EUROCONTROL

EUROPEAN AVIATION IN 2040

CHALLENGES OF GROWTH

Annex1
Flight Forecast to 2040

FLIGHTS IN 2040

16.2M

+53%

1.9%/year

HIGH
19.5M
+84%

SUMMARY

This report is part of the fifth *Challenges of Growth* study, which aims to deliver the best-achievable information to support long-term planning decisions for aviation in Europe. It is the first annex to the summary report "European Aviation in 2040" (Ref. 1) presenting the update of the EUROCONTROL 20-year forecast of IFR flight movements in Europe up to 2040.

Looking twenty or more years ahead, it is more robust to consider not just a single forecast, but a range of potential scenarios for how air transport in Europe, and the factors influencing it, might develop. This forecast uses four scenarios to explore the future of the aviation and the risks that lie ahead: Global Growth, Regulation and Growth (most-likely), Happy Localism and Fragmenting World.

Each scenario has different input assumptions: economic growth, fuel prices, load factors, hub-and-spoke versus point-to-point etc. This leads to different volumes of traffic, and different underlying patterns of growth: long- versus short-haul, rates of up-gauging of aircraft, etc.

Compared to the 20-year forecast published in 2013, and despite the fragile growth rates over the last five years, the current traffic matches the most-likely scenario from 2013, so the starting point of this new 20-year forecast is consistent with the previous one.

For Europe as a whole, the Regulation and Growth scenario (most-likely) has 16.2 million flights in 2040, 53% more than 2017 (Figure 1). That is 1.9% average annual growth per year over the 2017-2040 period, a rather slower growth rate than before 2008. Indeed, over the 20 years before the economic crisis, the number of IFR movements in Europe doubled from 5 million IFR movements in 1988 to 10 million in 2008. The deceleration in growth over the next 20 years is explained by slower rates of economic growth, increasing fuel prices and increasing congestion at airports.

The recent return to traffic growth after 10 years of stagnation has been vigorous, and there are newer growth drivers—long-haul, low-cost new aircraft types, middle-class growth in China, changes in propensity to fly—which are under-represented in our forecast models because of their short histories. For this reason we recommend that, in addition to the Regulation and Growth (most-likely) scenario, particular attention is paid to the Global Growth scenario, which forecasts 84% growth in flights to 19.5 million.

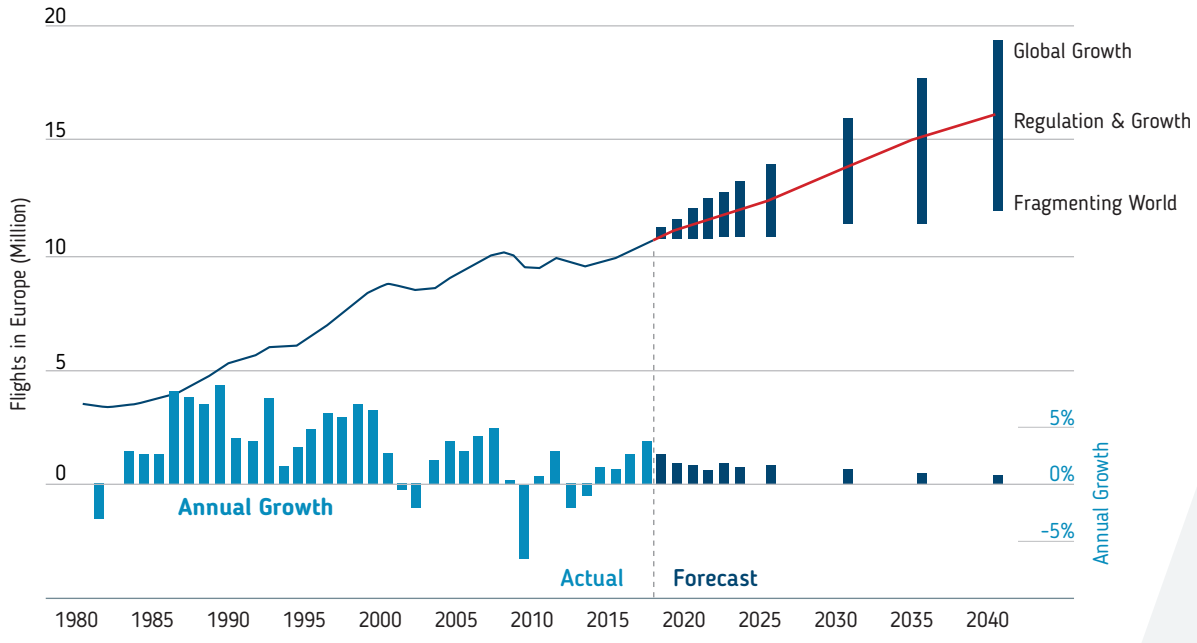

Figure 1 / *Overview of the future long-term traffic (IFR movements). The rate of growth in traffic is expected to slow down over the next twenty years, compared to the pre-2008 period.*

The traffic growth will be faster in the early years (2018-2030) than in the late years (2030-2040), stronger in Eastern Europe (Figure 2) and stronger for flights leaving and arriving Europe than for intra-European flights.

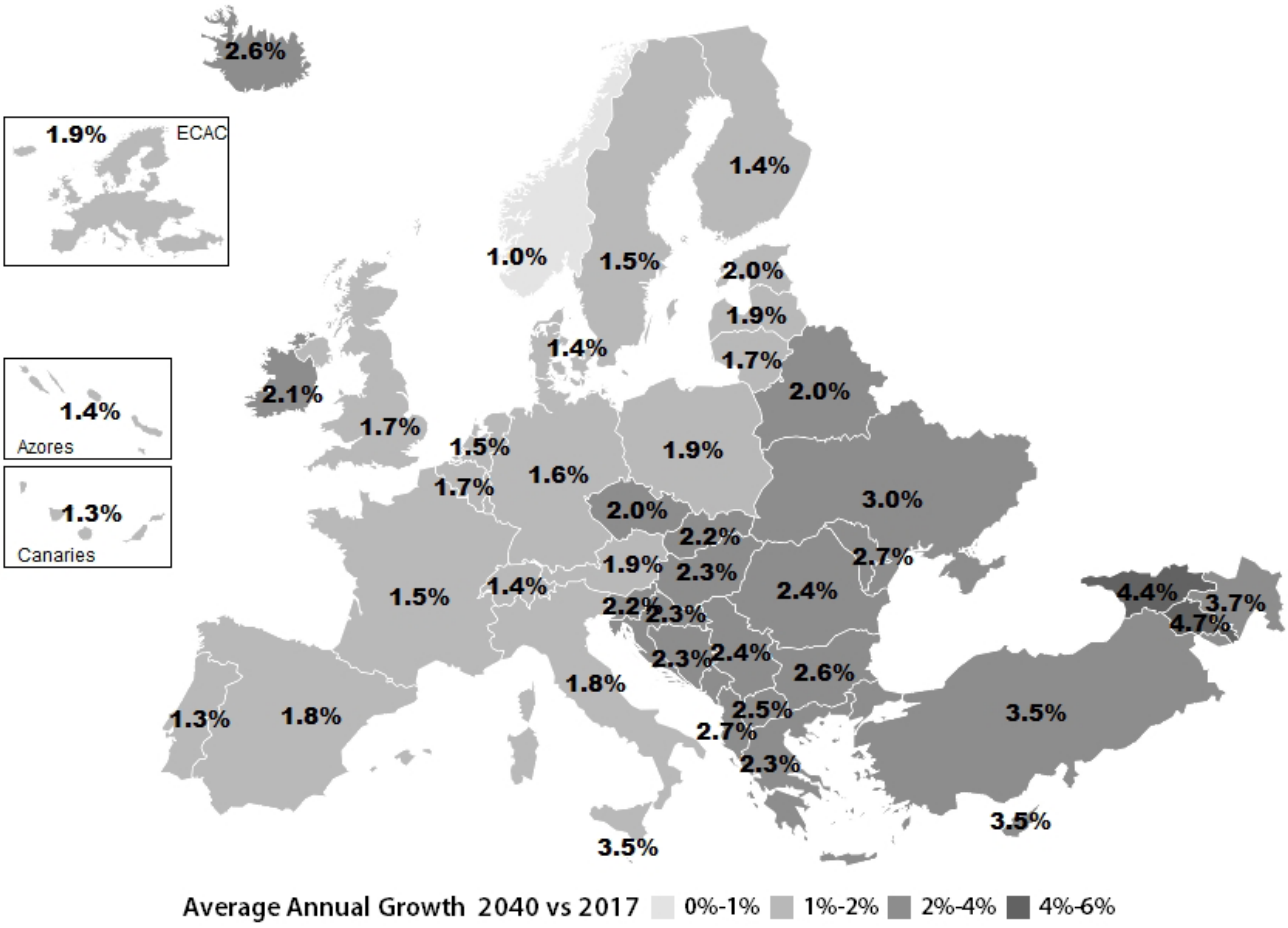

Figure 2 / *Growth forecast to 2040 (IFR movements) in Regulation and Growth shows differences between Western and Eastern rates (the same is true in other scenarios).*

Air traffic growth will be limited by the available capacity at the airports; this forecast is based on capacity plans reported by airports in a new survey. The combination of a slightly slower forecast, together with expanded airport capacity plans is that, in the Regulation and Growth (most-likely) scenario, around 1.5 million flights (accounting for 8% of the demand) will not be accommodated in 2040. The congestion is now lower than in the previous forecast at 2035, partly because the capacity expansion plans have been added where the bottlenecks will be. However, when the capacity limits are reached, congestion at airports will increase quite rapidly (especially in Global Growth) which will lead to extra pressure on the network, and more delays.

Dealing with airport congestion, we estimate that, in the Regulation and Growth scenario, the 1.5 million unaccommodated flights in 2040 would be equivalent to circa 160 million passengers unable to fly. This value takes into account the typical size of aircraft operating at these congested airports.
Speaking of aircraft size, there has been a

continuous increase in average aircraft size over recent years in Europe. In the future, we expect the trend to continue, with a progressive increase in the use of widebodies between 2025 and 2040 for the medium- and long-hauls, in the Regulation and Growth scenario.

In this forecast, we assume that the network will be constrained at airport level but not at airspace level. It implies that the airspace capacity will be expanded through additional resources. Developments to reduce en-route congestion problems are currently being studied in the forthcoming short- to medium-term horizon. In the longer term, large-scale research projects like SESAR, anticipate them too. This is discussed in the Network Congestion report (Ref. 2).

In 2017, there were 6 IFR flights per day by drones in controlled airspace, just 0.02% of total flights. We reviewed recent estimates for the growing use of unmanned aircraft systems, or 'drones', including sending out a questionnaire to industry. Only flights in current controlled airspace are in the scope of this report. Towards the end of the 2040 horizon, there may be significant numbers of replacement 'optionally piloted' aircraft, which do not increase the overall demand, but present regulatory, safety and acceptance challenges if industry are able to deliver this new technology and thus continue to improve efficiency.

The number of drone applications that add to rather than replace existing flights, appears much smaller; mainly border and maritime patrol. We estimate around 100 additional flights per day net by 2040 for this, based on our analysis of SESAR Joint Undertaking work, though there are up-side risks from new applications such as medium-haul cargo.

With a twenty-year horizon the forecast is clearly prone to changes in economic, political and social conditions. Some of the risks have been addressed in the four scenarios of this forecast but there are many other factors that have the potential to change aviation as we know it. Some of the major ones are discussed in the risks section. Users are advised to consider these when using the forecast results, in addition to the forecast scenarios.

CAPACITY GAP 2040

1.5M FLIGHTS

8% OF DEMAND

160M PEOPLE

INTRODUCTION

The Challenges of Growth studies aim to deliver the best-achievable information to support long-term planning for aviation in Europe. EUROCONTROL has completed four Challenges studies, in 2001, 2004, 2008 and 2013 (Ref. 3, 4, 5, 6). This fifth study, Challenges of Growth 2018 tackles the following question:

What are the challenges of growth for commercial aviation in Europe[1] between now and 2040?

A series of annex reports supports the summary report "European Aviation in 2040" (CG18, Ref. 1):

- Annex 1, this report, discusses in details the forecast of flights to 2040 and the effects of capacity constraints at airports.
- Annex 2 reports on environmental issues (Ref. 8) giving an up-dated assessment of the readiness of the aviation industry to adapt to the effects of climate change.
- Annex 3 looks at ways to mitigate the lack of capacity, starting with building more airport capacity, but also how to use differently what capacity there is (Ref. 7).
- Annex 4 reports on the impact of this lack of capacity in terms of congestion and delays (Ref. 2).

This report presents the forecast of annual numbers of instrument flight rules (IFR) movements in Europe[1] up to 2040. It has been prepared by the EUROCONTROL Statistics and Forecast Service (STATFOR) in 2017-2018 and it replaces the 20-year forecast issued in June 2013 (Ref. 9). It focuses on developments after 2023; traffic between now and 2023 is discussed in the EUROCONTROL seven-year forecast published in October 2017 (Ref. 10).

The main innovation of this 20-year forecast lies in the implementation of the Aircraft Assignment Tool (AAT) in 2016. The AAT enables us to model the evolution of the fleet in more detail.

The report contains a description of the methodology, a summary of the forecast scenarios (section 'Scope'), a discussion of the forecast results (section 'Forecast Results') and a discussion on en-route airspace capacity (section 'Airspace Capacity') and an insight on future impact of the Unmanned Aircraft Systems (section 'Drones in IFR Airspace'). The annexes give more detail on the acronyms used in this report (Annex A), geographical definitions (Annex B), busiest 20 airports (Annex C), the detailed forecast for Europe (Annex D) and the forecast per State (Annexes E and F).

1/ In European Civil Aviation Conference (ECAC), see Annex B.


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OVERVIEW

To see what future demand might be like, we start by stepping back

Last year: In 2017, Europe recorded strong and broad-based traffic growth taking flight totals to a record 10.6 million. Indeed, even 4% growth in flights in 2017 looks modest compared to almost twice that reported for passengers or passenger-km. So, current growth is certainly supported by strong demand.

Over the last 10 years: To build a forecast, we naturally step back and take a look at what could be observed in the past years. Over the last decade, traffic growth rates have been quite unusual: there has been a nine-year hiatus from 2009 and 2017 in that the number of IFR flights stagnated, as Europe endured a series of unprecedented crises (economic crises, increased geopolitical tensions outside Europe, high oil prices and waves of terrorism). This stagnation hid however different patterns for the different market segments and geographical differences. States located in the Eastern part of Europe, from Estonia down to Turkey still managed to grow at rates above 3% per year but states in the Southern part of Europe recorded more modest rates below 1% and states in the Northern part of Europe (including UK) stagnated. The aviation industry was forced to adapt, to change its way of operating in order to survive: greater reliance on ancillary revenues, restructuring, fleet rationalisation, cost-cutting (partly thanks to technology), increased competition and adaptation to customer demands, new pricing strategies, increased load factors, increased connectivity (and intermodality). Some airlines did not make it, while others have prospered.

Over the last 30 years: If we step back even further, before 2009, this was indeed another story: traffic had doubled over the period 1988-2008. This 20-year era was marked by other milestones: deregulation of aviation in Europe, expansion of the EU from 12 States in 1989 to 27 States in 2008, bringing free movement and an open aviation area, emergence of the low-cost airlines, self-booking of tickets made possible via the worldwide web.

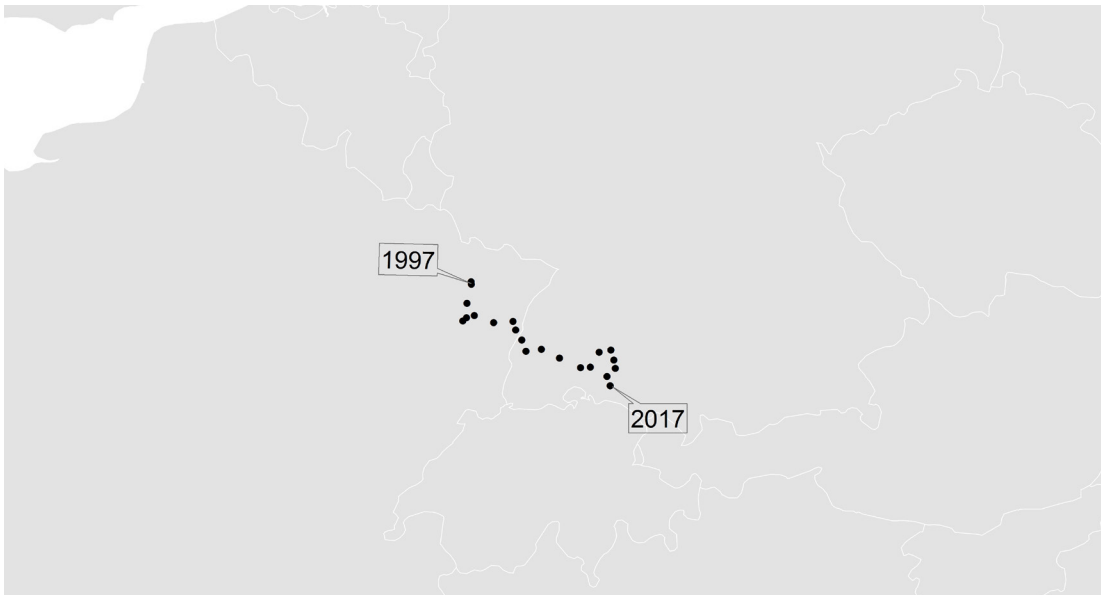
So, which path will future traffic follow? Increase, stagnation or even decline? A bit of all three? Nothing can be excluded and this is why, to project the traffic into the future, we start from the current traffic trends and develop several scenarios to capture the future. These scenarios reflect different stories materialised by several influencing factors, which we review here.

MARKET TRENDS

Low-cost Carriers: The dynamism of low-cost carriers (LCCs) helped traffic to grow again over the last decade. Some traditional airlines have created their own low-cost provider. LCCs have moved into primary markets at main airports and more recently are penetrating long haul and providing new hub connectivity to long-haul carriers. The recent expansion of low-cost airlines (Norwegian, WOW Air, LEVEL etc) into long-haul routes has been focused on the North- and Mid-Atlantic flows, with some Asian destinations in addition. This is creating new demand, but the extent to which it is also cannibalising existing demand to the detriment of full-service carriers (FSCs) is not yet clear; some are at least responding with unbundling their own long-haul services. Indeed, we do expect a different impact on demand (in relative terms) to LCCs penetration on intra-European markets. The medium-haul low-cost carriers have siphoned off a part of the FSCs' market share by offering cheaper fares. However, this price differential is more difficult to achieve for the long-haul low-cost carriers, given the specific constraints related to the cost of operating long-haul (aircraft, fuel and crew).

Major hubs in Europe and beyond: the centre of gravity of European traffic slowly moved towards east and south over the last 20 years. This trend is shown in Figure 3. There has been some hesitation, following the shift of tourism flows from south-east to south-west Europe, but overall the trend is expected to continue, for example with the opening of the new airport in Istanbul.

Figure 3 /
The centre of gravity of European aviation continues to move South and East. The centre of gravity is based on the average coordinate for a departure from all ECAC airports from 1997 to 2017.



In the aftermath of the economic crises, global operating profits and margins from commercial aviation have increased. Airlines have improved their operating cost structure (amongst which significantly lower fuel prices) and increased their passenger revenues and capacity utilisation which better enabled them to purchase new aircraft. Orders for **new generation aircraft** have been flourishing since 2013 and 2014, though we may be reaching the peak of the cycle. Since the last forecast, next generation aircraft have started flying (for example, Airbus A320Neo, Bombardier C Series). In 2017, we measured a 2% increase in seats per flight. This is the effect of both bigger aircraft operating and reconfiguration of the aircraft cabins to welcome more passengers. This is expected to continue over the next decades. While growth in load factors may be reaching its limits, an increase in **aircraft size** inevitably means slower growth of flights.

Beyond the current new-generation aircraft, aviation can also count on the development of other innovative projects. Recently, Airbus, Rolls-Royce and Siemens opted for the development (Ref. 11) of a **hybrid fuel/electric aircraft**, capable of carrying 50 to 100 passengers. The companies have formed a partnership to build a technology demonstrator with an electric motor replacing a gas turbine to test hybrid propulsion under flight conditions by 2020 with targeting in-service around 2030. On the other side of the Atlantic, Boeing has teamed up with a venture capital subsidiary of an airline and a start-up to develop a regional hybrid fuel/electric aircraft (Ref. 12) that would hold 10 to 30 passengers with a range up to 1,000 miles, expected to be tested by the next decade.

Interest is growing again in **supersonic aircraft** for commercial use and companies such as Boom

Technologies, Spike and Aerion aim to bring back ultra-fast jets by the mid-2020s. If these companies can make jets quiet and efficient, this could open new markets, as well as cannibalise existing ones. We have not included these aircraft in the forecast this time.

In 2017 there were a few flights each day, flown by drones or unmanned aircraft system. The outlook is for many more, but perhaps not in current IFR airspace. We explore this further, later in the report.

ECONOMIC IMPACT

Oil prices and supply are well represented in the scenarios of the forecast. Oil prices are currently relatively low compared to the 2011-2012 record highs caused by the Arab Spring and the civil war in Libya. At the end of 2017, prices started to (slowly) climb again as a result of a relatively tight market following a year of OPEC and Russian supply cuts, and restraint by US shale producers. This joint effort between OPEC and Russia had largely rebalanced the market. In our 2008 long-term forecast (Ref. 5), we included a "peak oil" scenario to reflect the fact that the World could run out of accessible oil reserves. This scenario was quite plausible 10 years ago. Since then, we have not seen any indisputable evidence for a near-term peaking of oil; it seems that the "peak oil" theory even started to fade away for two main reasons: the US, the world's largest oil consumer, discovered a decade ago some reserves of shale oil (and started to exploit them) and, thanks to the global efforts to develop greener energy, the demand patterns for oil are now expected to "plateau" and possibly to start declining, replacing the "peak oil (supply)" concept by "peak oil (demand)".

In the long run, economic growth remains the most important factor that influences the growth in demand for air travel. Figure 4 shows that from year to year demand for air travel followed GDP growth. In addition, the figure shows a slowing down of the economic growth rates from ~3% in 1975 to 1.5% in 2015 (regression line of the GDP growth), a deceleration which is mimicked by the flight growth. This close relationship can be summarised in terms of an "elasticity", which can be thought of as a multiplying factor that turns a percentage growth in GDP into a percentage growth in air traffic demand. After deregulation around 1990, EU28 average elasticity was higher than two (the red line in general above the blue), but since 2000, the EU28 elasticity is lower than two.

We expect the relationship between GDP and economic growth to continue, but economic growth is not forecast to be as strong in future as in the past, so this source of growth in demand for flying will diminish.

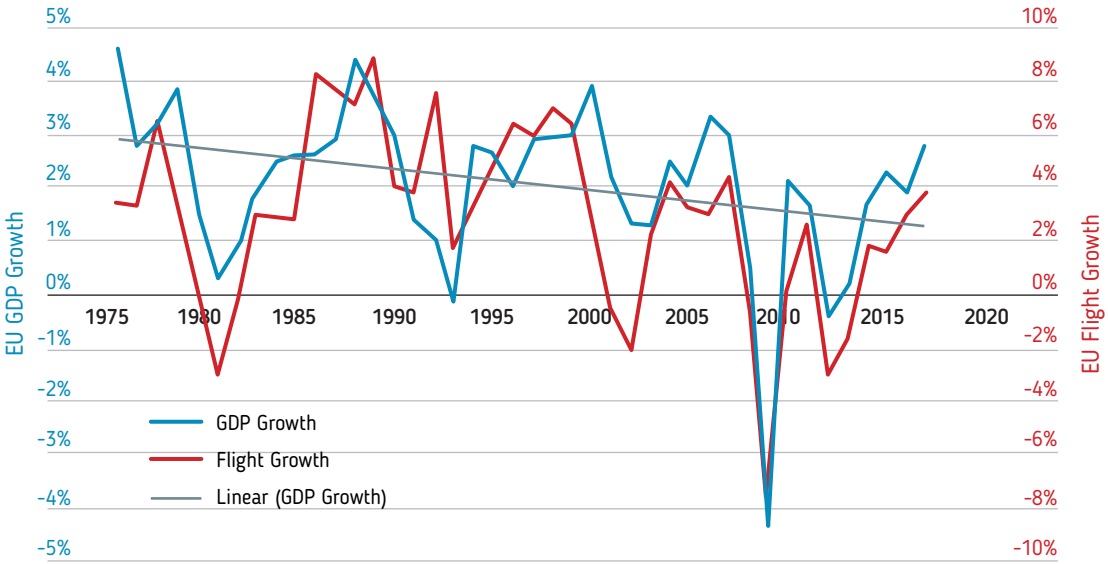


Figure 4 / *There is a long and strong correlation[2] between IFR movements (red line) and GDP in Europe (blue line) in Europe (EU28). The regression line (grey line) indicates the growth rates have halved over the last 40 years.*

2/ As the flight growth is scaled twice the GDP growth scale, the graph also shows that the elasticity of flight growth is <2 since 2000.

BEHAVIOURAL FACTORS

Airspace closure: Since 2014, airspace blockages such as in Eastern Ukraine, Syria and Libya have significantly changed traffic patterns in South-Eastern Europe, forcing aircraft operators to suddenly change their routes for **security concerns**, inevitably flying longer routes. These airspace closures are generally related to geopolitical events and we have seen more of them in the last decade. The crucial problem, when forecasting, is that the triggers for these airspace closures are not predictable. Conversely, predicting a re-opening date is as hard to anticipate. At European level, these re-routings do not much affect the total number of flights. However, as we display the forecast results at state level, the overflight patterns are of high importance when it comes to attribute them to one state rather than to its neighbour.

To counterbalance the unpredictable shifts of flows, we must add that there are and there will still be continuous initiatives to both optimise airspace design, enabling more direct routings (eg. free route airspace) and propose (distance) savings to airlines with improved flight planning efficiency.

Related to security concerns, we have also been observing recent **tourism swings** in response to terrorist attacks, or travel recommendations deterring trips to one country or another. Wars and natural disasters are also impossible to predict. Their impact on air traffic could be a temporary one, or more significant. Overall, we recently measured some important shifts in tourist flows, especially from the South-East of Europe, Egypt and Tunisia to the South-West. The same tourism swings might apply for health concerns, though there are only very limited examples of this.

Travellers—airline consumers—also made a shift in their way of consuming. Some studies (Ref. 13, 14) over the last decade have demonstrated that **buying experiences** is more gratifying, on average, than buying things. This is observed, at least in wealthy societies, in which people have a fair amount of disposable income, and can simply choose to spend more on experiences than on material goods. One reason that such experiential purchases tend to provide more enduring satisfaction is that they more readily, more broadly, and more deeply connect us to others; and are easily shareable on social media.

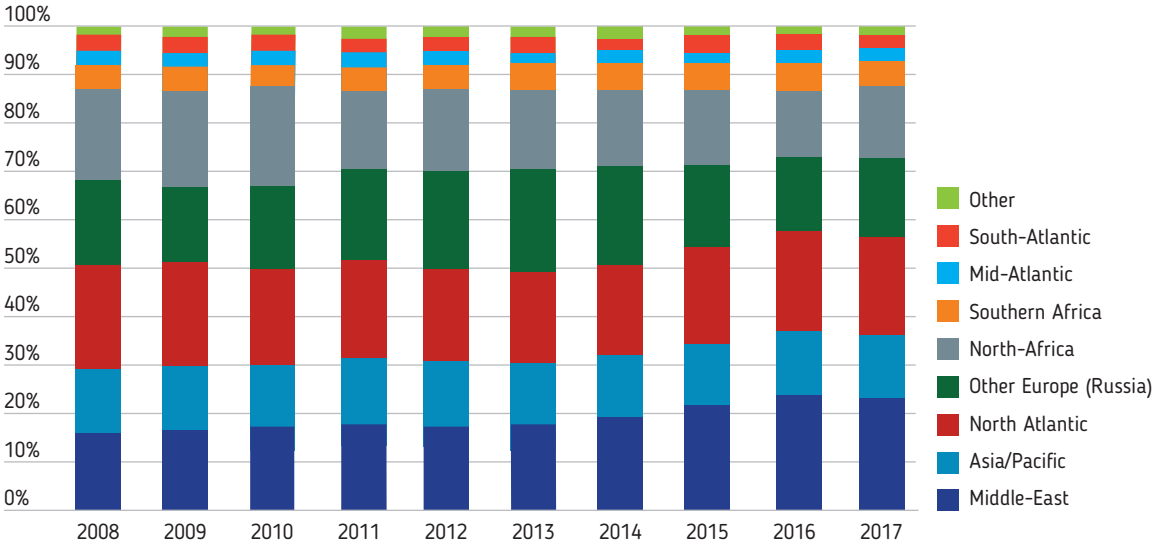


Figure 5 /
Middle-East and Asia/Pacific have increased their share of Europe intercontinental departures by 7 percentage points in 10 years.

Middle class: the rise of Asian & emerging aviation markets – and the resulting external demand influences Europe. The expanding middle class in these markets have a strong aspiration to air travel – and consider Europe as a prime destination. In particular, we expect Chinese airlines to develop based on their home markets, and also in a way similar to the Gulf carriers, targeting Europe. From that standpoint, it is also remarkable that while Gulf carriers have been hit by recent geopolitical instability, they have not only maintained but kept increasing capacity into Europe (Figure 5).

ENVIRONMENTAL FACTORS

Climate change: International aviation needs to respond to the 2°C and 1.5°C temperature goals of the Paris Agreement. ICAO encourages States to submit voluntary action plans outlining policies and actions, and annual reporting on international aviation CO_2 emissions to ICAO. After discussions with the STATFOR User Group, for this forecast we have assumed that the major impacts of this lie largely beyond 2035. That being said, environmental costs already have and will continue to have an impact from now until the end of the forecast. An "emission charge effect" has been factored in the forecast (varied by scenario) by assuming that the additional costs for aircraft operators would be passed onto passengers in an increase in fares.

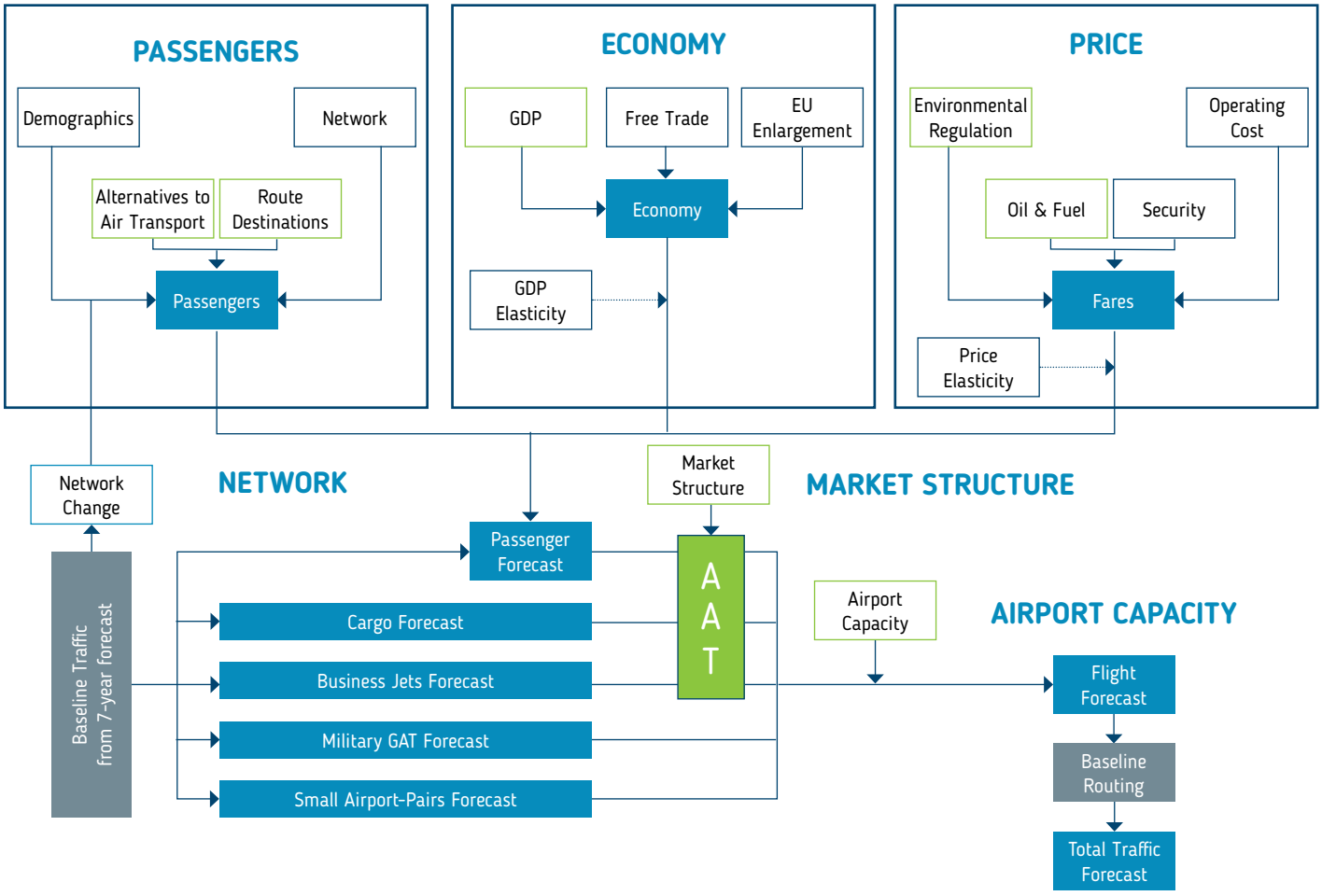
In addition, climate change itself poses risks for the later years of the forecast: the threats to the infrastructure and to daily operations, the changed travel patterns as Summer temperatures rise and skiing availability changes, the economic challenges of droughts. There is more on this in the environment report (Ref. 8).

METHODOLOGY

The 20-year forecast method, like the 7-year forecast method (Ref. 15), uses a model of economic and industry developments to grow the baseline airport-pair traffic and produce a view of future flight movements. Each 20-year forecast is strictly linked to a 'baseline' 7-year forecast whose final forecast year is used as the baseline year of the 20-year forecast. This also means that the 20-year forecast model makes no additional assumptions about events that may happen between now and the final year of the 7-year forecast (base year of the 20-year forecast) as these should be fully covered by the 7-year forecast. The current forecast uses as its baseline the forecast for 2023 of the 7-year forecast (Ref. 7) published in October 2017.

Figure 6 illustrates the 20-year forecast model and its sub-models which serve to produce forecasts of passenger, cargo, military GAT, business aviation and small airport-pairs flights[3].

Figure 6 /
Overview of the 20-year forecast model. Passenger component is the most detailed. Aircraft Assignment Tool (AAT) applies to passengers, cargo and business aviation forecasts.



3/ Passenger traffic on flows with less than 25 unidirectional flights a year.

Since passenger flights are the greatest part of all IFR flights (around 86% in 2017, see Figure 7), the passenger traffic sub-model is the most detailed and is structured around five main groups of factors:

- **Economy** factors represent the key economic developments driving the demand for air transport.
- Factors characterising the **passengers** and their travel preferences change patterns in travel demand and travel destinations.
- **Price** of tickets set by the airlines to cover their operating costs influences passengers' travel decisions and their choice of transport.
- More hub-and-spoke or point-to-point **network** may alter the number of connections and flights needed to travel from origin to destination.
- **Market structure** describes size of aircraft used to satisfy the passenger demand and converts the passenger numbers into flights. This important step in the forecasting process now includes the Aircraft Assignment Tool (AAT) which models the future fleet: anticipating the aircraft which will still be in service, the new aircraft which will be delivered, as well as the ones retired or phased out. AAT is applied to passenger, business aviation and cargo segments, accounting for 96% of the flights in Europe in 2017. The role of AAT is both to improve the quality of the forecast (compared to the previous forecast where the approach related to the fleet was assumption simpler extrapolation) and to be able to derive additional output results such as future fleet details, future number of passengers, future CO_2 emissions or fuel consumption. See Annex G for more details.

Compared to the passenger forecast, the all-cargo, military GAT, business aviation and small airport-pairs flight sub-models are less sophisticated, relying more on historical evolution, sometimes in combination with economic developments.

Total forecast arrivals and departures are restricted by airport capacity before the flights are 'flown' through the airspace (assuming same routing as at the end of the 7-year forecast) and the final forecast of total flights per State[4] is produced.

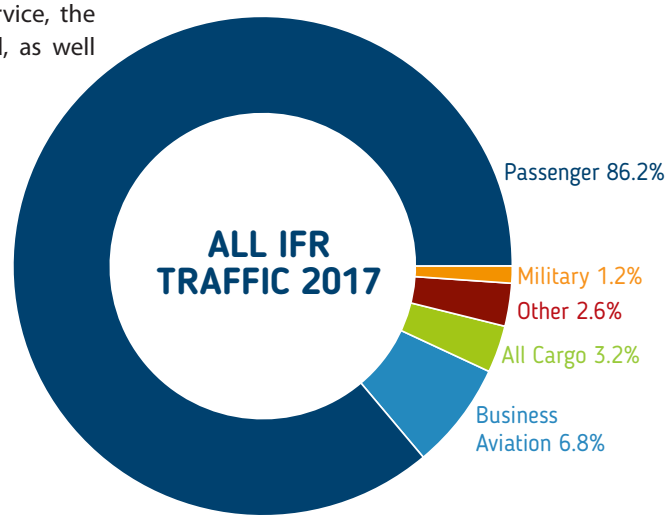


Figure 7 /
The forecasting methodology is different according to the type of flight. Not shown on this graph, small airport-pairs account for less than 3% of passenger flights.

4/ More precisely, the forecast is produced for each traffic zone (TZ) based on flight information regions which often coincide with States.

SCOPE

FOUR SCENARIOS FOR THE FUTURE

To structure the uncertainty surrounding the possible outlook in the long term, some scenarios are defined, with qualitatively-different representations of the many possible futures. Each scenario follows a specific path of events and developments that then drives the forecast traffic. The description of scenarios helps the user of the forecast to take well-informed decisions. There is no good or bad scenario but more contextual futures that guide users to anticipate the implications of future events, helping them prepare for change and uncertainty.

In the past, there have been a range of at least six different forecast scenarios created since 2004. The last 20-year forecast (CG13) published in June 2013 used four scenarios, largely based on previous long-term forecasts. Scenarios: Global Growth, Regulation and Growth and Fragmenting World drew on the work done for CONSAVE (Ref. 16), ACARE (Ref. 17) and the IPCC (Ref. 18) although they had been updated to reflect the views on likely future developments in aviation. A specific scenario had also been built as an alternative to the scenario Regulation and Growth named Happy Localism where Europe would develop in a more "inwards" perspective.

For this new forecast, the need for adapting these scenarios to reflect the future has been discussed in June 2016 together with a group of forecast expert users. A lot has happened in the aviation industry since CG13 forecast was released in June 2013 (Ref. 6). After two years of traffic declines in 2012 and 2013, traffic has started to grow again, slowly in 2014 and 2015 (below 2% per year) as the economic recovery was not complete all over Europe.

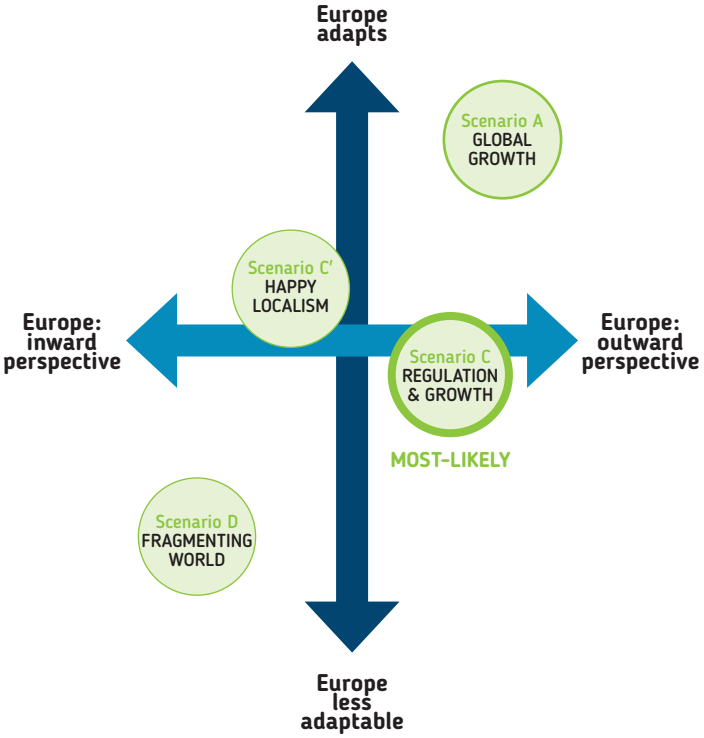


Figure 8 / *Four possible futures.*

Then, the traffic grew more dynamically in 2016 (~3%) to reach a 4% growth in 2017.

With 10.6 million flights controlled in Europe, 2017 hit a new record high and surpassed the 2008 record of 10.1 million flights. The summer months (July, August and September) were the busiest ever recorded in Europe, each totalling more than one million flights. The main market segments (passenger, business aviation, and all-cargo) all contributed to the strong flight growth.

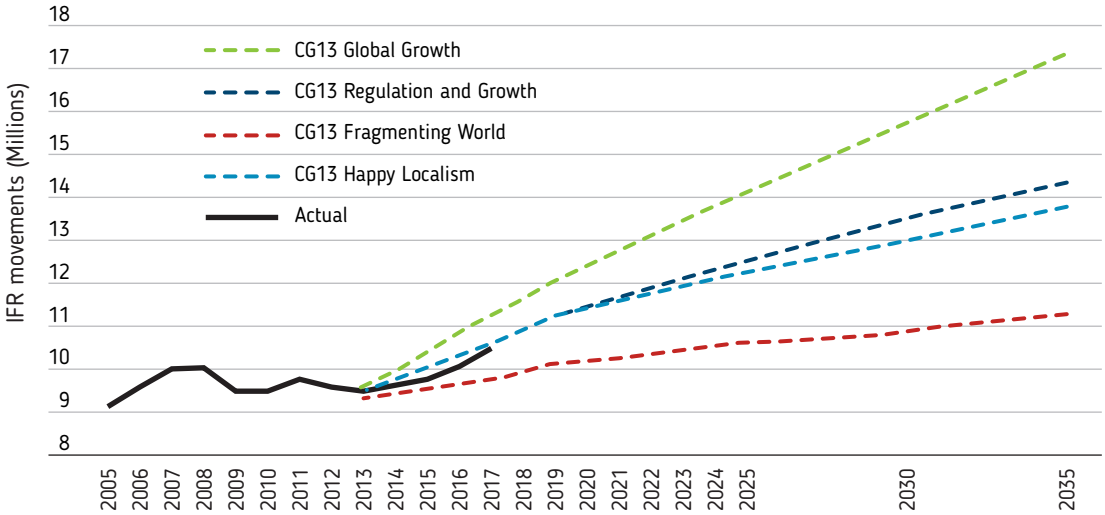


Figure 9 / *In 2017, strong growth saw traffic back on the most-likely (Regulation and Growth) scenario from the 2013 forecast*[5].

As shown in Figure 9, actual traffic finally developed slightly more slowly in 2014 and 2015 (than anticipated) in the base scenario of the CG13 forecast, but caught up in 2016 and 2017 before being back on track.

For this 20-year forecast report, after consultation with STATFOR User Group members and EUROCONTROL experts, we kept the same four scenarios as in the CG13 forecast (Ref. 6). These storylines are still valid as possible futures and are deemed to capture the uncertainty about what air transport might be like in 2040. In summary, these scenarios are:

Global Growth (Technological Growth): Strong economic growth in an increasingly globalised World, with technology used successfully to mitigate the effects of sustainability challenges such as the environment or resource availability.

Regulation and Growth: Moderate economic growth, with regulation reconciling environmental, social and economic demands to address the growing global sustainability concerns. This scenario has been constructed as the 'most-likely' of the four, most closely following both the current trends, and what are seen as the most-likely trends into the future.

Fragmenting World: A World of increasing tensions between regions, with more security threats, higher fuel prices, reduced trade and transport integration and knock-on effects of weaker economies.

Happy Localism: this scenario investigates an alternative path for the future. With European economies being exposed to shocks, increasing pressure on costs, stricter environmental constraints, air travel in Europe adapts to new global environment but taking an inwards perspective. There is less globalisation, more trade inside EU (e.g. Turkey joining Europe is important in this scenario). Also, less leisure travel to outside Europe, however certainly more inside EU. More point-to-point traffic within Europe. It does not mean that Europe does not grow or does not adapt to new technologies and innovation but its main focus is "local". Although this scenario is mostly based on Regulation and Growth scenario it also inherits some aspects of other scenarios like higher fuel prices or low business aviation traffic of scenario Fragmenting World.

5/ The CG13 forecast did not include ECAC as a region, so we use ESRA08 here instead (See Annex B).

As with every update of the 20-year forecast, input data have been fully revised using the latest available figures for GDP growth, population age structure, etc.

Figure 10 / *Summary of the input assumptions per scenario.*

	Global Growth	Regulation & Growth (most-likely)	Happy Localism	Fragmenting World
2023 traffic growth	High ↑	Base →	Base →	Low ↓
Passengers				
Demographics (Population)	Aging UN Medium-fertility variant	Aging UN Medium-fertility variant	Aging UN Medium-fertility variant	Aging UN Zero-migration variant
Routes and Destinations	Long-haul ↑	No Change →	Long-haul ↓	Long-haul ↓
Open Skies	EU enlargement later +Far & Middle-East	EU enlargement earliest	EU enlargement earliest	EU enlargement latest
High-speed rail (new & improved connections)	20 city-pairs faster implementation	20 city-pairs	20 city-pairs faster implementation	20 city-pairs later implementation
Economic conditions				
GDP growth	Stronger ↑	Moderate →	Weak ↓	Weaker ↓↓
EU Enlargement	+5 States, Later	+5 States, Earliest	+5 States, Earliest	+5 States, Latest
Free Trade	Global, faster	Limited, later	More limited, even later	None
Price of travel				
Operating cost	Decreasing ↓↓	Decreasing ↓	Decreasing ↓	No change →
Price of CO_2 in Emission Trading System	Moderate	Lowest	Lowest	Highest
Price of oil/barrel	Low	Lowest	Highest	High
Change in other charges	Noise: ↑ Security: ↓	Noise: ↑ Security: ↑	Noise: ↑ Security: →	Noise: → Security: ↑
Structure				
Network	Hubs: Middle-East ↑↑ Europe ↓ Turkey ↑ Point-to-Point: N. Atlantic ↑↑	Hubs: Middle-East ↑↑ Europe & Turkey ↑ Point-to-Point: N. Atlantic ↑	Hubs: Middle-East ↑↑ Europe & Turkey ↓ Point-to-Point: N. Atlantic ↑	No change →
Market Structure	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions

ECONOMY

GDP GROWTH

The economic forecast is one of the main drivers for air traffic growth (Figure 4).

The base GDP forecast has been prepared by Oxford Economics Ltd. (December 2017 update). The euro area and EU economies are both estimated to have grown by 2.4% in 2017, the fastest pace in a decade. The growth is likely to remain solid in the medium term, building on the result of both stronger cyclical momentum in Europe, where labour markets continue to improve and economic sentiment, particularly high, as well as a stronger than expected pick-up in global economic activity and trade. In the longer-term, the forecast growth for 2022-2040 in the EU28 averages 1.1% per annum and is directly used in Regulation and Growth.

A fixed offset is used to derive the economic forecast of the remaining scenarios: it is 0.2 percentage points (pp) higher in Global Growth, 0.5pp lower in Fragmenting World and 0.2pp lower in Happy Localism.

The Brexit negotiations on the terms of the UK withdrawal from the EU28 are still quite unclear at the time of writing. The Oxford Economic Ltd. forecasts are currently based on a purely technical assumption of status quo in terms of trading relations between the UK and the EU. The 2022-2040 forecast makes no other assumptions about the outcome of Brexit negotiations.

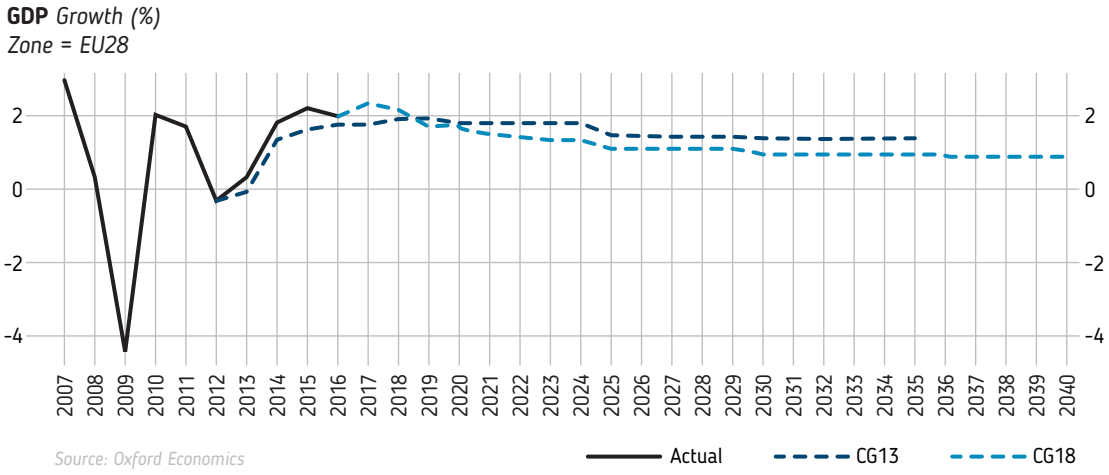


Figure 11 / *GDP growth forecast for EU28 has been revised downwards compared to CG13.*

In the most-likely scenario, the GDP growth trend for EU28 has been cut by around 0.4pp compared to what was expected for EU27 in the previous 20-year forecast (Ref. 6 and Figure 11).

The economic and traffic downturn started in 2009 and continued until 2013-2014. The latter resulted in successive downwards revisions of economic growth forecasts over the (short-term) period 2012-2013.

In the recent update of the EU economic forecast (December 2017), we observe downwards revision as well (Figure 11) but much smaller and over a longer period (until 2040).

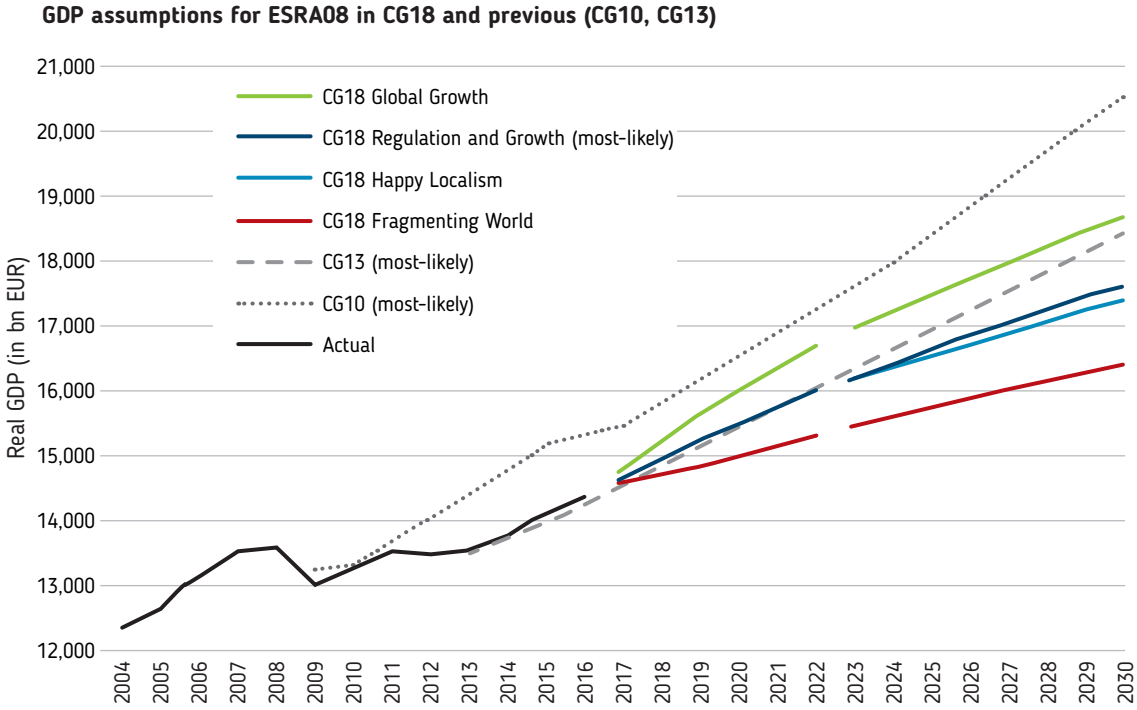


Figure 12 / *GDP forecast assumptions has been revised downwards compared to the most-likely profiles of the previous long-term forecasts (2013 and 2010).*

As shown in Figure 4, air traffic and economic growth are closely related. The strength of the relationship, ie the expected growth in passenger demand for a given GDP growth, is represented by a set of **GDP elasticity** figures. These are region-specific to cater for the differing maturity of the markets. Also, there is evidence that this relationship gradually changes with time: that is, as markets become more saturated, the demand for flights grows less for the same economic growth. Passenger-related elasticities have been fully recalibrated for this forecast. The study reviewed the elasticities for all region pairs for data over the last 30 years and also analysed the specific characteristics of the elasticity of some domestic flows in order to reflect the less rapid growth of these (a reduction factor is applied to the region-pair elasticity). The GDP elasticity figures are not varied by scenario. Lower values (<1) are observed on flows between North-Atlantic and Africa and on the flow connected to Mid-Atlantic. The highest values (>2) are often observed between Eastern Mediterranean (Turkey) and the other regions. The GDP multiplier for cargo is fixed.

FREE TRADE

In the 20-year forecast, we address liberalisation of trade between large trading blocs having already some element of **free trade** (governed by the rules of the World Trade Organisation, for example). The free trade effect is materialised by bi-directional boosting factors between European regions and outside Europe regions. The boosting factors are applicable for all regions, are bigger and have an earlier effect (from 2025) in Global Growth than in Regulation and Growth and Happy Localism. The latter has very limited boosting factors having an effect at a later stage (from 2035). Due to the nature of Fragmenting World, there are no boosting factors related to free trade. Trade is reduced in this scenario, which is, in a way, reflecting the consequences of countries' trade disputes, like the one currently taking place between the US and China, for example. The threat of trade wars looms ahead and is a risk to future economic growth.

EU ENLARGEMENT

This forecast has been built considering a European Union of 28 member states. However, the picture will change from 2019 as the United Kingdom will leave the club. The European Union is trying to find the right balance between deepening the relationships between members and widening its number of members. It has been observed in the past that EU accession brings some economic benefits to the joining states, as well as the existing members. More confidence in the political and economic stability of the new member boosts foreign direct investments and capital flows, cross-border trade increases and international competitiveness is further stimulated. This forecast anticipates that some Balkan states as well as Turkey, which are currently official or potential candidates, could join EU before 2040 (see Ref. 19). The different scenarios reflect the timing of accession as well as the strength of the impact on economic and traffic developments. Scenarios Regulation and Growth and Happy Localism count on earlier integration of these States than Global Growth scenario (where the global perspective is more important than the European one). However, Turkey joining the EU is a key assumption in Happy Localism scenario: both integration date and impact on GDP are optimistic. Fragmenting World is for a delayed integration (whichever State) with limited effect.

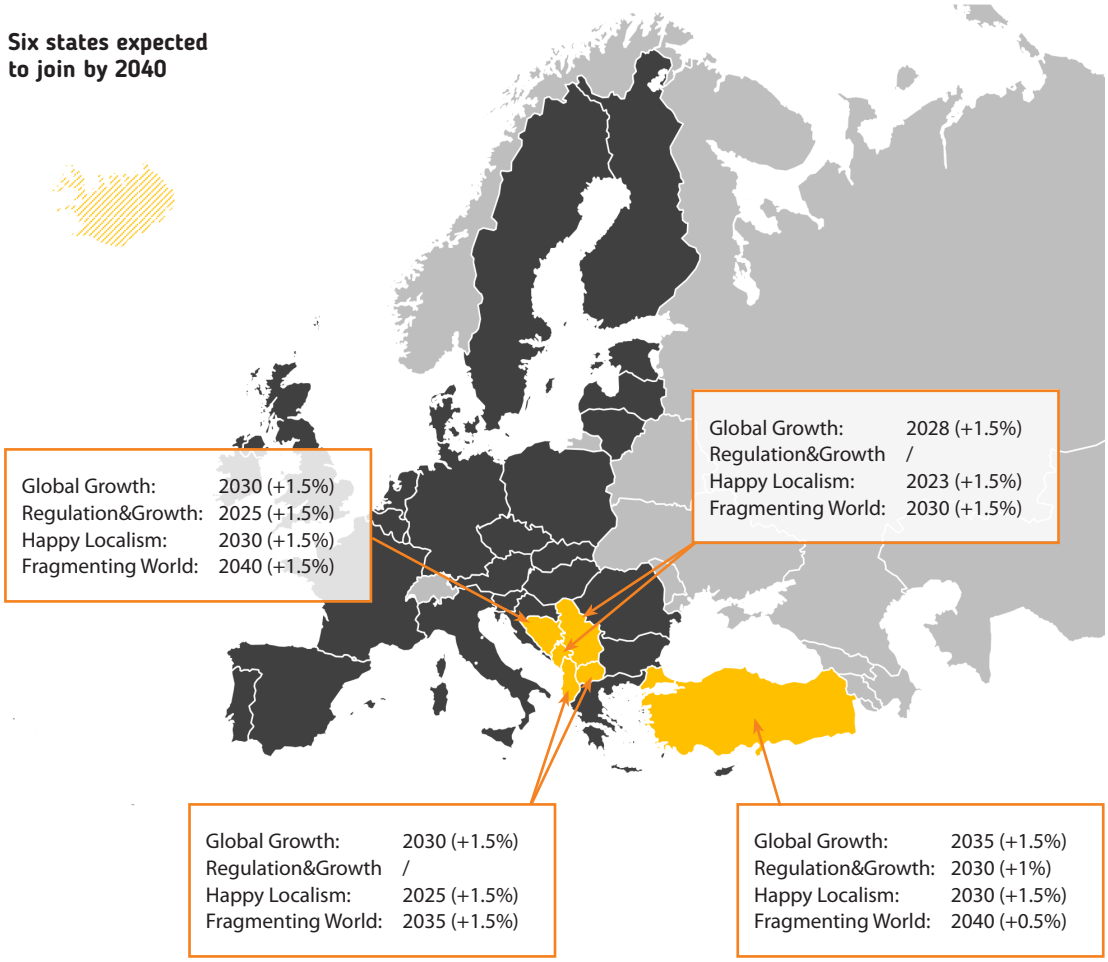


Figure 13 / *Candidate States for EU enlargement are located in South Eastern Europe. States could potentially join EU: Albania, Bosnia-Herzegovina, former Yugoslav Republic of Macedonia, Serbia, Montenegro and possibly Turkey.*

PASSENGERS:

ALTERNATIVES TO AIR TRANSPORT

High-speed trains (HST) are the main competitors for flying short-haul. The faster the connection, the bigger the share of train travellers compared to air travellers, particularly for city-centre to city-centre when access time is shorter than by air and journey times are shorter than by car. HST can offer comparable transport time for journeys of between 400 and 800 km.

Until 2014, we used in the forecast a model based on a study conducted for EUROCONTROL (Ref. 20) that describes how the market share of passengers depends on the rail travel time.

To improve accuracy, the model was re-calibrated in 2014 (Ref. 21) with more recent data and enhanced with the introduction of distance as a third variable. The model is applied to city-pairs, and since each city is defined in terms of a number of airports, this translates into an effect on flights between one group of airports and another group of airports. The new model was first introduced in the February 2015 Forecast (Ref. 20).

The European Commission is considering the importance of the multimodality[6] in the transport sector, in the context of the commitments to the Paris Agreement, especially regarding the congestion and air pollution reduction to improve the quality of life of European citizens. In place for more than two decades, the co-modality[7] services offered by certain air and rail operators allow passengers to transfer from rail to air (and vice-versa) using intermodal platforms. This leads to an increased cooperation rather than the more traditional commercial competition between the two transport modes. However, in this analysis our focus is on the reduction in short-haul flights that results from HST development.

The HST travel times (input data) have been updated for this 20-year forecast. The rail projects included in this forecast are only the ones for which improvements in travel time will be found within the forecast horizon (2023-2040).

There are now twenty projects which is far fewer than the number covered in the previous 20-year forecast: thirteen projects have been maintained from the 2013 assessment and seven projects have been added, notably new connections in the UK. On the other hand, eighteen projects have been frozen, cancelled or abandoned compared to the plans found in 2013 (projects in Portugal, eg. Lisbon-Madrid, Porto-Vigo, projects in France, LGV Montpellier-Perpignan). In the end, there are now twenty city-pairs which will be connected by HST between 2023 and 2040, with an implementation date corresponding to the announced plan in Regulation and Growth, an earlier implementation date in Global Growth and Happy Localism (the latter favours the green transport) and a later implementation date in Fragmenting World (limited investment).

ROUTES AND DESTINATIONS

Economic growth generates air travel and air transport brings economic benefits to the connected regions. The "routes and destinations" component of the 20-year forecast model allows capturing changes in passengers' preferences for routes or destinations rather than change in the total number of travels.

Regulation and Growth follows the notion of "business as usual" and does not alter the preferred routes or destinations. Regions coming closer in the open World of Global Growth together with better technology allowing cheaper long-distance journeys shift passenger preferences to long-haul travel. The tensions between regions with more security concerns and fewer cross-regions contacts in Fragmenting World turn passengers away from long-haul travel; except on North-Atlantic flow. Happy Localism reflects somehow the same assumption as in Fragmenting World as the general "Europe inwards" atmosphere reduces the extra-European tourism trips, hence reduces the long-haul growth and shifts to short-haul, especially intra-Europe.

6/ "Multimodality" in the transport sector, or "multimodal transport" refers to the use of different modes (or means) of transport on the same journey.

7/ "Co-modality" means the use of each mode of transport for the most suitable purpose and, where appropriate, the use of a combination of modes of transport.

PRICE

OIL PRICE

Oil prices steadily grow in Global Growth and Regulation and Growth reaching respectively $105 and $103 per barrel (in 2016$) by 2040.

The slight difference lies in the fact Global Growth uses EIA (Energy Information Administration) high economic growth where the oil extraction costs are reduced whereas Regulation and Growth elaborates on the EIA Reference scenario. EIA low oil and gas resource and technology scenario is used in scenarios Happy Localism and Fragmenting World: it results in speculation, high price volatility and high oil prices in the model, this is captured by persistently high oil prices starting at around $81/barrel in 2025 and climbing to around $115/barrel in 2040.
Due to higher refining margins in Happy Localism and Fragmenting World (than in Global Growth and Regulation and Growth), the kerosene prices increase somewhat faster and therefore have a stronger effect on fares when these costs are passed onto passengers.

These prices are lower than in the previous forecast. The Regulation and Growth equivalent was around $145 (2010$) in the 2013 forecast. As discussed earlier, shale oil is providing some damping of the overall growth.

oil price assumptions in CG18

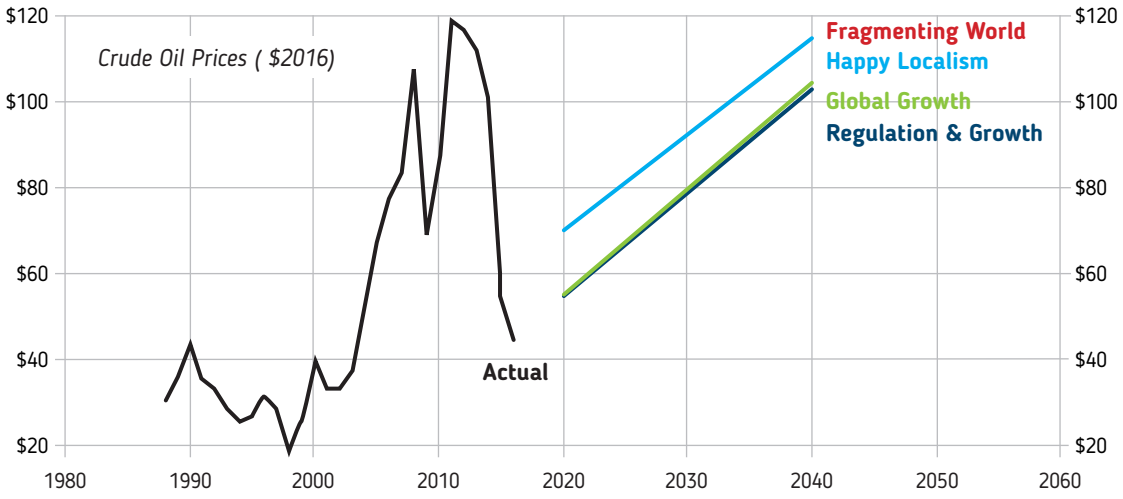


Figure 14 / *Crude oil is expected to reach between $105 and $115 per barrel.*

DEMOGRAPHICS

The method for demographics combines the population age structure predictions with age-specific **propensity to fly** which is allowed to change in the future.

Propensity to fly can be defined by the number of air trips per capita. This strongly determines future demand for air travel among business and leisure travellers. As the population pyramid shifts, so does average propensity to fly.

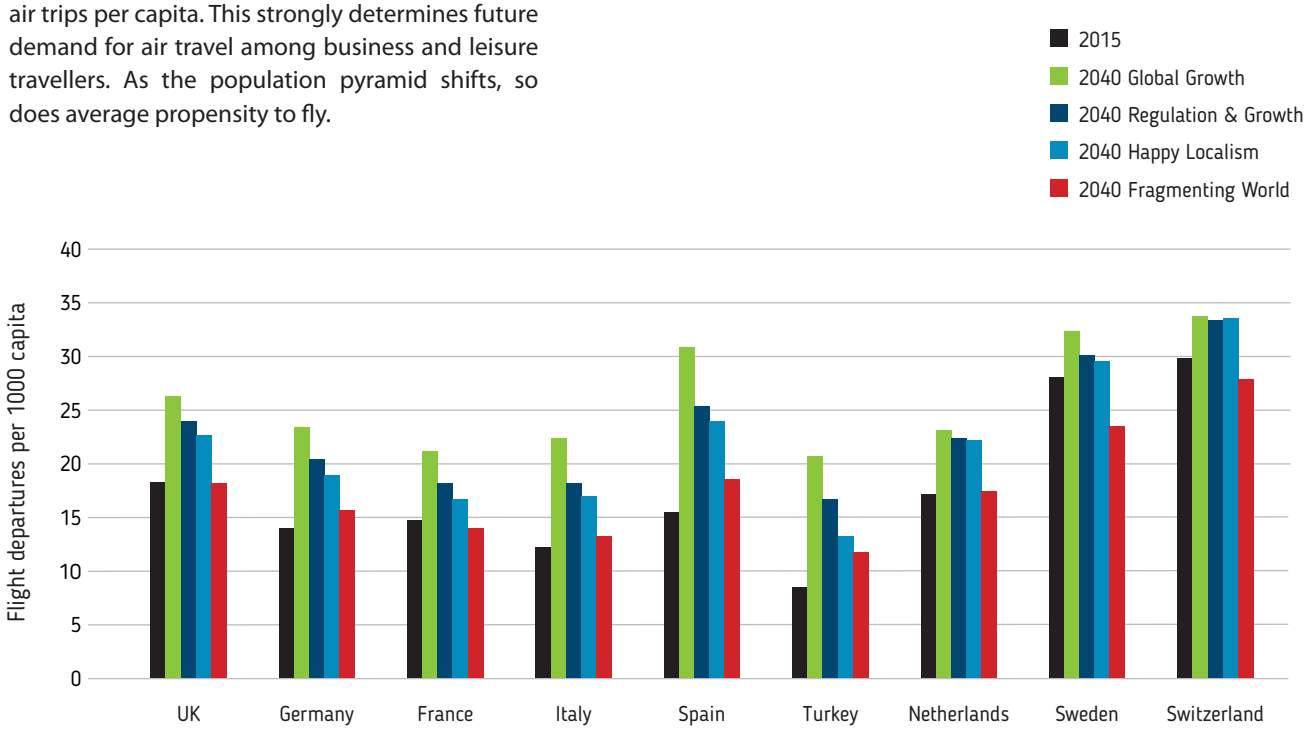


Figure 15 / *Current (2015) and future (2040) propensity to fly per scenario for busiest departing States[8]. Amongst this list, Turkey shows a factor 2 between current and future (Regulation and Growth) propensity to fly.*

The forecast assumptions are based on passenger surveys at Heathrow airport (over the period 2007-2015) and the main French airports (over 2010-2015). We consider the current distribution of business and leisure travellers by age category and create assumptions on how these travellers would change in the future. The economic crisis has provided an additional opportunity for governments to address what has long been identified: the sustainability, or rather unsustainability, of pension provisions. In many European countries there will be older pensioners, and poorer. In fact, the effects of this could be a higher propensity to fly on average, since those of working age fly more often both for work and for leisure as they do not necessarily have children to support anymore.

8/ Norway generated very high propensity to fly (80 in 2015) and has been omitted for clarity.

AIRPORT CAPACITY PLANS

Airport capacities are the limits on the ground of the forecast. For some airports, capacities are set to vary between scenarios implying different consequences on the air traffic. This forecast uses a fully-refreshed set of airport capacity figures more than one hundred airports, building on the systematic work done by the EUROCONTROL Network Manager Airport unit to collect directly from European airports current and future data covering (amongst others): airport capacity, significant events and works planned as well as efficiency enhancement initiatives.

This homogeneous source of data, available through an on-line tool called 'Airport Corner', is based on stakeholders' submissions up to December 2017, has been compiled, reviewed and validated. Where information for some key airports was not available, additional data was received from STATFOR User Group members.

The input data set contains capacity information for 111 airports located in Europe, covering 69% of all ECAC departures in 2017. As shown in the map (Figure 16), these airports are well distributed over Europe. All but four airports of the 50 busiest airports are included.

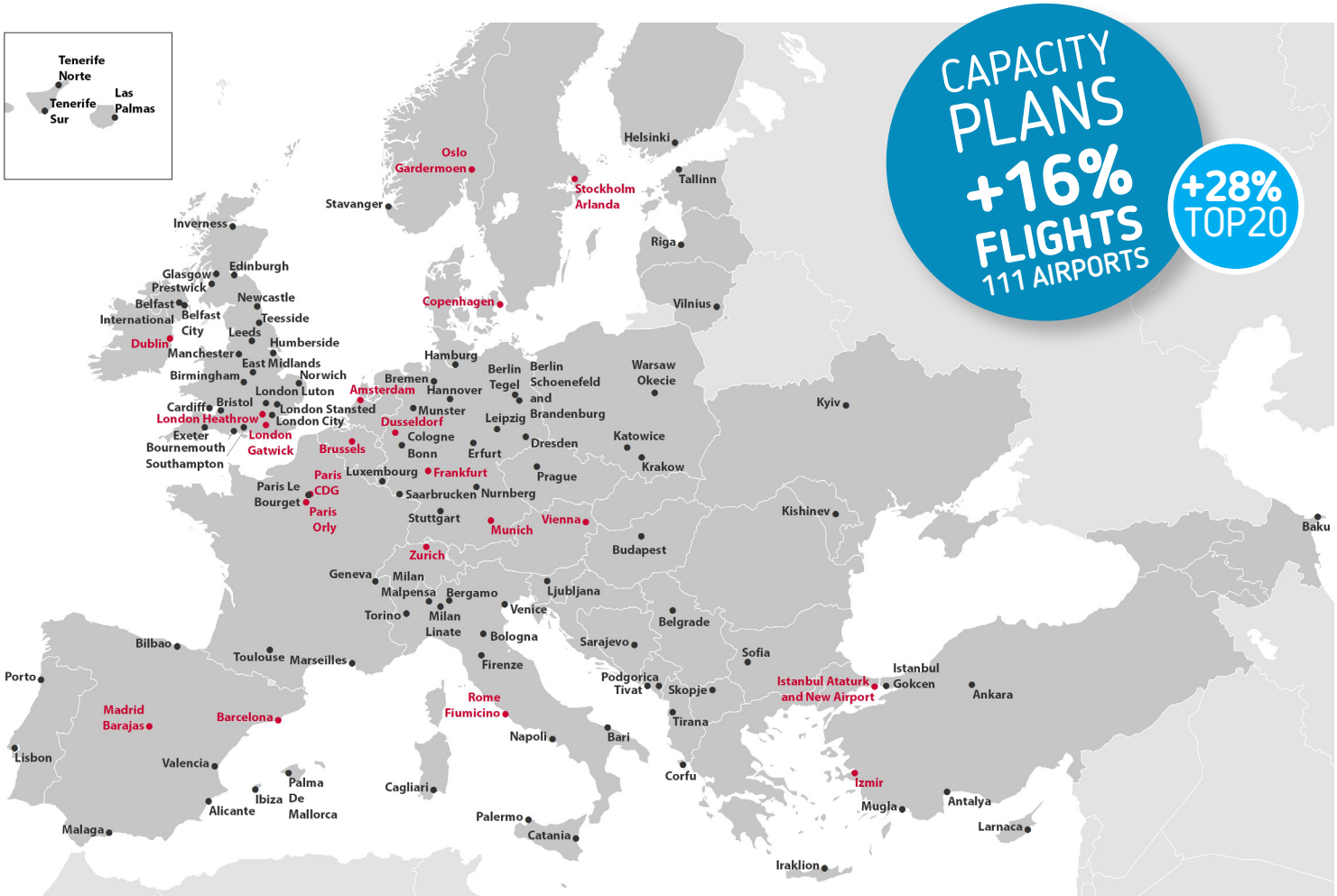


Figure 16 /
Map of the 111 airports for which future capacity plans have been considered (top 20 highlighted in red). All but four airports of the 50 busiest airports in 2017 are included.

When comparing the plans declared by airports in the previous 20-year forecast (CG13) to the ones taken on board for this forecast (CG18), we measured that capacity expansion plans are slightly bigger than five years ago: the like-for-like[9] comparison shows that if the capacity plans were anticipating 13% expansion in the previous forecast, they are now representing a 16% capacity increase (Figure 17). Further analysis shows that the capacity plans are concentrated in the busiest 20 airports, which are aiming for a 28% expansion (versus 18% in the previous forecast). In total, the top 20 airports are adding capacity for 2.4 million new flights (arriving and departing runway movements). The main reasons for this bigger figure rely on the fact that the expansion plans are concentrated where the bottlenecks are London Heathrow (LHR), Dublin (DUB) or Vienna (VIE) airports have planned one additional runway each. Furthermore, some expansion plans have been delayed (eg. slippage of Berlin Brandenburg (BER) opening) and some others, already anticipated in the previous forecast, are now more precise (eg. the new Istanbul New Airport will be running its operations with a 6-runway configuration (Ref. 22) from 2028). This forecast then includes potentially a net total of nine[10] additional runways to be built by 2040.

Lastly, there are almost no plans over the period 2035-2040, but the same was true in the previous forecast. Airports aim to be more responsive to how demand evolves, twenty years is largely beyond the firm planning horizon.

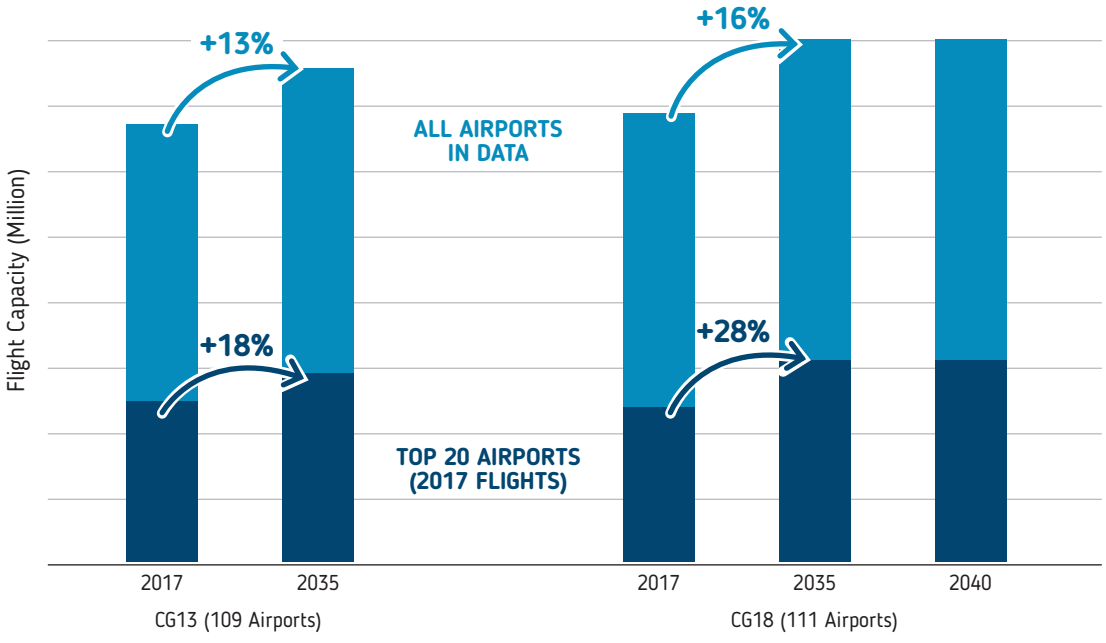


Figure 17 /
Like-for-like comparison of the expansion plans between the previous study (CG13) and this study (CG18).

9/ Like-for-like: comparison between CG13 and CG18 relying on: the same sample of 111 airports, the same beginning year (2017) and end year (2035), the same scenario Regulation and Growth.

10/ Berlin Tegel is expected to close when Berlin Brandenburg will open.

OTHER

NETWORK CHANGE

Network change of the airlines, i.e. concentration of traffic into hubs or use of more point-to-point operations, has an effect on the total number of flights and their regional distribution. This forecast assumes a growing importance of Middle-East hubs (namely Dubai, Abu Dhabi and Doha) for connecting traffic to and from the Middle-East, Asia/Pacific and Southern Africa, resulting in slower growth of transferring passengers at European hubs on these flows. This assumption is used in all but Fragmenting World (possible instability in the Middle-East). In scenarios Global Growth and Regulation and Growth, Istanbul airport plays also a key role with higher hubbing rates (to a lesser extent compared to previous Middle-East airports) for connecting traffic to and from Asia/Pacific and Southern Africa. This emphasis on Turkey is however not kept in Happy Localism where Europe is seen as a region increasingly flown over by long-haul international flights.

MARKET STRUCTURE

Load factors

The 'market structure' inputs describe the structure of air transport supply serving the demand for air transport analysed in the previous sections. The structure of the supply is represented by the characteristics of aircraft in use. Assumptions about load factors on these aircraft also enter the forecast model when converting the passenger numbers into flights.

Similarly as medium-term forecast traffic (to 2023) is used as a baseline for long-term traffic forecast, the last medium-term forecast load factors (in 2023) have been used as the baseline for the long-term load factors. The base load factors in 2023 are relatively high, between 74% and 91% depending on the flow and scenario (see Ref. 10).

In the previous 20-year forecast, they were capped at 85%, but their current increasing trend implies that an average of 90% is feasible.

The recent increase of load factors has shown that they could still grow and were sufficient to absorb flight demand. The numerical assumptions are the following: after 2023, load factors start to decline by around 0.25% annually in Global Growth, ranging from 71% to 84% depending on the regions, as profitable airlines are increasingly able to expand frequency at the expense of load factors.

In Regulation and Growth, load factors are expected to remain stable (no change compared to 2023, see Ref. 10). Happy Localism sees a moderate increase in load factors of about 0.25% annually after 2023, until a long-term operationally sustainable ceiling of around 79%-90%. In Fragmenting World, the load factors remain stable for short-haul and increase by 0.25% for long-haul, ranging from 80% to 90%.

Fleet

The future fleet is now considered in the forecast in the Aircraft Assignment Tool (AAT) component (see Annex G) developed collaboratively by EUROCONTROL, the European Aviation Safety Agency and the European Commission. The future market structure takes into account the fact that some aircraft will be retired by the end of the forecast and new aircraft will enter into service by then.

The retirement process of the Aircraft Assignment Tool is performed year by year, allowing the determination of the amount of new aircraft required each year. This way, the entry into service year can be derived for the replacement aircraft. A growth and replacement database is built using the Flightglobal Fleet Forecast - Deliveries by Region 2014 to 2033 and Eurocontrol assumptions. This forecast provides the proportion of deliveries for each type in each of the future years, which are re-scaled to match the EUROCONTROL forecast. The future fleet assumptions are not varied by scenario.

FORECAST RESULTS

SUMMARY OF RESULTS

Since 2016, European traffic (IFR movements) has passed the 10 million flights per year (again). By 2040, the traffic is expected to grow beyond 16 million of flights in Regulation and Growth and even close to 20 million in Global Growth. This corresponds to a total growth between 53% (Regulation and Growth) and 84% (Global Growth), a rather slower growth rate than before 2008 (see Figure 18). Indeed, over the 20 years before the economic crisis, the number of IFR movements in Europe grew by 100% from around 5 million IFR movements in 1988 to just above 10 million in 2008 (see Figure 18).

Overall, the forthcoming slowdown in growth is explained by slower economic growth rates (Figure 4 and Figure 11), increasing fuel prices (see Figure 14) and higher level of congestion at airports (see Figure 26).

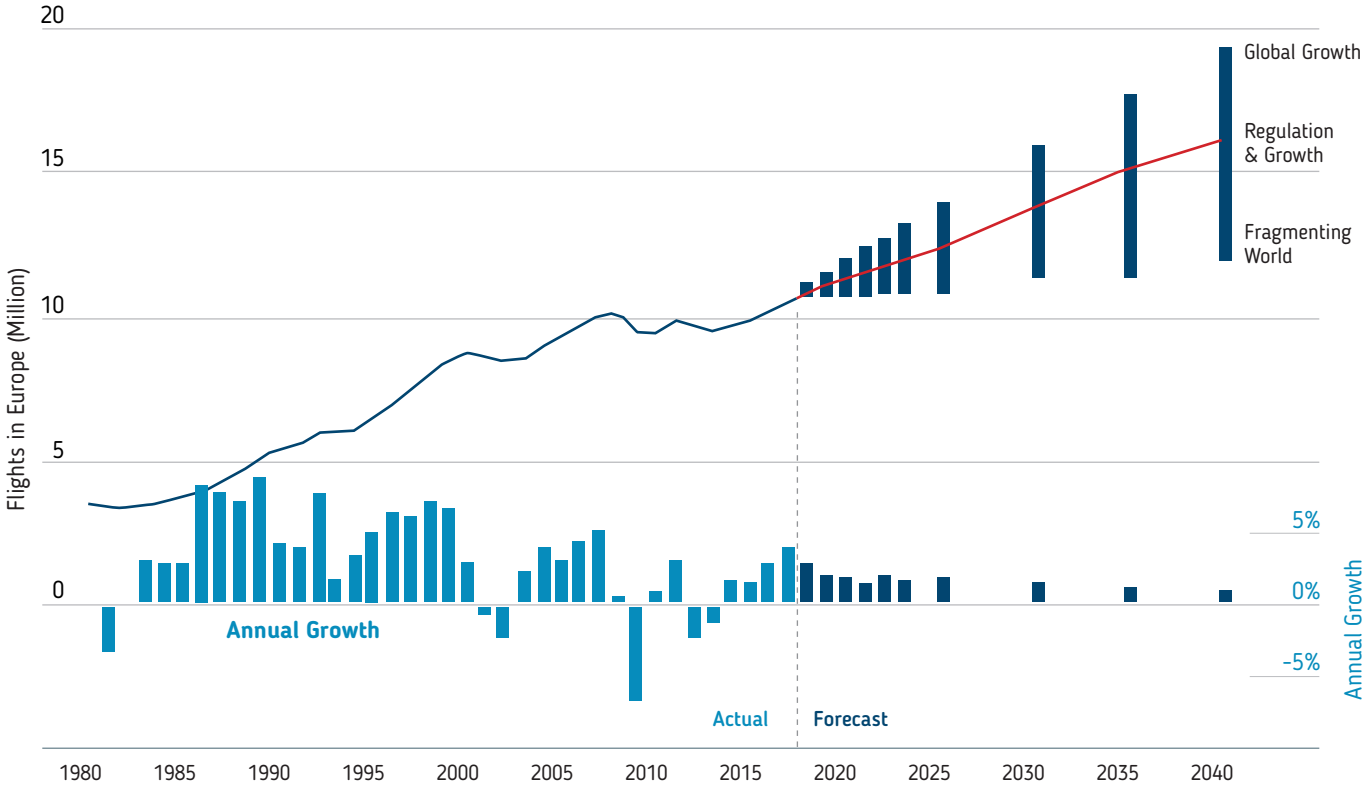


Figure 18 /
In Regulation & Growth flights increase by 53% between 2017 and 2040.

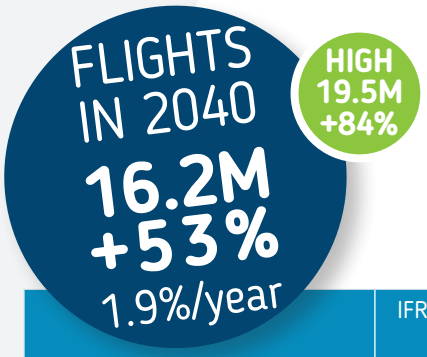


Figure 19 /
Summary of the key trafic values expected in the four scenarios for Europe by 2040.

	IFR Flights (million) 2040	Total growth 2040/2017	Average Annual Growth 2040/2017	Extra flights/day (thousands)
Global Growth	19.5	84%	2.7%	24
Regulation & Growth	**16.2**	**53%**	**1.9%**	**15**
Happy Localism	14.9	41%	1.5%	12
Fragmenting World	11.9	12%	0.5%	4

Each scenario paints a picture of a different future, with different pattern of traffic growth. Focusing on ECAC region which covers Europe, from Iceland to Azerbaijan (see Figure 46), we observe:

- In the most-likely scenario, Regulation and Growth, there will be 16.2 million flights in Europe in 2040, 53% more flights than in 2017. That is an average growth of 1.9% per year, around half of the historical rates between then 1960s and the 2008 previous peak. There will be a slow-down in growth rates from 2035 as market become more mature, economic growth decelerates and as the capacity limits become an issue (see Airport Capacity section).

- Global Growth is the most challenging scenario. Starting from the high-growth scenario of the 7-year forecast, Global Growth is supported by quite strong economic growth, a high propensity to fly, wide range of open skies agreements (compared to other scenarios) and relatively low fuel prices (similar as Regulation and Growth). This scenario records 19.5 million flights in 2040 in Europe, corresponding to 83% more flights than in 2017. In this scenario, growth rates are averaging 2.7% per year over the 23 years: up to 2025 average annual growth rates are expected to stand at 3.1% per year, capitalising on the recent traffic recovery, while the 2030-2040 period shows more moderate—but sustained in the long-term--growth rates of 2% per year. This decelerating trend is explained by a mix of factors: market maturity, larger aircraft, and capacity constraints at airports (see Airport Capacity).

The recent return to traffic growth has been vigorous, and there are newer growth drivers - long-haul, low-cost, new aircraft types, middle class growth in China, changes in propensity to fly – which are under-represented in our forecast models because of their short histories. For this reason we recommend that, in addition to the most-likely scenario Regulation and Growth, particular attention is paid to Global Growth.

- Happy Localism, although starting from the same 2023 traffic levels as Regulation and Growth, follows almost the same pattern in growth but at a slower pace as the economy is expected to develop less rapidly in this scenario from 2023 onwards. Moreover, this scenario includes higher fuel prices as well as higher load factors than in Regulation and Growth. The growth rates are expected to level off from 2025 onwards, resulting in 1.3 million fewer movements in Happy Localism compared to Regulation and Growth in 2040.

- Lastly, Fragmenting World starts from the low-growth scenario of the 7-year forecast, where a lot of factors hinder the traffic growth: high oil prices, slow economic development, no free trade agreements with outside Europe partners, high price of travel etc. This scenario points to stagnation of traffic as it records 11.9 million flights in 2040 in Europe, 12% more than in 2017. In this scenario, growth rates are averaging 0.5% per year over the 23 years. In 2040, the final number of flights in Fragmenting World corresponds to the expected number of flights by 2022 in the most-likely scenario or the expected number of flights by 2020 in Global Growth.

Figure 20 /
Summary of forecast for ECAC.

	IFR Movements (000s)												Total Growth 2040/2017
	2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	
Global Growth	9,617	9,921	9,707	9,601	9,768	9,920	10,193	10,604	14,044	16,018	17,809	19,462	1.8
Regulation & Growth	.	.	.	.	.	.	.	.	12,443	13,847	15,174	16,200	1.5
Happy Localism	.	.	.	.	.	.	.	.	12,410	13,449	14,231	14,917	1.4
Fragmenting World	.	.	.	.	.	.	.	.	10,877	11,375	11,669	11,911	1.1

	Average Annual Growth												AAGR 2040/2017
	2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	
Global Growth	0.9%	3.2%	-2.2%	-1.1%	1.7%	1.6%	2.7%	4.0%	3.6%	2.7%	2.1%	1.8%	2.7%
Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.2%	1.8%	1.3%	1.9%
Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.1%	0.9%	1.5%
Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.9%	0.5%	0.4%	0.5%

Growth will not be uniform across Europe. As shown in Figure 2, States in Eastern Europe will grow more quickly than Western ones (this remains true for each scenario). More specifically, States in South-East Europe, surrounding the Black Sea or on the Mediterranean sea are expected to see annual growth rates between 2.2% and 4.7% on average in Regulation and Growth, see Figure 2. These rates range from 3.3% to 5.8% in Global Growth. States located in North-East Europe also show sustained growth, though to a more limited extent as average annual growth rates are expected to see increases ranging from 1.4% to 3% in the most-likely scenario.

These Eastern states have typically less traffic than in Western Europe at the start of the horizon (except Turkey) thus a higher potential for growth than in Western Europe, as they are less mature economies, are developing faster (than in Western Europe) and there is more potential for air traffic growth. For example, in Regulation and Growth, most of the States in Eastern Europe will at least double their departures per 1,000 capita: (e.g. Croatia, Latvia, Estonia, Poland, Moldova), even triple (e.g. Bosnia-Herzegovina will see its yearly departures per 1,000 capita increasing from 2 in 2015 to 6 in 2040, Bulgaria: from 5.3 to 16 and Ukraine from 1.3 to 4). Extreme cases will see even larger changes (Georgia: from 3.3 to 16.4).

Even with these high increases, the values remain well below those of the more mature Western States: out of the four busiest States, UK was the most mature with 18.2 departures per 1,000 capita in 2015, followed by Spain (15.2), France (14.6) and Germany (13.9). These states show a lower potential for air travel growth in 2040 than the Eastern States: Spain is expected to outpace UK (26.2) with 30.7 departures per 1,000 capita while Germany (23.3) is expected to develop more than France (21.2) in Regulation and Growth.

Western European States have already quite mature markets, so lower traffic growth rates ranging between 1% and 2% per year are expected over the next 20 years. Some smaller markets in the West will grow more strongly: Iceland 2.6%, Ireland 2.2% and Morocco 2.6%. Iceland and Morocco have seen their traffic developing quickly in the recent years, thanks to low-cost markets, and have higher potential for growth than other mature Western states. Figure 21 shows the distribution of the total flights in 2040 in the most-likely Scenario. Germany, France and UK are expected to remain the busiest States in Europe handling respectively more than 4.7, 4.5 and 3.7 million flights. Turkey, currently ranked as the sixth busiest State will then be the fourth busiest with 3.1 million in 2040.

As shown in Figure 22, Turkey will show the biggest increase in terms of daily flights (compared to 2017) and is expected to handle around 4,700 more flights per day in 2040 than it did in 2017 in the most-likely scenario. This additional traffic, driven by the opening of the Istanbul New Airport, will mainly be domestic traffic (60%). The remainder will be international traffic, the top two flows being Middle-East (9%) and Germany (5%). In Global Growth, this additional traffic figure for Turkey could jump to 7,000 more flights per day in 2040 than in 2017 (Figure 22).

Other big increases in traffic will be found in Germany (around 4,000 additional flights per day than it had in 2017 in the most likely scenario). France and UK will have to manage each between 3,000 and 4,000 extra daily flights (most-likely scenario) in their airspace.

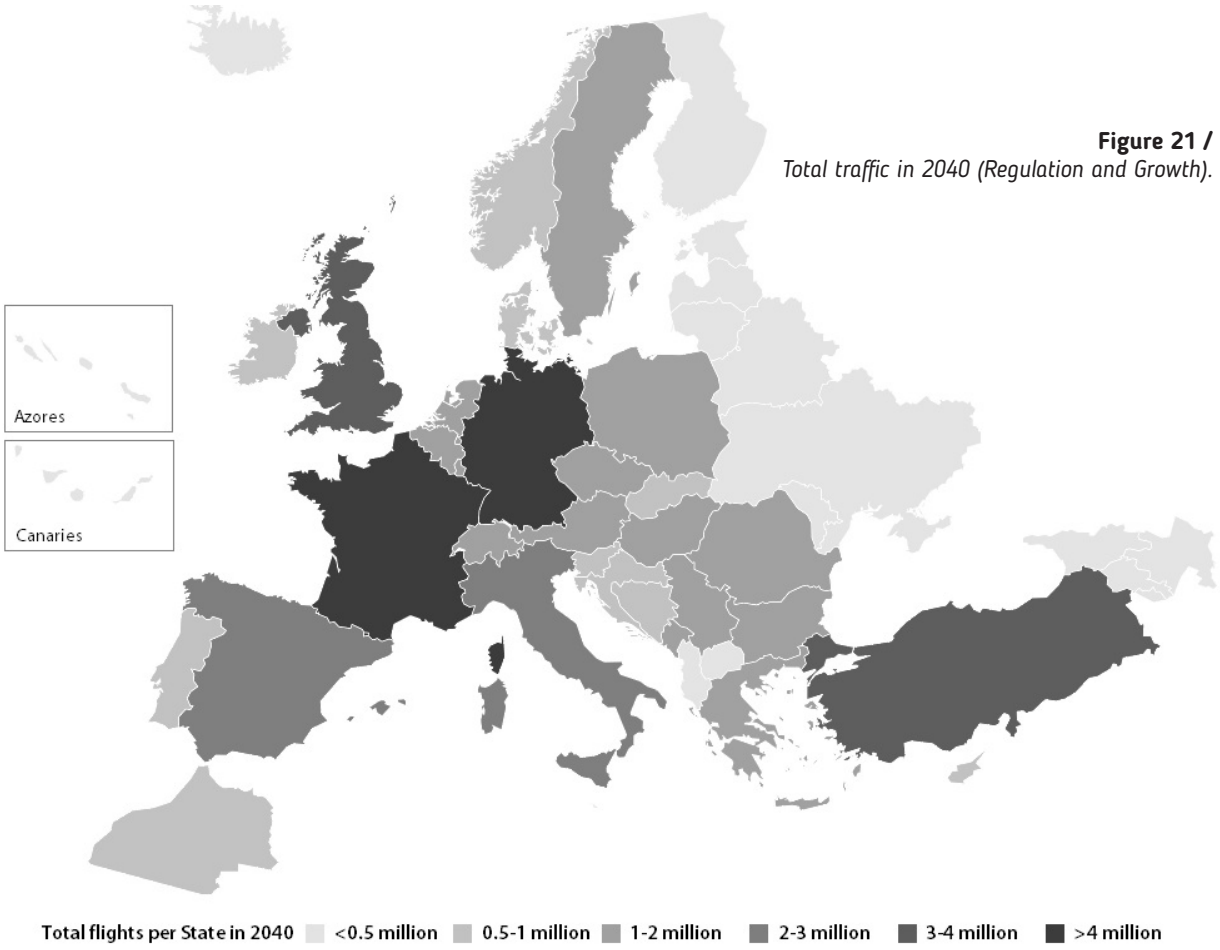
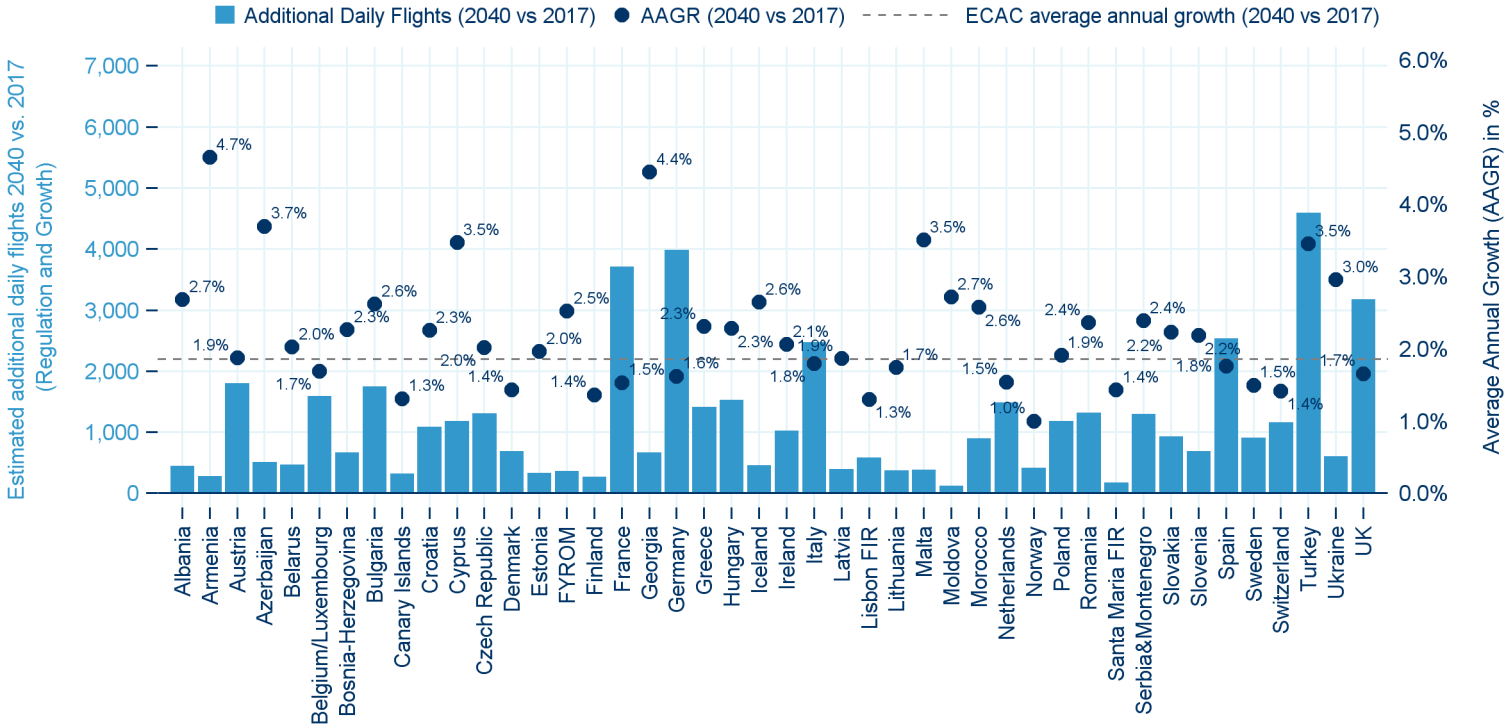


Figure 21 /
Total traffic in 2040 (Regulation and Growth).

Regulation and Growth (most-likely)



Global Growth

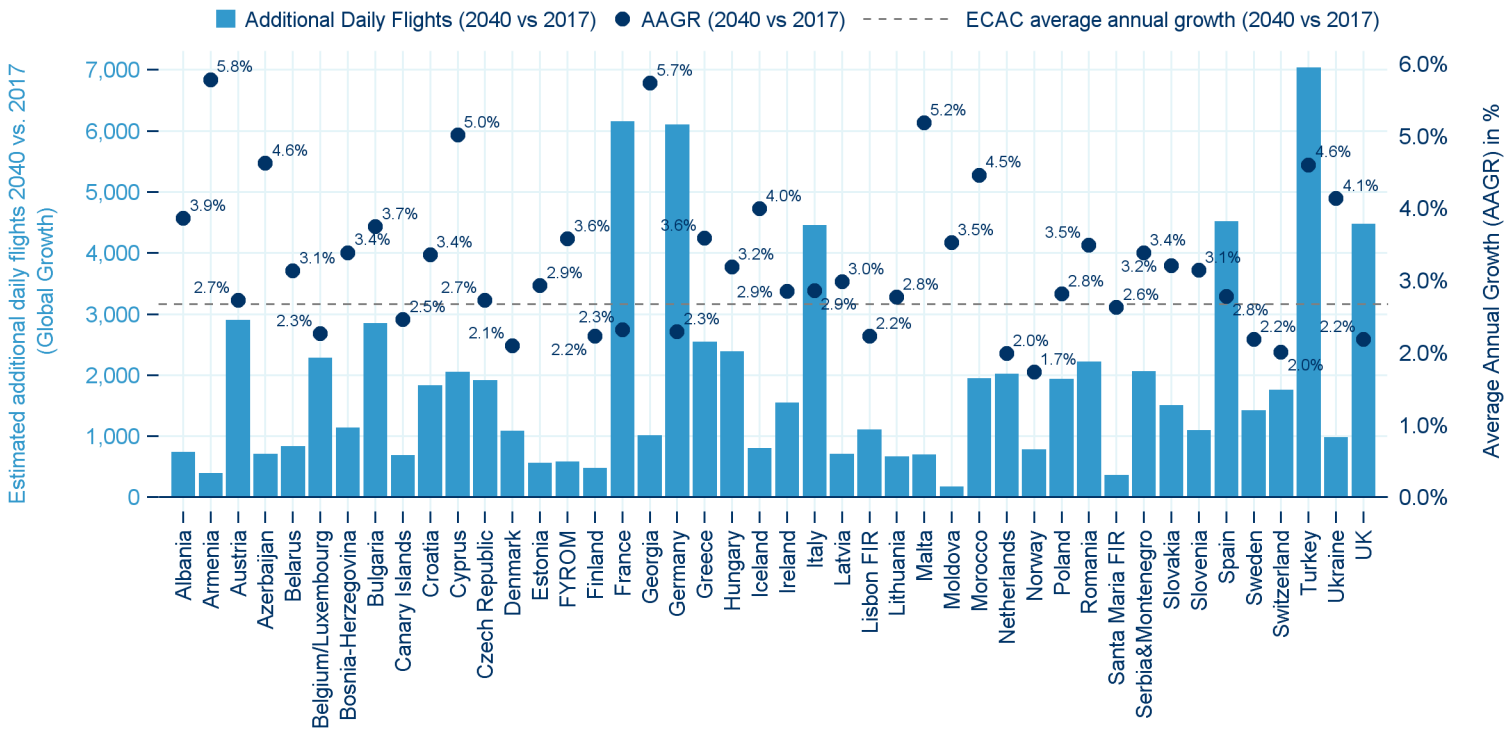


Figure 22 /
Average annual growth rate in 2040 and extra flights a day through airspace, Regulation and Growth (top) and Global Growth (bottom).

Figure 23 /
IFR movements and average annual growth rates per flow based on IFR movements in 2017 and 2040.

ECAC	IFR Movements (000s)								AAGR 2040/2017			
	2017				2040							
	Internal	Arr/Dep	Overflight	Total	Internal*	Arr/Dep**	Overflight	Total	Internal	Arr/Dep	Overflight	Total
Global Growth	8,364	2,058	182	10,604	13,656	5,209	597	19,462	2.2%	4.1%	5.3%	2.7%
Regulation & Growth					12,016	3,745	440	16,200	1.6%	2.6%	3.9%	1.9%
Happy Localism					11,323	3,184	410	14,917	1.3%	1.9%	3.6%	1.5%
Fragmenting World					8,987	2,603	322	11,911	0.3%	1.0%	2.5%	0.5%

* Internal: traffic within European States (intra-European)

** Arr/Dep: intercontinental traffic to and from Europe.

For Europe (ECAC, see Annex B), internal flights currently account for nearly 80% of the total traffic, arrivals and departures account for 19% and overflights (not departing, neither arriving in Europe) less than 2%. The general trend observed in this forecast is the progressive contraction of the share of the intra-European traffic (~74% in most-likely scenario in 2040), which is compensated by the increase of the share of the arrivals and departures (~23%). One of the reasons is the expected slowdown of growth in the already mature markets (Western Europe). Moreover, the lack of capacity at airports is also having an impact on the intra-European development.

This trend is even more marked in Global Growth (intra-European 70%, international 27%) where the global perspective is leading the traffic development: the long-haul flows are favoured over the short-haul ones. Moreover, the Middle-East hubs are preferred to the European ones in this scenario (except Turkey, with Istanbul playing a key role as a hub). The annual growth of the intra-European flow in this scenario averages 2% over the 20 years.

In the most-likely scenario, the share of intra-European flights will decrease by 5pp to 74% in 2040. This scenario is for a fast EU enlargement, which will slightly boost intra-European traffic and favours hubbing within Europe, which explains a slightly higher share of intra-European traffic than in the previous scenario. However, the expected annual growth rate of the intra-European flow in Regulation and Growth is 1.6% over 20 years. The arrival and departure flow will average 2.6% per year, but will only represent 23% of the total traffic by 2040. The overflight traffic is expected to grow at a 3.9% rate per year but remains less than 3% of the total traffic.

In Happy Localism, which favours a more "inwards" development of Europe and with a slower economic development than in Regulation and Growth, traffic growth is slower. The difference is smaller between intra-European growth and arrivals and departures growth.

In Fragmenting World, the distribution of the traffic is quite similar to Regulation and Growth and Happy Localism (75% intra-Europe and 22% arrivals and departures). However, this scenario expects a slow economic growth, a delayed EU enlargement, no changes in hubbing (compared to current situation). This leads to almost no growth for intra-European flights (0.3% per year on average) and a low 1% growth on arrival and departure flows.

More traffic in Europe will mean busier airports. In 2040, 22 airports will handle more than 150,000 departures per year in Regulation and Growth, a level of traffic currently achieved at 8 airports in 2017.

Figure 24 /
Average Annual Growth rates per market segment based on European departures and arrivals (IFR movements) between 2017 and 2040.

ECAC Arrivals and Departures	AAGR 2040/2017 (%)		
	Passenger	Business Aviation	All-Cargo
Global Growth	2.4%	2.5%	3.9%
Regulation & Growth	1.5%	2.1%	3.5%
Happy Localism	1.0%	2.1%	3.1%
Fragmenting World	-0.1%	1.4%	2.5%

Market Segments

The distribution of traffic per market segment will remain relatively stable over the next 20 years. All-cargo, accounting for the smallest share of traffic (amongst the 3 market segments discussed here, see Figure 7) will be growing more strongly. This segment is expected to expand to the Middle-East, Asia/Pacific and Africa.

Passenger flights will grow by 1.5% per year to 2040 in Regulation and Growth and are expected to stagnate in Fragmenting World. The share of traffic related to passenger flights in North-West Europe is expected to slightly shrink from 50% in 2017 to less than 47% in 2040 in the most-likely scenario, notably due to high congestion at the airports here. Conversely, the share of passenger traffic to Middle-East and North-Africa are expected to increase.

Business aviation market segment is expected to grow at an average rate of 2.1% per year between 2017 and 2040 in the most-likely scenario.

ECAC and other regions

Figure 25 shows that Middle-East and North-Africa regions will be the most dynamic partners: the average annual growth rate for flights departing ECAC to these regions is likely to be respectively 3.5% and 3.4% per year by 2040 in the Regulation and Growth scenario.

Asia/Pacific and Southern Africa regions are likely to see their traffic developing with Europe too as their growth rates will be around 3% per year.
The traffic between ECAC and Other Europe (including Russia) is expected to grow at rates just below 2% per year, a slower pace than the one anticipated in the previous forecast mostly explained by the downwards revision of the economic growth forecast in the region.

On the other hand, more mature markets, on the other side of the Atlantic will record more moderate growth rates between 1.1% (Mid-Atlantic) and 1.9% (North-Atlantic). On the latter one, the expected growth from Europe to the North-Atlantic region is now higher compared to what was expected in the previous forecast (see Ref. 9); this is mainly due to the upwards revision of the passenger-related elasticity factors between North-West Europe and the North-Atlantic (see GDP growth) as well as the increase of long-haul low-cost flights between Europe and North-Atlantic over the next five to ten years. The most dynamic (and significant) flows boosting the North-Atlantic rate will be the flows from South-Eastern Europe (Turkey, with average annual growth rate of +4.7%, Greece +3.6%), but also the North-Western ones (Belgium/Luxembourg +3%, Iceland +2.6% and Ireland +2.4%).

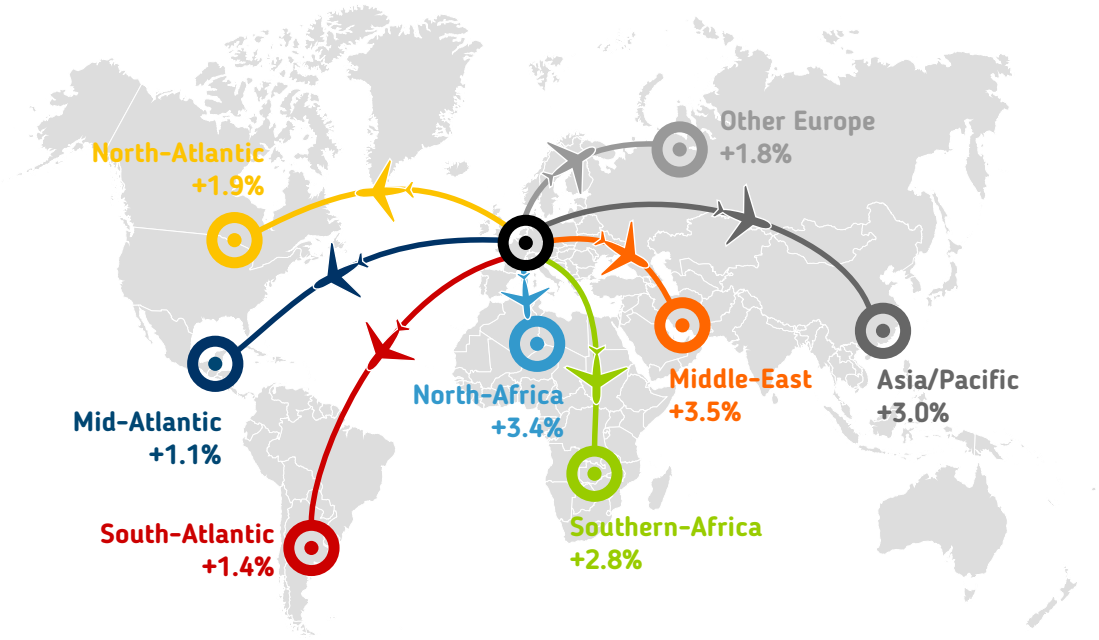
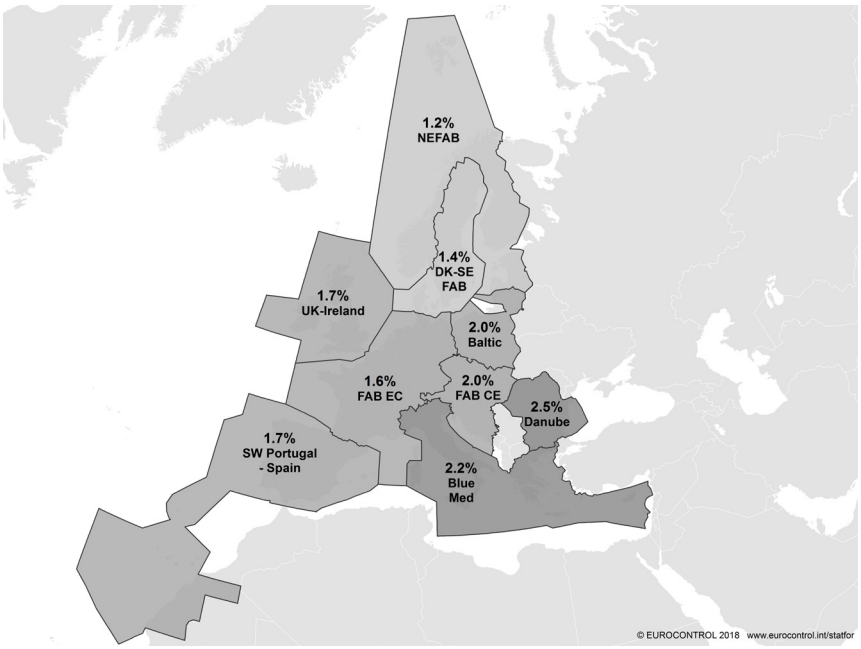


Figure 25 /
Average Annual Growth rates on main flows from Europe in 2040 (vs. 2017) - Regulation and Growth Scenario.

Functional airspace blocks

Figure 26 corresponds to the Figure 2 at Functional Airspace Block (FAB) level. In Regulation and Growth, the Danube FAB is expected to record the highest annual growth rate (2.5% per year). FABEC, which includes the core area of the European traffic, will be the busiest FAB with more than 8.6 million flights to handle in Regulation and Growth. FABEC average annual growth rates could reach 2.2% per year in 2040 in the Global Growth scenario.

Figure 26 /
Average Annual Growth rates for FABs in 2040 (versus 2017), Regulation and Growth scenario.



AIRPORT CAPACITY

One of the major challenges of future air traffic growth identified in the previous studies is the lack of capacity available at airports. In 2013, the 20-year forecast (Ref. 6) estimated the number of flights lost to insufficient airport capacity to be almost 2 million by 2035 in the most-likely scenario.

This forecast uses a fully-refreshed set of airport capacity figures covering 111 airports, building on the systematic work done by the EUROCONTROL Network Manager Airport unit to collect directly from European airports current and future data covering (amongst others).

The current sample of actual and future capacity data covers traffic at European airports that touch 84% of 2017 ECAC flights: 8.98 million flights in total either departed from or arrived at one of these airports. Over the period 2017-2035, the capacity of the system is expected to increase by 16%, not evenly distributed across the 111 airports[12] . This is a higher percentage of capacity expansion compared to the CG13 forecast figure which was 13% (109 airports).

Moreover, if we zoom into the top 20 airports in 2017 (see Annex C for the list), which covered 53% of the 2017 ECAC arrivals and departures, we observe that, over the 2017-2035 period, the capacity of these airports is expected to increase by 28% in the current plans, while, for the same set of airports, the increase of capacity was 18% in the previous CG13 forecast report.

This means that, since the last report - and maybe thanks to the last report? - capacity plans have tactically been adapted in the right places, the busiest airports. Another reason for the higher percentage of capacity expansion is that the last four years have seen the economy restarting where in 2013, the economic context was tough. Still, there are for airports some difficulties in obtaining finance and persuading all stakeholders of the benefits (especially related to environmental concerns, eg. noise).

Already anticipated in the last forecast, the creation of the Istanbul New Airport[12] which aims to be the biggest airport in the world is considered in this forecast. Additionally, one of the main changes is that we have integrated the UK Government's adoption of the Airport Commission report (Ref. 23) which concluded in 2015 that a new Northwest Runway at Heathrow airport represents the strongest option for increasing capacity at UK airports.

The impact of capacity limits on the network is shown in Figure 27.

	Unaccommodated IFR Movements (million)				Unaccommodated demand (%)			
	2025	2030	2035	2040	2025	2030	2035	2040
Global Growth	0.7	1.1	2.1	3.7	5%	7%	10%	16%
Regulation & Growth	0.3	0.5	0.9	1.5	2%	3%	6%	8%
Happy Localism	0.3	0.6	1.0	1.4	2%	4%	7%	9%
Fragmenting World	0.2	0.2	0.3	0.4	2%	2%	2%	3%

Figure 27 /
Number of unaccommodated flights due to lack of capacity at airports.

12/ For simplicity, and because the Istanbul New Airport code was not available at the time of the forecast production, we treated Istanbul Ataturk and Istanbul New Airport as one.

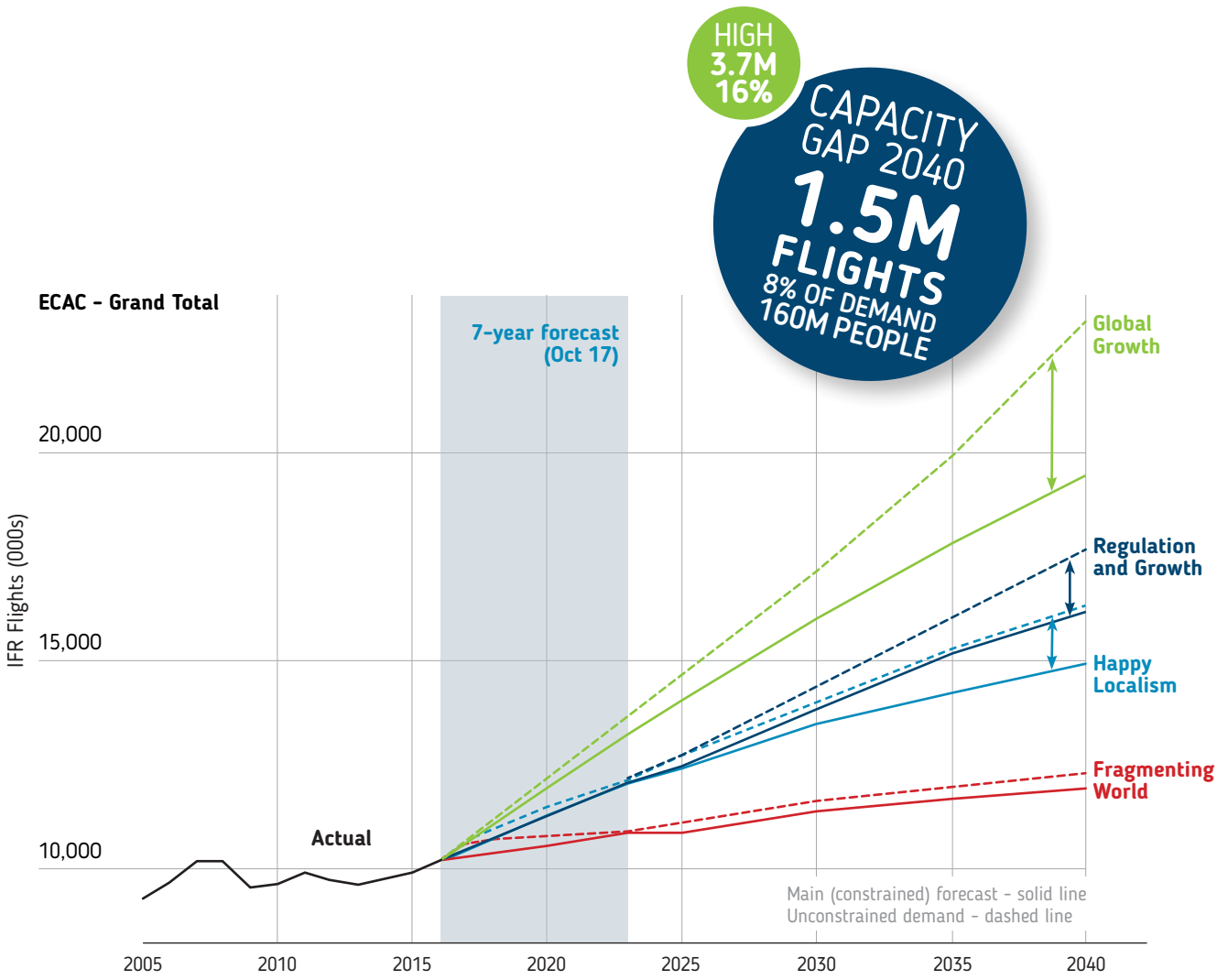


Figure 28 / *Comparison between constrained and unconstrained forecast.*

In Regulation and Growth, around 1.5 million flights will be lost due to lack of capacity, approximately 8% of demand in 2040 for ECAC. The lack of capacity will be important (in movements) in 2040 especially in Turkey but also in Poland, UK, Switzerland and the Netherlands (see Figure 30). Taking into account the expected aircraft size at the airports concerned, this is equivalent to 160 million passengers unable to fly.

The comparison of the unaccommodated demand with the previous forecast is difficult since the set of airports has changed, and the current sample contains both expansion and reduction of capacity. We need also to fall back on the 'ESRA08' region used in CG13, in place of ECAC which has recently replaced it.

With these caveats, we compare the 2035 gap between the demand and the ("accommodated") flights for ESRA08 in the most-likely scenario. In CG13 we estimated that 1.9 million flights would not be accommodated, 12% of demand. In this forecast, we estimate that the unaccommodated demand will drop by 1 million in 2035 to 0.9 million flights (equivalent to 6% of the demand). There are many changes that contribute to this, but at a high level, that one million is made up of, in the most-likely scenario:

- Demand is now lower by 0.6 million flights, with reductions in demand of 0.7 million and 0.2 million in Turkey (traffic losses in 2016) and Germany which are partly offset by increased in demand of 0.5 million in Spain and 0.3 million in France,

- But the number of flights expected in 2035 is now 0.4 million higher than in the previous forecast as UK manages to accommodate 0.4 million more flights, on just 0.1 million increase in demand, suggesting a 0.3 million

improvement in capacity. In fact, UK airports have a net decrease in capacity overall, but because this is an increase at Heathrow airport coupled with (mostly) decreases elsewhere, the capacity is better located for the demand.

- Similarly, the Netherlands has a 0.2 million improvement in 'effective' capacity, though a smaller increase in airport capacities.

Overall, the capacity gap is equivalent to 7 or 8 fully-used runways, but impossibly spread across the 21 cities that lack airport capacity.

The mismatch between capacity and demand is not the same across Europe as shown in Figure 29. The regions where the shortage is expected to be the most important are, in Regulation and Growth: Turkey, facing more than half a million flights in excess demand by 2040; and Germany, France and UK showing more than 0.3 million movements unaccommodated (each).

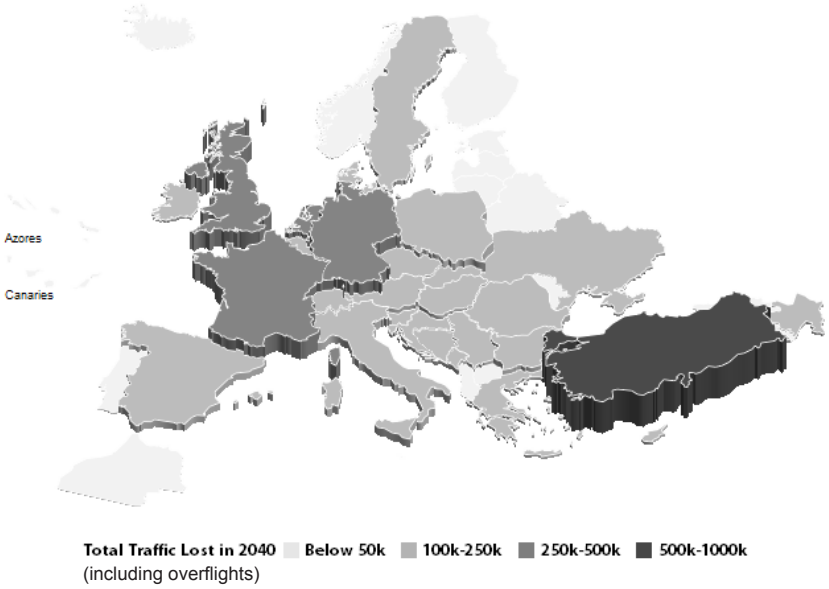


Figure 29 /
Demand excess for total flights (Regulation and Growth, 2040).

Happy Localism is similar to Regulation and Growth (most-likely): the level of unaccommodated demand in Europe will be around 1.4 million by 2040. Nevertheless, Turkey will be one of the more congested states as this scenario counts on Turkey joining the EU from 2030, earlier than in the other scenarios (see Figure 38).

In the fastest-growing scenario, demand for 3.7 million flights will be lost due to capacity shortfall in 2040, 16% of demand not accommodated. Again, in a like-for-like comparison (2035), we observe that the congestion levels are slightly lower than in the previous forecast. The unaccommodated demand of 4.4 million flights previously expected to be lost in 2035 will only happen more than five years later. The forecasted number of flights by 2035 is in fact quite unchanged from the previous forecast (see Figure 38) but the unaccommodated demand is now much lower than in the previous report as the future capacity will be added to the right places in the network. However, some areas remain congested, notably the busiest ones, as shown in Figure 30: Turkey, Poland and UK will face severe capacity shortages in 2040.

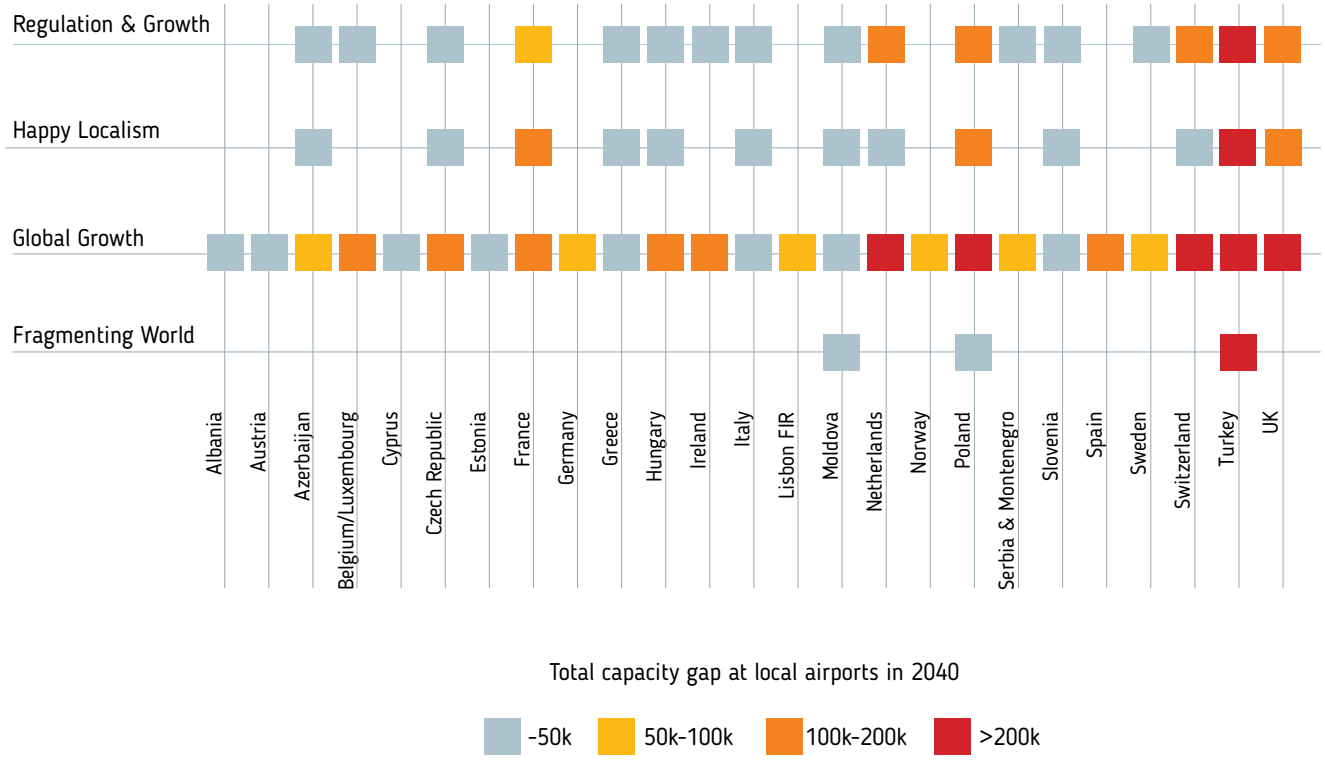
Overall, the capacity gap in Global Growth is equivalent to 15 fully-used runways, but impossibly spread across the 42 cities that lack airport capacity.

Fragmenting World scenario will be less exposed to the capacity constraints as the European growth of flights will be more limited in this scenario (see Figure 18). In 2040, the system will only be unable to accept the demand for 0.4 million flights.

To better investigate the issue of unaccommodated demand, two further reports of the Challenges of Growth Study 2018 investigate the impact of lack of airport capacity:

- Network congestion, which anticipates the impact for the European Network of a system operating with highly congested airports (Ref. 2). The en-route airspace capacity effects are briefly discussed below.
- Mitigation, which looks for realistic solutions to overcome the issue of unaccommodated demand (Ref. 7).

Figure 30 / In *Regulation and Growth*, the capacity gap is felt in 17 States or regions.



INCREASE OF AIRCRAFT SIZE

There has been a continuous increase in average aircraft size over the recent years in Europe.

The number of seats per aircraft has increased by 1.8% per year on average over the last five years, from a typical value of 126 seats to 139 seats per flight. This increase is a combined effect of the introduction into the European fleet of bigger aircraft, plus the stronger growth of long-haul relative to shorter-haul. Some aircraft operators have also reconfigured the cabin of their existing fleet with the introduction of lighter and thinner seats (additionally, no or less first class seating in some cases).

Figure 31 shows the change in number of flights per aircraft size between 2012 (dark blue) and 2017 (light blue). Nearly all the growth has been in the 151 to 210 seat class on intra-European flows. For intercontinental flows, this class, the 211-300 and the 400+ have seen most growth. The 151-201 seat class is where the B737-800 aircraft can be found, typically operated by low-cost airlines (Ryanair). The 211-400 includes the B787 aircraft which have been introduced in the network progressively since 2012. Finally, the aircraft with seating capacity between 401 and 500 seats (mainly the A380) have also shown strong growth (a +251% in 5 years, though limited to small number of flights), with 88% of them being operated on intercontinental flows.

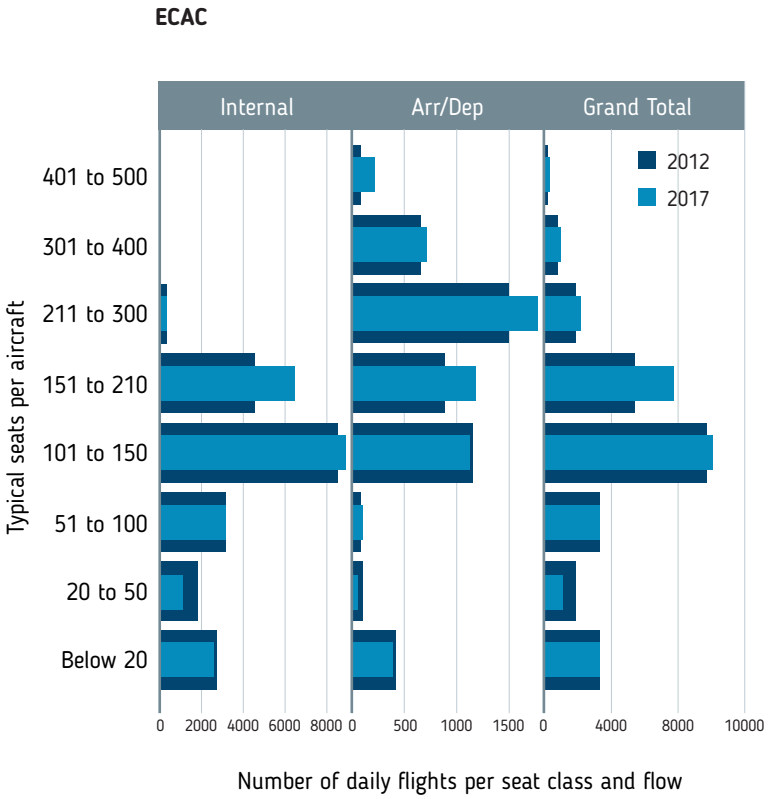


Figure 31 /
Between 2012 and 2017, there has been an increase in number of flights of larger aircraft size in ECAC, on average.

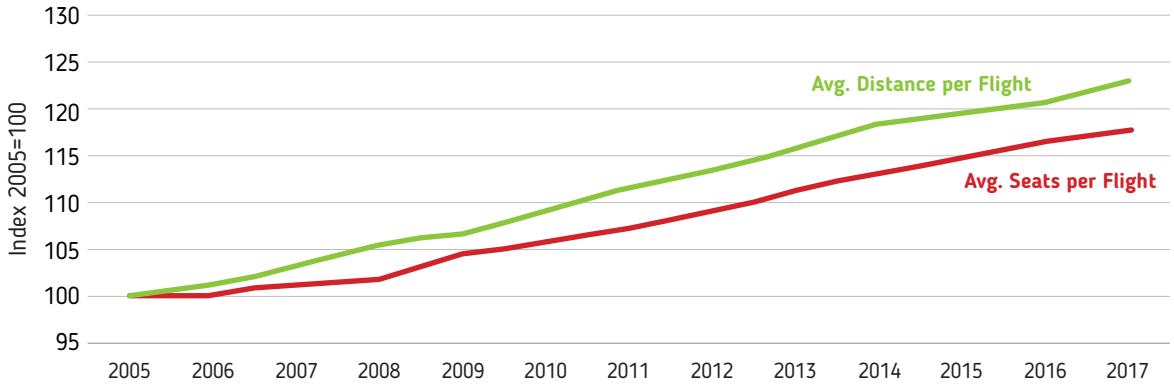


Figure 32 /
Since 2005, both the average distance flown and seats per flight have increased for all ECAC flights, with average distance flown growing faster.
Note: military and all-cargo flights excluded.

Over the recent years, there has been a clear increase in aircraft sizes together with a continuous increase in average distance flown per flight in ECAC (Figure 32).

The forecast shows that this trend is likely to continue.

When inspecting the forecast results for the passenger[14] market segment (Figure 33 and Figure 34), we first analysed that the narrowbody flights are and will still be the most flown aircraft (A319, A320, A321, B733, B738) with future share of 63% of the flights in the most-likely scenario. These single aisle are quite adapted for the domestic ECAC traffic (short- and medium-haul distances). They are and they will continue to be gradually replaced by the 'neo' and 'max' versions over the next 20 years.

The share of flights operated by smaller aircraft (under the Regional and Turboprop categories) will continue to grow until the early 2020s as some deliveries are still planned but their share will drop off by the end of the forecast.

The share of flights operated by widebody aircraft (such as A330, A350, B787, B777), also known as twin aisle, will see their share increasing from 12% currently up to 19% in the most-likely scenario. Their share will double in Global Growth.

Lastly, we have created a 'Large' aircraft category (A380, B748) while these aircraft are generally included into widebodies. In Global Growth, the 'Large' aircraft will reach 5% of all passenger flights by 2040, the biggest share amongst all scenarios.

Figure 34 shows that the medium-haul (legs between 1,500km and 4,000km) flights will be the segment where narrowbodies will be replaced by widebodies over the next 20 years. By 2040, the medium-haul flights (accounting for circa 23% of the passenger flights) will see an increase in aircraft sizes with the share of twin aisle flights almost doubling from a 20% in 2025 to 38% in 2040 (Regulation and Growth). Although not shown in the Figure 34, the increase of the share of flights operated by widebodies is observed for long-haul journeys as well.

14/ The passenger market segment accounts for by far (>86% in 2017) the largest share of ECAC flights

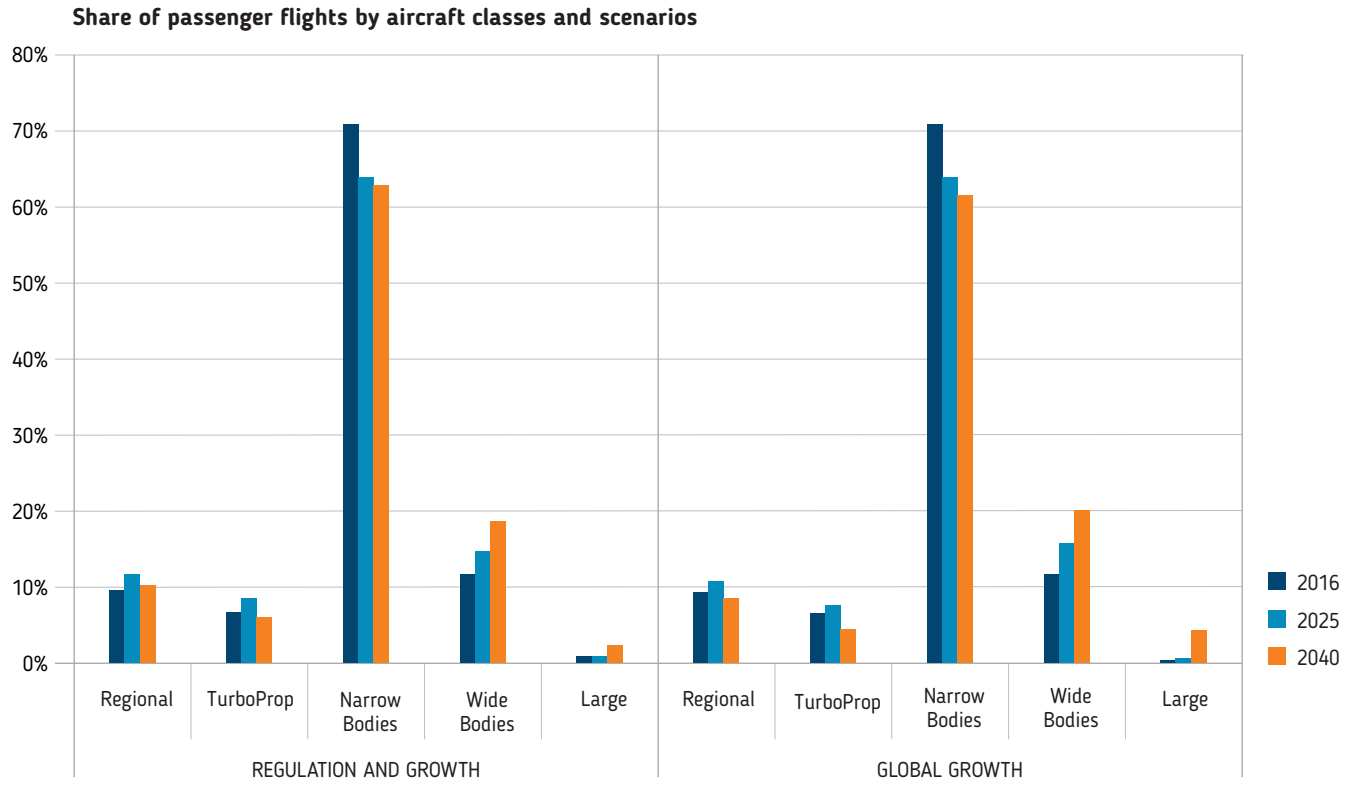


Figure 33 / *Share of passenger flights by type of aircraft in Regulation and Growth and Global Growth scenarios. By 2040, the smaller aircraft will be gradually replaced by narrowbodies, and some of the narrowbodies will be replaced by widebodies. Share of non-classified aircraft omitted in this graph.*

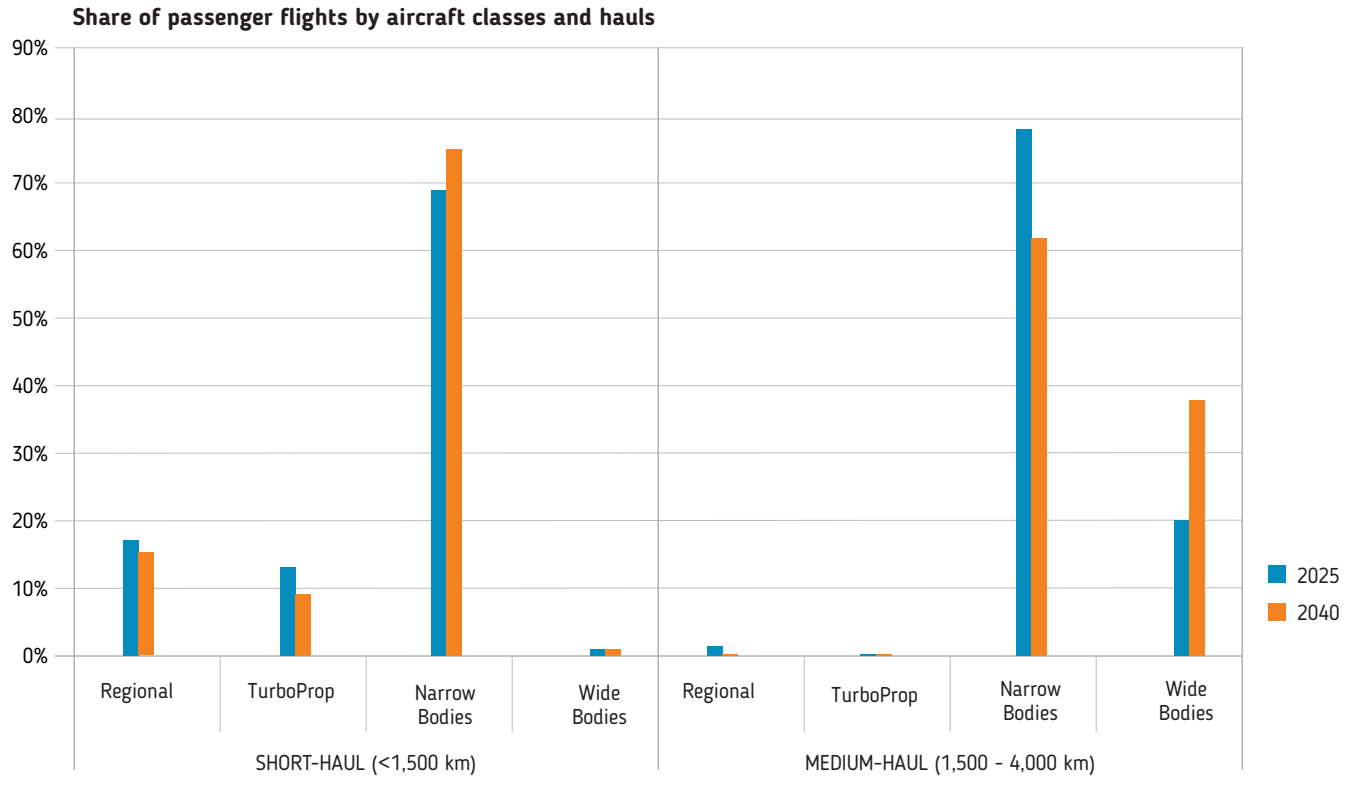


Figure 34 / *Share of passenger flights by type of aircraft and type of haul in ECAC. The distribution of aircraft types shows a progressive increase between 2025 and 2040 of the widebodies in the medium-haul flights. Share of non-classified and Large aircraft omitted in this graph as non significant at this range.*

HIGH-SPEED TRAIN

The 20-year forecast focuses on rail travel time as the major factor for capturing the share in the market. Despite the effects of the 2008 economic crisis, which led to the delay or the cancellation of numerous HST projects, the high-speed rail network continuously develops, new links are built, new connections added and connecting times improved. The CG18 forecast considers improvements on over 20 city-pairs from projects[15] being finished between 2023 and 2040.

Due to more passengers opting for high-speed train instead of travelling by air, the unconstrained demand for flights (in principal short-haul) will be reduced by around 0.4% in Europe by 2040 in the most-likely scenario as shown in Figure 35. The HST network does not develop in all parts of Europe to the same extent. Even if the HST network are cross border, the States with more projects in the pipeline are likely to see stronger reduction in demand for flights by 2040 (Figure 36), such as Sweden (-6.6%), Denmark (-2%), UK (-1%) and France (-0.9%).

This reduction in demand for flights does not directly translate in a reduction of operated flights. Increasingly, the high-speed train connects the major urban areas and notably where the airports are highly congested. This could result in easing the pressure on airports, freeing some capacity at strategic bottlenecks within the network, thus reducing the level of unaccommodated flights.

Regulation and Growth	2040
Denmark	-2.0%
France	-0.9%
Germany	-0.2%
Italy	-0.7%
Spain	-0.1%
Sweden	-6.6%
UK	-1.0%

Figure 36 /
Reduction in unconstrained demand for flights (%) by State, in the Regulation and Growth scenario.

	Percentage Change			
	2025	2030	2035	2040
Global Growth	0.0%	-0.1%	-0.3%	-0.3%
Regulation & Growth	0.0%	-0.1%	-0.2%	-0.4%
Happy Localism	0.0%	-0.1%	-0.3%	-0.3%
Fragmenting World	0.0%	0.0%	-0.1%	-0.3%

Figure 35 /
Change in flight demand due to HST per scenario.

15/ Priority projects such as the Brenner Base Tunnel, Lyon-Torino and Perpignan-Barcelona links, HS2 project in the UK, the Båstad-Ängelholm in Nordic States, etc. This figure excludes city-pairs which are too close to have a viable air link (Brussels-Lille for example).

PASSENGER FORECAST

As introduced in the methodology section, the passenger market segment is the greatest share of flights (86% of ECAC flights in 2017). This segment is classically looked at in terms of its number of passengers or revenue passenger kilometres (RPK). Indeed, in 2017, while passenger flights increased by 4.2% in Europe, the number of passengers at Europe's airports grew[16] by 8.2% in RPK terms (compared to 2016), the fastest growth since 2011 (see Ref. 24). European air transport demand was supported by a stronger regional economic backdrop. Moreover, the return of a growth dynamic in Eastern Europe (Turkey, Ukraine, Moldova, Georgia) as well as in Russia (Ref. 20) contributed to this strong performance. The stronger increase in passengers (RPK) is partly due to the general trend in longer flights and larger aircraft and partly explained by the increasing load factors (see Increase of Aircraft Size).

Based on Eurostat data at airport-pair level directly, together with an analysis of other Eurostat flows and on data from PRISME datawarehouse, an estimated of number of passengers can be derived. In 2017, the number of passengers in ECAC is estimated at 1.17 billion in our statistics. The passenger growth has been quite sustained over the last 5 years, as we measured an average annual growth rate of 5.4% per year over the 2012-2017 period.

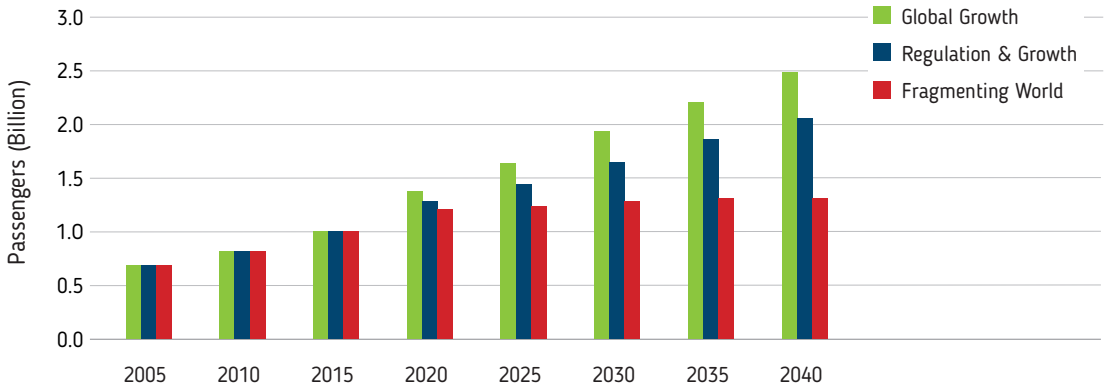
By 2040, the number of passengers from ECAC is expected to reach 2.05 billion in the most-likely scenario, corresponding to an annual average growth rate of 2.5% per year. The growth rates will start from 2.7% per year over the first part of the horizon (2020-2025). They will be supported by the continuation of the current trends as well as the rising demand of middle class travellers from Asia/Pacific and emerging economies. At the end of the horizon (2035-2040), the growth rates will slow down to 1.7% per year, explained by the fact the economic growth will slow down, and the network will be more congested at airports.

Dealing with airport congestion we estimated that, in Regulation and Growth, the 1.5 million unaccommodated flights in 2040 (See Airport Capacity previous Section), of which there are 1.3 million unaccommodated passenger flights, are equivalent to circa 160 million passengers unable to fly. This value, estimated at airport-pair level, is based on the typical size of aircraft operating at these airports.

In Global Growth, the number of passengers departing ECAC is expected to reach 2.51 billion, a 3.4% average annual growth rate per year between 2017 and 2040. The number of unaccommodated passengers could jump up to 360 million in this scenario.

Conversely, in Fragmenting World, the number of passenger would only grow by 0.5% per year to reach 1.33 billion over the 20 years. In this case, 40 million passengers would be unaccommodated.

Figure 37 /
Expected number of passengers per scenario based on ECAC passenger flights.



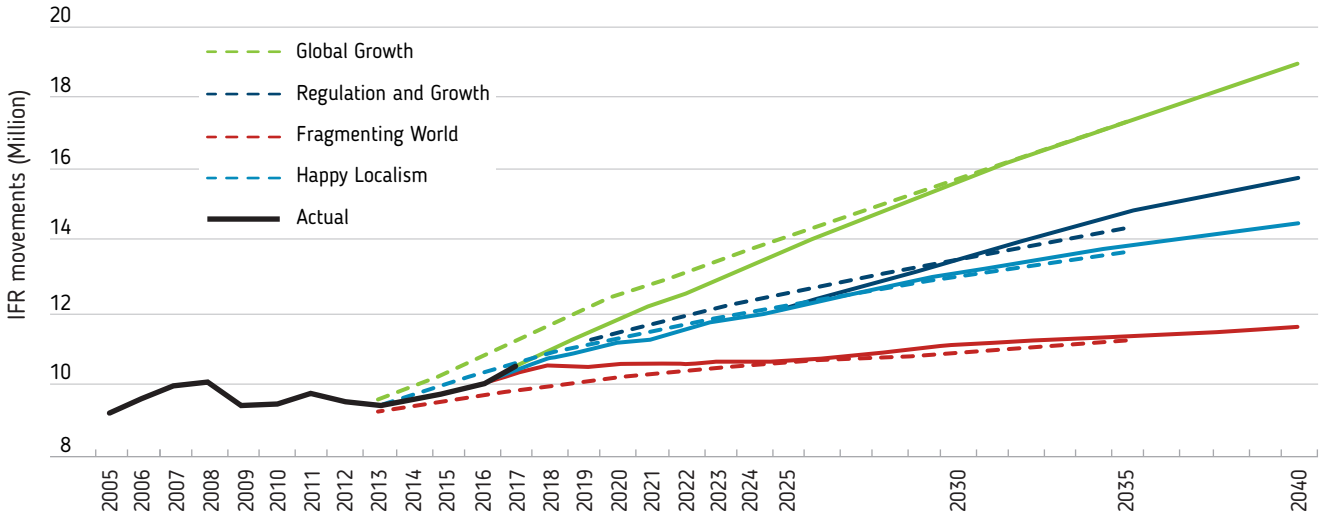
COMPARISON WITH PREVIOUS FORECAST

The last Eurocontrol 20-year forecast published in June 2013 (Ref. 6) developed four scenarios for the future of air traffic up to 2035: Global Growth, Regulation and Growth, Fragmenting World and Happy Localism. The same scenarios have been re-used in the current forecast. A comparison of the CG13 with the current forecast (CG18) is presented in Figure 38.

This 20-year forecast has similar flight growth and volumes to the previous 20-year forecast published in 2013. After the second economic crisis (2012) and some shifts of tourism flows from South Eastern Europe to South Western Europe since 2016, the traffic started to recover slowly, reaching some quite strong rates of growth in 2016 and 2017.

When comparing the two forecasts at European level, the current forecast starting point (2017) is in line with the most-likely scenario of the previous 20-year forecast (for 2017). The first years of this forecast show narrower range of possible future because the uncertainty has reduced in the short-term horizon.

Figure 38 /
Comparison between current 20-year forecast (solid lines) and previous 20-year forecast (dashed lines)[17].



17/ The CG13 forecast did not include ECAC as a region, so we use ESRA08 here instead.

In the most-likely scenario, the EU economic growth rates used in the forecast have been slightly reduced downwards from 2020 onwards compared to those used in the 2013 forecast (see Figure 10). Moreover, in the other scenarios, the economic uncertainty surrounding the first part of the horizon plays a stronger role than in 2013, which explains a wider range (Ref. 12). After 2030, the baseline economic growth is expected to be more moderate than previously, around 1% lower. Dealing with the oil prices, they were around $110 per barrel in 2013, below the 2008 peaks ($145/barrel) but still quite high at that time for the aircraft operators. Since then, oil prices have decreased steadily for three years, which lifted some of the pressure on them for aircraft operators, hence favouring traffic growth.

Also having a substantial impact on traffic development, this forecast relies on increased capacity expansion plans. Compared to five years ago, they are now more concentrated where the bottlenecks are, which enables more flights to be routed through the network and slightly less congestion.

At European level, this forecast expects largely the same number of movements in 2035 as forecasted in 2013; Regulation and Growth scenario showing the biggest deviation with 0.4 million more flights in 2035 than what was forecasted in 2013 (Figure 38).

The 2017-2035 growth rates in the scenarios Global Growth and Regulation and Growth are faster in this forecast (than in the previous one) because the capacity constraints are weighing less than in 2013 over the network.

Happy Localism shows a good match of level and growth between the current (CG18) and the previous (CG13) forecasts over the 20 years, apart from the above-mentioned factors, there is a relative stability in the input assumptions of the two forecasts.

In Fragmenting World, growth rates are slower than previously until 2025 due to the wider economic uncertainty. The growth rates after 2025 remain quite similar to the 2013 ones.


MD
MD

AIRSPACE CAPACITY

In this forecast, we assume that the network will be constrained at airport level but not at airspace level. Under the current assumptions, the expected traffic increase--airport constrained--will generate a rise in demand at en-route centre level. It will be a challenge to provide an adequate quality of service, day in, day out, in these circumstances.

Like the total traffic increase presented at State level in Figure 21 (Regulation and Growth), the en-route centres located in the core area but also in the Eastern part of Europe will record very high density of traffic (see Figure 36). This remains true for the other scenarios.

Our "no constraint" assumption at airspace level implies that the airspace capacity will be expanded through additional resources, for example, to accommodate the future traffic demand.

A lot of efforts to integrate ATC system throughout Europe have been performed so far (eg. fragmentation reduction) together with the Single European Sky program. EUROCONTROL Network Manager is currently part of the strategic airspace study for DGMOVE looking in detail at how airspace optimisation can reduce the en-route congestion problem. In the more medium- to long-term, SESAR, addresses this challenge which needs considerable work to manage the expected traffic increase by 2040.

Figure 38 shows the additional flights per day in equal-sized blocks of airspace that are typically smaller than an airspace sector.

This is addressed in more detail in the CG18 report "Network Congestion" (Ref. 2).

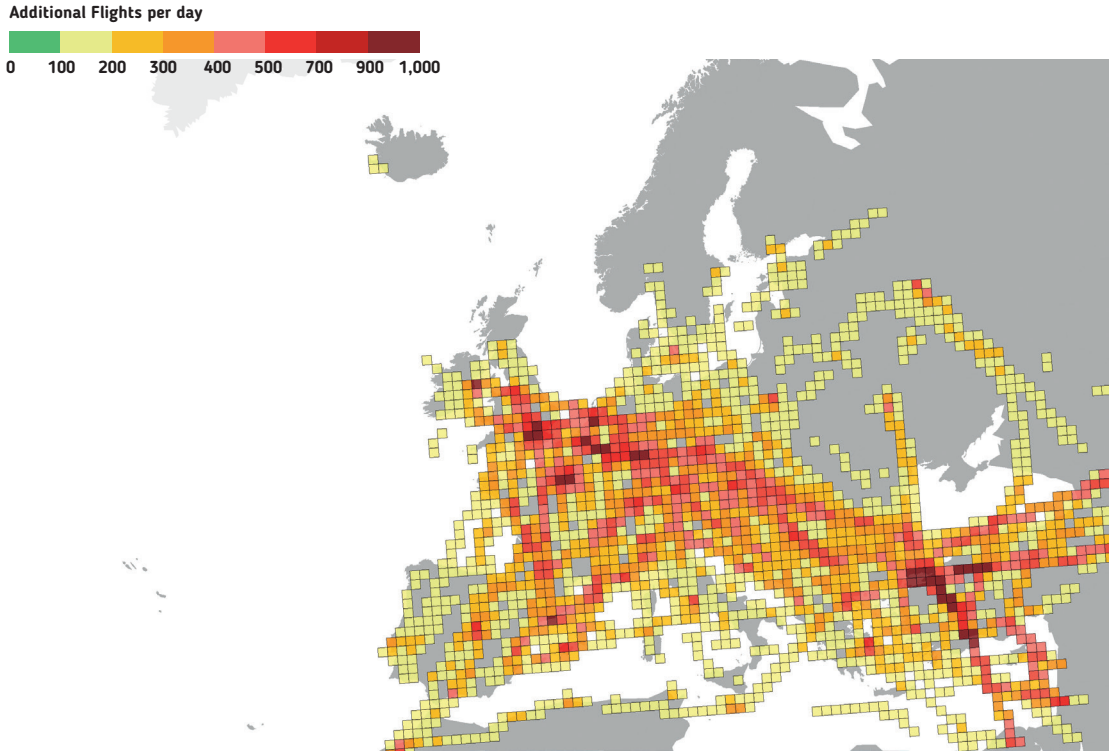


Figure 39 /
Density map of the additional flights per day by 2040 in Regulation and Growth at En-route airspace level (versus 2016). The core area and the eastern part of Europe will be highly loaded.

DRONES IN IFR AIRSPACE

For this forecast, we reviewed the challenges from the growth of Unmanned Aircraft Systems (UAS), or 'drones'. The SESAR Joint Undertaking (SJU) published a detailed study of the outlook for drones[18] operating in Europe in 2016 (Ref. 25). Many of these operations are beyond the scope of Challenges of Growth, since it is focused on flights under instrument flight rules (IFR).

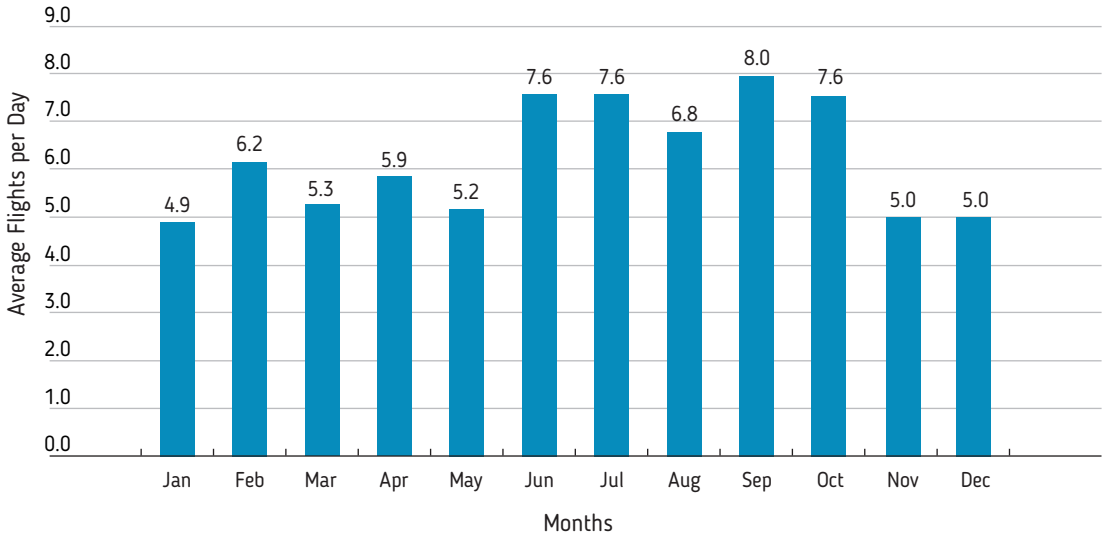
Rapid growth of drones might lead in future to a change in how 'IFR' is understood, to encompass all sorts of operations, including those that use air traffic management techniques and technologies that are yet to be developed. We will instead continue to use 'IFR' in today's sense. So our scope is drones that will be used in operations that involve filing an instrument flight rules (IFR) flight plan, meaning that they will come under the control of a civil air traffic controller for some or all of the flight. In EASA terms, we imagine nearly all 'certified' UAS will fall into this IFR grouping, and 'specific' UAS will not.

BASELINE – CURRENT FLIGHTS

In 2017 there were already a few such UAS flights each day. These were nearly all military or border patrol missions. They are not always explicitly identified in the flight plan data as UAS, so some detective work was needed, and the results given here are a careful estimate, rather than incontrovertibly complete. In Network Manager (NM) data from the whole of 2017, we found an average of 6.3 flights per day by UAS in the ECAC area. There are around 80 clearly identifiable individual drones, and numerous flights by others, so we estimate of order 100 drones in the fleet. Figure 40 shows the seasonal variation around the average number of flights. These are relatively long missions: a total of 35,000 flight hours (15 hours/flight), around 10 times longer than the average flight.

This is the baseline. It is small, compared to the average of 29,000 IFR flights/day total in Europe (0.02% of flights).

Figure 40 /
In 2017 there were on average 6.3 IFR flights/day by UAS.

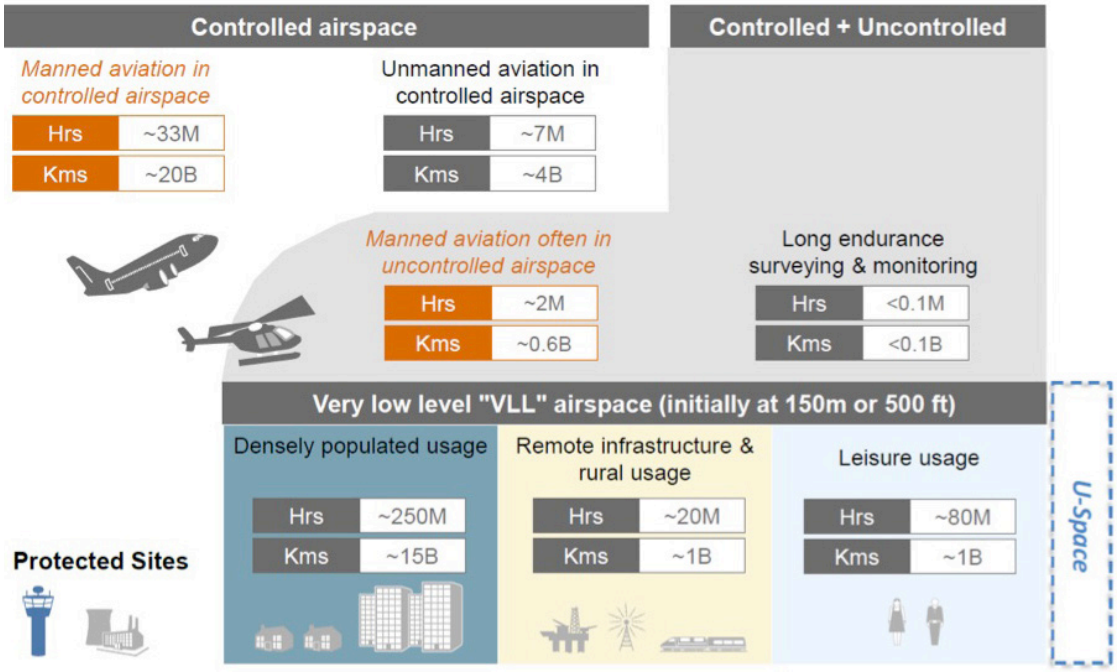


18/
The study mostly uses 'drone' rather than UAS, and we will use both here..

SJU OUTLOOK

The SJU outlook study predicts that around 20% of flight hours will be 'optionally piloted' by 2050 (Ref. 25, p6). Figure 41 shows that this 20% comes from around seven million flight hours in controlled airspace by unmanned aviation out of a total of 40 million. However, a significant proportion of these will be flights by replacements of existing, 'manned aviation', so we need to look in more detail.

Figure 41 /
Outlook to 2050 for drones
(source: SJU study, Ref. 26, 27)



The study identified (Ref. 25, p17) around 40 medium- and high-altitude drones (MALE and HALE) in service in early 2016 in the EU, based on European Defence Agency data. The NM data just described above, suggest the numbers are higher in ECAC as a whole, but it is still this relatively small fleet, rather than 1,000 or so smaller military drones, which lead to the filing of IFR flight plans. The SJU report discusses two routes to growth of this fleet: a 'stable' 4% annual growth, meaning without reaching any sort of plateau from saturation of missions at that rate of growth (see Figure 4 of Ref. 25); plus replacement of existing fleet with 'optionally piloted' systems. Replacement might add some technical complexity, but otherwise does not lead to additional challenges, so is not of primary interest for Challenges of Growth.

Working from our higher baseline count for 2017, pro rata that implies around 250 MALE and HALE drones in 2040, although improved reliability in future generations of UAS should mean that fewer are needed to achieve the same number of missions, so we round down to 200. In terms of flights, at the same growth rate, that suggests around 15 flights per day. The need for such missions will depend on the prevailing security situation in Europe and around its borders, so 15 per day is consistent with a security situation similar to today, for example with instability in Syria and Libya.

The SJU report raises in addition a number of civil government and commercial uses for 'complex certified drone systems' (p18) including:

- search and rescue (SAR), border and environmental protection. The number of such drones may level off at around 100 (pp 19, 22, 60) in Europe before 2040, due to their high speed and long endurance, covering some 85,000 kilometres of borders and coasts per day (p25). The SJU assumption seems to be approximately 1 flight/day per drone. In practice to achieve this is likely to need a larger number of UAS, but we assume that operational availability is sufficiently mature by 2040 for this to be a rate of one spare for each two operational.

- 'optionally piloted' cargo aircraft, which the SJU predicts as coming into service 'sometime after 2030' (p4) with the 500-aircraft all-cargo fleet replaced over the next 15 years (p27). Presumably, as a one-for-one replacement, this would not change the overall number of all-cargo IFR flights. 'Last-mile' cargo operations are assumed to be below 150m and therefore out of scope.

- and, once 'societal acceptance' is achieved, remotely-piloted passenger aircraft, though the implication is that this is unlikely in any significant numbers before our 2040 horizon. Similar to all-cargo flights, one-for-one replacement does not change the overall number of IFR flights.

- a number of uses, such as agriculture, monitoring electrical transmission lines, where there seem to be two possible scenarios: either a large number of drones would be flown low-level, or a smaller number at higher altitudes (eg p57). We follow the SJU in assuming the outcome is nearer the former.

- Tethered drones for energy production, which we assume will be installed away from congested airspace (p55) and therefore not part of the additional challenge.

As the report notes, the rate of acceptance by society of large, remotely-piloted aircraft will depend on the rate of development of technology and regulation, but also on the rate of acceptance of self-driving vehicles for ground transportation. On the current timetable, ICAO standards and recommended practices (SARPS) for use of UAS in controlled airspace should be ready by 2023, with subsequent regulation and implementation meaning that operations are unlikely to begin before 2025.

For all-cargo and passenger operations, the assumption of one-for-one replacement and thus neutrality in terms of growth implicitly assumes that the new technology of remote piloting does not change the economics of operation. If, on the other hand, there are cost savings which are passed on to consumers in terms of lower prices, then some demand stimulation would be normal. Such changes in demand will not necessarily be linear or incremental, but could be relatively sudden. Pilot costs are a larger proportion of short-haul flights, since there are fewer passengers per pilot. So reduced pilot costs could make new, low-density routes viable, in much the way that new regional jet types opened up new markets in the 1990s.

This is a clear upside risk to the assessment. We note that in China, for example, work is progressing on large drones (around 1 tonne capacity) for cargo operations (Ref. 28). These would have a cruising altitude well above 150m and a range over 2,000 kilometres, so could enable a radical change in how some cargo is distributed. Even if the business case for a delivery service of this size and range is yet to be shown, it illustrates how UAS could change aviation in ways not possible with on-board pilots. Currently, there are about 250,000 internal, all-cargo flights in ECAC per year, so if UAS allowed this to double, the order of magnitude increase would be about 1,000 flights per day. We propose this as an indicative, high-side forecast scenario.

Application	2017	2040	Comments
Military (MALE, HALE)	6 flights/day ~100 UAS	15 flights/day ~200 UAS	Excludes replacement of piloted by remotely-piloted. Consistent with some significant areas of insecurity near European borders.
Search & Rescue, Border protection, forestry	0	100 flights/day ~150 UAS	
Cargo	0	0 [1,000 flights/ day high-side]	Assume all increase is replacement of piloted by remotely-piloted. So no additional demand, but upside risks, for which we include an order of magnitude indicator.
Passenger	0	0	Assume all increase is replacement of piloted by remotely-piloted. So no additional demand.
Agriculture, Energy Surveying & Sensing	0	0	Assume growth is in the 'specific' category, operating below 150m.
Energy Generation	0	0 flights/day ~20,000 UAS	Tethered, so not counted in the flights total.
Total		100 additional flights/day	

In total, we have around 100 additional flights/day net over the period in currently controlled airspace, having excluded a larger number of replacement flights.

Figure 42 /
Summary of additional demand from UAS in IFR airspace.

QUESTIONNAIRE

For this study, we circulated a questionnaire to industry to answer three broad questions:

1. Are SJU-derived estimates of around 100 military medium- and high-altitude long-endurance (MALE & HALE) UAS in 2040 in EUabout right?

2. For civilian uses, how many UAS will be flying IFR and on what sorts of mission?

3. Will there be pressure from the growth of other UAS, particularly flying in 'U-space', to relinquish IFR-controlled airspace for other uses, and could this mean a reduction of capacity for IFR?

We received 61 responses to the questionnaire, across a broad range of organisations: civil, military, operator, manufacturer and others. But it was clear that we were asking difficult questions. There were respondents who had substantial experience in implementing UAS initiatives and who, even so, found it difficult to respond with confidence.

We were able to work with 28 of the responses where people had been able and willing to look forward to 2025 and 2040. Of these respondents, 22 were civil, 4 civil-military and 2 military. They included 4 operators, 7 manufacturers, 11 ATM organisations. In working with their responses, we must take care not to be more confident about the results than they were, and to keep in mind that this is a small set of respondents compared to the size of the industry as a whole.

GROWTH OF TRAFFIC

The operators were relatively consistent in expecting growth of their UAS fleet by a factor of 2-3 between 2025 and 2040. The manufacturers had more wide-ranging ideas of growth of their in-service fleet, but the average was more like a factor of 10. These views are not necessarily contradictory. They imply that a significant part of the growth in the UAS fleet will come from new entrants. These could be, eventually, a few large entrants, or numerous small entrants, but in a relatively new industry with demand that is widespread geographically and through a wide range of applications, it would be natural for growth to come from new entrants.

The numbers of flights expected by manufacturers and operators was around one per week per UAS. These numbers are much lower than those underlying the SJU report calculations. From our 2017 data, we have perhaps 100 drones and fewer than 50 flights per week, so it is clear that many drones are currently flying less than once per week. Respondents are likely to be influenced by this current experience; and indeed respondents other than operators and manufacturers estimated rather higher utilisation. Current UAS are typically in military fleets; being non-certified aircraft in non-commercial environments the expectations for 'despatch reliability', as an airline would put it, are much lower. Reality matches that expectation.
Under the ICAO SARPS mentioned earlier, future UAS in IFR airspace are likely to be certified (in the EASA sense, Ref. 29). We cannot say they will all be certified since there may remain some uncertified military drones, albeit with better reliability, given the next generation of technology. We have assumed that no role, as yet undetermined, emerges for 'specific' UAS in the EASA sense to operate in IFR airspace.

Future generations of UAS, especially certified UAS might reasonably be expected to have higher reliability and availability. This should come as technology improves, but also as the range of applications extends and commercial operators insist on better reliability. From their comments (see later), respondents also had safety and hence acceptability in mind. This would also drive towards improved system reliability.

Respondents clearly had that expectation: hours per UAS per year were expected to increase by a factor of 5 between 2025 and 2040. This is the median value; some expected an increase an order of magnitude (ie 10 times) greater.

As for the total hours expected in IFR airspace, the range of the responses was very wide. For 2025, a typical per-country response was around 5,000 hours per year. From this an estimate for all countries would be a few hundred thousand, which is of the same order of magnitude as implied by Figure 42. But some countries had much higher expectations. It is hard to see, even at this relatively short horizon, that any robust aggregate can be derived. The situation for 2040 was even more variable.

So, in terms of capturing the challenges of the growth of IFR UAS, there are some strong conclusions. 2025 is not far off in terms of capacity planning. Forecasting is already difficult, because UAS is a new industry with many possibles and few actuals to act as the foundation for estimates of the future. On top of that we add in the dimension of IFR, which generates further uncertainty: when will the regulations be in place? What will they allow and not? And what business will be viable in these circumstances? Industry is far from a consensus or even a broad understanding of these, so more work is needed.

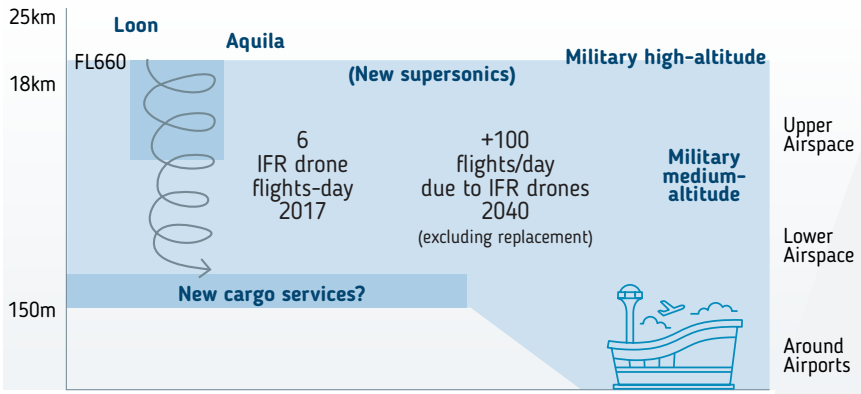


Figure 43 / *Outlook for additional flights from drones in IFR airspace, rather than replacements, is moderate. But the upside risks are high.*

OBSTACLES TO ADOPTION

In the questionnaire, we asked about the main obstacles that were likely to affect the rate of adoption of UAS. We approached this both directly, and by asking about down-side risks to the forecasts that respondents had given, ie factors that could lead to the numbers and usage of UAS being lower than expected. Figure 44 gives an idea of the relative importance of these factors, as seen by the respondents to the questionnaire:

- Certification and regulation issues are high on the risk list, including lack of a standard approach to regulation across Europe. As was mentioned earlier, drones that currently operate in controlled airspace are typically military, so do not need to be certified. Respondents see achieving certification as a potential cause for delay in achieving widespread civil use of drones in this context.

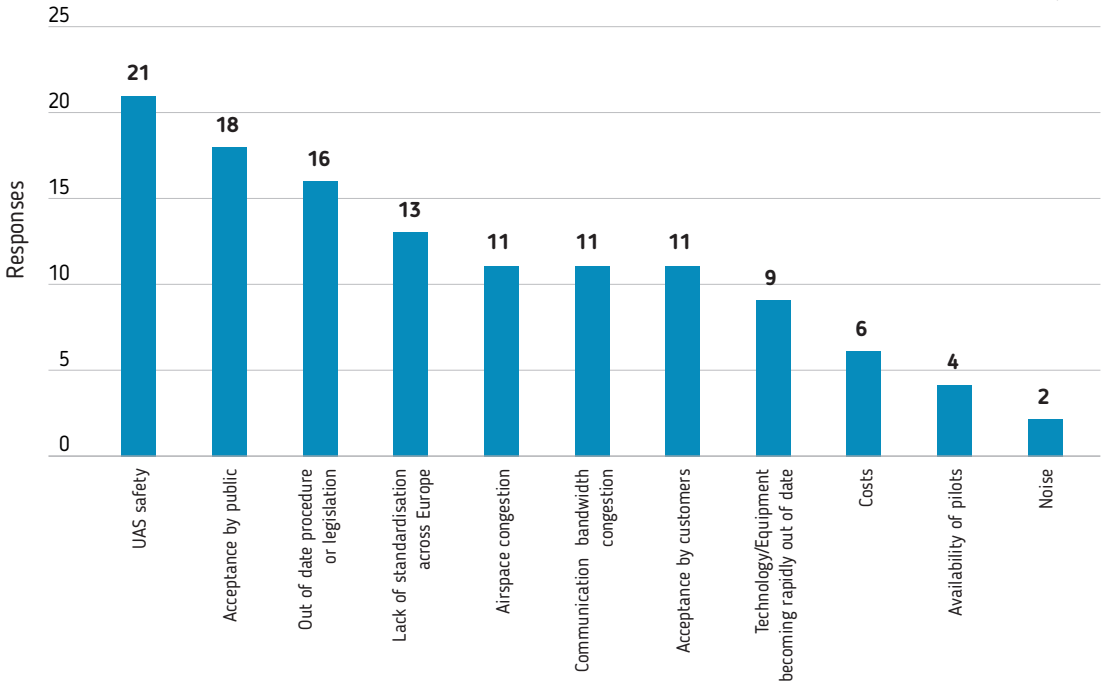
- Acceptance by the public was seen by respondents to be a more significant issue than acceptance by customers. Though the reasons for this are not clear, some respondents mentioned the risks of accidents (especially if there are fatalities) turning public opinion against the nascent industry.

- Although costs were a possible risk, some respondents also mentioned economic risks, for example an economic down-turn affecting demand, and the risk of lack of investment. So respondents recognised a range of financial risks.

Technical issues came noticeably low down the list of risks, though security, bandwidth and operating range were mentioned. In fact, a number of respondents highlighted the pace of technology change as an upside risk, ie a factor that could lead to faster growth than otherwise expected. This suggests an optimism about the potential for disruptive technology to bring change rapidly, for example by making advances in sense-and-avoid capability through machine learning.

Other upside risks on the forecast levels of demand include more rapid acceptance, but also increased need, if security threats continue to increase.

Figure 44 /
Certification and regulation issues are high on the expected list of obstacles to adopting UAS in controlled airspace.



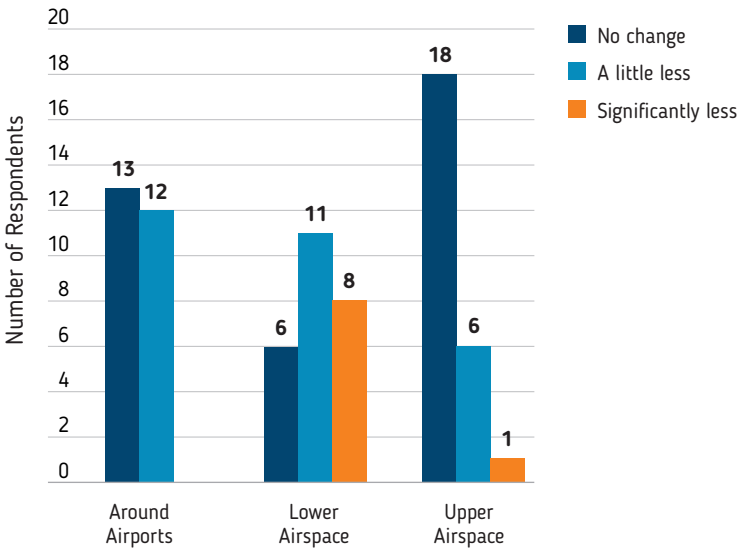
PRESSURE ON CURRENT, CONTROLLED AIRSPACE

In the questionnaire, our main focus was on UAS and missions that would take place in what is currently controlled airspace. However, rapid growth of UAS operations outside currently controlled airspace could begin to restrict capacity in controlled airspace, either through boundary issues, or with pressure to release airspace (in an analogous way to pressure from other industries to release communication spectrum assigned to aviation). Respondents were asked whether this was likely to lead to a little or significantly less capacity in three locations, around airports and in the lower and upper airspace[19].

The results are shown in Figure 45. The majority expected little impact at all in the upper airspace. This response is entirely consistent with this part of the airspace being either well away from most UAS activity, or being the location for UAS missions that most resemble current operations such as, in the longer term, cargo flights without on-board pilots and replacing existing cargo flights. However, both these responses and the SJU report pay little account to very high-level, commercial UAS operations such as Google Project Loon (Ref. 30), or Facebook Project Aquila (Ref. 31), some of which are already deployed. While for most of the time, these would be above IFR airspace (20km altitude for Aquila, for example, or around FL660), they would need to pass through controlled airspace during ascent and descent (See Figure 43). Presumably, routine ascents and descents could be planned away from congested airspace, but an urgent maintenance descent leading to a managed but wide, slow spiral downwards would occupy a significant block of airspace.

Around airports, considerable UAS activity might be expected, for local freight and passenger connections, as well as in support of airline and airport operations, such as maintenance and security. But respondents saw no change in, or only a little less, capacity in controlled airspace as a result. Airports are already tightly delimited and constrained for approach, landing, taxi and departure, often with high-frequency traffic, so there is limited scope here for further constraints to enable UAS operations. Rather the contrary: UAS operations will have to work around the needs of current aircraft operations. Respondents thought that the biggest effect will be in the lower airspace, with several seeing significantly less airspace being available in future for 'traditional' aircraft, as a result of demands for UAS operations. A wide range of potential missions require drones to cover large areas or long distances, for example some linked to surveying, communications and remote sensing, in agriculture, or for transport and energy infrastructure maintenance, or for telecoms. There are trade-offs between flying higher to get a wider coverage, and lower to get finer resolution or stronger signal. There will certainly be some of these missions where that trade-off tips in favour of flying higher. Even if these are not IFR controlled flights, their operators may begin to press for access to lower IFR airspace, or at least pushing up the 150m ceiling.

Figure 45 /
Lower airspace is seen as more likely to be under pressure from other UAS.



19/ Without getting too tied down on the precise definition of these.

QUESTIONNAIRE SUMMARY

There are many potential applications of drones in what is currently controlled IFR airspace but, even at a relatively near horizon of 2025, little agreement amongst industry experts about the scale of the additional demand, the additional these will create. Their estimates differed by orders of magnitude, so we keep to the SJU-derived numbers for their report summary. It is clear that more needs to be done to understand and to help industry understand how this new area of aviation might develop.

There was more agreement on the qualitative challenges of the large-scale adoption of drones, especially: achieving a consistent regulatory regime across Europe, public acceptability, and the pressure to reduce controlled airspace to make room for low-level operations.

RISKS

Users of the forecasts are strongly advised to use the forecast range (from Fragmenting World to Global Growth) as an indicator of risk. These four scenarios only cover a limited range of possibilities. Also, this flight forecast elaborates on a medium-term flight forecast prepared in the conditions of unstable economic situation with serious risk of further aggravation and downside effects on traffic development.

The main sources of uncertainty in the forecast are:

- The economic forecasts used here were updated in December 2017. The economic outlook remains uncertain, but presents a mix of upside and downside risks. Economic risks are to some extent synchronised, so do not balance out across Europe as routing risks do. Some are beginning to ask when the next economic downturn in Europe will arrive. Economic growth is not forecast to be as strong in future as in the past, so this source of growth in traffic demand will diminish but this is medium-term downside risk. Beyond economic growth, there are other factors, related to business transformations (eg. propensity to fly, long-haul low-cost), that could have an impact and boost the traffic over the long-term. All the more these are long-term, downside risks.

- More generally, future **network changes** (e.g. new routes) and airlines' changing choice of routes are not modelled by the forecast for example. The possible re-opening of some zones in Ukraine is an upside risk for Ukraine (and Moldova) and a downside risk for others (neighbouring states).

- **Tourism trends** are quite variable. The forecast does not identify which will be the new holiday 'destination of preference' in a given year. Terrorist attacks have led to more variability in tourism destinations. This is more likely a downside risk for the concerned countries and an upside risk for the countries that would, benefit from the changes. However, all states' overflights in Europe are likely to be affected, either upwards and downwards, by these changes.

- **Oil prices** remain changeable with oil being increasingly an item of speculation and investment. With fuel accounting for circa 20-25% or even more of costs of the airlines, this can have an effect on fares and cost of travel for customer. As far as oil is concerned, some assumptions have been made to produce the forecast, but there are some risks to be considered, as much can change over the next twenty years.

- Participation of aviation in the **carbon neutral growth market-based scheme**, currently under debate (CORSIA), was factored into this forecast via assumptions on CO_2 costs from 2025 onwards. However, such regulatory measures (eg. new tax regimes or further environmental limits) contribute to the uncertainty of air transport growth, can be introduced rapidly and change the local outlook for flight growth.

- **Terrorist attacks**, bans of one country on another one, wars and natural disasters. These are impossible to predict. Their impact on air traffic could however be a temporary one, or more significant. Overall, this is a downside risk for the country impacted by the event.

- **New aircraft types, new business models, drones** were discussed in earlier sections The uncertainty linked to the timing of their introduction is a risk.

- Recent events related to **global trade protectionism** showed that trade liberalisation does not run only in one direction. It is too soon to show if the impact will be rather a short-term one or a longer term.

A. GLOSSARY

AAGR	Average annual growth rate
AAT	Aircraft Assignment Tool
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATM	Air Traffic Management
CG10, CG13, CG18	Challenges of Growth 2010, 2013, 2018
CORSIA	Carbon Off setting and Reduction Scheme for International Aviation
Drone	(we use this interchangeably with UAS 'unmanned air systems' here)
EASA	European Aviation Safety Agency
ECAC	European Civil Aviation Conference
EIA	Energy Information Administration
ESRA	EUROCONTROL Statistical Reference Area
ETS	Emission Trading System
EU	European Union
Europe	unless otherwise specified, this refers to airspace of the ECAC States
FAB	Functional Airspace Block
FIR/UIR	Flight Information Region/Upper flight Information Region
FSC	Full Service Carrier
GAT	General Air Traffic
GDP	Gross Domestic Product
high	refers to the Global Growth scenario
HST	High-Speed Train
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
LCC	Low-cost Carrier
LGV	Ligne Grande Vitesse
most-likely	refers to the Regulation and Growth scenario
NM	Network Manager
NMD	Network Management Directorate
OPEC	Organization of Petroleum Exporting Countries
PRISME	ATM Datawarehousing service of EUROCONTROL
RPK	Revenue Passenger Kilometre
SES	Single European Sky
SESAR	Single European Sky ATM Research
SJU	SESAR Joint Undertaking
STATFOR	Statistics and Forecast Service of EUROCONTROL
SUG	STATFOR User Group
TZ	Traffic Zone
UAS	Unmanned Air Systems (we use this interchangeably with 'drone' here)
UN	United Nations
Unaccommodated demand	the forecast flights that exceed an airport's reported capacity

B. GEOGRAPHICAL DEFINITIONS

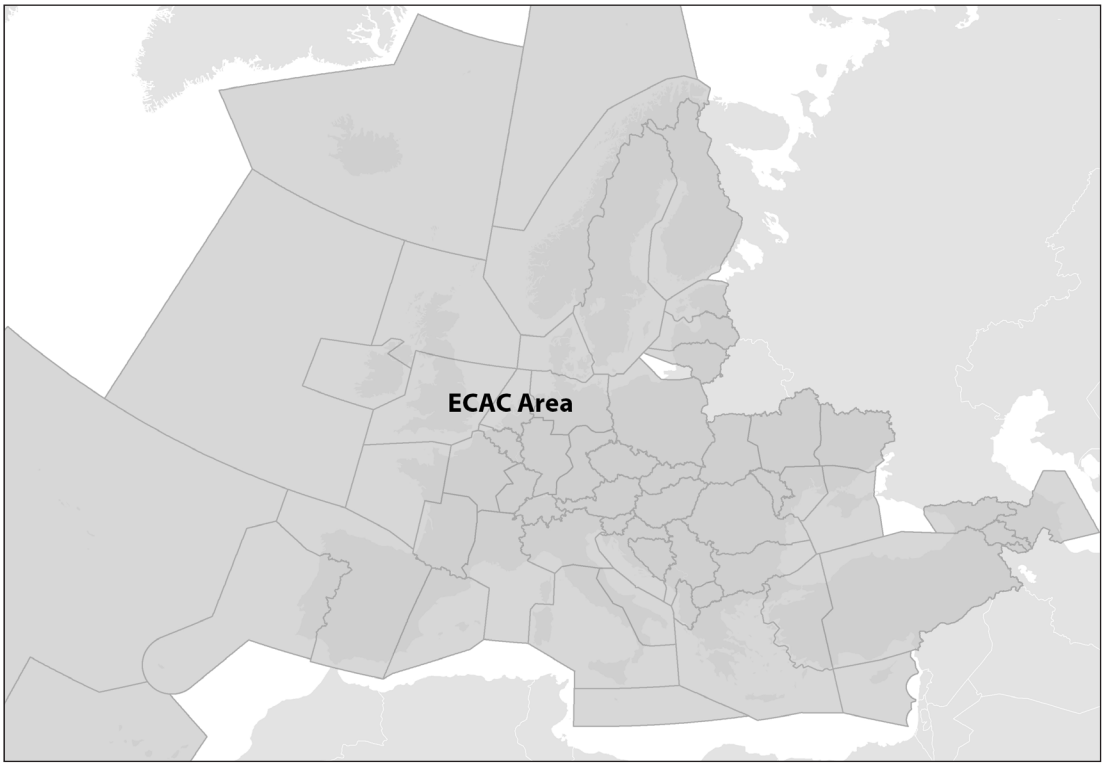


Figure 46 /
Map of the European Civil Aviation Conference (ECAC) Area.

ECAC

The European Civil Aviation Conference (ECAC) is an intergovernmental organization which was established by ICAO and the Council of Europe. ECAC now totals 44 members, including all 28 EU, 31 of the 32 European Aviation Safety Agency member states, and all 41 EUROCONTROL member states.

It is now used as a basis for comparison at European level in the forecasts.

EU28

This 7-year forecast report includes EU28, taking the accession of Croatia into account. The traffic counts include Canaries and Azores.

Figure 47 /
The EUROCONTROL Statistical Reference Area.

ESRA08 or ESRA

The EUROCONTROL Statistical Reference Area (ESRA) was designed in 2008 to include as much as possible of the ECAC area for which data were available from a range of sources within the Agency. 'ESRA08' was introduced in the 7-year forecast report published in 2009. It was used as a basis for comparison at European level in the forecasts up to September 2015. It remains only for comparison with previous forecasts.

TRAFFIC REGIONS

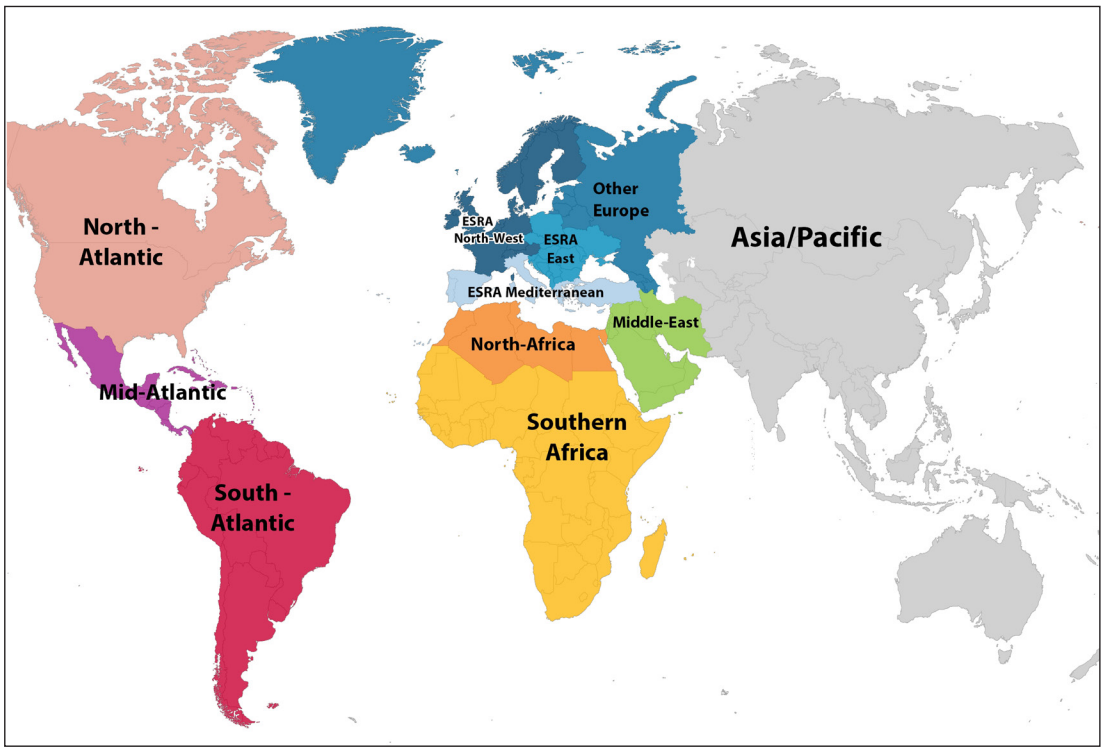
The traffic regions are defined for statistical convenience and do not reflect an official position of the EUROCONTROL Agency. As far as possible, these regions have been aligned with ICAO statistical and forecast regions. Traffic flows are described as being to or from one of a number of traffic regions listed in Figure 48. Each traffic region is made up of a number of traffic zones (=States), which are indicated by the first letters of the ICAO location codes for brevity.

Figure 48 / *Regions used in flow statistics as of August 2012.*

	ICAO region/country
ESRA North-West	EB, ED, EF, EG, EH, EI, EK, EL, EN, ES, ET, LF, LN, LO, LS
ESRA Mediterranean	GC, LC, LE, LG, LI, LM, LP, LT
ESRA East	BK, EP, LA, LB, LD, LH, LJ, LK, LQ, LR, LU, LW, LY, LZ, UK
Other Europe	BG, BI, EE, EK (Faroe Islands), ENSB (Bodo Oc.), EV, EY, GE, LX, UB, UD, UG, UH, UI, UL, UM, UN, UO, UR, US, UU, UW, Shanwick Oc., Santa Maria FIR
North Atlantic	C, K, P
Mid-Atlantic	M, T
South-Atlantic	S
North-Africa	DA, DT, GM, HE, HL
Southern Africa	D, F, G, H, (except DA, DT, HE, HL, GC, GM)
Middle-East	L, O (except OA, OP)
Asia/Pacific	A, N, P, Y, OA, OP, R, V, W, Z (except ZZZZ), U (except UK and areas in Other Europe)

As far as "Europe" is concerned, it is split into two regions: ESRA (defined in one of the previous section) and Other Europe. For flow purposes, ESRA is split into a "North-West" region mostly of mature air traffic markets, a "Mediterranean" region stretching from the Canaries to Turkey and with a significant tourist element, and an Eastern region. The 'Other Europe' region (i.e. non ESRA) includes the States along the border of ESRA and extends from Greenland to the Urals and Azerbaijan. The map of the nine traffic regions used in our statistics is displayed in Figure 49. The definition of Europe, and its sub-regions, using ECAC has not yet been defined.

Figure 49 /
Map of the Traffic Regions used in flow statistics.



FUNCTIONAL AIRSPACE BLOCKS

On top of the traffic zones, this report also presents the forecast of IFR movements from 2014 to 2020 for the Functional Airspace Blocks (FAB). A FAB is a block of airspace based on operational requirements regardless of the State boundaries (Figure 50). FAB initiatives (definitions) are now frozen according to the targets defined to improve the performance of the European air traffic management network. STATFOR defines the FABs based on the FIR[21] boundaries. The definition of FAB-FIR is:

- UK-Ireland FAB (Scottish FIR&UIR, London FIR&UIR, Shannon FIR&UIR)
- Danish-Swedish FAB (Copenhagen FIR, Sweden FIR)
- Baltic FAB (Warszawa FIR, Vilnius FIR&UIR)
- BLUE MED FAB (Nicosia FIR&UIR, Athinai FIR&UIR, Brindisi FIR&UIR, Milano FIR&UIR, Roma FIR&UIR, Malta FIR&UIR)
- Danube FAB (Sofia FIR, Bucarest FIR)
- FAB CE (Zagreb FIR, Budapest FIR, Ljubljana FIR, Praha FIR, Wien FIR, Sarajevo FIR&UIR, Bratislava FIR)
- FABEC (Brussels FIR&UIR, Langen FIR, Munchen FIR, Rhein UIR, Hannover UIR, Bremen FIR, Amsterdam FIR, Bordeaux FIR, Reims FIR, Paris FIR, France UIR, Marseille FIR, Brest FIR, Switzerland FIR, Switzerland UIR)
- North European FAB (Tallinn FIR, Finland FIR&UIR, Enor FIR, Riga FIR, Bodo Oceanic FIR)
- South West FAB (Canarias FIR&UIR, Lisboa FIR, Madrid FIR&UIR, Barcelona FIR&UIR).

Figure 50 /
FABs as stipulated by the European Commission (definition based on FIR boundries).

21/
Note that the Performance Review Unit at EUROCONTROL uses the FAB-ANSP definition.

SES-RP2

The SES-RP2 area mentioned in this report is covering the 30 States that are involved in the EU-wide performance target setting for the **second period**, namely: 28 EU member States plus Norway plus Switzerland. SES-RP2 includes Canarias but not Azores. The SES-RP2 zone is also called RP2Region in our reports.

The "SES" region presented in previous reports (Traffic Tables of the Annexes) is not reported anymore, as it could introduce some confusion with respect to the SES-RP2 above mentioned.

Figure 51 /
States within SES-RP2 Region in this report (Performance Scheme Region for the Second Review Period).

C. TOP 20 AIRPORTS

Rank	Airport Code	Airport Name	Total movements (000s)	Share of Total (%)
1	EHAM	AMSTERDAM	508.3	2.38
2	LFPG	PARIS CDG	482.7	2.26
3	EGLL	LONDON HEATHROW	476.0	2.23
4	EDDF	FRANKFURT	475.5	2.23
5	LTBA	ISTANBUL ATATURK	451.1	2.11
6	EDDM	MUNICH	401.8	1.88
7	LEMD	MADRID BARAJAS	387.5	1.81
8	LEBL	BARCELONA	323.5	1.51
9	LIRF	ROME FIUMICINO	297.4	1.39
10	EGKK	LONDON GATWICK	285.9	1.34
11	LSZH	ZURICH	263.5	1.23
12	EKCH	COPENHAGEN	259.3	1.21
13	ENGM	OSLO GARDERMOEN	251.2	1.18
14	ESSA	STOCKHOLM ARLANDA	248.9	1.17
15	LOWW	VIENNA	240.1	1.12
16	EBBR	BRUSSELS	232.7	1.09
17	LFPO	PARIS ORLY	232.1	1.09
18	EIDW	DUBLIN	222.3	1.04
19	EDDL	DUSSELDORF	221.1	1.04
20	LTFJ	ISTANBUL GOKCEN	214.1	1.00
Other	-	-	14,878.7	69.68
Total	**-**	**-**	**21,353.8**	**100.00**

Figure 52 /
Movements per Airport (Departures+Arrivals).
Period: 2017.

D. SUMMARY OF FORECAST FOR ECAC

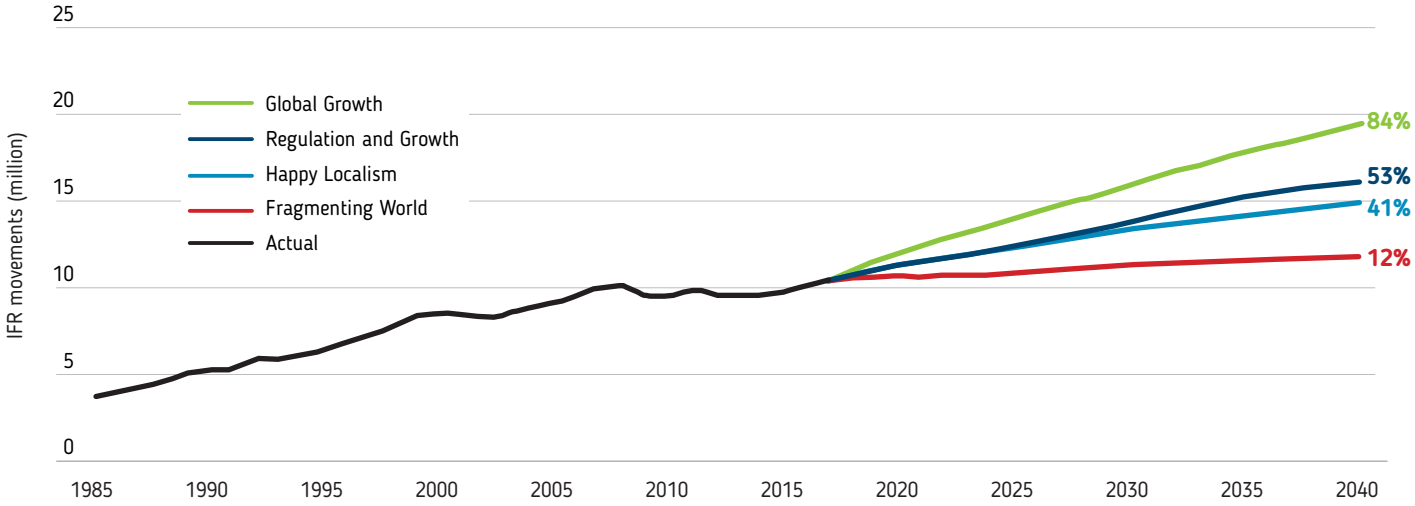


Figure 53 /
Expected IFR movements in Europe in the four scenarios by 2040.

Figure 54 /
Expected IFR movements per flow in the four scenarios by 2040.

ECAC		IFR Movements (000s)											
		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040
Internal	Global growth	7,760	8,006	7,750	7,574	7,680	7,854	8,138	8,364	10,717	11,939	12,894	13,656
	Regulation & Growth	.	.	.	.	.	.	.	.	9,552	10,533	11,399	12,016
	Happy Localism	.	.	.	.	.	.	.	.	9,530	10,312	10,865	11,323
	Fragmenting World	.	.	.	.	.	.	.	.	8,351	8,688	8,863	8,987
Arrival/ Departure	Global growth	1,724	1,778	1,812	1,862	1,907	1,889	1,883	2,058	3,033	3,703	4,438	5,209
	Regulation & Growth	.	.	.	.	.	.	.	.	2,640	3,008	3,408	3,745
	Happy Localism	.	.	.	.	.	.	.	.	2,629	2,837	3,015	3,184
	Fragmenting World	.	.	.	.	.	.	.	.	2,307	2,434	2,520	2,603
Overflight	Global growth	133	136	145	165	181	177	172	182	295	376	477	597
	Regulation & Growth	.	.	.	.	.	.	.	.	251	305	367	440
	Happy Localism	.	.	.	.	.	.	.	.	251	300	352	410
	Fragmenting World	.	.	.	.	.	.	.	.	219	253	286	322
Total	**Global growth**	9,617	9,921	9,707	9,601	9,768	9,920	10,193	10,604	14,044	16,018	17,809	19,462
	Regulation & Growth	.	.	.	.	.	.	.	.	12,443	13,847	15,174	16,200
	Happy Localism	.	.	.	.	.	.	.	.	12,410	13,449	14,231	14,917
	Fragmenting World	.	.	.	.	.	.	.	.	10,877	11,375	11,669	11,911

ECAC		Annual Growth												AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040		
Internal	Global growth	-0.4%	3.2%	-3.2%	-2.3%	1.4%	2.3%	3.6%	2.7%	3.1%	2.1%	1.5%	1.2%	2.2%	63%
	Regulation & Growth	.	.	.	.	.	.	.	.	1.7%	1.9%	1.6%	1.1%	1.6%	44%
	Happy Localism	.	.	.	.	.	.	.	.	1.6%	1.5%	1.0%	0.9%	1.3%	35%
	Fragmenting World	.	.	.	.	.	.	.	.	0.0%	0.7%	0.4%	0.3%	0.3%	7%
Arrival/ Departure	Global growth	6.3%	3.2%	1.9%	2.7%	2.4%	-0.9%	-0.3%	9.2%	5.0%	4.1%	3.7%	3.3%	4.1%	153%
	Regulation & Growth	.	.	.	.	.	.	.	.	3.2%	2.6%	2.5%	1.9%	2.6%	82%
	Happy Localism	.	.	.	.	.	.	.	.	3.1%	1.5%	1.2%	1.1%	1.9%	55%
	Fragmenting World	.	.	.	.	.	.	.	.	1.4%	1.1%	0.7%	0.7%	1.0%	26%
Overflight	Global growth	11.0%	1.9%	6.6%	14.0%	9.9%	-2.2%	-3.2%	5.8%	6.2%	4.9%	4.9%	4.6%	5.3%	228%
	Regulation & Growth	.	.	.	.	.	.	.	.	4.1%	3.9%	3.8%	3.7%	3.9%	142%
	Happy Localism	.	.	.	.	.	.	.	.	4.1%	3.6%	3.3%	3.1%	3.6%	126%
	Fragmenting World	.	.	.	.	.	.	.	.	2.4%	2.9%	2.5%	2.4%	2.5%	77%
Total	**Global growth**	0.9%	3.2%	-2.2%	-1.1%	1.7%	1.6%	2.7%	4.0%	3.6%	2.7%	2.1%	1.8%	2.7%	84%
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.2%	1.8%	1.3%	1.9%	53%
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.1%	0.9%	1.5%	41%
	Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.9%	0.5%	0.4%	0.5%	12%

E. SUMMARY FORECAST PER REGION (IFR MOVEMENTS)

Figure 55 /

Summary of Forecast IFR Movements Per Traffic Zone (thousands).

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Albania	Global growth	181	197	195	201	198	202	187	194	282	346	411	463	3.9%	2.4
	Regulation & Growth	.	.	.	.	.	.	.	.	245	291	326	356	2.7%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	244	284	309	332	2.4%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	210	228	242	256	1.2%	1.3
Armenia	Global growth	53	57	56	52	51	42	39	55	90	120	157	199	5.8%	3.6
	Regulation & Growth	.	.	.	.	.	.	.	.	81	100	125	155	4.7%	2.8
	Happy Localism	.	.	.	.	.	.	.	.	80	97	116	138	4.1%	2.5
	Fragmenting World	.	.	.	.	.	.	.	.	72	85	98	114	3.2%	2.1
Austria	Global growth	1,137	1,154	1,133	1,114	1,152	1,168	1,174	1,232	1,650	1,892	2,096	2,289	2.7%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	1,446	1,619	1,767	1,888	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1,443	1,576	1,671	1,758	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	1,250	1,306	1,336	1,363	0.4%	1.1
Azerbaijan	Global growth	120	124	130	129	127	129	135	142	227	299	351	401	4.6%	2.8
	Regulation & Growth	.	.	.	.	.	.	.	.	199	244	298	326	3.7%	2.3
	Happy Localism	.	.	.	.	.	.	.	.	198	229	262	286	3.1%	2.0
	Fragmenting World	.	.	.	.	.	.	.	.	175	200	227	257	2.6%	1.8
Belarus	Global growth	196	225	240	255	269	263	277	293	402	464	525	595	3.1%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	352	387	424	464	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	351	376	396	422	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	306	321	330	345	0.7%	1.2
Belgium/ Luxembourg	Global growth	1,035	1,091	1,089	1,101	1,133	1,165	1,188	1,240	1,607	1,802	1,950	2,074	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1,440	1,601	1,722	1,821	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1,435	1,550	1,638	1,715	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	1,259	1,305	1,324	1,339	0.3%	1.1
Bosnia-Herzegovina	Global growth	250	276	268	262	298	311	319	359	505	599	690	773	3.4%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	437	504	558	601	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	436	489	527	558	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	376	400	416	429	0.8%	1.2
Bulgaria	Global growth	503	539	540	551	683	767	757	783	1,135	1,357	1,592	1,824	3.7%	2.3
	Regulation & Growth	.	.	.	.	.	.	.	.	987	1,136	1,305	1,419	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	985	1,082	1,156	1,218	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	855	912	949	983	1.0%	1.3
Canary Islands	Global growth	275	298	275	265	284	281	310	333	464	512	553	582	2.5%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	394	421	441	449	1.3%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	393	418	432	435	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	337	342	337	322	-0.1%	1.0

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Croatia	Global growth	459	497	495	492	520	535	540	587	836	987	1,127	1,254	3.4%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	723	826	912	981	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	721	808	868	921	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	621	661	688	709	0.8%	1.2
Cyprus	Global growth	285	281	270	277	304	319	322	360	594	741	917	1,107	5.0%	3.1
	Regulation & Growth	.	.	.	.	.	.	.	.	500	588	697	789	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	498	558	607	655	2.6%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	426	471	504	532	1.7%	1.5
Czech Republic	Global growth	668	695	679	680	700	746	797	817	1,144	1,309	1,414	1,517	2.7%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	1,008	1,124	1,223	1,294	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	1,006	1,102	1,172	1,235	1.8%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	866	907	927	948	0.6%	1.2
Denmark	Global growth	595	625	605	618	619	626	640	647	809	910	979	1,043	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	727	793	852	897	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	724	774	804	840	1.1%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	637	652	655	656	0.1%	1.0
Estonia	Global growth	156	178	189	183	191	194	200	215	295	345	387	418	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	259	285	311	337	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	258	279	295	312	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	223	233	238	246	0.6%	1.1
former Yugoslav Republic of Macedonia	Global growth	125	124	113	113	146	152	146	171	241	292	342	384	3.6%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	211	248	278	303	2.5%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	211	243	266	286	2.3%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	182	196	207	218	1.1%	1.3
Finland	Global growth	242	267	252	243	248	248	247	263	327	364	402	436	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	291	312	336	358	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	292	311	328	345	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	255	259	259	262	0.0%	1.0
France	Global growth	2,794	2,968	2,923	2,902	2,947	2,992	3,124	3,241	4,217	4,709	5,132	5,489	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	3,739	4,093	4,378	4,594	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	3,730	4,007	4,206	4,360	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	3,263	3,383	3,447	3,474	0.3%	1.1
Georgia	Global growth	94	110	108	110	116	122	126	142	242	319	411	512	5.7%	3.6
	Regulation & Growth	.	.	.	.	.	.	.	.	211	261	327	387	4.4%	2.7
	Happy Localism	.	.	.	.	.	.	.	.	210	245	281	319	3.6%	2.2
	Fragmenting World	.	.	.	.	.	.	.	.	185	214	244	278	3.0%	2.0

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Germany	Global growth	2,981	3,078	3,018	2,990	3,030	3,080	3,146	3,259	4,180	4,702	5,102	5,486	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	3,750	4,129	4,435	4,714	1.6%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	3,740	4,030	4,232	4,443	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	3,309	3,417	3,455	3,517	0.3%	1.1
Greece	Global growth	655	656	633	623	678	713	700	745	1,078	1,281	1,482	1,676	3.6%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	923	1,049	1,169	1,261	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	922	1,025	1,102	1,166	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	794	846	874	892	0.8%	1.2
Hungary	Global growth	622	617	589	600	670	744	776	822	1,189	1,376	1,537	1,692	3.2%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	1,034	1,173	1,295	1,381	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	1,032	1,138	1,211	1,268	1.9%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	893	944	976	1,002	0.9%	1.2
Iceland	Global growth	102	111	123	131	145	160	180	200	279	343	417	493	4.0%	2.5
	Regulation & Growth	.	.	.	.	.	.	.	.	247	284	323	365	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	246	269	296	327	2.2%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	217	231	245	261	1.1%	1.3
Ireland	Global growth	513	523	521	522	537	566	610	621	820	979	1,096	1,186	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	731	827	911	992	2.1%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	727	788	844	895	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	648	668	681	691	0.5%	1.1
Italy	Global growth	1,712	1,726	1,685	1,648	1,680	1,696	1,734	1,786	2,456	2,810	3,122	3,411	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2,091	2,339	2,548	2,688	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2,087	2,289	2,422	2,530	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	1,777	1,873	1,925	1,949	0.4%	1.1
Latvia	Global growth	214	235	233	236	243	244	246	268	366	424	477	527	3.0%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	314	345	377	410	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	313	337	356	378	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	266	278	286	296	0.4%	1.1
Lisbon FIR	Global growth	429	450	438	449	480	505	559	613	850	925	979	1,017	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	724	775	809	825	1.3%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	723	765	788	793	1.1%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	616	626	617	596	-0.1%	1.0
Lithuania	Global growth	206	233	236	242	257	260	261	277	374	421	468	519	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	323	350	379	411	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	322	342	358	379	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	276	285	291	302	0.4%	1.1

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Malta	Global growth	95	81	97	109	102	102	110	116	202	249	307	369	5.2%	3.2
	Regulation & Growth	.	.	.	.	.	.	.	.	163	192	225	255	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	163	185	206	227	3.0%	2.0
	Fragmenting World	.	.	.	.	.	.	.	.	136	150	162	173	1.8%	1.5
Moldova	Global growth	54	60	64	74	56	45	42	50	71	84	99	111	3.5%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	66	76	87	93	2.7%	1.9
	Happy Localism	.	.	.	.	.	.	.	.	66	74	83	87	2.4%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	58	66	74	78	1.9%	1.6
Morocco	Global growth	339	352	324	334	359	361	383	411	679	804	958	1,121	4.5%	2.7
	Regulation & Growth	.	.	.	.	.	.	.	.	540	607	674	737	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	539	597	651	696	2.3%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	442	467	484	494	0.8%	1.2
Netherlands	Global growth	1,013	1,085	1,083	1,109	1,138	1,176	1,241	1,287	1,611	1,823	1,935	2,023	2.0%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1,483	1,655	1,749	1,829	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1,478	1,597	1,682	1,762	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	1,302	1,344	1,357	1,374	0.3%	1.1
Norway	Global growth	537	563	587	610	619	603	599	591	698	776	832	877	1.7%	1.5
	Regulation & Growth	.	.	.	.	.	.	.	.	627	666	701	742	1.0%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	626	654	671	695	0.7%	1.2
	Fragmenting World	.	.	.	.	.	.	.	.	553	553	542	538	-0.4%	0.9
Poland	Global growth	598	655	684	692	702	699	755	793	1,100	1,240	1,366	1,500	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	975	1,062	1,144	1,225	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	974	1,048	1,109	1,172	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	831	878	914	953	0.8%	1.2
Romania	Global growth	469	487	487	513	598	635	619	673	956	1,133	1,307	1,482	3.5%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	830	945	1,065	1,153	2.4%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	828	911	973	1,027	1.9%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	718	763	792	818	0.9%	1.2
Santa Maria FIR	Global growth	118	123	118	121	125	136	151	162	221	250	274	295	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	195	209	218	225	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	194	200	203	204	1.0%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	172	173	171	167	0.1%	1.0
Serbia & Montenegro	Global growth	543	558	535	518	554	605	619	654	928	1,118	1,269	1,407	3.4%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	807	935	1,046	1,125	2.4%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	806	908	977	1,035	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	694	743	782	805	0.9%	1.2

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Slovakia	Global growth	370	382	381	397	436	468	498	515	747	865	966	1,064	3.2%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	650	732	804	855	2.2%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	649	715	763	801	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	560	592	613	629	0.9%	1.2
Slovenia	Global growth	328	353	346	329	348	347	353	386	540	630	711	786	3.1%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	476	540	592	634	2.2%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	475	528	566	601	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	412	435	451	464	0.8%	1.2
Spain	Global growth	1,608	1,665	1,557	1,528	1,587	1,640	1,766	1,880	2,598	2,963	3,286	3,530	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2,240	2,472	2,670	2,805	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2,235	2,434	2,583	2,678	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	1,925	2,007	2,048	2,041	0.4%	1.1
Sweden	Global growth	664	724	724	730	739	751	767	808	998	1,122	1,232	1,328	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	910	992	1,074	1,137	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	909	976	1,022	1,082	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	802	830	841	843	0.2%	1.0
Switzerland	Global growth	1,025	1,063	1,045	1,019	1,033	1,046	1,069	1,110	1,433	1,572	1,666	1,751	2.0%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1,266	1,404	1,489	1,532	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1,263	1,370	1,439	1,491	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	1,100	1,148	1,175	1,193	0.3%	1.1
Turkey	Global growth	965	1,038	1,066	1,141	1,269	1,355	1,334	1,416	2,303	2,788	3,396	3,983	4.6%	2.8
	Regulation & Growth	.	.	.	.	.	.	.	.	2,011	2,361	2,823	3,092	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	2,005	2,209	2,375	2,492	2.5%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	1,741	1,907	2,018	2,119	1.8%	1.5
Ukraine	Global growth	427	450	464	492	318	210	191	232	358	423	502	589	4.1%	2.5
	Regulation & Growth	.	.	.	.	.	.	.	.	309	354	409	453	3.0%	2.0
	Happy Localism	.	.	.	.	.	.	.	.	309	343	379	409	2.5%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	263	284	305	326	1.5%	1.4
UK	Global growth	2,181	2,241	2,211	2,225	2,269	2,322	2,449	2,534	3,140	3,624	3,946	4,167	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	2,863	3,194	3,454	3,693	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2,856	3,115	3,295	3,461	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	2,572	2,666	2,710	2,742	0.3%	1.1
ECAC	Global growth	9,617	9,921	9,707	9,601	9,768	9,920	10,193	10,604	14,044	16,018	17,809	19,462	2.7%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	12,443	13,847	15,174	16,200	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	12,410	13,449	14,231	14,917	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	10,877	11,375	11,669	11,911	0.5%	1.1

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
ESRA08	Global growth	9,490	9,782	9,546	9,445	9,602	9,749	10,010	10,393	13,728	15,620	17,339	18,917	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	12,171	13,525	14,792	15,765	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	12,139	13,137	13,872	14,511	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	10,642	11,112	11,374	11,577	0.5%	1.1
EU28	Global growth	8,820	9,050	8,779	8,634	8,797	8,934	9,206	9,559	12,501	14,208	15,702	17,084	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	11,066	12,276	13,342	14,221	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	11,037	11,954	12,624	13,228	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	9,668	10,069	10,297	10,466	0.4%	1.1
Baltic FAB	Global growth	679	741	768	776	788	790	843	889	1,241	1,402	1,551	1,709	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	1,095	1,194	1,290	1,387	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	1,093	1,177	1,246	1,320	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	932	984	1,023	1,068	0.8%	1.2
BLUE MED FAB	Global growth	2,270	2,267	2,212	2,193	2,282	2,327	2,371	2,485	3,549	4,150	4,737	5,314	3.4%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	3,021	3,423	3,804	4,087	2.2%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	3,015	3,339	3,571	3,770	1.8%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	2,574	2,743	2,845	2,913	0.7%	1.2
Danube FAB	Global growth	734	758	746	758	829	895	903	951	1,390	1,652	1,914	2,172	3.7%	2.3
	Regulation & Growth	.	.	.	.	.	.	.	.	1,207	1,381	1,567	1,694	2.5%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	1,204	1,325	1,413	1,487	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	1,042	1,109	1,152	1,187	1.0%	1.2
FAB CE	Global growth	1,863	1,914	1,864	1,854	1,928	2,001	2,060	2,153	2,967	3,411	3,774	4,119	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2,591	2,912	3,185	3,394	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2,585	2,841	3,022	3,179	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	2,228	2,343	2,412	2,473	0.6%	1.1
FABEC	Global growth	5,431	5,671	5,564	5,499	5,571	5,667	5,848	6,048	7,741	8,671	9,407	10,077	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	6,933	7,635	8,178	8,633	1.6%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	6,914	7,444	7,822	8,171	1.3%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	6,090	6,302	6,404	6,497	0.3%	1.1
NEFAB	Global growth	924	988	1,001	1,012	1,030	1,015	1,006	1,031	1,262	1,416	1,542	1,645	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1,121	1,202	1,281	1,366	1.2%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	1,119	1,182	1,225	1,278	0.9%	1.2
	Fragmenting World	.	.	.	.	.	.	.	.	979	991	986	993	-0.2%	1.0
South West FAB	Global growth	1,765	1,823	1,702	1,663	1,727	1,782	1,930	2,059	2,852	3,241	3,585	3,850	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2,452	2,699	2,910	3,051	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2,446	2,659	2,816	2,914	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	2,106	2,190	2,227	2,212	0.3%	1.1

IFR Movements Per Traffic Zone (thousands)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
UK-Ireland FAB	Global growth	2,216	2,272	2,237	2,254	2,299	2,358	2,488	2,576	3,198	3,694	4,022	4,246	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	2,912	3,249	3,514	3,758	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2,906	3,168	3,353	3,521	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	2,615	2,710	2,755	2,787	0.3%	1.1
DK-SE FAB	Global growth	953	1,008	978	999	1,005	1,011	1,035	1,061	1,301	1,457	1,589	1,706	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1,180	1,285	1,384	1,464	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1,178	1,260	1,316	1,388	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	1,038	1,069	1,078	1,080	0.1%	1.0
SES-RP2	Global growth	9,100	9,343	9,087	8,946	9,113	9,243	9,506	9,850	12,808	14,524	16,013	17,389	2.5%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	11,346	12,555	13,617	14,498	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	11,316	12,229	12,890	13,492	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	9,920	10,309	10,520	10,680	0.4%	1.1

F. SUMMARY FORECAST PER REGION (GROWTH)

Figure 56 /

Summary of Forecast IFR Movements Per Traffic Zone (growth).

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Albania	Global growth	12.0%	8.8%	-1.1%	2.8%	-1.1%	1.8%	-7.5%	3.8%	4.8%	4.1%	3.5%	2.5%	3.9%	2.4
	Regulation & Growth	.	.	.	.	.	.	.	.	3.0%	3.5%	2.3%	1.8%	2.7%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	2.9%	3.0%	1.7%	1.5%	2.4%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	1.0%	1.6%	1.2%	1.1%	1.2%	1.3
Armenia	Global growth	9.3%	8.1%	-2.0%	-6.6%	-3.4%	-17.0%	-7.6%	39.9%	6.5%	5.9%	5.5%	4.8%	5.8%	3.6
	Regulation & Growth	.	.	.	.	.	.	.	.	5.0%	4.5%	4.5%	4.4%	4.7%	2.8
	Happy Localism	.	.	.	.	.	.	.	.	5.0%	3.8%	3.6%	3.5%	4.1%	2.5
	Fragmenting World	.	.	.	.	.	.	.	.	3.5%	3.3%	2.9%	3.0%	3.2%	2.1
Austria	Global growth	2.2%	1.5%	-1.8%	-1.7%	3.4%	1.3%	0.6%	4.9%	3.7%	2.8%	2.1%	1.8%	2.7%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.3%	1.8%	1.3%	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.8%	1.2%	1.0%	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.9%	0.5%	0.4%	0.4%	1.1
Azerbaijan	Global growth	11.0%	2.8%	5.4%	-1.3%	-1.2%	1.4%	5.1%	4.6%	6.1%	5.6%	3.3%	2.7%	4.6%	2.8
	Regulation & Growth	.	.	.	.	.	.	.	.	4.3%	4.2%	4.1%	1.8%	3.7%	2.3
	Happy Localism	.	.	.	.	.	.	.	.	4.3%	3.0%	2.7%	1.8%	3.1%	2.0
	Fragmenting World	.	.	.	.	.	.	.	.	2.7%	2.8%	2.5%	2.5%	2.6%	1.8
Belarus	Global growth	7.7%	15.0%	6.7%	6.2%	5.6%	-2.2%	5.3%	5.4%	4.1%	2.9%	2.5%	2.5%	3.1%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	2.3%	1.9%	1.8%	1.8%	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.3%	1.4%	1.1%	1.2%	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.5%	1.0%	0.6%	0.9%	0.7%	1.2
Belgium/ Luxembourg	Global growth	1.5%	5.4%	-0.2%	1.0%	2.9%	2.8%	2.0%	4.4%	3.3%	2.3%	1.6%	1.2%	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1.9%	2.1%	1.5%	1.1%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.8%	1.6%	1.1%	0.9%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.7%	0.3%	0.2%	0.3%	1.1
Bosnia-Herzegovina	Global growth	11.0%	10.0%	-2.6%	-2.2%	14.0%	4.2%	2.6%	12.6%	4.4%	3.4%	2.9%	2.3%	3.4%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	2.5%	2.9%	2.1%	1.5%	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.5%	2.3%	1.5%	1.2%	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	0.6%	1.3%	0.8%	0.6%	0.8%	1.2
Bulgaria	Global growth	5.6%	7.1%	0.1%	1.9%	24.0%	12.0%	-1.3%	3.4%	4.7%	3.6%	3.3%	2.8%	3.7%	2.3
	Regulation & Growth	.	.	.	.	.	.	.	.	2.9%	2.9%	2.8%	1.7%	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	2.9%	1.9%	1.3%	1.0%	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	1.1%	1.3%	0.8%	0.7%	1.0%	1.3
Canary Islands	Global growth	3.2%	8.2%	-7.7%	-3.4%	6.9%	-0.9%	11.0%	7.1%	4.2%	2.0%	1.6%	1.0%	2.5%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	2.1%	1.3%	1.0%	0.3%	1.3%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	2.1%	1.2%	0.7%	0.1%	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.3%	-0.3%	-0.9%	-0.1%	1.0

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Croatia	Global growth	8.7%	8.4%	-0.4%	-0.6%	5.5%	3.0%	0.9%	8.7%	4.5%	3.4%	2.7%	2.2%	3.4%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	2.6%	2.7%	2.0%	1.5%	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	2.3%	1.5%	1.2%	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	0.7%	1.3%	0.8%	0.6%	0.8%	1.2
Cyprus	Global growth	6.4%	-1.2%	-4.1%	2.8%	9.7%	4.8%	1.0%	11.6%	6.5%	4.5%	4.4%	3.8%	5.0%	3.1
	Regulation & Growth	.	.	.	.	.	.	.	.	4.2%	3.3%	3.5%	2.5%	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	4.2%	2.3%	1.7%	1.5%	2.6%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	2.2%	2.0%	1.3%	1.1%	1.7%	1.5
Czech Republic	Global growth	3.2%	4.0%	-2.3%	0.0%	3.1%	6.5%	6.9%	2.4%	4.3%	2.7%	1.6%	1.4%	2.7%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.7%	2.2%	1.7%	1.1%	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	1.8%	1.2%	1.1%	1.8%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.7%	0.9%	0.5%	0.4%	0.6%	1.2
Denmark	Global growth	3.3%	5.1%	-3.2%	2.3%	0.0%	1.3%	2.1%	1.1%	2.8%	2.4%	1.5%	1.3%	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.5%	1.8%	1.4%	1.0%	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.4%	1.3%	0.8%	0.9%	1.1%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	-0.2%	0.5%	0.1%	0.0%	0.1%	1.0
Estonia	Global growth	2.1%	14.0%	6.1%	-3.1%	4.6%	1.2%	3.4%	7.5%	4.0%	3.2%	2.3%	1.6%	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.3%	2.0%	1.7%	1.6%	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.3%	1.5%	1.2%	1.1%	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.4%	0.9%	0.5%	0.7%	0.6%	1.1
former Yugoslav Republic of Macedonia	Global growth	-0.1%	-0.4%	-9.6%	0.1%	30.0%	3.9%	-4.3%	17.5%	4.4%	3.9%	3.2%	2.3%	3.6%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	2.7%	3.2%	2.3%	1.7%	2.5%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	2.7%	2.9%	1.8%	1.5%	2.3%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	0.8%	1.5%	1.1%	1.0%	1.1%	1.3
Finland	Global growth	0.6%	11.0%	-5.8%	-3.5%	1.9%	0.0%	-0.4%	6.4%	2.8%	2.2%	2.0%	1.6%	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1.3%	1.4%	1.4%	1.3%	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.3%	1.3%	1.0%	1.0%	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	-0.4%	0.3%	0.0%	0.2%	0.0%	1.0
France	Global growth	-0.2%	6.2%	-1.5%	-0.7%	1.6%	1.5%	4.4%	3.8%	3.3%	2.2%	1.7%	1.4%	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1.8%	1.8%	1.4%	1.0%	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.8%	1.4%	1.0%	0.7%	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.7%	0.4%	0.2%	0.3%	1.1
Georgia	Global growth	22.0%	16.0%	-1.7%	2.1%	5.2%	5.5%	2.8%	13.2%	6.8%	5.7%	5.2%	4.5%	5.7%	3.6
	Regulation & Growth	.	.	.	.	.	.	.	.	5.0%	4.4%	4.6%	3.4%	4.4%	2.7
	Happy Localism	.	.	.	.	.	.	.	.	5.0%	3.2%	2.8%	2.5%	3.6%	2.2
	Fragmenting World	.	.	.	.	.	.	.	.	3.3%	3.0%	2.7%	2.6%	3.0%	2.0

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Germany	Global growth	1.7%	3.2%	-1.9%	-0.9%	1.3%	1.7%	2.1%	3.6%	3.2%	2.4%	1.6%	1.5%	2.3%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1.8%	1.9%	1.4%	1.2%	1.6%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.7%	1.5%	1.0%	1.0%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.6%	0.2%	0.4%	0.3%	1.1
Greece	Global growth	2.6%	0.2%	-3.5%	-1.6%	8.8%	5.1%	-1.7%	6.5%	4.7%	3.5%	3.0%	2.5%	3.6%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	2.7%	2.6%	2.2%	1.5%	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.7%	2.2%	1.5%	1.1%	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	0.8%	1.3%	0.6%	0.4%	0.8%	1.2
Hungary	Global growth	2.4%	-0.8%	-4.4%	1.9%	12.0%	11.0%	4.3%	5.9%	4.7%	3.0%	2.2%	1.9%	3.2%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	2.9%	2.5%	2.0%	1.3%	2.3%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.9%	2.0%	1.3%	0.9%	1.9%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	1.0%	1.1%	0.7%	0.5%	0.9%	1.2
Iceland	Global growth	0.6%	9.0%	11.0%	6.8%	11.0%	11.0%	12.0%	11.3%	4.2%	4.3%	3.9%	3.4%	4.0%	2.5
	Regulation & Growth	.	.	.	.	.	.	.	.	2.6%	2.8%	2.6%	2.5%	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	1.8%	1.9%	2.0%	2.2%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	1.0%	1.3%	1.1%	1.3%	1.1%	1.3
Ireland	Global growth	-3.1%	1.9%	-0.4%	0.3%	2.8%	5.4%	7.8%	1.8%	3.5%	3.6%	2.3%	1.6%	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.1%	2.5%	2.0%	1.7%	2.1%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.4%	1.2%	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.5%	0.6%	0.4%	0.3%	0.5%	1.1
Italy	Global growth	3.9%	0.8%	-2.3%	-2.2%	1.9%	1.0%	2.2%	3.0%	4.1%	2.7%	2.1%	1.8%	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.3%	1.7%	1.1%	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.9%	1.1%	0.9%	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	-0.1%	1.1%	0.5%	0.3%	0.4%	1.1
Latvia	Global growth	4.0%	9.8%	-1.0%	1.3%	2.8%	0.7%	0.7%	8.9%	4.0%	3.0%	2.4%	2.0%	3.0%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	1.9%	1.8%	1.7%	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.5%	1.1%	1.2%	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	-0.1%	0.9%	0.6%	0.7%	0.4%	1.1
Lisbon FIR	Global growth	5.6%	4.8%	-2.7%	2.6%	6.8%	5.1%	11.0%	9.5%	4.2%	1.7%	1.1%	0.8%	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	2.1%	1.4%	0.9%	0.4%	1.3%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	2.1%	1.2%	0.6%	0.1%	1.1%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.3%	-0.3%	-0.7%	-0.1%	1.0
Lithuania	Global growth	7.3%	13.0%	1.0%	2.9%	6.0%	1.2%	0.2%	6.2%	3.8%	2.4%	2.1%	2.1%	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	1.9%	1.7%	1.6%	1.7%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.9%	1.2%	0.9%	1.2%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	-0.1%	0.7%	0.4%	0.8%	0.4%	1.1

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Malta	Global growth	12.0%	-15.0%	20.0%	13.0%	-6.8%	0.7%	7.1%	5.3%	7.2%	4.3%	4.3%	3.8%	5.2%	3.2
	Regulation & Growth	.	.	.	.	.	.	.	.	4.4%	3.3%	3.3%	2.5%	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	4.4%	2.6%	2.1%	2.0%	3.0%	2.0
	Fragmenting World	.	.	.	.	.	.	.	.	2.1%	1.9%	1.6%	1.3%	1.8%	1.5
Moldova	Global growth	24.0%	11.0%	5.7%	16.0%	-24.0%	-19.0%	-8.0%	20.1%	4.5%	3.4%	3.3%	2.3%	3.5%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	3.4%	2.9%	2.8%	1.4%	2.7%	1.9
	Happy Localism	.	.	.	.	.	.	.	.	3.4%	2.6%	2.2%	1.1%	2.4%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	1.8%	2.4%	2.4%	1.1%	1.9%	1.6
Morocco	Global growth	8.6%	3.9%	-8.1%	3.3%	7.6%	0.3%	6.3%	7.3%	6.5%	3.4%	3.6%	3.2%	4.5%	2.7
	Regulation & Growth	.	.	.	.	.	.	.	.	3.5%	2.4%	2.1%	1.8%	2.6%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	3.4%	2.1%	1.8%	1.3%	2.3%	1.7
	Fragmenting World	.	.	.	.	.	.	.	.	0.9%	1.1%	0.7%	0.4%	0.8%	1.2
Netherlands	Global growth	1.7%	7.2%	-0.2%	2.4%	2.6%	3.4%	5.5%	3.7%	2.8%	2.5%	1.2%	0.9%	2.0%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.8%	2.2%	1.1%	0.9%	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.8%	1.6%	1.0%	0.9%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.6%	0.2%	0.2%	0.3%	1.1
Norway	Global growth	2.2%	4.9%	4.2%	3.9%	1.4%	-2.5%	-0.8%	-1.2%	2.1%	2.1%	1.4%	1.1%	1.7%	1.5
	Regulation & Growth	.	.	.	.	.	.	.	.	0.7%	1.2%	1.0%	1.1%	1.0%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	0.7%	0.9%	0.5%	0.7%	0.7%	1.2
	Fragmenting World	.	.	.	.	.	.	.	.	-0.8%	0.0%	-0.4%	-0.1%	-0.4%	0.9
Poland	Global growth	5.8%	9.4%	4.6%	1.1%	1.4%	-0.3%	7.9%	5.0%	4.2%	2.4%	2.0%	1.9%	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.6%	1.7%	1.5%	1.4%	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	1.5%	1.1%	1.1%	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.6%	1.1%	0.8%	0.8%	0.8%	1.2
Romania	Global growth	8.2%	3.8%	0.0%	5.3%	17.0%	6.1%	-2.4%	8.5%	4.5%	3.5%	2.9%	2.6%	3.5%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	2.6%	2.6%	2.4%	1.6%	2.4%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	1.9%	1.3%	1.1%	1.9%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.8%	1.2%	0.8%	0.6%	0.9%	1.2
Santa Maria FIR	Global growth	4.5%	4.3%	-3.9%	2.7%	2.8%	8.8%	11.0%	7.5%	4.0%	2.4%	1.9%	1.5%	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	2.3%	1.3%	0.9%	0.6%	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	2.3%	0.5%	0.4%	0.1%	1.0%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	0.7%	0.2%	-0.2%	-0.4%	0.1%	1.0
Serbia & Montenegro	Global growth	5.9%	2.7%	-4.1%	-3.1%	6.9%	9.3%	2.3%	5.6%	4.5%	3.8%	2.6%	2.1%	3.4%	2.2
	Regulation & Growth	.	.	.	.	.	.	.	.	2.7%	3.0%	2.3%	1.5%	2.4%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	2.4%	1.5%	1.1%	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	0.7%	1.4%	1.0%	0.6%	0.9%	1.2

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
Slovakia	Global growth	9.8%	3.1%	-0.3%	4.4%	9.8%	7.2%	6.4%	3.5%	4.8%	3.0%	2.2%	2.0%	3.2%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	3.0%	2.4%	1.9%	1.2%	2.2%	1.7
	Happy Localism	.	.	.	.	.	.	.	.	2.9%	1.9%	1.3%	1.0%	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	1.1%	1.1%	0.7%	0.5%	0.9%	1.2
Slovenia	Global growth	4.8%	7.5%	-2.0%	-4.8%	5.8%	-0.2%	1.7%	9.3%	4.3%	3.1%	2.4%	2.0%	3.1%	2.0
	Regulation & Growth	.	.	.	.	.	.	.	.	2.7%	2.6%	1.9%	1.4%	2.2%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	2.1%	1.4%	1.2%	1.9%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	0.8%	1.1%	0.7%	0.6%	0.8%	1.2
Spain	Global growth	1.8%	3.6%	-6.5%	-1.9%	3.9%	3.3%	7.7%	6.4%	4.1%	2.7%	2.1%	1.4%	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.2%	2.0%	1.6%	1.0%	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.2%	1.7%	1.2%	0.7%	1.6%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.8%	0.4%	-0.1%	0.4%	1.1
Sweden	Global growth	1.5%	9.1%	-0.1%	0.9%	1.2%	1.6%	2.2%	5.4%	2.7%	2.4%	1.9%	1.5%	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.5%	1.7%	1.6%	1.2%	1.5%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.5%	1.4%	0.9%	1.2%	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	-0.1%	0.7%	0.3%	0.0%	0.2%	1.0
Switzerland	Global growth	0.7%	3.6%	-1.7%	-2.4%	1.4%	1.2%	2.3%	3.8%	3.2%	1.9%	1.2%	1.0%	2.0%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.7%	2.1%	1.2%	0.6%	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.6%	1.6%	1.0%	0.7%	1.3%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	-0.1%	0.9%	0.5%	0.3%	0.3%	1.1
Turkey	Global growth	13.0%	7.6%	2.6%	7.1%	11.0%	6.8%	-1.6%	6.0%	6.3%	3.9%	4.0%	3.2%	4.6%	2.8
	Regulation & Growth	.	.	.	.	.	.	.	.	4.5%	3.3%	3.6%	1.8%	3.5%	2.2
	Happy Localism	.	.	.	.	.	.	.	.	4.5%	1.9%	1.5%	1.0%	2.5%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	2.6%	1.8%	1.1%	1.0%	1.8%	1.5
Ukraine	Global growth	14.0%	5.6%	3.0%	6.1%	-35.0%	-34.0%	-9.4%	19.2%	5.6%	3.4%	3.5%	3.3%	4.1%	2.5
	Regulation & Growth	.	.	.	.	.	.	.	.	3.7%	2.7%	2.9%	2.1%	3.0%	2.0
	Happy Localism	.	.	.	.	.	.	.	.	3.6%	2.1%	2.0%	1.5%	2.5%	1.8
	Fragmenting World	.	.	.	.	.	.	.	.	1.6%	1.5%	1.4%	1.3%	1.5%	1.4
UK	Global growth	-4.2%	2.8%	-1.4%	0.6%	2.0%	2.4%	5.4%	3.5%	2.7%	2.9%	1.7%	1.1%	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.5%	2.2%	1.6%	1.3%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.5%	1.7%	1.1%	1.0%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.7%	0.3%	0.2%	0.3%	1.1
ECAC	Global growth	0.9%	3.2%	-2.2%	-1.1%	1.7%	1.6%	2.7%	4.0%	3.6%	2.7%	2.1%	1.8%	2.7%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.2%	1.8%	1.3%	1.9%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.1%	0.9%	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.9%	0.5%	0.4%	0.5%	1.1

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
ESRA08	Global growth	0.8%	3.1%	-2.4%	-1.1%	1.7%	1.5%	2.7%	3.8%	3.5%	2.6%	2.1%	1.8%	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.1%	1.8%	1.3%	1.8%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.1%	0.9%	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.9%	0.5%	0.4%	0.5%	1.1
EU28	Global growth	0.2%	2.6%	-3.0%	-1.7%	1.9%	1.6%	3.0%	3.8%	3.4%	2.6%	2.0%	1.7%	2.6%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	1.8%	2.1%	1.7%	1.3%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.8%	1.6%	1.1%	0.9%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.8%	0.4%	0.3%	0.4%	1.1
Baltic FAB	Global growth	5.5%	9.2%	3.6%	1.0%	1.5%	0.3%	6.6%	5.6%	4.3%	2.5%	2.0%	2.0%	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.6%	1.7%	1.6%	1.5%	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.6%	1.5%	1.2%	1.2%	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.6%	1.1%	0.8%	0.8%	0.8%	1.2
BLUE MED FAB	Global growth	3.5%	-0.1%	-2.4%	-0.8%	4.0%	2.0%	1.9%	4.8%	4.6%	3.2%	2.7%	2.3%	3.4%	2.1
	Regulation & Growth	.	.	.	.	.	.	.	.	2.5%	2.5%	2.1%	1.4%	2.2%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.4%	2.1%	1.4%	1.1%	1.8%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.4%	1.3%	0.7%	0.5%	0.7%	1.2
Danube FAB	Global growth	6.8%	3.3%	-1.5%	1.5%	9.4%	8.0%	0.9%	5.1%	4.9%	3.5%	3.0%	2.6%	3.7%	2.3
	Regulation & Growth	.	.	.	.	.	.	.	.	3.0%	2.7%	2.6%	1.6%	2.5%	1.8
	Happy Localism	.	.	.	.	.	.	.	.	3.0%	1.9%	1.3%	1.0%	2.0%	1.6
	Fragmenting World	.	.	.	.	.	.	.	.	1.2%	1.3%	0.8%	0.6%	1.0%	1.2
FAB CE	Global growth	3.2%	2.7%	-2.6%	-0.6%	4.0%	3.8%	3.0%	4.5%	4.1%	2.8%	2.0%	1.8%	2.9%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.3%	2.4%	1.8%	1.3%	2.0%	1.6
	Happy Localism	.	.	.	.	.	.	.	.	2.3%	1.9%	1.2%	1.0%	1.7%	1.5
	Fragmenting World	.	.	.	.	.	.	.	.	0.4%	1.0%	0.6%	0.5%	0.6%	1.1
FABEC	Global growth	0.5%	4.4%	-1.9%	-1.2%	1.3%	1.7%	3.2%	3.4%	3.1%	2.3%	1.6%	1.4%	2.2%	1.7
	Regulation & Growth	.	.	.	.	.	.	.	.	1.7%	1.9%	1.4%	1.1%	1.6%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.7%	1.5%	1.0%	0.9%	1.3%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.7%	0.3%	0.3%	0.3%	1.1
NEFAB	Global growth	2.1%	7.0%	1.3%	1.1%	1.8%	-1.5%	-0.9%	2.5%	2.6%	2.3%	1.7%	1.3%	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.1%	1.4%	1.3%	1.3%	1.2%	1.3
	Happy Localism	.	.	.	.	.	.	.	.	1.0%	1.1%	0.7%	0.8%	0.9%	1.2
	Fragmenting World	.	.	.	.	.	.	.	.	-0.6%	0.2%	-0.1%	0.1%	-0.2%	1.0
South West FAB	Global growth	1.9%	3.3%	-6.6%	-2.3%	3.9%	3.1%	8.3%	6.7%	4.2%	2.6%	2.0%	1.4%	2.8%	1.9
	Regulation & Growth	.	.	.	.	.	.	.	.	2.2%	1.9%	1.5%	1.0%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	2.2%	1.7%	1.2%	0.7%	1.5%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.8%	0.3%	-0.1%	0.3%	1.1

IFR Movements (Growth)		2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	AAGR 2040/ 2017	Traffic Multiple 2040/ 2017
UK-Ireland FAB	Global growth	-4.3%	2.5%	-1.5%	0.7%	2.0%	2.5%	5.5%	3.5%	2.7%	2.9%	1.7%	1.1%	2.2%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.5%	2.2%	1.6%	1.3%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.5%	1.7%	1.1%	1.0%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.2%	0.7%	0.3%	0.2%	0.3%	1.1
DK-SE FAB	Global growth	2.4%	5.7%	-3.0%	2.2%	0.6%	0.6%	2.3%	2.6%	2.6%	2.3%	1.7%	1.4%	2.1%	1.6
	Regulation & Growth	.	.	.	.	.	.	.	.	1.3%	1.7%	1.5%	1.1%	1.4%	1.4
	Happy Localism	.	.	.	.	.	.	.	.	1.3%	1.4%	0.9%	1.1%	1.2%	1.3
	Fragmenting World	.	.	.	.	.	.	.	.	-0.3%	0.6%	0.2%	0.0%	0.1%	1.0
SES-RP2	Global growth	0.2%	2.7%	-2.7%	-1.6%	1.9%	1.4%	2.8%	3.6%	3.3%	2.5%	2.0%	1.7%	2.5%	1.8
	Regulation & Growth	.	.	.	.	.	.	.	.	1.8%	2.0%	1.6%	1.3%	1.7%	1.5
	Happy Localism	.	.	.	.	.	.	.	.	1.8%	1.6%	1.1%	0.9%	1.4%	1.4
	Fragmenting World	.	.	.	.	.	.	.	.	0.1%	0.8%	0.4%	0.3%	0.4%	1.1

G. AIRCRAFT ASSIGNMENT TOOL

Credible forecasting of aviation emissions requires transparent and robust modelling of the evolution of the future fleet operations: that is, given a forecast of air traffic, which current and future aircraft will be used to deliver the flights?

EUROCONTROL's Statistics and Forecast Service (STATFOR) commenced work on building such a capability in 2010 by conducting a requirements analysis, focusing on the existing environmental modelling and traffic forecasting tools in Europe. The analysis concluded that, in the current set-up, there are some significant gaps in the traffic forecast data that hamper their use by the environmental tools and the analysis therefore concluded with a recommendation to complement the existing suite of tools by an Aircraft Assignment Tool (AAT) to bridge these gaps. This work has been co-developed by the European Commission, EASA and EUROCONTROL.

The high level processes performed by the Aircraft Assignment Tool (AAT) are presented in Figure 57. As for any forecast, the baseline flight data (historical operations for a baseline year, eg. 2017) by airport-pair containing detailed characteristics like aircraft type, aircraft engine, aircraft age, number of seats or payload, market segments… is loaded. From this baseline, an aggregation is made at airport-pair level which calculates the total number of seats per aircraft (for passenger and business aviation market segments), or similarly the total payload per aircraft (for cargo market segment). Using the forecast growth per airport-pair calculated upstream, the number of passengers is multiplied by the passenger growth number for the airport-pair in the specified target (spot year). Similarly, the payload (tons) is multiplied by the cargo growth number in the specified target year. In parallel, retirement and phase-out procedures are applied to the flights in the baseline. These are performed according to statistics generated from the fleet database (e.g. oldest airframe, average age of the aircraft type) and figures provided by the user who can define phase-out or retirement rules. Knowing future number of passengers (Figure 58) on "still active" aircraft, the number of unassigned seats can be deduced, and; new aircraft are then assigned on these "free" seats based on a growth and replacement assumptions and an aircraft distribution strategy (based on historical data).

The same principal applies for cargo flights with "unassigned payload" which has to be distributed over new freighters. In a final process (not shown in the Figure), these new aircraft are converted into individual flights again. The process is repeated for each spot year.

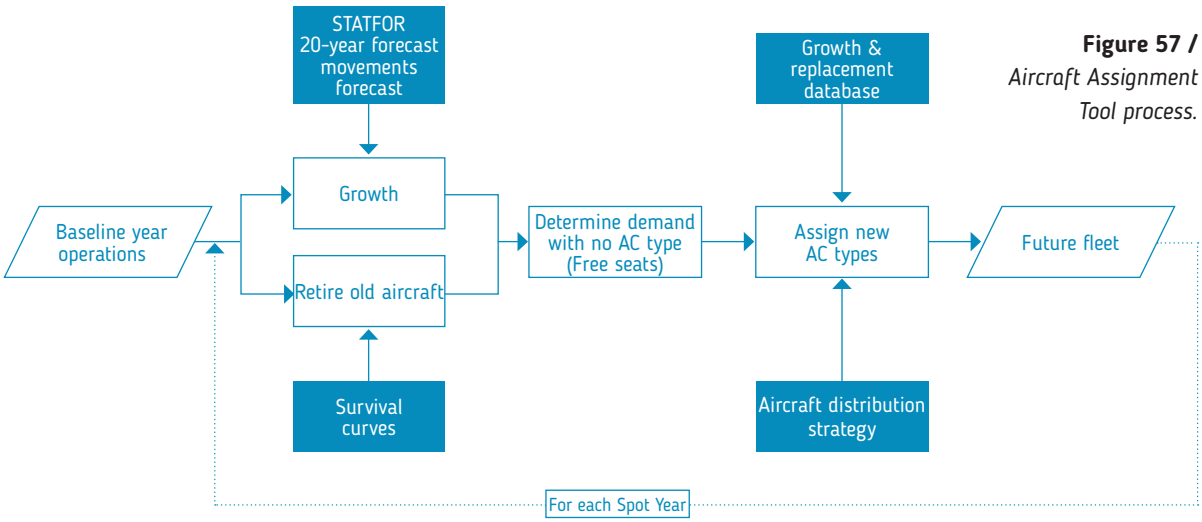
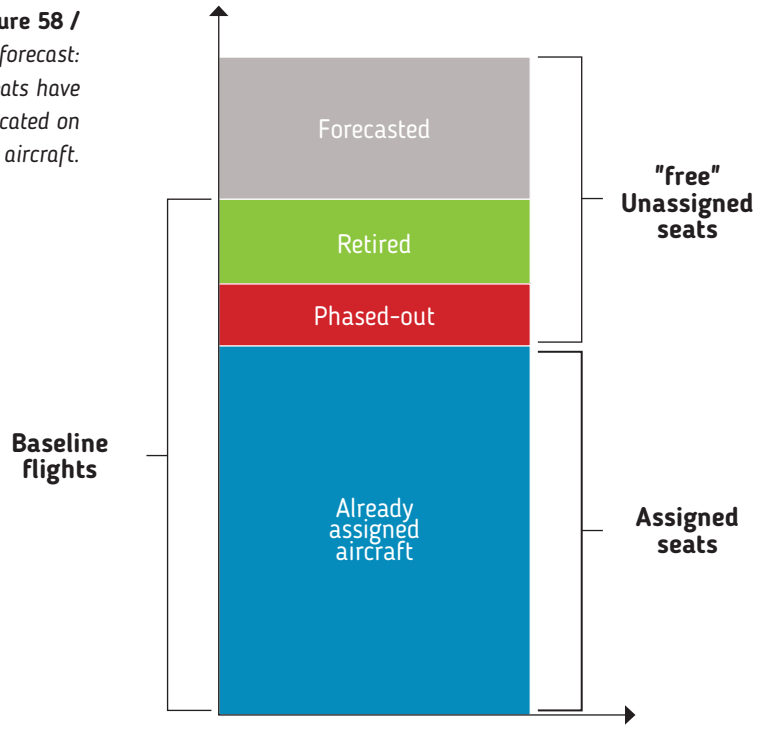


Figure 57 / *Aircraft Assignment Tool process.*

Figure 58 /
AAT passenger forecast: unassigned seats have to be allocated on (future) aircraft.



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