Rolls-Royce. More than 1,000 highly qualified engineers and managers work exclusively for Rolls-Royce through partners, TCS and QuEST, providing high quality engineering solutions and services across the entire product development life-cycle.

Rolls-Royce's base in Bengaluru fosters Indian talent, providing prospective engineers with a broad training programme with experienced Rolls-Royce engineers. The aim of the company is to realise the ambition of Bengaluru becoming a major aviation hub. By 2017, Rolls-Royce's Bengaluru new engineering centre will employ 500 additional people to support their civil aerospace business. Through a joint venture with another manufacturer, HAL International Aerospace, Rolls-Royce is manufacturing high-tech components for the Trent family of jet engines.

Rolls-Royce is also helping to foster Indian talent by sponsoring the Chevening Rolls-Royce Science and Innovation Leadership Programme, a scholarship programme for high potential, mid-career Indian professionals to Said Business School, University of Oxford. The company also helps develop STEM skills in children from local economically disadvantaged communities.



Jet engine manufacturer, GE Aviation, has had a presence in India for a number of years, with an established technology centre in Bengaluru employing 4,000 experts, as well as engineering centres in Hyderabad, Chennai and Mumbai, which collectively employ over 700 engineers. These engineers are focused on supporting the engineering sciences, product engineering centre, engineering tools, aviation systems and digital solutions. The Indian engineering branches work on a range of different GE products, including the GENx and GE9X engines, as well as the LEAP engine, which GE produces as part of CFM International alongside French technology company Safran Aircraft Engines. In the avionics field, GE also produces components for the Airbus A350 wing in India.

“India is a growth engine for Asia, and we see huge potential for the country in the manufacturing space.”

- JEFF IMMELT, CHAIRMAN AND CEO OF GE

In 2015, GE opened a brand new multi-modal manufacturing facility in Pune, which will produce components for a number of GE jet engines. The advanced manufacturing plant covers 67 acres and will employ 1,500 workers who will share production lines, support infrastructure and equipment such as 3D printers and laser inspection technology. The hope is that, by 2020, \$20 million in engine parts will be produced from the facility.

GE describes the facility as a ‘brilliant factory’, meaning that the factory equipment and computers talk to each other over the ‘industrial internet’ in real time, share information, and make decisions to preserve quality and prevent downtime.

“Make in India is at the heart of Honeywell’s strategy in the country and that has been for 40 years.”

- ARIJIT GHOSH,
PRESIDENT, HONEYWELL
AEROSPACE INDIA



Honeywell

Honeywell has an 80-year history in India with more than 15,000 employees in 50 cities across the country. More than 6,000 engineers work on innovative technologies every day, helping tackle some of India’s and the world’s toughest challenges in energy efficiency, safety, security and customer productivity. Honeywell has five engineering and technology development centres and seven manufacturing facilities in the country. More than 3,000 products, solutions and applications have been engineered in India.

On the aerospace side specifically, Indian employees are critical contributors to many of the company’s leading-edge technologies that are advancing the science of flight and meeting the needs of Honeywell customers everywhere in the world. Products produced by Honeywell in India range from technologies for the smallest turboprop aircraft to the largest commercial jets.

Honeywell technologies developed and manufactured in India contribute to improving the safety and efficiency of commercial and business aviation.

Honeywell also cooperates with resident Indian companies, such as Hindustan Aeronautics and Tata Power’s Strategic Engineering Division. In September

2014, Honeywell and Tata Power signed a technology-sharing agreement for Honeywell’s TALIN inertial navigation system. This agreement allows India to co-produce its first locally produced advanced navigational system, supporting the Indian government’s ‘Make in India’ campaign.

To help support its host country, Honeywell has been investing heavily in the next generation of Indian aerospace engineers and pilots. Its Technology Solutions engineering arm, based in Bengaluru, has close connections with schools and universities and is committed to training young Indian engineers in, among other things, aerospace. This investment in Indian people’s skills is a prime example of how the ‘Make in India’ initiative is helping the country develop in ways other than strict economic growth.

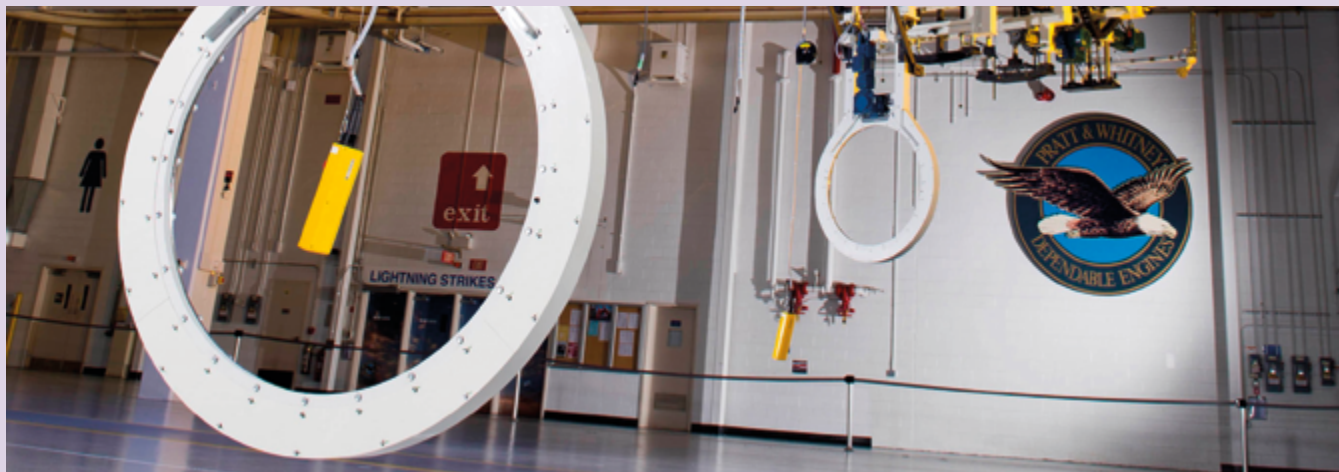


Since Boeing began supplying aircraft to Tata Airlines over 75 years ago, the American manufacturer has had commercial ties with India. Now, with the ‘Make in India’ campaign in full flow, Boeing is playing its part in supporting the initiative.

Shortly before Prime Minister Modi officially launched the drive to attract foreign investment into manufacturing in India, Boeing formed a joint venture with Tata Advanced Systems Limited to collaborate in producing aerospace integrated systems solutions. Indian workers now play a crucial role in building components for a number of Boeing aircraft through TAL Manufacturing Solutions, for example, the complex floor beams used in the 787-9.

A significant aspect of ‘Make in India’, alongside manufacturing itself, is ensuring that the investment from abroad is focused on developing Indian talent. This nurturing of talent is often realised through partnerships with universities and research organisations, something that Boeing has been active in doing, well before ‘Make in India’ was officially launched, having had a research and development presence in India since 1995.

In 2005, Boeing entered into a strategic partnership with IISc Bangalore, which conducts research on materials and sciences for structural alloys, as well as smart materials and structures, making it only one of ten universities worldwide that enjoys such a relationship with Boeing. The company also encourages the professional development of young engineers through various skill-based initiatives, working alongside colleges and universities and providing vocational training.



In September 2015, Pratt & Whitney opened a new customer training centre in the Indian city of Hyderabad. At the facility, aircraft engineers and technicians will be trained on all models of Pratt & Whitney engines, both existing and new ones. Over 300 aircraft based in India are powered by Pratt & Whitney engines, and this number is set to increase with many new Geared Turbofan engines projected to enter service in India in the coming years. Having a dedicated customer training centre in the country is the best way for the technology company to ensure that its airline customers are well versed in their use.

As Hyderabad is a key location for many aircraft operators in India, setting up shop in the city was the logical choice, making the facility Pratt & Whitney's third global training centre, alongside their East Hartford and Beijing locations.

Pratt & Whitney has, however, had previous connections to India. In 2013, Pratt & Whitney took up residence at the Indian Institute of Science in Bengaluru to conduct advanced research into gas turbine jet engine technology in India, as well as research aimed at making these engines more efficient and environmentally friendly.

The office supports a full-time professor in gas turbine engineering. In the longer term, Pratt & Whitney hopes that its presence at the research centre will attract engineering talent to the gas turbine engine field, promoting the skills of Indian students.



European aircraft manufacturer, Airbus, has had a presence in India since the 1980s, when it began partnering with Hindustan Aeronautics Limited to produce passenger doors for the A320 aircraft, an arrangement that still exists today.

In recent years, Airbus has been scaling up its activities in India through its subsidiary, Airbus India Operations. Established in 2013, this branch of Airbus unifies the company's engineering activities in the country, including Emerging Technologies and Concepts, strategy and international cooperation. Airbus, like many other players in the aerospace industry recognises the strategic importance of the vast subcontinental country and has made a long-term commitment to playing its part in developing the Indian aerospace sector.

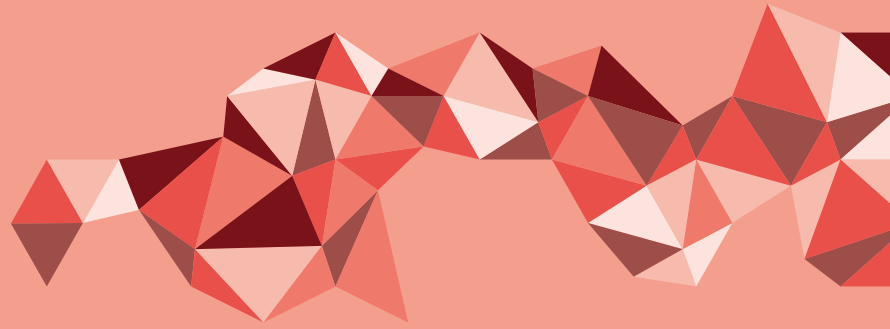
Over 400 engineers are already employed at the Airbus facility in Bengaluru and, in keeping with the goals of the 'Make in India' campaign, there are plans to increase the company's contribution to the Indian economy. In the coming years, Airbus aims to make further investment in India and create over 10,000 highly skilled jobs in a range of aerospace activities.

In March 2016, the company announced plans to invest \$40 million to set up a pilot and maintenance training centre in the Delhi area, which will house four A320 full-flight simulators and will have the capacity to train over 8,000 pilots and 2,000 engineers over ten years from 2018 onwards.

Airbus has also been investing in untapped talent in India through the Airbus Bizlab initiative, which helps start-up companies develop engineering ideas from concept to thriving businesses. In March 2016, Airbus selected four separate start-ups based in Bangalore in India, which will be granted access to a large number of Airbus coaches, experts and mentors, helping them get their ideas off the ground.

“This customer training facility marks a major milestone for Pratt & Whitney. We will continue to invest in talent and infrastructure to support the industry's growth here.”

- PALASH ROY CHOWDHURY, COUNTRY MANAGER INDIA, PRATT & WHITNEY



National Analysis

National Analysis

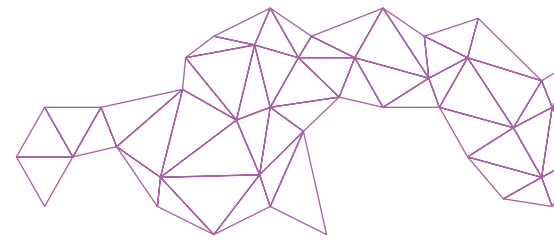
National figures for employment and GDP supported by aviation, with analysis provided by Oxford Economics for those countries where reliable data are available and estimations are possible at the national level. Estimates are conducted based on indicators such as airport employment, airport passenger traffic¹⁷⁵ and airline passenger numbers¹⁷⁶. For other countries that are not included below, not enough data are available for a reliable country-specific analysis.

Africa

	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Egypt	70	96	18	827	1,011	1,248	1,115	210	10,577	13,150
Kenya	18	129	58	412	617	756	492	220	1,683	3,151
Morocco	35	36	16	741	828	418	373	166	8,516	9,473
Nigeria	28	19	8	38	93	390	251	114	540	1,295
South Africa	70	133	57	234	493	2,969	3,066	1,320	5,118	12,473

Asia-Pacific

	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Australia	173	104	60	292	628	13,771	12,941	7,475	30,219	64,405
China	1,280	2,276	710	1,189	5,454	32,774	30,461	9,497	15,453	88,184
Chinese Taipei	61	46	20	316	443	3,818	2,211	947	13,725	20,701
Hong Kong	79	84	30	170	363	9,275	6,521	2,315	14,656	32,766
India	394	570	351	6,193	7,508	4,456	2,736	1,685	21,219	30,095
Indonesia	185	530	136	1,711	2,562	4,307	4,016	1,030	14,371	23,724
Japan	322	220	205	356	1,103	24,645	15,931	14,834	27,476	82,886
Malaysia	124	104	15	220	463	1,975	2,594	369	6,301	11,239
New Zealand	31	32	15	175	254	2,824	2,762	1,291	11,486	18,362
Philippines	130	78	24	969	1,200	1,064	580	176	7,423	9,243
Singapore	107	72	23	145	347	11,884	6,208	2,013	14,823	34,928
South Korea	134	169	68	400	771	10,943	9,312	3,761	20,177	44,193
Thailand	108	385	86	2,683	3,262	4,345	4,098	912	38,972	48,327



Europe

	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Austria	32	20	10	17	78	2,203	2,031	1,001	1,589	6,825
Belgium	36	25	12	37	109	3,093	2,920	1,424	3,956	11,393
Cyprus	6	2	1	58	67	308	109	73	3,472	3,962
Czech Republic	24	18	6	13	61	869	757	241	465	2,332
Denmark	32	18	12	13	75	2,534	2,297	1,580	1,430	7,842
Finland	21	14	8	21	64	1,795	1,482	840	2,236	6,354
France	319	408	198	240	1,165	33,841	41,994	20,386	22,195	118,415
Germany	325	303	167	250	1,045	25,716	27,579	15,169	16,560	85,024
Greece	33	24	11	357	426	3,234	1,619	714	19,132	24,698
Hungary	14	14	7	20	55	784	480	226	684	2,175
Iceland	6	6	2	29	44	242	617	231	2,718	3,808
Ireland	35	27	11	93	167	5,010	3,558	1,469	12,206	22,243
Italy	157	146	47	241	591	10,943	14,044	4,498	20,514	49,999
Latvia	4	5	2	13	24	175	186	58	469	888
Luxembourg	13	1	1	4	19	1,287	350	185	737	2,558
Malta	4	3	1	40	47	189	155	49	2,332	2,725
Netherlands	94	45	24	140	303	6,972	5,515	2,987	9,970	25,445
Norway	46	34	18	36	133	5,533	6,487	3,340	4,801	20,161
Poland	40	44	17	27	128	1,972	1,525	574	960	5,031
Portugal	32	35	19	175	260	2,411	1,810	951	7,636	12,809
Romania	29	42	14	38	123	1,065	982	322	768	3,137
Russia	344	423	86	227	1,080	12,758	11,008	2,240	6,391	32,399
Spain	195	127	76	1,029	1,427	15,701	10,154	6,052	81,382	113,289
Sweden	90	50	29	69	238	7,704	5,999	3,509	7,071	24,283
Switzerland	59	38	27	53	178	6,562	5,486	3,903	5,964	21,914
Turkey	138	116	23	823	1,099	5,429	3,562	709	38,571	48,271
United Kingdom	334	360	252	607	1,553	30,945	32,400	22,723	47,584	133,652

Note that the country figures shown will not necessarily equal the regional totals expressed elsewhere in the report. In part, this is because individual country figures are computed using country-specific multipliers, whereas regional figures are computed using region-specific multipliers. The former are smaller than the latter because of the effects of 'leakage' – spending that occurs outside of the country or region as a result of imports; an individual country will have more leakage than will a region, since some imports will occur within-region.



Latin America and the Caribbean

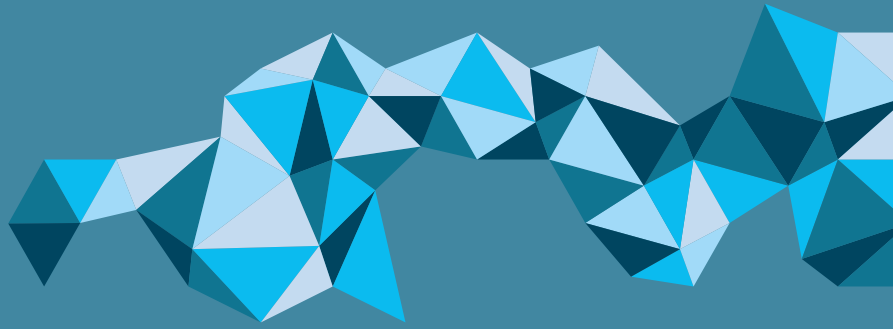
	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Argentina	72	60	37	127	296	2,491	1,834	1,115	4,141	9,580
Brazil	265	403	185	280	1,133	9,675	10,584	4,855	7,813	32,928
Chile	35	80	32	43	189	2,656	2,605	1,032	1,471	7,763
Colombia	65	62	18	318	463	1,203	1,061	303	5,324	7,891
Dominican Republic	8	15	6	387	416	251	240	96	6,798	7,386
Ecuador	11	25	10	147	193	354	339	136	2,192	3,021
Mexico	212	301	112	423	1,049	16,553	7,901	2,931	10,379	37,764
Peru	27	37	15	202	280	499	477	190	3,186	4,352

Middle East

	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Israel	24	45	26	92	187	4,850	3,862	2,262	7,440	18,415
Jordan	14	16	8	54	92	435	357	188	1,388	2,368
Lebanon	10	9	5	149	173	348	278	153	4,701	5,480
Saudi Arabia	103	90	37	305	534	11,200	6,112	2,500	14,498	34,310
United Arab Emirates	138	99	56	398	691	9,461	7,453	4,183	25,732	46,829

North America

	Employment (000s)					GDP (US \$ million)				
	Direct	Indirect	Induced	Tourism	Total	Direct	Indirect	Induced	Tourism	Total
Canada	232	128	47	165	572	19,292	12,797	4,732	12,116	48,938
United States	2,203	1,522	1,202	1,230	6,158	232,471	180,466	142,513	124,698	680,147



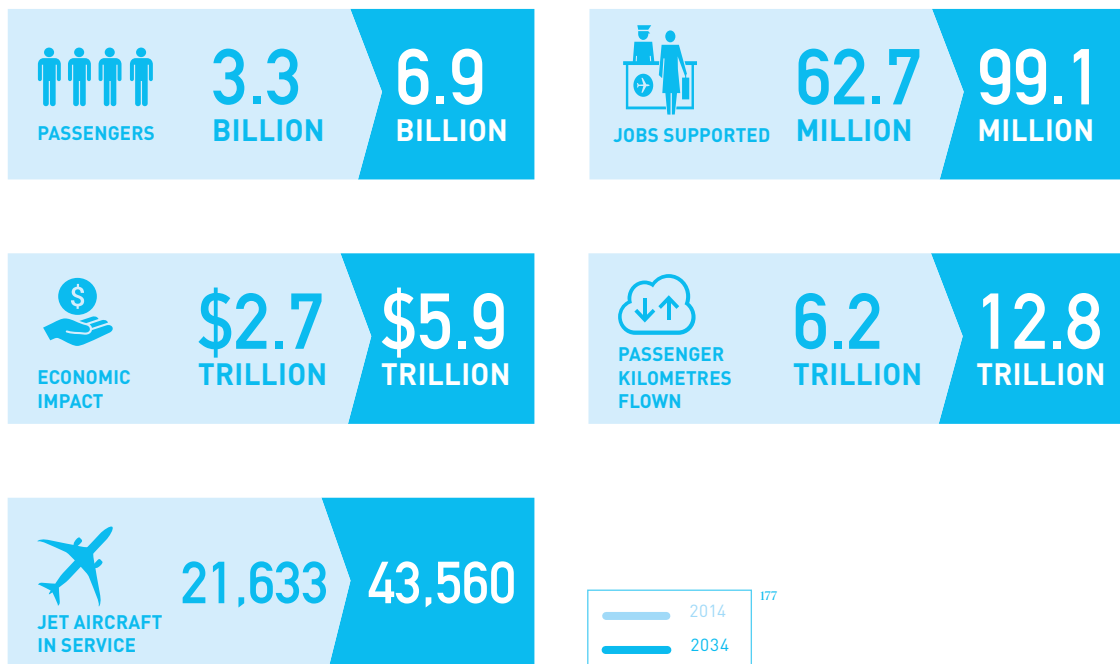
A growth industry

An assessment of the
next 20 years of aviation



A GROWTH INDUSTRY

An assessment of the next 20 years of aviation



The contribution of the air transport industry in 20 years' time

A conservative analysis¹⁷⁸ suggests that demand for air transport will increase by an average of 4.3% per annum over the next 20 years. That implies that demand for air travel will increase by a factor of 2.3 over the period.

If this growth path is achieved, then in 2034 the air transport industry will contribute¹⁷⁹:

- » 14.9 million direct jobs and \$1.5 trillion of GDP to the world economy;
- » Including indirect and induced contributions, 39.6 million jobs and \$3.9 trillion in GDP;
- » Once the impacts of global tourism are taken into account, a total of 99.1 million jobs and \$5.9 trillion in GDP.

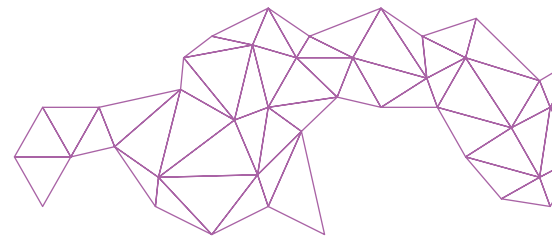
“What if...”: a sensitivity analysis

These forecasts are based on the air transport sector growing at the predicted rate. However, looking ahead 20 years is naturally fraught with uncertainty, and unexpected political and economic events could throw these predictions off course. The question is how could the economic contribution of air transport be impacted if demand, for one reason or another, is reduced? To account for unforeseen fluctuations in activity, Oxford Economics undertook a sensitivity analysis. By changing key assumptions driving the results, a sensitivity analysis can assess a range of potential alternative economic outcomes.

For example, if the average annual growth in passenger numbers for each region covered in this report turns out to be one percentage

point lower than currently expected between 2014 and 2034, then in 2034:

- » Worldwide, there would be 1.4 million fewer direct jobs in the air transport sector.
- » Taking into consideration the direct, indirect, and induced impacts, there would be 3.8 million fewer jobs supported by air transport.
- » Once the impacts of tourism are included, the air transport sector would support a total of 10.5 million fewer jobs than would otherwise be the case under the baseline scenario.
- » Worldwide, the direct, indirect, and induced GDP for air transport would be \$690 billion (2014 prices) lower than it otherwise would be.
- » An additional \$350 billion would be lost because of a reduction in tourism activity.



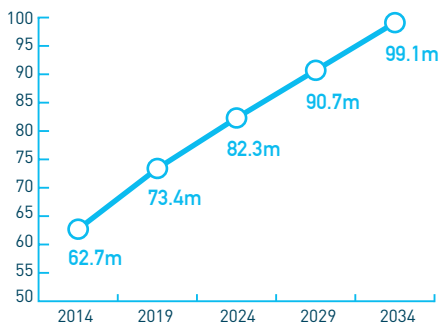
AIR TRANSPORT IS FORECAST TO SUPPORT 99.1 MILLION JOBS BY 2034

Onwards and upwards

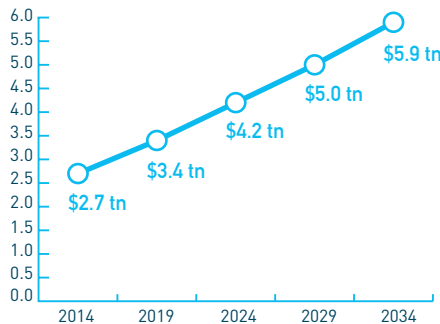
Growing support for employment and economic activity, 2014-2034¹⁸⁰



Jobs (millions)



GVA (\$ tn)



Developing technology: a sustainable future

While the aviation industry is expected to grow significantly in the coming decades, with more demand from passengers forecast up to 2034 and beyond, the industry is confident that this growth can be reconciled with its environmental responsibilities. It is hoped that the industry's goal to cap aviation's net CO₂ emissions at 2020 levels through carbon-neutral growth will be enabled at the 2016 ICAO Assembly with an historic agreement on the introduction of a global market-based measure for aviation emissions.

However, it is the industry's long-term goal of cutting overall emissions to half of what they were in 2005 by 2050 that remains the major focus. The market-based measure will be used as a holding measure while the industry

progresses towards this goal. To achieve it, the sector will need to continue to be a world leader in technological innovation.

One of the main methods by which aviation is expected to drastically cut overall carbon emissions is the development of sustainable alternative fuels. These fuels can be up to 80% less carbon intensive over their life cycle, and work is already well underway to commercialise them. 5,500 commercial flights are expected to have taken place on these fuels by the end of 2016, and a number of influential businesses within the industry have shown an encouraging level of commitment to further developing this new energy source.

Operational and infrastructural improvements can also yield significant gains, and have already done so, but the most significant savings in emissions will be achieved through new aircraft technology.

A number of technology research organisations are exploring new, disruptive aircraft designs, which will literally change the shape of aviation. Each of these conceptual designs has advantages and feasibility barriers to overcome.

The most radical design is the 'blended wing body' aircraft, which is essentially a large wing housing a payload area within its main 'body' section. With an optimised aerodynamic design and new means of engine integration, it is thought that this design could cut emissions by 50% per tonne kilometre. However, there remains a significant degree of uncertainty as to its technical feasibility and ability to be integrated into existing infrastructure.

The blended wing body concept is still a long way from becoming a reality, but there are other, less drastic departures from traditional



All-electric aircraft concept



Strut-braced wing aircraft concept

designs in the pipeline that could provide major reductions in aircraft emissions.

In Europe, the Clean Sky project, partly funded by the European Commission, brings together partners from the aerospace sector and is charged with researching and developing new technologies to significantly increase the environmental performances of aircraft. Clean Sky's main research stream, one upon which much of their hopes are placed, is the counter-rotative open rotor engine, which would propel a so-called 'strut-braced wing' aircraft. This engine consists of two rotor fans that rotate in opposite directions on a turbo engine. The concept is expected to enable reductions of over 35% in fuel burn and CO2 emissions per passenger-kilometre when compared to the standard reference aircraft. It is hoped that a ground demonstration of the engine will take place in 2016.

In the US, NASA has also been working on new aeronautical technology including a 'morphing wing' design, which changes shape in response to the flow of air over the wings. NASA has also been working towards launching a new electric aircraft in 2019, which will use 18 individual electric motors to provide thrust. Tests have already been carried out on the wings themselves in 2016.

Airbus, too, has experimented with all-electric aircraft, with the two-seater 'E-Fan' having already taken to the skies. There is, however, much more work to be done to achieve electric-powered flight on a commercial scale. The challenge for battery-powered aircraft is to create batteries powerful enough to provide lift, whilst also being light enough to not adversely impact performance.

For any of these concepts to become a reality, investment and dedication are essential, but it is something that the industry is committed to pursuing.



Cutting emissions through space-age technology



The American National Aeronautics and Space Administration (NASA) is better known for its work on space travel, but in 2009 NASA expanded its focus on civil air travel and started the Environmentally Responsible Aviation (ERA) project.

As the name suggests, the aim of this project is to research and develop new technologies that will reduce aviation's impact on the environment. NASA has contributed certain technologies to the commercial aviation sector before, but the founding of the ERA project represents a step up in NASA's work in this field. In many cases, trying to alleviate one undesirable effect of air travel, such as emissions, noise or pollution, means sacrificing another to some degree. The ERA project, however, was set up with the goal of minimising all the negative effects at once, so called 'integrated solutions'.

The project concluded at the end of 2015 and the agency announced that the technologies researched could save US airlines over \$250 billion in fuel costs, which would amount to substantial emissions savings. Though the price of jet fuel naturally fluctuates, that still equates roughly to 302 billion litres of fuel and over 77 million tonnes of CO2 emissions saved.

Outcomes of the ERA project include work on developing lightweight composite materials, morphing wing technology and a hybrid wing concept. They also teamed up with US engine manufacturers Pratt & Whitney and GE Aviation to develop more efficient engine components.

NASA is hopeful that, by 2025, all of the technologies developed through the ERA project will be found flying somewhere in the US fleet. The technology is available, the next step is for manufacturing partners to work on incorporating them into their own designs.

Shaping the millennials. How access to democratised air transport has shaped a generation

MILLENNIALS ARE BETTER EDUCATED AND MORE WIDELY TRAVELLED THAN ANY PREVIOUS GENERATION, YET THE AIR TRANSPORT INDUSTRY HAS TO MAKE MORE EFFORT TO CONNECT WITH THEM, BOTH AS CUSTOMERS AND EMPLOYEES

Essay by Peter Jordan

Scan the pages of the tourism news (or any other sector, such as finance, advertising, or retail for that matter) and it won't take too long to stumble upon a headline declaring some fact or other about millennials. Constantly connected, in the jaws of the credit crunch, self-absorbed and constantly seeking support at work; there are many clichés surrounding those who entered their late teens and thus became independent consumers after the year 2000 (hence the name 'millennials'). As is the way with clichés, they often have some basis in real life.

Yet amid all the headlines and hype, it can be difficult to gain a picture of how this generation is influencing the air transport industry. There is also considerable value to understanding what, conversely, the air transport industry is doing to millennials. Why? Because both of these have implications for how millennials will expect to interact with this industry, both as consumers and potential employees, in the years to come.

It may seem obvious, but the first step to taking a critical look at the millennial generation is to recognise that not all millennials are the same. Between the ages of 16-35, across the globe young people tend to go through the same joys and pains of youth, yet throughout this period their tastes and attitudes don't stay the same, as anyone with children will surely know. The life choices millennials make are also strongly defined by the time and place in which they grow up. If there is so much variation among millennials

around the world, why are they regarded collectively as so different to other generations that have gone before, especially in terms of their travel behaviour? In my view there are two interconnected phenomena that unite the experiences of millennials, and that have helped shape their attitude towards travel: the expansion of the internet (and social media in particular) and the globalisation that has brought with it political interdependence.

That the internet has expanded into almost every corner of modern life is not news. Besides, it's not just millennials that do their travel planning, booking and experience-sharing online. However millennials are the first generation to have grown up in the era of 'internet everywhere'. They're used to being constantly connected, and grew up in the age of online commerce. They've also become fluent in metasearch, accustomed to booking last-minute and finding out what to do while 'on the go'. For millennials, constant connectivity has also brought the expectation of (and addiction to) instant communication which has strongly influenced the way that they interact with their friends and family.

It's made the world smaller and caused a psychological shift in how they view the prospect of travelling thousands of miles away from home. Furthermore, just as millennials expect to be able to reach friends, family and even their favourite celebrity via social media and instant messaging, why not their preferred brands too? Airlines have learned this quickly, pushing their customer service conversations onto Facebook Messenger, WhatsApp and Twitter in order to respond to the growing mass of 'silent travellers'.

Aside from its practical applications, social media has had an arguably more important psychological effect on millennials' travel behaviour. Today, for millennials, social media has become the go-to space for news, gossip, advice and most importantly inspiration. By witnessing friends who take to the skies for the first time to study abroad or go backpacking, it has helped to engender a strong sense of 'I can do that too'; a stream of influence that their parents' generation just wasn't subjected to. Used while travelling or at home, social media has also blurred the lines between what is global and what is local, helping to nurture a broader world view and stimulate curiosity – all to the benefit of the travel industry.

Just as millennials may not perceive the same psychological barriers to travel as their parents, it is also important to note that this generation has witnessed the gradual removal of physical barriers to travel, too. In Europe, this post-Cold-War generation has seen the removal of passport checks that came with the Schengen Agreement in 1995 as well as the eastward expansion of the European Union less than a decade later.

For European youth (and those who visit from further away) the notion of circulating freely around the continent without so much as the flash of an ID card is totally normal. Elsewhere it is significant that young Chinese citizens have seen their country open up rapidly to the outside world, while millennials in Southeast Asia and Latin America will be the first generation to truly benefit from the closer union of nations and relaxing of visa regulations that is to come with ASEAN and MERCOSUR integration.



In terms of regional economic and social development these events are vitally important, especially as countries aim to compete in the knowledge economy of the future. As barriers to travel have been removed and skies have been opened, it has made the prospect of studying and working abroad more attractive. Europe provides a good example for this, because the extraordinary growth of the EU's Erasmus programme (with over three million young people participating in work and study exchange in its 30-year history) is unlikely to have occurred without the air transport links that brought countries together. In fact, asked what the EU means to them, 57% of Europeans between 15 and 24 years old now cite the freedom to travel, work and study anywhere they like¹⁸¹. Thus, the 'knowledge hubs' of the future will also depend on being well-connected transport hubs with high connectivity and ease of access.

While this integration may sound logical, it is certainly not a smooth or automatic process, especially in the developing world where the majority of the world's millennials live. Nevertheless, if the personal and professional ambitions of this globally-curious, ambitious generation are to be unlocked, then the air transport industry will have to work harder to expand in the parts of the world where it matters most. Southeast Asia provides an interesting example of how this expansion can mobilise a generation. Over the past decade the region's point-to-point route map has become rapidly denser thanks especially to the expansion of low cost carriers (LCCs) such as AirAsia. As with elsewhere in the world, LCCs have proved to be a hit in countries with large, young

populations of first-time travellers. Attracted by low fares, flexible online booking options and a strong, fresh-faced brand image, for many Asian millennial travellers LCCs offer their first experience of flying, and of international travel. It is also interesting to note for millennials in Asia that LCCs are also becoming lifestyle brands offering insurance, finance, hotel bookings and even movie rental. Thus air travel has become a means of expressing personal taste and a part of everyday consumption patterns for many young people in the region¹⁸².

Unfortunately this scenario is rather different to that found in Africa, another continent with a large, youthful population. In Africa, it's not just protectionism of state airlines that is restraining the growth of intra-regional travel; travel bureaucracy is highly restrictive too. Currently, Africans need visas to enter 55% of states on the continent. This kind of red tape is clearly impeding the free movement of people which will be the foundation of deeper and closer integration of the continent¹⁸³. Across the developing world, research consistently shows how millennials share the characteristics of ambition, hope for the future, and the notion that the best opportunities will come as a result of having had some international experience. The expansion of air routes in continents that are currently underserved (such as Africa and Latin America) will play a fundamental role in allowing millennials to fulfil these ambitions and unlock their potential for contributing to their regions' economic and social development.

While the air transport industry will have to continue to make its case to government,

it will also face the double challenge of proving its relevance to the next generation of travellers, and employees. This might seem strange in light of my earlier observations on the growth of travel, and of airlines becoming part of millennials' personal brand, but some defining attitudes among millennials are forcing a rethink towards the way companies interact with them.

Firstly, as millennials perceive fewer barriers to travel, one side-effect for the air transport industry will surely be its increasing 'commoditisation', i.e. that flying will simply become a means of getting from A to B, rather than an experience that's worth spending more on. Of course, this is a process which has already started, arguably through the ease of booking online and also with the spread of low cost airlines which position their product as a preferred alternative to competitors with 'frills'. Besides, thanks to the rise of online travel planning, millennials are the first generation to have grown up with the possibility of mixing budget and luxury experiences throughout their journey. This has produced a generation of 'selective spenders' who think carefully about where their hard-earned cash is going (especially if they don't have much of it), and have learned to pick and choose what they share online. Therefore, airlines and airports that really try to position themselves by offering a high-quality experience will have to strive hard to ensure that they give millennials good reasons to select their product over a budget alternative, and to ensure that the quality of that experience is at least as important as the one millennials hope to find in their chosen destination.



Next, the air transport industry will also have to adapt to the fact that the lines between business and leisure travel are rapidly becoming blurred, as mobile devices allow people to work from more or less anywhere, and ‘bleisure travel’ becomes more popular. Yes, it’s a horrible word, but one which encapsulates a growing trend (led by millennials) to combine leisure travel while on business. If travellers take more ownership for time and money spent while on business, this will have serious implications for corporate travel, destination marketing and frequent traveller programmes.

Millennials’ desire to take back more time for themselves, and an expectation of greater flexibility from their employers, points to a wider shift in attitudes, compared to their parents, and the consequences of this will intensify for employers in the future. A study by INSEAD Business School of over 16,000 millennials in 43 countries found that the desire for a greater ‘work-life’ balance was very real and deeply felt. This was interpreted variously as ‘enough leisure time for my private life’ (57%), ‘flexible work hours’ (45%) and giving recognition and respect for employees (45%)¹⁸⁴. Notably, millennials want to feel supported in the workplace, with management that inspires and guides with continual feedback. As the INSEAD study pointed out, popular employers will be the ones that empower their people to fulfil both career and personal goals simultaneously, without one pre-empting the other, and helping employees define their own specific career paths¹⁸⁵.

Furthermore, according to a study of nearly 8,000 millennials from 29 countries conducted this year by Deloitte¹⁸⁶, young

people from this generation also prefer to be part of a business that behaves responsibly towards society, with almost nine in ten (87%) stating that “the success of a business should be measured in terms of more than just its financial performance”. Sixty-two percent of respondents said that business performance could be judged by how it treats its employees.

As an industry defined by punishing schedules and the challenge of delivering profitability, the air transport industry may struggle to meet millennials in the middle when it comes to fulfilling those expectations, especially since they are now shared across the globe. Breaking down the silos and gender imbalances that still persist within the industry will be vital too since millennials’ attitudes towards diversity are strikingly different to older generations. Airlines work hard to show a welcoming, diverse face to their customers, but can the same yet be said of the image they present to their potential employees? They can surely do more to show that they respect and welcome differences in age, gender, race and sexuality because millennials increasingly expect it. In short, if recruiting the best talent is necessary to remain competitive (after all, employees are one of the few elements that truly stand out in an industry which offers a standardised product) then the industry will have to take note of millennials’ deeply felt aspirations and demonstrate what it can do to help this generation meet its personal and professional ambitions in a meaningful way.

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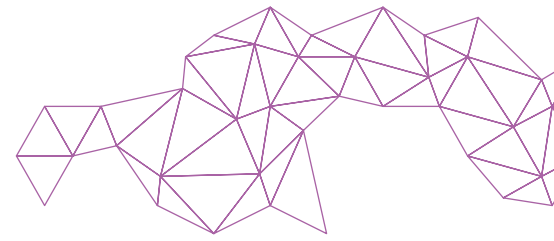
Millennials...

- » 20% of international tourists today¹⁸⁷.
- » 75% want to travel abroad as much as possible¹⁸⁸.
- » Fastest-growing age-range for travel spend¹⁸⁹.
- » Over 60% of current Chinese overseas travellers¹⁹⁰.
- » 88% want to work for a company that shares the same social responsibility values as them and most would actively consider leaving a company which had a bad reputation¹⁹¹.
- » 50% would avoid certain sectors of the economy completely, because of a bad social reputation (including oil and gas, defence, insurance, government and the chemical sector)¹⁹².
- » 7% of the millennials would not want to work in transport¹⁹³.
- » Generation almost universally believes climate change to be a serious problem, supports a transition to clean energy¹⁹⁴, with higher concerns being shown in Latin America and Asia than in Europe.
- » 67% of millennials in one survey said their investment decisions are a way to ‘express their social, political and environmental values’¹⁹⁵.
- » 73% believe it is possible to achieve market rates of return on companies based on their ‘social or environmental impact’¹⁹⁶.



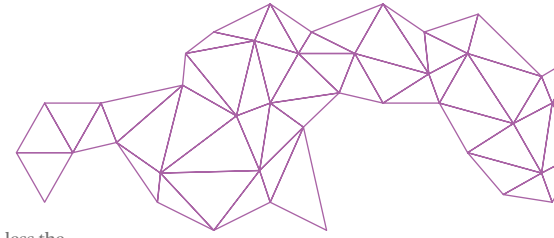
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- ¹⁵³ Asia-Pacific includes the following countries: Afghanistan, Australia, Bangladesh, Bhutan, Brunei, Cambodia, China, Chinese Taipei, Fiji, Hong Kong SAR, India, Indonesia, Japan, Kazakhstan, Kiribati, Kyrgyz Republic, Lao People's Democratic Republic, Macau SAR, Malaysia, Maldives, Mongolia, Myanmar, Nepal, New Zealand, North Korea, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, South Korea, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Tonga, Turkmenistan, Uzbekistan, Vanuatu and Vietnam
- ¹⁵⁴ The ASEAN Briefing: <http://bit.ly/IHfTna>
- ¹⁵⁵ Europe includes the following countries: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Greenland, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and United Kingdom. For the member countries of the European Union, see that section on page 47
- ¹⁵⁶ Revenue passenger kilometres are a measure of the number of revenue paying passengers on board a flight and the distance they travel on that flight
- ¹⁵⁷ This is the lower of the latest revenue passenger kilometre forecasts by Boeing, Airbus, and Embraer for the period 2015-2034
- ¹⁵⁸ Eurocontrol, *Challenges of Growth, 2013*: <http://bit.ly/25jV90R>
- ¹⁵⁹ The Latin America and Caribbean region include the following countries: Antigua and Barbuda, Argentina, The Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras,
- Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay and Venezuela. Please note that for a previous *Aviation: Benefits Beyond Borders* study released in 2012, Mexico was included in the North America region, whereas for this analysis it is included in Latin America and the Caribbean
- ¹⁶⁰ IATA, *Enabling Aviation to Drive Growth in Latin America*: <http://bit.ly/1MwmXjy>
- ¹⁶¹ World Economic Forum, *Travel and Tourism Competitiveness Report 2015*: <http://bit.ly/1KhKogv>
- ¹⁶² Countries in the Middle East region include: Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates and Republic of Yemen
- ¹⁶³ NATS, *Economic benefits of improvements to Middle East Air Traffic Control*: <http://bit.ly/1Q7DspG>
- ¹⁶⁴ North America includes Canada and the United States of America. Please note that for the previous *Aviation: Benefits Beyond Borders* study released in 2012, Mexico was included in the North America region, whereas for this analysis it is included in Latin America and the Caribbean
- ¹⁶⁵ Federal Aviation Administration (FAA), *Economic Impact Report 2015*: <http://lusa.gov/1ScOZpG>
- ¹⁶⁶ The APEC economies include: Australia, Brunei, Canada, Chile, China, Chinese Taipei, Hong Kong SAR, Indonesia, Japan, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, South Korea, Thailand, United States and Vietnam
- ¹⁶⁷ IATA PaxIS. Passenger numbers in the following sections: APEC, EU28, Developing Countries, Small Island States and OECD do not include charter traffic
- ¹⁶⁸ The European Union member states as of 2013 include: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom.
- ¹⁶⁹ IATA PaxIS figures, not including charter traffic. All passengers departing EU airports for destinations domestic, intra-EU and extra-EU. Due to statistical methods, it is also true to say that the total number of passengers carried by air in the European Union in 2014 was 876 million (Eurostat figures), which includes all international passengers on both arrival and departure in the EU, but counts each intra-EU passenger only once
- ¹⁷⁰ Eurostat report 6,781 aircraft in service in Europe in 2011, although this probably includes business jets and general aviation. *European Energy, transport and environment indicators, 2013 edition*: <http://bit.ly/1qsD8z8>
- ¹⁷¹ Small island states in this analysis are the members of the Alliance of Small Islands States, excluding Singapore: Antigua and Barbuda, Bahamas, Barbados, Belize, Cape Verde, Comoros, Cook Islands, Cuba, Dominica, Dominican Republic, Fiji, Federated States of Micronesia, Grenada, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Marshall Islands, Mauritius, Nauru, Niue, Palau, Papua New Guinea, Samoa, Seychelles, São Tomé and Príncipe, Solomon Islands, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu and Vanuatu. For more information, see www.aosis.info
- ¹⁷² Developing countries are all countries defined as low, lower-middle or upper-middle income by the World Bank, and include: Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Costa Rica, Côte d'Ivoire, Democratic Republic of Congo, Democratic Republic of Timor-Leste, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gabon, Georgia, Ghana,
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- ¹⁷³ Members of the Organisation for Economic Cooperation and Development (OECD), being Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States at www.oecd.org
- ¹⁷⁴ World Bank: <http://bit.ly/1O94DOO>
- ¹⁷⁵ ACI *Airport Economic Survey 2013*
- ¹⁷⁶ IATA Economics
- ¹⁷⁷ Oxford Economics forecast for jobs and GDP. ATAG forecast for passengers and RPKs, based on Boeing and Airbus forecast data. Boeing forecast for jets based on a global traffic growth forecast of 4.9% per annum
- ¹⁷⁸ Several of the world's largest aircraft manufacturers, including Airbus, Boeing, Bombardier and Embraer, use 'revenue passenger kilometres' (i.e. one RPK unit equals one kilometre travelled by a revenue-paying passenger) to calculate the future demand for air transport. Oxford Economics derived a conservative



global growth rate as the weighted average of each of the lowest regional growth rates taken from the forecasting reports of Airbus, Boeing and Embraer. As such, it is not the global traffic forecast of either of the three manufacturers. It represents a conservative estimate and is consistent with the regional analyses in this report

¹⁷⁹ All in 2014 prices

¹⁸⁰ IATA Economics analysis. Economic impact based on GVA.

Full results on a year-by-year basis are included here:

	Global jobs	Global GVA \$ billion
2015	64,996,032	\$2,838
2016	67,674,280	\$3,005
2017	69,568,585	\$3,142
2018	71,490,124	\$3,287
2019	73,412,314	\$3,439
2020	75,509,487	\$3,597
2021	77,212,877	\$3,738
2022	78,898,108	\$3,885
2023	80,583,339	\$4,038
2024	82,268,571	\$4,197
2025	83,953,802	\$4,362
2026	85,639,033	\$4,525
2027	87,324,265	\$4,687
2028	89,009,496	\$4,855
2029	90,694,727	\$5,029
2030	92,379,959	\$5,209
2031	94,065,190	\$5,385
2032	95,750,421	\$5,568
2033	97,435,653	\$5,756
2034	99,120,884	\$5,951

¹⁸¹ The Economist, *What Europe Means to the Young*, September 2015: <http://econ.st/liOpZ84>

¹⁸² Gen C Traveller, January 2015: <http://bit.ly/27RikyK>

¹⁸³ African Development Bank, 2016: *Africa Visa Openness Report*

¹⁸⁴ Universum, 2015, *How Experience Changes Millennials in the Workplace*

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¹⁸⁶ Deloitte, 2016, *The Deloitte Millennial Survey*

¹⁸⁷ UN World Tourism Organization (UNWTO), cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁸⁸ BCG, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁸⁹ American Express Business Insights, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁹⁰ 2013 *Annual China Outbound Tourism Development Report*, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁹¹ PwC *Millennials at work, reshaping the workforce*

¹⁹² PwC *Millennials at work, reshaping the workforce*

¹⁹³ PwC *Millennials at work, reshaping the workforce*

¹⁹⁴ Vox article, citing several surveys "Millennials love clean energy, fear climate change, and don't vote. This campaign wants to change that.", April 30, 2016: <http://bit.ly/ITBqTFR>, and Telefonica study of millennial attitudes worldwide, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁹⁵ US Trust study, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁹⁶ US Trust study, cited in Bank of America Merrill Lynch report *Generation Next - Millennials Primer*, May 2015

¹⁹⁷ Gross value added (GVA) is the difference between the revenue a

firm or industry generates, less the bought-in costs needed to produce that revenue. GVA summed across all firms and industries in an economy is equal to GDP (after minor adjustments for taxes and subsidies)

¹⁹⁸ GDP measures the total revenue an economy generates, less the bought-in costs required to generate that revenue (with a minor adjustment for taxes and subsidies). It is often used to measure economic growth or to indicate when an economy has entered or exited a recession

¹⁹⁹ Where a given country-specific input-output table was unavailable, a proxy input-output table was chosen based on geographical proximity and economy size

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Methodology

Oxford Economics analysed six key aviation sectors

ATAG commissioned Oxford Economics to estimate the aviation sector's global economic contribution in 2014, and how it might evolve over the next two decades. This follows Oxford Economics' analyses of the aviation sector's economic impacts for previous editions of *Aviation: Benefits Beyond Borders* in 2014, 2012 and 2008, and previous similar publications reaching back to 1991.

The number of jobs and gross value added (GVA) that are created or supported by aviation are assessed for six key sectors: airlines, airport operators, airport service providers (such as retailers and hoteliers), civil aircraft manufacturers, air navigation service providers, and tourism activity that air travel makes possible¹⁹⁷.

The analysis was for six regions and 60 major countries

Oxford Economics analysed six regions, including Africa, Asia-Pacific, the Middle East, Europe, Latin America, and North America, and 60 major countries that account for 94% of global GDP¹⁹⁸.

Three economic impact channels were estimated

The analysis considers three channels of spending that are in all standard economic impact studies. The first is the **direct** channel, which is the operational spending airlines, airports, civil aircraft manufacturers, airport operators, air navigation service providers,

and firms that serve tourists undertake to generate profits and employ people at their operational sites.

The second is the **indirect** channel – the aviation sector's procurement of inputs of goods and services from other businesses in the economy. This spending supports additional jobs and GDP contributions along the sector's supply chains.

The third is the **induced** channel, comprising wage payments to staff. Some or all of those wages are subsequently spent in the consumer economy, which supports further economic activity and jobs in retail and leisure outlets and their supply chains.

Indirect and induced impacts are estimated at the country level using **multipliers** that Oxford Economics calculated from 51 **input-output tables** sourced from the OECD and official national statistical websites¹⁹⁹. At the regional level, these impacts are estimated using global multipliers that account for the substantial cross-border economic activity spurred by the aviation sector.

The estimates are based on comprehensive, new data

Oxford Economics conducted a comprehensive search for the latest available direct jobs and gross value added statistics for aviation related industries from official national statistical agencies in 60 countries. The search turned up over 370 new sources of official statistics. This allowed for comprehensive and up-to-date estimates of jobs and gross value added contributions that the aviation sector made to global economies in 2014.

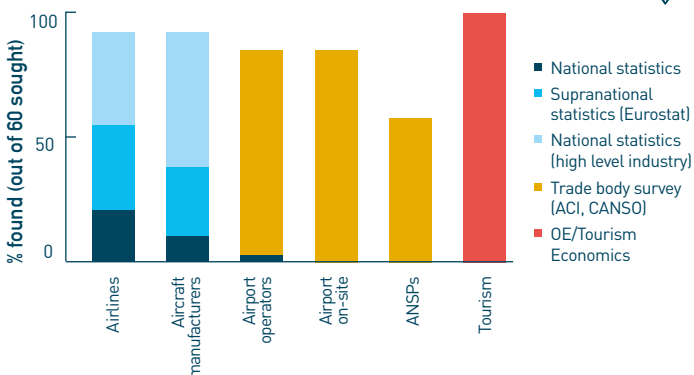
Airports Council International generously provided detailed data on jobs, revenues, and costs from its 2015 Airport Economics Survey, which asked about the 2014 financial year for over 800 airports across the world. Those respondents accounted for over 70% of all airport traffic in 2014.

Oxford Economics also made use of detailed employment and financial data published by the Civil Air Navigation Services Organisation, a trade body whose members help manage 85% of the world's air traffic.

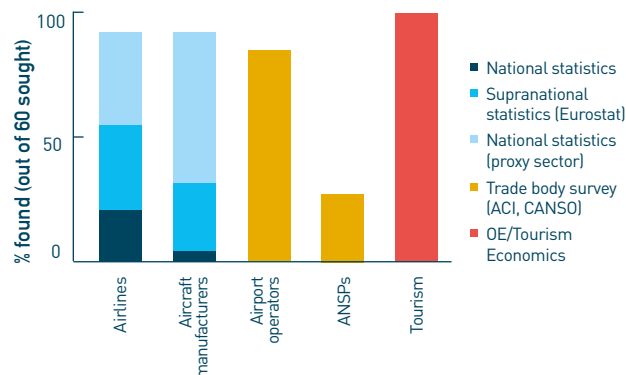
Finally, Oxford Economics used its own estimates of tourism impacts, based on IMF Balance of Payments data on tourist activities and expenditures, to assess the number of jobs and amount of GDP supported by tourists who travel to their destinations by air. Oxford Economics also publishes the World Travel & Tourism Council annual social and economic benefits reports, with which this report aligns.

Figure 1 shows the extent of new employment data used in this report, while Figure 2 shows the same for gross value added. Where new data were unavailable, Oxford Economics relied on data collected on the aviation sector by the International Air Transport Association and ACI in 2009/10. The extent of new, official data used in our latest analysis has resulted in substantial differences compared with the previous publication of *Aviation: Benefits Beyond Borders*, particularly at the country level. This underscores the importance of the large-scale data collection exercise Oxford Economics undertook for this report; the aviation sector's dynamism and pace of change demands it to build a definitive and up-to-date snapshot of the size and scope of the aviation sector's impacts throughout the world in 2014.

New employment data collected for 60 countries



New GDP data collected for 60 countries



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