

Standard Inputs for EUROCONTROL Cost-Benefit Analyses

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Economics.Business-Cases@eurocontrol.int

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Abstract		
<p>This document provides values for commonly used data items in cost-benefit analyses, together with details of the sources and a discussion of the applicability and use of the values.</p> <p>The values have been compiled from publicly available documents. They are average values and may not be appropriate in all circumstances.</p>		
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DOCUMENT APPROVAL

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DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
0.1	31/07/02	Working Draft	All
1.0	23/09/02	Revised and upgraded to Released Issue	All
2.0	02/04	Updated to 2004 values	All
3.0	06/07	Updated to 2006 values	All
4.0	10/09	Updated to 2009 values	All
5.0	12/11	Updated to 2010 values	All
6.0	09/13	Updated to 2012 values, review and replacement of some values, addition of four new values	All
7.0	11/15	Updated to 2014 values, review and replacement of some values, addition of three new values	All

Table of Contents

INTRODUCTION.....	1
CONVERSIONS, INFLATION, COST OF FUEL, EXCHANGE RATE	3
GEOGRAPHICAL AREAS	5
Operational Values	
AIRCRAFT OPERATING COSTS	7
AVERAGE NUMBER OF PASSENGERS PER MOVEMENT	9
CANCELLATION COST	11
CANCELLATION RATE	13
COST OF DELAY	14
COST OF DISTANCE FLOWN.....	18
COST OF DIVERSION	20
EN-ROUTE ANS COSTS.....	21
GROUND HANDLING TIME	23
IFR FLIGHT DISTANCE OVERALL.....	24
IFR FLIGHT DURATION OVERALL	26
IFR FLIGHT INFORMATION PER OPERATOR SEGMENT.....	28
LOAD FACTOR - CARGO	30
LOAD FACTOR - PASSENGER	31
PASSENGER DISTRIBUTION	33
PASSENGER VALUE OF TIME	35
RATE OF FUEL BURN	38
ROUTE CHARGES SHARE PER AIRCRAFT OPERATOR SEGMENT	41
Safety Related Values	
ACCIDENT/INCIDENT STATISTICS.....	43
VALUE OF A STATISTICAL INJURY	46
VALUE OF A STATISTICAL LIFE (VSL)	48
Economic Values	
ANSPS EMPLOYMENT COST	51
ASSET LIFE	54
COST OF AVIATION FUEL	56
DISCOUNT RATE	58
EXCHANGE RATE	60
VALUE OF AN AVERAGE PASSENGER FLIGHT.....	61

Environmental Values

AMOUNT OF EMISSIONS RELEASED BY FUEL BURN	64
COST OF NOISE	66
COST OF POLLUTANTS.....	70

Traffic and Capacity Related Values

AIR TRAFFIC DELAY STATISTICS	72
AIR TRAFFIC STATISTICS AND FORECASTS	74
DISTANCE FLOWN BY CHARGING ZONE.....	76
FLEET AGE.....	78
FLEET SIZE	81
MEDIUM TERM CAPACITY PLANNING	85
NUMBER OF IFR FLIGHTS.....	86

Ground Infrastructure

ATM COST EFFECTIVENESS INDICATORS.....	89
ATM OPERATIONAL UNITS	90
CNS INFRASTRUCTURE.....	92

General Information

ACRONYMS.....	96
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Introduction

This document provides a set of standard inputs for data commonly used in economic and financial ATM-related analyses and appraisals. The standard inputs will save time in the development of, for example, CBAs and economic impact assessments and will also help to achieve greater consistency and comparability between different CBAs.

The current, 7th, edition has been improved in the following ways:

- All prices have been updated to 2014 Euros unless otherwise specified. The costs can be easily adjusted with the indices table given in section “Conversions, inflation, cost of fuel and exchange rate” on [page 3](#);
- A table showing the member states per geographical area has been added;
- Some values have been reviewed and replaced with more up-to-date information, namely Cancellation Cost and IFR Flight Duration;
- Three new values have been added:
 1. Cancellation Rate,
 2. IFR Flight Information per Operator Segment,
 3. ANSPs Employment Cost.
- Whenever values are contentious as single values, a range of low, base and high values are given, allowing for sensitivity analyses.

The online version has been updated and will be made available shortly after publication of this edition. Access can be requested from: <https://ost.eurocontrol.int/sites/siws/>

As with the previous version the review was extended to a wide panel of ATM experts worldwide including IATA, ANSPs, EASA, Airspace Users, Airports, Industry, Universities, SESAR JU and EUROCONTROL.

The standard inputs have been compiled from EUROCONTROL and publicly available documents. They are average values and may not be appropriate in all circumstances. The document also gives details of the sources of information and a discussion of the applicability and use of the values.

This document will remain a living document; therefore comments and suggestions are very welcome; readers are invited to send them to the following address:
Economics.Business-Cases@eurocontrol.int

Details per data item

For each Standard Input the following information is provided where relevant:

Section	Description
Definition	A statement that describes the concept.
EUROCONTROL Recommended Value or Source	One or a set of recommended values or sources put forward by EUROCONTROL for the specific indicator.
Source & Date	The source documents and their publication dates.
Description	Any relevant information or details regarding the Standard Input. Information can be found here regarding how the value is computed, the specific use of the indicator, etc. Information may also be included regarding the limitations on the use of the values.
Other Possible Values	Other values found in different sources that are included for the purpose of information or discussion.
Related Standard Inputs	A link to other related Standard Inputs included in the document in order to increase the consistency of the document.
Further Reading	References to other interesting sources.
Comments	Any issues or further comments regarding the source or derivation of the value, e.g. the degree of confidence in the values and sources cited.

Conversions, Inflation, Cost of Fuel, Exchange Rate

1 Inflation

All values are given in Euro (€) at December 2014 price levels (unless otherwise indicated). They have been inflated from values given in the source documents by means of the EUROSTAT European Union (EC6-1972, EC9-1980, EC10-1985, EC12-1994, EU15-2004, EU25-2006, EU27-2013, EU28) harmonised index of consumer prices (HICP). The annual change in the index is shown below. The values of the index are available at:

<http://ec.europa.eu/eurostat>

Annual average inflation values		
Year	Index	Rate of change
2014	120.72	0.66%
2013	120.06	1.50%
2012	118.28	2.60%
2011	115.23	3.10%
2010	111.77	2.10%
2009	109.49	1.00%
2008	108.42	3.70%
2007	104.59	2.30%
2006	102.20	2.20%
2005	100.00	2.20%
2004	97.88	2.00%
2003	95.95	2.00%
2002	94.11	2.10%
2001	92.19	2.20%
2000	90.21	1.90%
1999	88.53	1.20%
1998	87.49	1.30%
1997	86.38	1.70%

2 Exchange Rate Conversion

Values in pounds sterling (GB £) and US dollars (US \$) have been converted to Euros (€) using the 2014 average euro foreign exchange rate.

Currency	Currency : €	€ : Currency
US \$	0.75272	1.32850
GB £	1.24051	0.80612

Further information can be found in the related standard input [Exchange Rate](#) (page 60).

3 Cost of Fuel

The cost of fuel used in this document is based on the 2014 average Jet fuel price handled by IATA (unless otherwise specified).

US \$ / US gallon	€ / kg
2.78	0.70

Details can be found in the related standard input [Cost of Aviation Fuel](#) (page 56).

4 Conversion Values

1 nautical mile (NM)	1.852 km
1 kilometre (km)	0.53996 NM
1 tonne (metric - 1000 kg) of jet fuel	325.33 US gallons 1 235 litres 7.8 barrels
1 barrel (bbl) of jet fuel	42 US gallons 158.99 litres 0.1291 ton = 129.10 kg
1 US gallon of jet fuel (US gal)	3.7854 litres 3.073 kg 6.7764 lb
Density of kerosene	0.812 kg/litre
1 litre of fuel (l)	0.26417 US gallons
1 kilogramme of fuel (kg)	2.2046 lb
1 pound of fuel (lb)	0.45359 kg

5 For Further Information

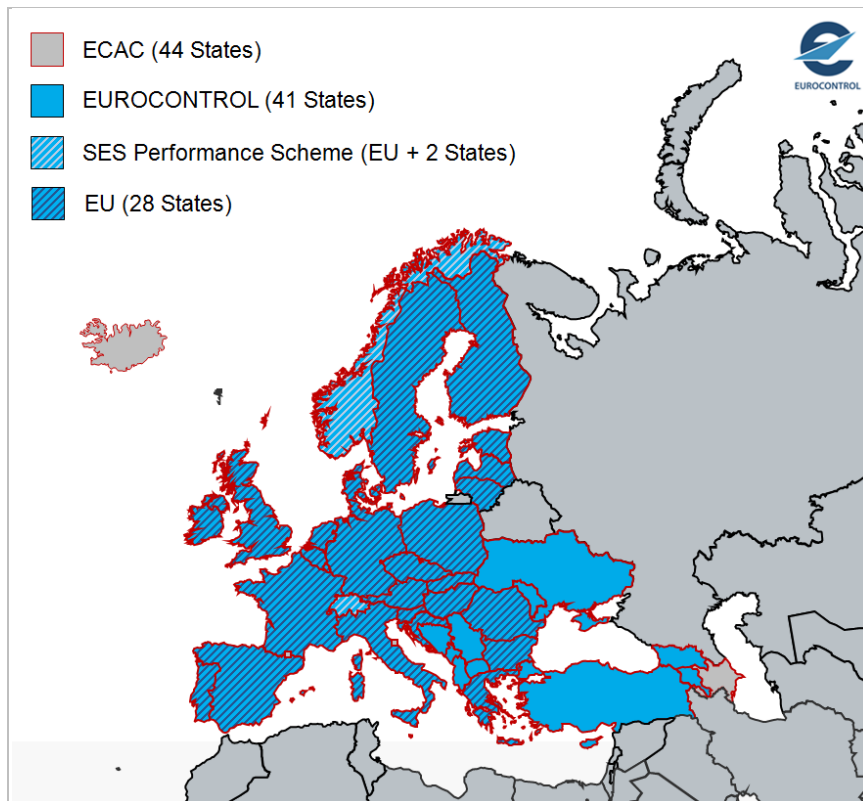
For any questions relating to this document, please contact EUROCONTROL using the EUROCONTROL CBA e-mail: Economics.Business-Cases@eurocontrol.int

Website: <http://www.eurocontrol.int/articles/business-cases-and-cost-benefit-analyses>

Geographical Areas

1 Member States (and FIR for ESRA08) and Geographical Areas

States / Flight Information Region (FIR)	ECAC	EUROCONTROL	ESRA08 (Traffic region)	EU28	SES (EU28+2)
Albania	✓	✓	✓		
Armenia	✓	✓			
Austria	✓	✓	✓	✓	✓
Azerbaijan	✓				
Belgium	✓	✓	✓	✓	✓
Bosnia and Herzegovina	✓	✓	✓		
Bulgaria	✓	✓	✓	✓	✓
Croatia	✓	✓	✓	✓	✓
Cyprus	✓	✓	✓	✓	✓
Czech Republic	✓	✓	✓	✓	✓
Denmark	✓	✓	✓	✓	✓
Estonia	✓	✓		✓	✓
Finland	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓
FYROM	✓	✓	✓		
Georgia	✓	✓			
Germany	✓	✓	✓	✓	✓
Greece	✓	✓	✓	✓	✓
Hungary	✓	✓	✓	✓	✓
Iceland	✓				
Ireland	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓
Latvia	✓	✓		✓	✓
Lithuania	✓	✓		✓	✓
Luxembourg	✓	✓	✓	✓	✓
Malta	✓	✓	✓	✓	✓
Moldova	✓	✓	✓		
Monaco	✓	✓			
Montenegro	✓	✓	✓		
Netherlands	✓	✓	✓	✓	✓
Norway	✓	✓	✓		✓
Poland	✓	✓	✓	✓	✓
Portugal	✓	✓		✓	✓
Romania	✓	✓	✓	✓	✓
San Marino	✓				
Serbia	✓	✓	✓		
Slovakia	✓	✓	✓	✓	✓
Slovenia	✓	✓	✓	✓	✓
Spain	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓
Switzerland	✓	✓	✓		✓
Turkey	✓	✓	✓		
Ukraine	✓	✓	✓		
United Kingdom	✓	✓	✓	✓	✓
Canary Islands FIR			✓		
Lisbon FIR			✓		
Santa Maria FIR			✓		
Total	44	41	37	28	30



2 Comment

ESRA08 consists of 34 traffic zones. Traffic zones are defined by an aggregation of Flight Information Regions (FIR/UIR) of States. These do not take delegation of airspace into account.

Further information on Traffic Region Definitions is available in the EUROCONTROL, STATFOR 7-year IFR Flight Movements and Service Units Forecast, Annex 1.

<https://www.eurocontrol.int/sites/default/files/content/documents/official-documents/forecasts/seven-year-flights-service-units-forecast-2015-2021-Feb2015.pdf>

Aircraft Operating Costs

Content

- Definition
- EUROCONTROL Recommended Source
- Description
- Other Possible Source

1 Definition

Flight and ground costs that are linked to the operation of an aircraft, such as fuel, crew, landing fees, ground handling, aircraft parking, air bridges and maintenance.

2 EUROCONTROL Recommended Source

Source 1	IATA (2013) - Airline Operational Cost Task Force (AOCTF) (now the Airline Cost Management Group, ACMG ¹), Airline Cost Conference Geneva - August 2013 http://www.iata.org/whatwedo/workgroups/Documents/acc-2013-gva/0930-1015_AOCTF_FY2012_Report_FERJAN.pdf
Source 2	IATA (2015) - Airline Cost Management Group (ACMG), Airline Cost Conference 2015 Geneva - August 2015 http://www.iata.org/whatwedo/workgroups/Pages/acc-2015.aspx

3 Description

Source 1 refers to the 2013 Airline Cost Conference and provides an overview of the operating cost for 10 Aircraft (B737 NG, A320 family, B737 Classic, B777, A330, B747, A340, B767, A380, Regional Jet being a combined fleet of EMB-170, EMB-190 and CRJ).

Aircraft Type	Flight Ops. Aircraft (in € million)	Flight Ops. /Flight Hour	Flight Ops. /Flight Cycle	Flight Ops. /Available Seat Km (€ Cents)	Flight Ops. /Available Ton Km (€ Cents)
B737 NG	10.3	3 226	5 771	3.25	26.54
A320 Family	11.3	3 600	7 554	3.54	28.59
B737 Classic	10.3	3 593	4 907	4.16	35.90
B777	37.8	8 718	50 205	3.57	21.23
A330	26.3	6 837	29 879	3.29	20.92
B747	33.5	10 858	67 299	3.36	24.03
A340	37.7	9 187	68 922	4.45	25.22
B767	26.3	6 217	40 315	3.71	19.95
A380	47.9	14 636	141 349	3.90	31.10
Regional Jet	6.8	2 670	4 244	4.70	36.44

(adjusted from \$2012)

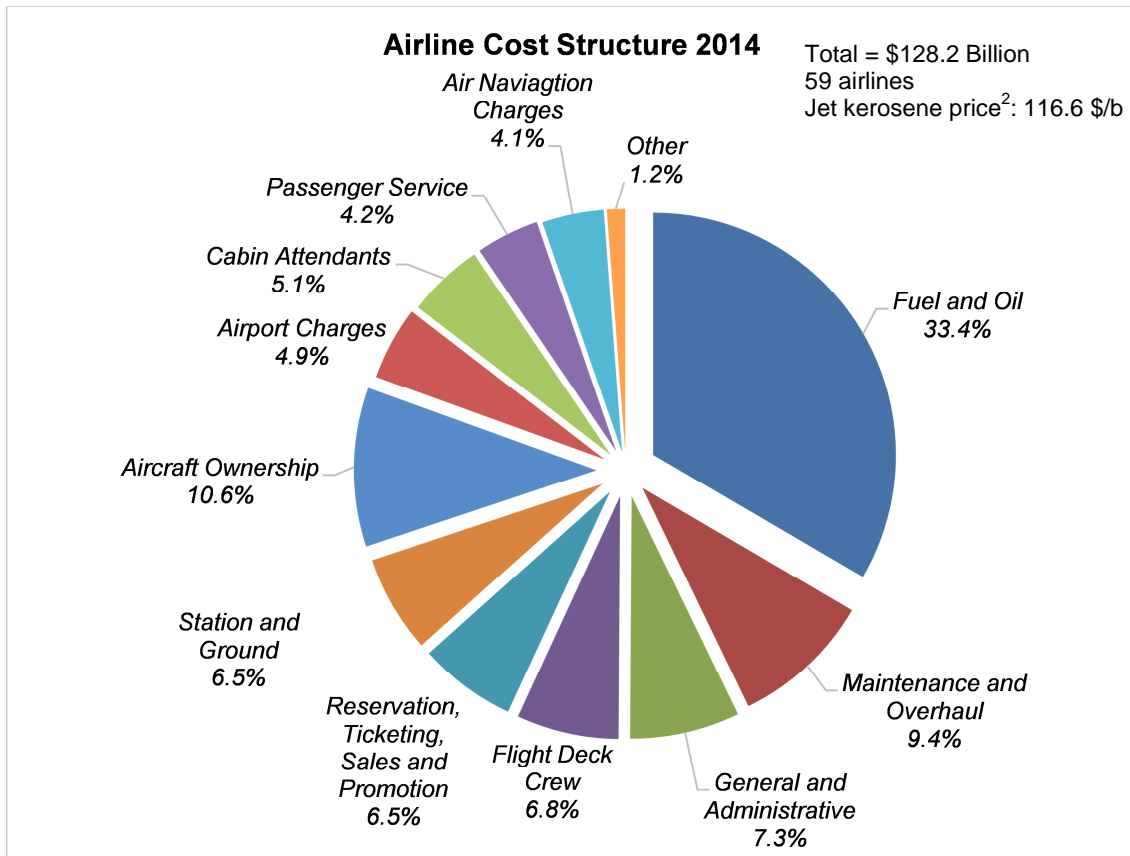
Source 2 refers to conference material used at the 3rd IATA Airline Cost Conference in Geneva on August 26th and 27th, 2015.

¹ IATA industry group focusing on matters concerning airline costs and measures to optimize them

The presentation “ACMG best year ever” presented by IATA shows the key highlights of the 2014 Cost Management Group (ACMG). The data used for the analysis is the result of the submission of 59 airlines worldwide with European airlines representing 51% of the share and 47% of the passengers carried.

The presentation, among others, provides information on:

- Aircraft type analysis (total 3 224 Aircraft)
- Strategic KPIs (Financial Performance)
- Operational KPIs (Fuel Cost and Efficiency, Staff Productivity, Employments Costs, On-time Performance)
- Airline Cost Structure as shown below:



4 Other Possible Source

Source	IATA (2013) - 2012 Airline Operational Cost Task Force Report http://www.iata.org/whatwedo/workgroups/Documents/acmg-mock-report.pdf
Description	The report examines operational costs for 2012. More precisely, it consolidates and analyses AOCTF airlines' operational data, cost structures and unit costs. The relevant data were collected from 30 airlines around the world.

² Note that the actual price paid for jet kerosene fuel will vary from the global average price depending on a range of airline and region-specific factors

Average Number of Passengers per Movement

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Values

1 Definition

Average³ number of passengers per movement (take-off or landing) in Europe.

2 EUROCONTROL Recommended Values

Value	<p>Values for the main 34 European airports (all operations).</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #e0e0e0;"></th> <th style="background-color: #e0e0e0;">2013</th> <th style="background-color: #e0e0e0;">2010</th> <th style="background-color: #e0e0e0;">2008</th> </tr> </thead> <tbody> <tr> <td>Passengers per IFR movement</td> <td>111</td> <td>102</td> <td>96</td> </tr> </tbody> </table>		2013	2010	2008	Passengers per IFR movement	111	102	96
	2013	2010	2008						
Passengers per IFR movement	111	102	96						
Source	<p>PRC and FAA, “2013 Comparison of Air Traffic Management-related Operational Performance: U.S./Europe”, June 2014 (page 37): https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systems/ato_intl/benchmarking/</p> <p>PRC and FAA, “2010 U.S./Europe Comparison of ATM-Related Operational Performance”, March 2012 (page 16): http://www.eurocontrol.int/documents/useurope-comparison-atm-related-operational-performance-2010</p> <p>PRC and FAA, “2008 U.S./Europe Comparison of ATM-Related Operational Performance”, October 2009 (page 13): http://www.eurocontrol.int/documents/useurope-comparison-atm-related-operational-performance</p>								

3 Description

The table below provides high-level indicators for the main 34 airports in Europe using data reported largely from the airports.

The Passenger per IFR movement is calculated by dividing the ‘Average number of annual passengers per airport’ by ‘Average number of annual movements per airport’.

A movement is either a take-off or a landing at an airport.

	2013	2010	2008
Average number of annual IFR movements per airport ('000)	228	237	260
Average number of annual passengers per airport (million)	25.4	24	25

³ Called (arithmetic) mean in mathematics and statistics

4 Other Possible Values

Value 1	ACI World Airport Traffic Reports				
		2014	2012	2010	2008
	Average number of passengers per movement for Europe	88	84	79	75
Source 1	ACI Media Releases http://www.aci.aero/News/Releases/Most-Recent				
Description 1	<p>The Average number of passengers per movement' for Europe is obtained by dividing the number of 'passengers' by the number of 'Movements' (excluding cargo, approximately 3.5% of all flights – see Number of IFR Flights (page 86))</p> <p>As these values relate to a larger number of airports than in the recommended value with a wider variety of aircraft sizes (in terms of passengers) the average number of passenger is lower.</p>				
Value 2	Average number of passengers per departing flight, EU28				
		2014	2013		
	Average number of passengers per departing flight	114	110		
Source 2	EUROSTAT, Air passenger transport by reporting country (extract: avia_paoc) http://ec.europa.eu/eurostat/web/transport/data/database				
Description 2	<p>The Average number of passengers per movement for a given year is obtained by dividing the number of 'departing passengers on board' by the number of 'departing flight for that year',</p> <p>The EUROSTAT Air transport domain contains national and international intra and extra-EU data. This provides air transport data for passengers (in number of passengers) and for freight and mail (in 1 000 tonnes) as well as air traffic data by airports, airlines and aircraft. Data are transmitted to Eurostat by the Member States of the European Union as well as the Candidate Countries, Iceland, Norway and Switzerland. The air transport data have been calculated using data collected at airport level.</p>				

Cancellation Cost

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Input
- Comments

1 Definition

The average cost of cancelling a commercial scheduled flight on the day of operations.

2 EUROCONTROL Recommended Values

Value 1		Narrowbody			Widebody		
	Cost of Cancellation	Traditional Network Carrier ⁴		Low Cost Carrier	Traditional Network Carrier		
	Seats	50	120	180	189	250	400
	Proposed value (€)	6 200	15 200	23 600	18 400	78 400	114 500
	of which passenger care & compensation (€)	3 100	7 600	12 400	17 500	40 500	64 800
		(€2014)					
Value 2	System wide average cancellation cost 2014: € 17 600						
Source	Data supplied by the airline member of the SESAR CBA team. Expert judgment derived from an analysis of 2012 total flights performed in Europe.						

3 Description

The values refer to cancellation on the day of operation and include:

- Service recovery costs, i.e. passenger care and compensation costs (passenger vouchers, drinks, telephone calls, hotels);
- Loss of revenues;
- Interline costs;
- Loss of future value, i.e. passenger opportunity costs (individual passenger delay expressed in value);
- Crew and catering costs;
- Passenger compensation for denied boarding and missed connection (estimated on the application of the EU regulation);
- Luggage delivery costs;
- Operational savings (fuel, airport and navigation fees, maintenance, handling outstations, lounges outstations).

⁴ Traditional carrier estimates can be used for regional carriers.

Ground handling costs e.g. ramp services, passenger services, field operation services are not included.

4 Related Standard Input

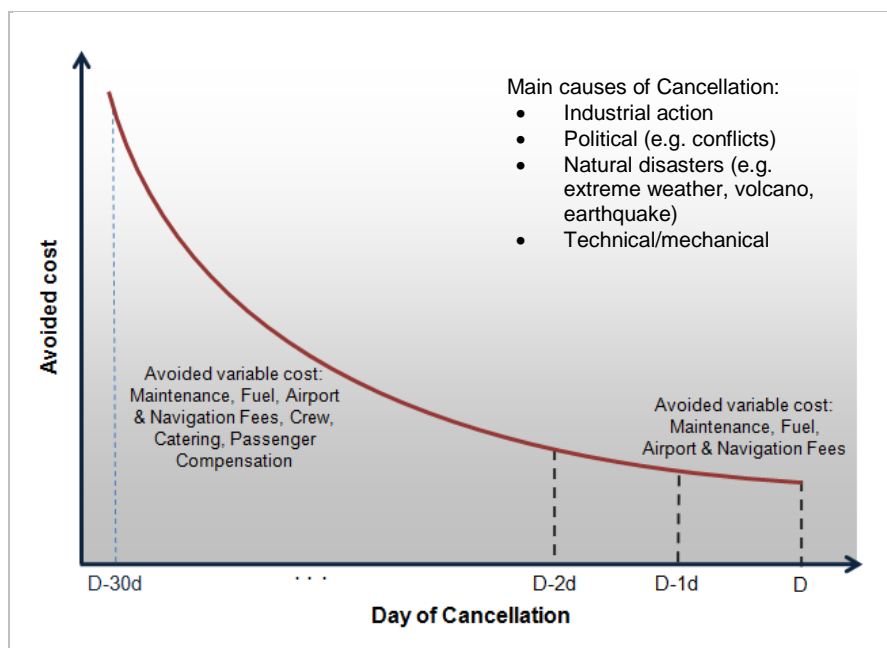
[Cancellation Rate](#) (page 13)

5 Comments

When a flight is performed, the airline incurs these out of pocket expenses (i.e. variable costs) but receives revenues which are 60-100% greater than the out of pocket expenses. Cancelling a flight means that the airline forgoes a substantial operating profit. Also, in addition to the loss, costs for the care and compensation of passengers are incurred.

Cancellation cost varies as a function of the time of cancellation.

Timely cancellation will enable the airline to take the necessary measures to mitigate the cost impact, for example, by rebooking passengers on another flight and allocating crew and aircraft to a different destination. Therefore, the cancellation costs will be minimal and are more in the region of incurred opportunity cost and passenger value of time. When the cancellation is nearer the flight time, i.e. on the day of operation, the cost of cancellation increases to cover expenses such as fuel, maintenance, airport and navigation fees, crew and catering.



Cancellation Rate

Content

- Definition
- EUROCONTROL Recommended Value
- Description
- Related Standard Input

1 Definition

IFR Flight cancellation rate in Europe.

2 EUROCONTROL Recommended Value

Value	1.5% in 2014
Source	EUROCONTROL (2015) - Based on data supplied by airports as per Annex IV of EC Regulation N° 691/2010, CODA, 2015 http://www.eurocontrol.int/publications/coda-digest-annual-2014

3 Description

For 2014, airlines providing operational cancellation data to CODA reported operational cancellations of 1.5% (this includes peaks of up to 8% on days with industrial action).

The results are based on operational cancellation data supplied by 30 of the 50 European coordinated airports reporting to CODA under EC Regulation N° 691/2010.

Chapter 4 of the referenced document contains a detailed analysis of the cancellations.

4 Related Standard Input

[Cancellation Cost](#) (page 11)

Cost of Delay

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Value
- Related Standard Inputs
- Comments

1 Definition

The average cost per minute to the airline of ground or airborne delay of a passenger air transport aircraft.

2 EUROCONTROL Recommended Values

Value 1	<p>Direct cost to an airline (for system wide use or individual airline studies)</p> <table border="1"> <thead> <tr> <th></th> <th colspan="2">Delay cost per minute (€)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Tactical with network effect (includes reactionary delay)</td> <td>Ground</td> <td>49.5</td> </tr> <tr> <td>Airborne</td> <td>69.2</td> </tr> <tr> <td rowspan="2">Strategic (buffer built into schedule)</td> <td>Ground</td> <td>16.7</td> </tr> <tr> <td>Airborne</td> <td>51.0</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(Adjusted to 2014 values)</i></p>		Delay cost per minute (€)		Tactical with network effect (includes reactionary delay)	Ground	49.5	Airborne	69.2	Strategic (buffer built into schedule)	Ground	16.7	Airborne	51.0
	Delay cost per minute (€)													
Tactical with network effect (includes reactionary delay)	Ground	49.5												
	Airborne	69.2												
Strategic (buffer built into schedule)	Ground	16.7												
	Airborne	51.0												
Value 2	<p>Overall cost to an airline (for individual airline studies, includes passenger opportunity cost)</p> <table border="1"> <thead> <tr> <th></th> <th colspan="2">Delay cost per minute (€)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Tactical with network effect (includes reactionary delay)</td> <td>Ground</td> <td>90.8</td> </tr> <tr> <td>Airborne</td> <td>110.5</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(Adjusted to 2014 values)</i></p>		Delay cost per minute (€)		Tactical with network effect (includes reactionary delay)	Ground	90.8	Airborne	110.5					
	Delay cost per minute (€)													
Tactical with network effect (includes reactionary delay)	Ground	90.8												
	Airborne	110.5												
Source 1 and 2	<p>University of Westminster (2004) for the EUROCONTROL PRC, "Evaluating the true cost to airlines of one minute of airborne or ground delay", May 2004 https://www.eurocontrol.int/sites/default/files/content/documents/sesar/business-case/evaluating_true_cost_of_delay_2004.pdf</p> <p>University of Westminster (2008) - Updated in Technical Discussion Documents (TDD) 5, 6 & 9 for the EUROCONTROL CARE INO III programme, October, November & June 2008 respectively http://www.eurocontrol.int/eec/public/standard_page/proj_CARE_INO_III_Dynamic_Cost.html</p> <p>University of Westminster (2011) for the EUROCONTROL PRU, "European airline delay cost reference values" – March 2011 https://www.eurocontrol.int/sites/default/files/content/documents/sesar/business-case/european_airline_delay_cost_reference_values_2011.pdf</p>													

3 Description

Values 1 and 2 are based on the methodology developed by the University of Westminster on behalf of the Performance Review Unit of EUROCONTROL.

The University of Westminster Report, published in 2004 and updated in 2011, represents the most recent and comprehensive appraisal of the cost of delays in the air traffic management system in Europe⁵. It contains a detailed assessment of the delay cost for 12 specific aircraft types and also derives an estimate of the average delay cost per minute in Europe. The appraisal considers the length of the delay, where the delay is incurred and whether only the initial delay is considered or whether the cost of reactionary knock-on effects (network effect) is included. It is to be noted that an ATFM delay is not considered as a delay for these purposes.

Three kinds of delays are calculated:

- Tactical delay *without network effect*: the actual initial delay without the effect of consequential delay caused either to the aircraft incurring the initial delay or to other aircraft.
- Tactical delay *with network effect*: the actual delay including the effect of consequential delay (reactionary delay) caused either to the aircraft incurring the initial delay or to other aircraft.
- Strategic delay: the buffer built into schedules in anticipation of delays.

For each type, the delay cost is split into:

- Ground delay: phases of flight before take-off and after landing of the aircraft;
- Airborne delay: en-route and arrival management phases, excluding the initial climb-out phase to 3 000 ft and from 3 000 ft to touchdown, which are not considered as generating delays.

The following table details the components of the cost of delay given in the recommended values:

Delay costs per minute (€)	Tactical without network effect		Tactical with network effect		Strategic	
	Ground	Airborne	Ground	Airborne	Ground	Airborne
Fuel costs	0.1	19.8	0.2	19.8	1.3	24.0
Maintenance costs	0.5	1.0	0.6	1.1	-	11.7
Crew costs	7.2	7.2	8.6	8.6	8.4	8.4
Ground and passenger handling	-	-	-	-	-	-
Airport charges	0.5	-0.0	0.6	0.1	-	-
Aircraft ownership costs ⁶	-	-	-	-	6.9	6.9
Passenger compensation	22.0	22.0	39.6	39.6	-	-
Direct cost to an airline	30.3	50.0	49.5	69.2	16.7	51.0
Passenger opportunity cost	22.9	22.9	41.2	41.2	-	-
Overall cost	53.2	72.9	90.8	110.5	16.7	51.0

(Adjusted to 2014 values)

⁵ The University of Westminster is currently finalising a full update of the 2010 values published in March 2011, to 2014 values. This new report, with full tabulations, will be published in December 2015, and will extend the range of aircraft covered to 15. This will also include feedback on a consultation distributed to airlines, focusing on updating the cost of passenger delay incurred by airlines, largely driven by Regulation (EC) No 261/2004. It is expected that strategic delay costs will increase by approximately 10% relative to the 2010 values, with primary tactical delay costs increasing by approximately 20%.

⁶ Includes depreciation, rent & lease costs

It is suggested to use the values as follows:

- The **Direct cost to an airline** values, which represent actual monetary payments, should be used when:
 - a) considering the cost of delay at the *network level* (i.e. delay over the whole fleet for all airlines)
 - b) only the direct airline costs are of interest.
- The **Overall cost values** should be used when considering the cost of delay to a *single airline* as, in addition to the direct cost to an airline, it includes the Passenger opportunity cost. This cost represents the loss of potential future earnings for a single airline. It should not be considered when the cost of delays are analysed for the whole fleet as the loss to one airline would, to a large extent, be a gain to another airline.
Note also that the passenger opportunity cost implicitly comprises the passenger value of time⁷ as the latter will depend on the passenger's acceptance of the occurred delay. Including the passenger value of time in addition to the passenger opportunity cost would be double counting.

Calculation method:

The values have been obtained by indexing the 2010 airline operating costs reported in the previous edition (Edition 6, September 2013) of the Standard Inputs with the inflation rate and calculating the fuel cost using 2014 jet fuel prices. No consideration is given to changes in the airline operating costs since 2010.

The following conversion indices were used:

Parameter	Value
Price index (Inflation)	Year 2014
Cost of fuel US \$/US gallon	\$ 2.78
US \$ - € exchange rate 2014	€ 1 = \$ 1.3285

The cost of fuel used in the tables does not account for the mark-up for delivery of the kerosene to the airport nor the hedging practiced by the airlines to buy their fuel. Consequently, the fuel price variations from one airport to another and from one airline to another are not included in the delay cost calculations.

Caveat related to the use of costs in Business Cases

It is not correct when comparing two scenarios to calculate the delay difference as a benefit without taking into account the corresponding marginal cost of capacity. In other words, there is a delay threshold below which the marginal cost of capacity outweighs the delay avoidance benefit.

The volatility of the cost of kerosene plays a significant role in the total cost variation. For some aspects of the analysis such volatility can introduce a bias in the decision as to whether an investment is justified or not. The detailed table, broken down into its different cost components, offers the capability to avoid such a bias and to undertake different sensitivity analyses.

Every CBA should carefully consider whether the improvements envisaged by the project are of a tactical or strategic nature. For a correct use and precise understanding of the tactical and strategic delay concepts refer to section 4 and Annex I of the University of Westminster Delay study of 2004 referenced above.

⁷ The value to a passenger of time spent travelling that might alternatively be spent working or at leisure.

4 Other Possible Value

Value	In Euro							
	Private travel	Sight-seeing	Sport	Business	Training	Aerial work	Air rescue	State aircraft
	€ 170	€ 189	€ 111	€ 1 108	€ 245	€ 1 104	€ 2 631	€ 1 879
	<i>(Adjusted from 2001 to 2014 prices)</i>							
Source	AOPA (2001) - Survey of German aircraft owners by AOPA Germany							
Description	<p>GA aircraft costs: AOPA Germany surveyed its members on the cost of delay for GA aircraft. Values are presented in terms of operating cost per flight hour or revenue per flight hour. These are not necessarily the 'costs of delay' but may be useful in assessing the impact of delay on GA users.</p> <p>These values are the results of a questionnaire sent out in 2002 to 400 German aircraft owners, which were chosen in an anonymous and representative way by DFS. Cost-figures for "Sport" are low because gliders and ultra lights are included. Many business flights are not commercial because companies use their own aircraft in corporate aviation.</p>							

5 Related Standard Inputs

[Cost of Distance Flown](#) (page 18), [Cost of Aviation Fuel](#) (page 56), [Exchange Rate](#) (page 60), [Inflation](#) (page 3) and [Passenger Value of Time](#) (page 35)

6 Comments

The cost of delay is an important and controversial value as it is frequently used to quantify the benefits of investments in Air Traffic Management/Communication, Navigation, and Surveillance and, hence, to justify these investments.

Cost of Distance flow

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Input

1 Definition

The average cost to an airline of one nautical mile flown by one of its passenger air transport aircraft.

2 EUROCONTROL Recommended Values

Value	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #e0e0e0;">Type of delay</th> <th style="background-color: #e0e0e0;">€/NM</th> </tr> </thead> <tbody> <tr> <td>Marginal (tactical)</td> <td>10.6</td> </tr> <tr> <td>Average (strategic)</td> <td>7.5</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(Adjusted to 2014 values)</i></p>	Type of delay	€/NM	Marginal (tactical)	10.6	Average (strategic)	7.5
Type of delay	€/NM						
Marginal (tactical)	10.6						
Average (strategic)	7.5						
Source	<p>University of Westminster (2004) for the EUROCONTROL PRC, "Evaluating the true cost to airlines of one minute of airborne or ground delay", May 2004 https://www.eurocontrol.int/sites/default/files/content/documents/sesar/business-case/evaluating_true_cost_of_delay_2004.pdf</p> <p>University of Westminster (2008) - Updated in Technical Discussion Documents (TDD) 5, 6 & 9 for the EUROCONTROL CARE INO III programme, October, November & June 2008 respectively http://www.eurocontrol.int/eec/public/standard_page/proj_CARE_INO_III_Dynamic_Cost.html</p> <p>University of Westminster (2011) for the EUROCONTROL PRU, "European airline delay cost reference values" – March 2011 https://www.eurocontrol.int/sites/default/files/content/documents/sesar/business-case/european_airline_delay_cost_reference_values_2011.pdf</p>						

3 Description

The value is based on the same data and methodology used to derive the value for the cost of delay but the data is used to derive the cost of flying a nautical mile rather than flying for a minute where:

- Marginal cost (€/NM) equals one additional nautical mile flown due to delay
- Average cost (€/NM) equals one nautical mile flown

In this context, the tactical cost of delay reflects the costs associated with 'unplanned' airborne delays. These are marginal costs of those additional nautical miles flown due to the delay. The additional delay would be costed at the actual direct operating costs i.e. fuel, maintenance, crew cost, ground and air navigation charges and passenger compensation for long delays.

Strategic delay costs reflect the costs 'planned' into the schedule, a flight that could be performed in 1 hour is planned for 1 hour 10 minutes based on historical data which shows 10 minutes of delay. Those additional 10 minutes are costed at the average cost which would include direct operating

variable and fixed costs and indirect operating cost. Because some of these costs can be mitigated (staff and fuel cost) the overall value is lower than for tactical 'unplanned' delay.

4 Related Standard Input

[Cost of Delay](#) (page 14)

Cost of Diversion

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Comments

1 Definition

The average cost for a commercial scheduled flight of a diversion to an airport other than the one initially planned.

2 EUROCONTROL Recommended Values

Value 1	Type of flight		Cost of flight diverted (€)	
	Regional flights		820 – 5 870	
	Continental flights		1 180 – 8 800	
	Intercontinental flights		5 870 – 64 600	
<i>(Adjusted from 2006 prices)</i>				
Source 1	Data supplied by the airline members of the SESAR evaluation team; derived from an analysis of 2006 ECAC data			

Value 2	Type of flight		Cost of flight diverted (€)	
	Business Aviation		7 400	
	<i>(Adjusted from 2012 prices)</i>			
Source 2	Data supplied by the airline members of the SESAR CBA team (2015)			

3 Description

For Value 2, the estimated cost for Business Aviation assumes that for each diverted flight there is one additional positioning flight.

4 Comments

There is no consideration of the penalties associated with late delivery of cargo as this type of data is not yet readily available.

In 2014 from the total number of flights with a destination in the EUROCONTROL Network Manager Area 19 390 flights (0.22%) landed at an airport other than initially planned.

En-route ANS Costs

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Comments

1 Definition

The costs of Air Navigation Services (ANS) in en-route airspace that is under the control of States/ANSPs.

2 EUROCONTROL Recommended Values

Value 1	€2009 Prices Zone: SES States ⁸ (EU-27 + 2)	2009	2010	2011	2012	2013	2014	2009-2014 AAGR ⁹
		Actuals					Estimate	
Total en-route ANS costs (M€2009)		6 248	6 072	5 972	6 048	5 948	6 155	-0.3%
Total en-route service units (Million)		98	100	105	104	105	109	2.1%
Total en-route ANS costs per SU (€2009)		63.7	60.4	56.9	58.4	56.6	56.6	-2.3%
Source 1	EUROCONTROL (2015) - Performance Review Report (PRR 2014), May 2015, chapter 6 https://www.eurocontrol.int/sites/default/files/publication/files/prr-2014.PDF							

Value 2	€2009 Prices Zone: SES States (EU-28 ¹⁰ + 2)	2015	2016	2017	2018	2019
		SES Target Setting (RP2)				
Total en-route ANS costs (M€2009)		6 148	6 056	5 904	5 757	5 613
Total en-route service units (Million)		109	110	111	113	114
Total en-route ANS costs per SU (€2009)		56.6	55.0	53.0	51.0	49.1
Source 2	European Commission (2014) - Commission Implementing Decision (2014/132/EU) setting the Union-wide performance targets for the ATM network and alert thresholds for the second reference period 2015-2016, 11 March 2014 https://www.eurocontrol.int/sites/default/files/content/documents/single-sky/pru/legals-docs/Implementation-Decision-2014-132-EU-performance-targets-RP2.pdf					

⁸ SES Member States are listed in [Member States \(and FIR for ESRA08\) and Geographical areas](#)

⁹ Annual Average Growth Rate

¹⁰ Addition of Croatia compared to table in Value 1 (Croatia joined the EU on 1st July 2013)

3 Description

ANS en-route costs per Service Unit (SU), **Value 1**, is measured on the basis of the total actual and determined en-route ANS costs (in real terms) divided by the number of en-route Service Units. A Service Unit (SU), used for the calculation of route charges, multiplies Aircraft Weight factor by Distance factor¹¹.

En-route costs can be calculated for a specific zone e.g. the Single European Sky (SES) member states (28 EU states plus Norway and Switzerland) or a Functional Airspace Block (FAB).

The en-route ANS determined costs for a reference period of five years are costs pre-determined by the SES States as referred to in Article 15(2)(a) of Regulation (EC) No 550/2004¹² for providing air navigation services. These include amounts for interests on debt, return on equity, depreciation of assets, as well as staff costs and non-staff operating costs for maintenance, operations, management and administration. These costs are determined at national level and comprise the costs of several entities (National Supervisory Authority, Air Navigation Service Provider(s), MET service provider and the State contribution to EUROCONTROL budget).

The **Value 2** table summarises the main relevant indicators defined in the Performance Scheme regulation and shows the changes in the en-route ANS costs per SU between 2015 and 2019 for the SES States (EU28+2).

Further information is available from

http://www.eurocontrol.int/prudata/dashboard/eur_view_2014.html

4 Comments

Terminal ANS costs and ANSP gate-to-gate economic performance are described separately in chapter 6 of the EUROCONTROL Performance Review Report (PRR 2014), May 2015 identified above.

¹¹ *The Unit Rate of Charge is the charge in Euro applied by a Charging Zone to a flight operated by an aircraft of 50 metric tonnes (weight factor of 1.00) and flying 100 kilometres (distance factor of 1.00) in the charge area of that State. Further information on the Unit rates calculation can be found following this link:*

<http://www.eurocontrol.int/sites/default/files/content/documents/route-charges/reference-documents/customer-guide-2014-version-9-0-final.pdf>

¹² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004R0550:20091204:EN:PDF>

Ground Handling Time

Content

- Definition
- EUROCONTROL Recommended Values
- Comment

1 Definition

The total duration in minutes for ground handling of an aircraft. Ground handling is the service necessary for an aircraft's arrival at and departure from an airport other than air traffic services.

2 EUROCONTROL Recommended Values

Value ¹³	Aircraft Category ¹⁴	Low (minutes)	Base (minutes)	High (minutes)
	Heavy	60	75	90
	Medium	41	51	61
	Light	29	36	43
Source	Airport CDM Cost Benefit Analysis EUROCONTROL Experimental Centre September 2005 http://www.euro-cdm.org/library/cdm_cba_2005.pdf			

3 Comment

Ground handling time typically varies as a function of:

- The given airport
- The type of flight (short, medium and long haul)
- The type of company (regular airline, low cost, business aviation, etc.)
- The type of aircraft (B738, A320, etc.)
- The type of service (charter, regular, positioning, etc.)

An aircraft at its home base airport will have longer ground handling time for maintenance purposes.

¹³ Low = Base – 20%, High = Base + 20%

¹⁴ Heavy, medium and light aircraft category relate ICAO wake vortex categories based on the maximum certificated take-off mass (http://www.skybrary.aero/index.php/ICAO_Wake_Turbulence_Category):

- **H** (Heavy) aircraft types of 136 000 kg (300 000 lb) or more;
- **M** (Medium) aircraft types less than 136 000 kg (300 000 lb) and more than 7 000 kg (15 500 lb); and
- **L** (Light) aircraft types of 7 000 kg (15 500 lb) or less.

IFR Flight Distance Overall

Content

- Definition
- EUROCONTROL Recommended Value
- Description
- Related Standard Inputs

1 Definition

The mean distance, in nautical miles, of an IFR flight¹⁵ within the EUROCONTROL Statistical Reference Area (ESRA08).

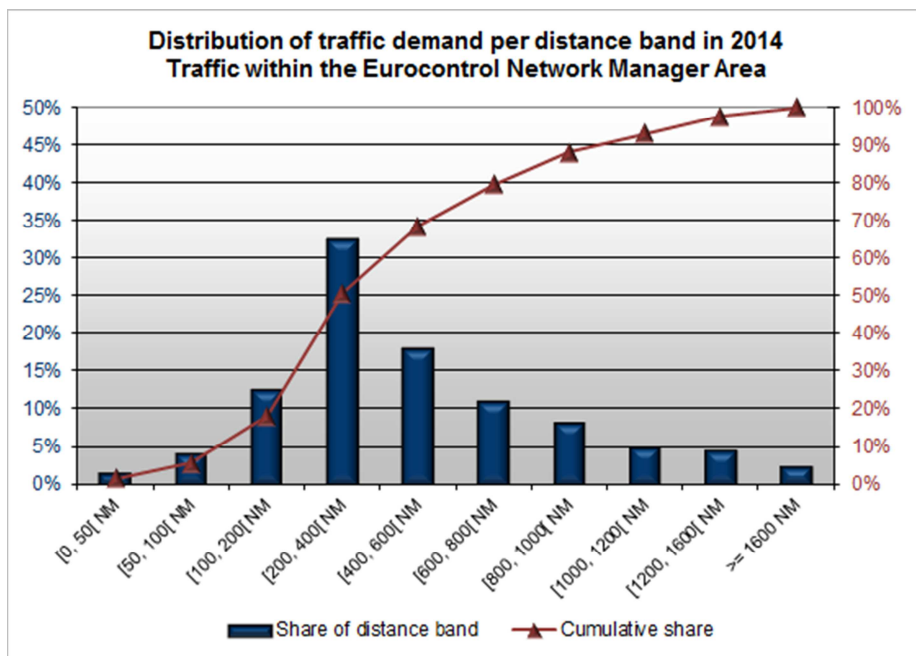
2 EUROCONTROL Recommended Value

Value	580 NM (1 074 km)
Source	EUROCONTROL – STATFOR, period 2014 – data available on request http://www.eurocontrol.int/articles/statistics (requires an access request ¹⁶)

3 Description

The value is obtained by dividing the total distance flown by the yearly number of IFR flights in the airspace of the European Statistical Reference Area (ESRA08)¹⁷.

The graph below shows that approximately 80% of the IFR flight distances are between 100 NM and 1 000 NM and about 50% of the flights have a range of 200 and 600 NM.



¹⁵ Departures, landings and overflights

¹⁶ Instructions for registering for access to the STATFOR Interactive Dashboard can be found at <http://www.eurocontrol.int/articles/statistics>

¹⁷ ESRA08 traffic region is described here: [Member States \(and FIR for ESRA08\) and Geographical areas](#)

4 Related Standard Inputs

[Air Traffic Statistics and Forecasts](#) (page 74), [Distance Flown by Charging Zone](#) (page 76), [IFR Flight Duration Overall](#) (page 26) and [IFR Flight Information per Operator Segment](#) (page 28)

IFR Flight Duration Overall

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Inputs

1 Definition

The mean duration, in hours, of an IFR flight¹⁸ within the EUROCONTROL Statistical Reference Area (ESRA08).

2 EUROCONTROL Recommended Values

Value 1	Average time from Take-off to Landing	
	Year	Minutes
	2014	91
	2013	90
	<i>(Values based on flights in the ESRA08¹⁹ area)</i>	
Source 1	EUROCONTROL (2015) - Performance Review Report (PRR 2014), May 2015 https://www.eurocontrol.int/sites/default/files/publication/files/prr-2014.PDF EUROCONTROL (2014) - Performance Review Report (PRR 2013), May 2014 http://www.eurocontrol.int/publications/performance-review-report-prr-2013	
Value 2	Average time Taxi-in and Taxi-out	
		Airport type
		min
	Taxi-in	Average airport
		High complexity airport (peak)
		Medium complexity airport (peak)
	Taxi-out	Average airport
		High complexity airport (peak)
		Medium complexity airport (peak)
	<i>(2013 Values based on flights in the ESRA08 area)</i>	
Source 2	EUROCONTROL (2015) - Computed from actual data provided by the EUROCONTROL Central Office for Delay Analysis (CODA)	

¹⁸ Departures, landings and overflights

¹⁹ ESRA08 traffic region is described here: [Member States \(and FIR for ESRA08\) and Geographical areas](#)

Value 3	Taxi-out <u>additional time</u> per departure (average per departure)	
	Year	Minutes
	2014	3.24
	2013	3.27
	2012	3.04
Source 3	PRB (2015) - ANS performance monitoring (EU wide level, 2014) Taxi-out additional time Performance Indicator (January–December 2014) http://www.eurocontrol.int/prudata/dashboard/eur_view_2014.html	

3 Description

Value 1 is obtained by dividing the total yearly IFR flight hours in Europe (ESRA08) by the yearly number of IFR flights:

- IFR flight hours within European airspace: 14.6 million
- IFR flights within European airspace: 9.60 million

Value 2 is based on actual data from CODA.

The taxi-in and taxi-out durations are calculated on the basis of and analysis of:

- 7 high complexity airports and an average duration of 11 peak hours.
- 4 medium complexity airports and an average duration of 2 peak hours.

Value 3 is published by the Performance Review Body (PRB) of the Single European Sky.

The PRB has developed an online performance monitoring dashboard which aims at supporting NSAs in their monitoring activities. It presents information related to the performance scheme at different levels: EU-wide, Performance Plan (either national or FAB) and Airports.

The dashboard covers all Key Performance Indicators (KPIs) and Performance Indicators (PIs) like additional taxi-out time regulated by the performance scheme Regulation.

In addition, KPIs are presented against adopted targets. The dashboard contains links to metadata detailing the calculation of each indicator as well as a download function which allows stakeholders to use the data for their own purpose.

4 Related Standard Inputs

[IFR Flight Distance Overall](#) (page 24), [IFR Flight Information per Operator Segment](#) (page 28) and

IFR Flight Information per Operator Segment

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Inputs

1 Definition

The mean distance, fuel consumption and flight duration of an IFR flight within the ECAC region.

2 EUROCONTROL Recommended Values

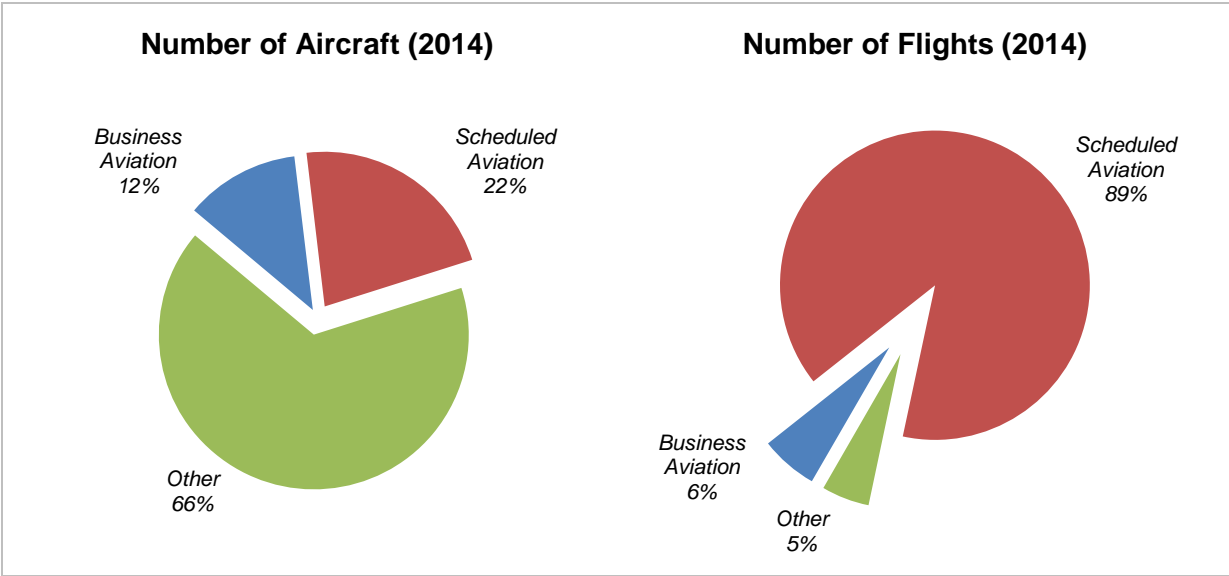
Value	Operator Segments	No. IFR Flights (x1000)	Average distance	Average Fuel Consumption	Average Flight Duration
	Scheduled Airlines	8 655	652 NM (1 207 km)	7 547 kg	100 minutes (1.66 hours)
Business Aviation	600	485 NM (898 km)	1 136 kg	82 minutes (1.37 hours)	
Total Scheduled and Business	9 255	641 NM (1 187 km)	7 132 kg	99 minutes (1.64 hours)	
<i>(Average values for 2014)</i>					
Source	EUROCONTROL - Derived from an analysis of 2014 IFR flights performed in Europe				

3 Description

The calculations were made based on the following assumptions:

- 2014 full year total distance and ECAC distance flown have been extracted from data collected by the Network Manager
- EUROCONTROL fuel consumption and carbon dioxide (CO₂) estimation tool approved by the European Commission with the Commission Regulation (EU) No. 606/2010.
- The latest version of the BADA²⁰ model 4 was used to correct the fuel consumption of the flights that are not flying 100% of their total distance within the ECAC region. This is necessary as 50% of the flight duration or distance does not equate to 50% of the fuel burn.
- 126 aircraft types have been identified for Scheduled Airlines and 70 aircraft types for Business Aviation. They represent 78% of the flights in the ECAC region. General Aviation, Military and other types of operations account for the remaining flights. In terms of the number of flights Scheduled aviation accounts for 89% of flights and Business Aviation 6%.

²⁰ BADA base of Aircraft Data <https://www.eurocontrol.int/services/bada>



4 Related Standard Inputs

[IFR Flight Duration Overall](#) (page 26), [IFR Flight Distance Overall](#) (page 24) and [Fleet Size](#) (page 81)

Load Factor - Cargo

Content

- Definition
- EUROCONTROL Recommended Value
- Description

1 Definition

The percentage of cargo space filled by paid cargo.

2 EUROCONTROL Recommended Value

Source 1

Association of European Airlines (AEA) website - Statistics
<http://www.aea.be/statistics>

Source 2

IATA - Economics
Air Freight Market Analysis
<http://www.iata.org/publications/economics/Pages/air-freight-monthly-analysis.aspx>

3 Description

Cargo can be defined as either freight carrier or passenger/cargo carrier.

Load Factor - Passenger

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Comments

1 Definition

The percentage of seats filled by fare-paying passengers.

2 EUROCONTROL Recommended Values

Value 1	Value	Type of Flight	Load Factor
	1.	Average scheduled	80.6%
		European Routes	76.2%
		Long haul	83.3%
	2.	Regional scheduled	71.2%
	3.	Low cost airlines	86.0%
Source 1	<p>1. Association of European Airlines (AEA) website – Statistics, 2014 http://www.aea.be/statistics</p> <p>2. European Regions Airline Association (ERA) - 2014/2015 Yearbook available upon request http://www.eraa.org/about/contactus</p> <p>3. European Low Fares Airline Association (ELFAA) website – Statistics, December 2014 http://www.elfaa.com/statistics.htm</p>		
Value 2	Europe: 80.8%		
Source 2	<p>IATA (2014) - Air Passenger Monthly Analysis - December 2014 http://www.iata.org/publications/economics/Pages/Air-Passenger-Monthly-Analysis.aspx</p>		

3 Description

The values are calculated by dividing Revenue Passenger-kilometres flown (paying passenger x km flown) by Available Seat-kilometres flown (Available seats x km flown) on revenue passenger services.

Note that some low cost carriers report their load factor as a percentage of tickets sold, not seats filled (i.e. they include no-shows).

4 Comments

The AEA Summary Report, ERA and ELFAA websites, identified above, provide a range of operating statistics for member airlines.

Similarly, a wide range of statistics for IATA is available at <http://www.iata.org/publications/economics/Pages/index.aspx>

Passenger Distribution

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading

1 Definition

The average distribution of aircraft passengers according to travel purpose.

2 EUROCONTROL Recommended Values

Value 1	Purpose of Travel (UK)		2014
	Business		21.2%
	Holidays		41.9%
	Visiting friends and relatives		34.0%
	Miscellaneous		2.9%
Source 1	UK Department for Transport (2015) – Aviation Statistics, July 2015 AVI0108 - Purpose of travel at selected UK airports: time series https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport		

Value 2	Purpose of Travel (France)		2013/2014
	Business		29.4%
	Holidays		43.1%
	Visiting friends and relatives		23.6%
	Miscellaneous		3.8%
Source 2	Direction Générale de l'Aviation Civile (DGAC) (2014) – France, Enquête Profil des Passagers aériens 2013-2014, September 2014 http://www.developpement-durable.gouv.fr/IMG/pdf/SDE1-1411c_-_Rapport_Annuel_ENPA_2013-2014_presentation_internet.pdf For previous reports: http://www.developpement-durable.gouv.fr/Enquete-Nationale-des-Passagers,29286.html		

3 Description

Results for **Value 1** are based on the UK CAA passenger Survey, which is carried out at selected airports (Gatwick, Heathrow, Luton, Stansted and Manchester, sample size ca. 153 000) each year. From 2004 to 2014 there was a 5% decrease in business travel and a 5% increase in travel to visit friends and relatives. Travelling for holidays has slightly decreased by 1% but for other purposes has remained stable.

Value 2 is based on a yearly survey carried out by the French DGAC since 2009. The results are based on a sample size of ca. 36 000 passengers departing from the 10 largest French airports (Paris CDG, Paris Orly, Lyon Saint Exupéry, Marseille Provence, Nice Côte d’Azur, Toulouse Blagnac, Bâle-Mulhouse, Beauvais, Bordeaux Mérignac and Nantes Atlantique).

4 Further Reading

UK Department for Transport

From the UK Department for Transport: Table TDGB0114: Overseas travel by air: visits to and from the UK: by area and purpose - all modes 2003-2013. This does not include domestic travel by air:

<https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons>.

Visits to and from the UK by purpose of travel	2013
Business visit	16%
Holiday	55%
Visiting friends and relatives	24%
Miscellaneous	5%

UK CAA (2014)

CAA Passenger Survey Report 2014

<http://www.caa.co.uk/docs/81/2014CAAPaxSurveyReport.pdf>

UNWTO (2015)

The United Nations World Tourism Organization publishes in its Yearly Compendium the Arrivals by main purpose (personal, business and professional).

<http://statistics.unwto.org/publication/compendium-tourism-statistics-2015-edition>

Passenger Value of Time

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Values
- Related Standard Input
- Further Reading

1 Definition

The value to a passenger of time spent travelling that might alternatively be spent working or at leisure.

2 EUROCONTROL Recommended Values

Value 1	<p>Estimated Value of Travel Time (average EU25)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #e0e0e0;">Per Hour</th> <th style="background-color: #e0e0e0;">Air Carrier</th> </tr> </thead> <tbody> <tr> <td>Personal²¹</td> <td>€ 13.61 – € 20.84</td> </tr> <tr> <td>Business</td> <td>€ 42.07</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(Adjusted from 2002 prices)</i></p>	Per Hour	Air Carrier	Personal ²¹	€ 13.61 – € 20.84	Business	€ 42.07
Per Hour	Air Carrier						
Personal ²¹	€ 13.61 – € 20.84						
Business	€ 42.07						
Source 1	<p>European Commission (2006) - HEATCO, Developing Harmonised European Approaches for Transport Costing and Project Assessment - Deliverable 5 Proposal for Harmonised Guidelines, IER Germany, February 2006 Commissioned by the EU (6th RTD Framework Programme) http://heatco.ier.uni-stuttgart.de/</p>						
Value 2	€ 47 - € 60 per hour per passenger (adjusted from 1999 prices)						
Source 2	<p>Institut du Transport Aérien (2000) - "Costs of Air Transport Delay in Europe", ITA, November 2000 http://www.eurocontrol.int/sites/default/files/content/documents/single-sky/pru/publications/other/cost-of-air-transport-delay-in-eu-ita.pdf</p>						

3 Description

The passenger value of time is an opportunity cost which corresponds to the monetary value associated with a traveller (passenger) during a journey. It is, essentially, how much a traveller would be willing to pay (WTP - Willingness To Pay) in order to save time during a journey (e.g. by travelling on a quicker service or a faster mode), or how much 'compensation' they would accept, directly or indirectly, for 'lost' time²².

²¹ Range varies in function of the length of the trip: short or long distance, commuting or other travel purpose

²² University of Westminster – European airline delay cost reference values report - Annex C – 31 March 2011

It is to be noted that the value of time is not cited as a function of delay duration here. This is an important consideration when using the value; the longer the delay duration the higher the value.

4 Other Possible Values

Value 1	€ 126 per hour per Business Aviation passenger (adjusted from 2011 prices)
Source 1	Data supplied by the airline members of the SESAR CBA team (2012)
Description 1	Given that typical business jet passengers are high-level executives/CEOs the passenger cost for lost time adapted from the EUROSTAT was estimated three times the value of a regular flyer.

Value 2	<p>Based on US DOT Guidance on Passenger Value of Time for Air and High Speed Rail Travel by Trip Purpose</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Per Hour²³</th> <th>Air Carrier</th> </tr> </thead> <tbody> <tr> <td>Personal</td> <td>US \$ 33.6 (€ 25.3)</td> </tr> <tr> <td>Business</td> <td>US \$ 61.9 (€ 46.6)</td> </tr> <tr> <td>All purposes</td> <td>US \$ 45 (€ 34.0)</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(2014 values and 2014 exchange rate)</i></p>	Per Hour ²³	Air Carrier	Personal	US \$ 33.6 (€ 25.3)	Business	US \$ 61.9 (€ 46.6)	All purposes	US \$ 45 (€ 34.0)
Per Hour ²³	Air Carrier								
Personal	US \$ 33.6 (€ 25.3)								
Business	US \$ 61.9 (€ 46.6)								
All purposes	US \$ 45 (€ 34.0)								

Source 2	<p>US Department of Transportation (2014) - Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, July 9, 2014 https://www.transportation.gov/sites/dot.g2ov/files/docs/USDOT%20VOT%20Guidance%202014.pdf</p>
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Description 2	<p>The value of passenger time saved or lost as a result of investments in transportation facilities or regulatory actions.</p> <p>This version of the guidance updates the guidance furnished by the Office of the Secretary of Transportation (OST) (“Departmental Guidance for the Valuation of Travel Time in Economic Analysis,” Office of the Secretary of Transportation Memorandum, April 9, 1997).</p> <p>The value of travel time for business travel is calculated on the basis of median hourly gross wage (hourly wage plus fringe benefits).</p> <p>The value for personal travel is based on annual household income category divided by 2 080 hours of work per year.</p> <p>When considering general aviation passengers as a separate category, a value of 70 percent of the median hourly income of Aircraft Owners and Pilots Association (AOPA) members is established for personal travel and 100 percent of median hourly income for business travel.</p> <p>The fractions of 70 percent and 100 percent were recommended by a panel of transportation economists.</p>
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²³ Values are left in US\$ due to exchange rate fluctuations

5 Related Standard Input

[Cost of Delay](#) (page 14)

6 Further Reading

Economic Development Research Group Inc (USA), (2015)

Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions, ACRP WOD 22, April 2015

Commissioned by the US Transportation Research Board of the National Academies

<http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2800>

The objective of this research was to prepare a guidebook that assists airport planners, managers, and operators in using benefit-cost analysis and other analytical techniques to make airport capital investment decisions in the US.

Rate of Fuel Burn

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Value and Sources
- Related Standard Input

1 Definition

Average number of kilogrammes per hour of fuel burn by an aircraft in different flight phases and with different load factors.

2 EUROCONTROL Recommended Values

Value	Fuel burn rates (kg/hr) in flight phases where delay can occur:									
	Flight Phase	APU only	Station only	Active taxi-out	En-route			Arrival Management ²⁴		
	% max payload weight	n/a	From 50% to 80%	From 50% to 80%	50%	65%	80%	50%	65%	80%
B737-300	115	690	822	2 355	2 436	2 523	1 821	1 872	1 929	
B737-400	115	690	894	2 337	2 412	2 500	2 160	2 232	2 308	
B737-500	115	690	894	2 169	2 226	2 290	1 507	1 536	1 569	
B737-800	115	690	816	2 485	2 574	2 670	2 102	2 256	2 299	
B757-200	150	820	1 296	3 195	3 312	3 418	2 443	2 538	2 609	
B767-300ER	150	1 120	1 536	4 514	4 728	4 943	4 106	4 296	4 499	
B747-400	280	2 700	2 868	9 484	9 810	10 126	6 221	6 414	6 609	
A319	120	630	696	2 240	2 304	2 374	1 959	2 028	2 099	
A320	120	630	924	2 279	2 358	2 432	2 224	2 304	2 390	
A321	120	730	828	2 695	2 790	2 887	2 394	2 490	2 588	
ATR42	95	102	306	419	432	446	415	426	439	
ATR72	95	240	366	628	630	640	522	528	536	

Source	University of Westminster (2011) - for the EUROCONTROL PRU, "European airline delay cost reference values" – March 2011 http://www.eurocontrol.int/documents/european-airline-delay-cost-reference-values

²⁴ Ref. Table F3 on p.68 of the UwM Final Report "European airline delay cost reference values". The Arrival management fuel burn assumes linear holding between FL50 and FL100. The average fuel burn between those FL was calculated using BADA tables for flight durations within 10% or 10 minutes of the average flight duration assumed per aircraft type in Table B1 on p.60.

3 Description

The above data are to be treated as approximations that give an indication of the average fuel burn per flight phase. However, these data do not take into account weather and atmospheric influences, the impact of speed etc, and, hence, are to be used with a correction factor when applied in a specific context.

The data originate from the delay studies by the University of Westminster and capture those phases of flight where delay occurs, i.e. the ground, en-route and arrival phase.

4 Other Possible Value and Sources

Value 1	<ol style="list-style-type: none"> 1) Average fuel burn per minute of flight = 49 kg 2) Average fuel burn per nautical mile (NM) of flight = 11 kg
Source 1	<p>ICAO (2007) - "Global Aviation Plan", ICAO, Doc 9750 AN/963, 3rd Ed. 2007 (Attachment 1, App-H08)</p> <p>http://www.icao.int/publications/Documents/9750_3ed_en.pdf</p>
Description 1	<ol style="list-style-type: none"> 1) This number is derived by dividing the total JET A1 consumption (55 billion US gal) by the total of minutes flown (3.4 billion) by all airlines (scheduled and non-scheduled) as per IATA statistics for 2005. 2) This number is derived by dividing the total JET A1 consumption (55 billion US gal) by the total of kilometres flown (27.9 billion) by all airlines (scheduled and non-scheduled) as per IATA statistics for 2005.
Source 2	<p>EUROCONTROL Advanced Emission Model (AEM)</p> <p>http://www.eurocontrol.int/services/advanced-emission-model-aem</p>
Description 2	<p>The EUROCONTROL Advanced Emission Model (AEM) is a stand-alone tool, which can estimate:</p> <ul style="list-style-type: none"> • the mass of fuel burnt by the main engines of a specified type of aircraft with a specified type of engine flying a specified 4D trajectory; • the corresponding masses of certain gaseous and particulate emissions which are produced by the burning of that fuel. The gases whose masses can be estimated include CO₂, H₂O, the oxides of nitrogen (NO_x) and sulphur (SO_x), unburnt hydrocarbons (HC), CO, benzene and some other volatile organic compounds (VOCs) and gases (TOGs). <p>The data input into the AEM is a set of flight profiles containing the types of aircraft and engine as well as 4D trajectory descriptions. This data is processed by the AEM on a flight-by-flight basis. The more precisely the trajectories are defined, depending on the user requirements for the study, the more precisely the resulting data on fuel burnt and emissions generated will be estimated.</p> <p>Apart from the 4D trajectory descriptions, the AEM requires other input data, such as known (type of aircraft, type of aircraft engine) combinations or emission indices. This data is provided by external suppliers so as to ensure its quality.</p> <p>The tool access requires an AEM user license.</p>

Source 3	EUROCONTROL BADA (Base of Aircraft Data) http://www.eurocontrol.int/services/bada
Description 3	BADA is an aircraft performance database. It provides a set of ASCII files containing performance and operating procedure data for 186 different aircraft types. For 71 of these aircraft types this data has been developed using reference sources such as Flight Manuals, Operating Manuals, etc. These are the so-called directly supported aircraft. For the other 115 types the data is specified to be the same as one of the directly supported aircraft.
Source 4	ICAO Engine Emissions Databank https://easa.europa.eu/document-library/icao-aircraft-engine-emissions-databank
Description 4	Rates of fuel burn for different phases of flight for individual engine types may be found in the manufacturers' datasheets in the ICAO Engine Emissions Databank.

Route Charges Share per Aircraft Operator Segment

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Input

1 Definition

The proportion of route charges²⁵ from Air Traffic Management (ATM) services in Europe (infrastructure, staff and other operational costs) per Aircraft Operator segment.

2 EUROCONTROL Recommended Values

Value	Segment	% of flights	% of KM flown	% of total charges collected
	Traditional scheduled airlines	55.2%	62.8%	74.3%
Low cost airlines	24.9%	19.2%	8.7%	
Business aviation	7.2%	4.8%	6.7%	
Charter flights	5.4%	6.1%	4.7%	
All cargo	3.5%	4.9%	3.3%	
Military	1.3%	1.3%	0.9%	
Other	2.6%	0.9%	1.5%	
Total	100.0%	100.0%	100.0%	

Source: EUROCONTROL Network Manager flight plans, PRISME Fleet data, and EUROCONTROL Central Route Charges Office, geographical coverage ECAC, year 2012 (detailed data not available for distribution)

3 Description

Airspace users have to pay for the services they use when flying in ECAC controlled airspace and so incur route charges for every flight they make. Route charges vary per charging zone. An "en-route charging zone" is a volume of airspace for which States establish a single cost base and a single unit rate. This "en-route charging" zone extends from the ground up to, and including, upper airspace. These are charged to the airspace users every month by EUROCONTROL's Central Route Charges Office (the CRCO).

The CRCO works out which portions of airspace were overflown for each flight and using a special formula, which, amongst other elements, takes the aircraft's weight into account (so smaller aircraft pay less) it calculates what each State is owed and on behalf of the States bills the airspace user. It then returns the appropriate proportion of the total route charge to each State over which the aircraft

²⁵ There are different sorts of air navigation charges: route charges, terminal navigation charges, and communication charges. The distribution above relates to route charges only.

flew. Information on the calculation of route charges can be found following this link:
<http://www.eurocontrol.int/articles/establishing-route-charges>

States use that money to fund en-route air navigation services, i.e. air traffic control and meteorological services.

A not significant amount of less than 1% of kilometres flown could not be allocated to a segment.

The operator segmentation used above is derived from STATFOR segmentation rules available in the STATFOR Interactive Dashboard (free registration to STATFOR OneSky Team required²⁶). Once registered, the STATFOR Interactive Dashboard can be accessed by logging into the EUROCONTROL Extranet.

4 Related Standard Input

[Distance Flown by Charging Zone](#) (page 76)

²⁶ *Instructions for registering for access to the STATFOR Interactive Dashboard can be found at*
<http://www.eurocontrol.int/articles/statistics>

Accident/Incident Statistics

Content

- Definition
- EUROCONTROL Recommended Sources
- Description
- Further Reading

1 Definition

Statistical studies and databases containing relevant quantitative and qualitative data on aviation accidents and incidents.

Accident: An occurrence associated with the operation of an aircraft ..., in which (a) a person is fatally or seriously injured... or (b) the aircraft sustains damage or structural failure ...or (c) the aircraft is missing or is completely inaccessible*²⁷

Incident: An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation*

* Definitions: ICAO, Annex 13

2 EUROCONTROL Recommended Sources

Source 1	EUROCONTROL (2015) - "Annual Safety Report 2014", EUROCONTROL Safety Regulation Commission (SRC), February 2015 https://www.eurocontrol.int/sites/default/files/content/documents/single-sky/src/src-docs/src-doc-54-e1.0.pdf
Source 2	EASA Annual Activity Report 2014 http://easa.europa.eu/newsroom-and-events/general-publications
Source 3	IATA Safety Report 2014, Issued April 2015 http://www.iata.org/publications/Documents/iata-safety-report-2014.pdf

3 Description

Source 1: The 2014 Annual Safety Report of the EUROCONTROL Safety Regulation Commission (SRC) provides a reference source on all matters related to the safety of Europe's air traffic management system, its performance to date and the issues affecting its future. The report focuses on safety occurrences with a direct or indirect ATM contribution.

²⁷ Accident full definition: An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which (a) a person is fatally or seriously injured as a result of: being in the aircraft; or direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or direct exposure to jet blast (except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers or crew); or (b) the aircraft sustains damage or structural failure which: adversely affects the structural strength, performance or flight characteristics of the aircraft and would normally require major repair or replacement of the affected component (except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin); or (c) the aircraft is missing or is completely inaccessible. (ICAO Annex 13)

Source 2: This document presents statistics on European and worldwide civil aviation safety. The statistics are grouped per type of operation and per aircraft category.

Source 3: This report provides the industry with critical information derived from the analysis of aviation accidents to understand safety risks in the industry and propose mitigation strategies.

4 Further Reading

EU (2010)

EU Regulation 996/20 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:295:0035:0050:EN:PDF>

(Containing a definition of accidents and incidents)

EU Single Sky Performance Review Body

Annual Monitoring Reports, years 2012, 2013 and 2014

<http://www.eusinglesky.eu/prb-report-library.html>

The Annual Monitoring Reports are prepared by the Performance Review Body (PRB) of the Single European Sky (SES).

Volume 1 of the reports provides a summary of European Air Navigation Services (ANS) performance in four Key Performance Areas (KPAs: safety, environment, capacity and cost-efficiency).

Volume 4 of the reports describes the process to assess and review the National/FAB Performance Monitoring Reports (PMRs) from the safety perspective and provide feedback on safety performance, measured by Safety Performance Indicators (SPIs).

It refers to, and uses data from, the States subject to the provisions of the SES Performance Scheme (RP1 SES States).

EUROCONTROL SRC (2005)

EUROCONTROL, Safety Regulation Commission (SRC) Document 2: Ed. 4.0 "Aircraft Accidents/Incidents and ATM Contribution: Review and Analysis of Historic Data", May 2005

<https://www.eurocontrol.int/sites/default/files/article/content/documents/single-sky/src/src-docs/src-doc-2-e4.0.pdf>

This SRC document presents a comprehensive summary of data on accidents and incidents largely derived from:

- "World Aircraft Accident Summary", Civil Aviation Authority (CAA) [now published by Airclaims Ltd. - ISSN 1366-6800]
- "ADREP" database, International Civil Aviation Organization (ICAO)
- "Aviation Safety Network" database

EVAIR, EUROCONTROL Voluntary ATM Incident Reporting Safety Bulletin

EVAIR collects ATM incidents which involve pilots and controllers. The established process and kind of the provided data enable day-to-day analysis and in this regard the identification of the incident causes. The data are collected from the whole ECAC region as well as from some neighbouring airspaces such as the Eastern part of the ICAO EUR region, Middle East, Africa, etc.

www.eurocontrol.int/services/evair

ICAO Safety Reports

Reports on worldwide aviation safety performance and collaborative efforts among international air transport stakeholders to further improve safety in light of the sustained growth of the sector.

<http://www.icao.int/safety/Pages/Safety-Report.aspx>

Performance Review Commission (2014)

The annual Performance Review Reports issued by the Performance Review Commission provide an annual review of ATM safety performance in Europe (Chapter 3 in PRR 2014).

<http://www.eurocontrol.int/articles/prc-and-prb-publications>

SKYbrary

SKYbrary is an electronic repository of safety knowledge related to ATM and aviation safety in general. It contains information about accidents and serious incidents per aircraft type and is also a portal that provides users access to the safety data made available on the websites of various aviation organisations (regulators, service providers, industry).

http://www.skybrary.aero/index.php/Main_Page

It also provides links to the latest published statistical summaries:

http://www.skybrary.aero/index.php/Aviation_Safety_Statistics

Value of a Statistical Injury

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading
- Related Standard Input
- Comments

1 Definition

The monetary value of an improvement in safety to achieve a (small and similar among the population) injury risk reduction that would prevent one statistical injury²⁸.

2 EUROCONTROL Recommended Values

Value	AIS²⁹ Level	Severity	Fraction of VSL
	AIS 1	Minor	0.003
	AIS 2	Moderate	0.047
	AIS 3	Serious	0.105
	AIS 4	Severe	0.266
	AIS 5	Critical	0.593
	AIS 6	Fatal	1.000
Source	US Federal Aviation Agency (2015) – Policy and Guidance, Benefit Cost Analysis Economic Values for Evaluation of FAA Investment and Regulatory Decisions: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses”, US Department of Transportation http://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/		

3 Description

The data presented above represent the value of improvements in safety that lead to a reduction of the risk of a statistical injury as a proportion of the Value of a Statistical Life (VSL) depending on the severity of the injury. The VSL is based on the concept of the willingness-to-pay (WTP) for a small risk reduction to prevent one statistical (i.e. unidentified in terms of age, gender etc.) injury.

Injuries are categorised according to the Abbreviated Injury Scale (AIS).

Injuries are classified into six categories on the Abbreviated Injury Scale (AIS), from AIS Code 1 for minor injuries to AIS Code 6 for fatal injuries. To establish a valuation for each injury level the level is related to the loss of quality and quantity of life resulting from an injury typical of that level. This loss is expressed as a fraction of a fatality. The willingness-to-pay (WTP) to avoid an injury of a particular level is estimated by multiplying the fraction by the value of life.

²⁸ Source : “The Value of a Statistical Life”, H. Anderson and N. Treich, Ecole d’économie de Toulouse, February 2009
http://swopec.hhs.se/vtiwps/abs/vtiwps2008_001.htm

²⁹ Abbreviated Injury Scale

As aviation injury data are often incomplete and/or unavailable at AIS, aviation injuries are reported by the number of victims suffering “serious” and “minor” injuries as defined by ICAO. Under this classification, serious injury victims are typically (but not always) those with at least one injury at AIS 2 or higher and minor injury victims typically (but not always) have injuries at the AIS 1 level only.³⁰

4 Further Reading

European Commission (2014), DG Regional Policy

Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020, December 2014

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

European Commission (2009), DG Transport and Energy

Cost-benefit analysis (for assessment impacts of road safety measures).

http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/cost_benefit_analysis.pdf

5 Related Standard Input

[Value of a Statistical Life](#) (page 48)

6 Comments

Table 3 “Recommended values of safety” of the 2009 (Safety) CBA by the EC (see “Further Reading”) shows that a fraction of 13% to 14% of the VSL is used for a “severe injury” and a fraction of 1% for a “slight injury” (Values based on national currencies only).

Comparing this with the MAIS values, the value life for a “severe injury” lies in the range MAIS 3 to MAIS 4 (6% and 19% respectively) and the value for a “slight injury” lies in the range MAIS 1 to MAIS 2 (0.2% and 1.6% respectively).

The EC safety CBA focus on road safety per country and does not take account of the willingness-to-pay principle in their monetisation of safety. The values would, therefore, generally be lower. As the MAIS is a proportion of the VSL it does take account of the willingness-to-pay principle.

The guide to Cost-Benefit Analysis of Investment Projects offers practical guidance on major EU projects appraisals. In addition to the presentation of the regulatory requirements for the project appraisal process and related decision, it provides general principles for carrying out CBAs and outlines of project analysis in sectors like e.g. transport, environment, energy etc. It makes explicit those aspects of the CBA that are sector specific.

The above data should be treated with caution as it can have legal implications.

³⁰ *Economic Values for FAA Investment and Regulatory Decisions, A Guide*
http://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/ECONOMICVALUESFORFAAINVESTMENTANDREGULATORYDECISIONS10032007.pdf

Value of a Statistical Life (VSL)

Content

- Definition
- EUROCONTROL Recommended Value
- Description
- Other Possible Value
- Related Standard Input
- Further Reading

1 Definition

The monetary value of an improvement in safety to achieve a (small and similar among the population) mortality risk reduction that would prevent one statistical death³¹.

2 EUROCONTROL Recommended Value

Value	€ 1 - 2 million
Source	European Commission (2009), "Part III : Annexes to Impact Assessment Guidelines", 15 January 2009 http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_annex_en.pdf

3 Description

In the "Annex to Impact Assessment Guidelines", the EC identifies several methods for quantitatively evaluating proposals with potential health impacts. They distinguish between non-monetary and monetary approaches. For the latter they distinguish between:

Human Capital (Accounting based approach)

A method used to calculate the value of lost productive capacity due to a traffic fatality. For several reasons this approach, which was mostly used to calculate the benefits from reduced mortality in the past, is no longer popular and now often combined with the "willingness-to-pay" principle approach of the VSL.

VSL Preference Based Approaches (see p. 42 of document identified in "EUROCONTROL Recommended Value")

The VSL is derived by investigating individuals' willingness-to-pay (WTP-principle) for a lower risk of mortality, divided by that risk reduction. The VSL method is used to estimate the value of lost quality of life. In the valuation of safety this approach is often used together with the human capital approach. The Guide to Cost-Benefit Analysis of Investment Projects, EC (2014) - referred to below in the Further Reading - section provides more details on how to calculate the VSL.

It should be noted that the European Aviation Safety Agency (EASA) uses the value of € 2 million³².

³¹ Source : "The Value of a Statistical Life", H. Anderson and N. Treich, Ecole d'économie de Toulouse, February 2009
http://swopec.hhs.se/vtiwps/abs/vtiwps2008_001.htm

³² EASA (2013)— Rulemaking Directorate Notice of Proposed Amendment 2013-20 - page 88
<https://easa.europa.eu/system/files/dfu/NPA%202013-20.pdf> -

4 Other Possible Value

Value	Special Drawing Rights (Air Carrier Liability) € 139 841 (August 2015)
Source	Council Decision 2001/539/EC of 5 April 2001 on the conclusion by the European Community of the Convention for the Unification of Certain Rules for International Carriage by Air (the Montreal Convention) [Official Journal L 194 of 18.07.2001]. http://europa.eu/legislation_summaries/transport/air_transport/l24255_en.htm
Description	<p>The above Council Decision ratifies the ICAO Montreal Convention. Under this Convention, air carriers are strictly liable for proven damages up to 113,100 Special Drawing Rights (SDR) (Updated from 100,000 on December 31, 2009), a mix of currency values established by the International Monetary Fund (IMF) (http://www.imf.org/external/np/fin/data/sdr_ir.aspx) Where damages of more than 113,100 SDR are sought, the airline may avoid liability by proving that the accident which caused the injury or death was not due to their negligence or was attributable to the negligence of a third party. This defence is not available where damages of less than 113,100 SDR are sought. The Convention also amended the jurisdictional provisions of Warsaw and now allows the victim or their families to sue foreign carriers where they maintain their principal residence, and requires all air carriers to carry liability insurance.</p> <p>The Montreal Convention was brought about mainly to amend liabilities to be paid to families for death or injury whilst on board an aircraft. The Montreal Convention, formally the Convention for the Unification of Certain Rules for International Carriage by Air, is a treaty adopted by a Diplomatic meeting of ICAO member states in 1999.</p> <p>The Montreal Convention was ratified by the European Union by means of Council Decision 2001/539/EC of 5 April 2001 on the conclusion by the European Community of the Convention for the Unification of Certain Rules for International Carriage by Air (the Montreal Convention) [Official Journal L 194 of 18.07.2001].</p>

5 Related Standard Input

[Value of a Statistical Injury](#) (page 46)

6 Further Reading

European Commission (2014), DG Regional Policy

Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020, December 2014

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

European Commission (2009), DG Transport and Energy

Cost-benefit analysis (for assessment impacts of road safety measures).

http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/cost_benefit_analysis.pdf

OECD (2011), Environment Directorate

Valuing Mortality Rate Reductions in Regulatory Analyses of Environmental, Health and Transport Policies: Policy Implications

<http://www.oecd.org/env/tools-evaluation/48279549.pdf>

European Commission (2001), DG Environment

Recommended Interim Values for the Value of Preventing a Fatality in DG Environment Cost Benefit Analysis”, Recommended VSL value: € 1 – 2 million.

http://ec.europa.eu/environment/enveco/others/pdf/recommended_interim_values.pdf

US DOT (2014)

Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S Department of Transportation Analysis – 2014 Adjustments

https://www.transportation.gov/sites/dot.gov/files/docs/VSL_Guidance_2014.pdf

World Health Organization (2014), Regional Office for Europe

Health Economic Assessment Tool (HEAT) – Value of a Statistical Life

<http://www.heatwalkingcycling.org/index.php?pg=requirements&act=vsl&PHPSESSID=q3jkco40bnm8aj7poon2v765o5>

ANSPs Employment Cost

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading

1 Definition

ANSPs' average annual employment cost for one Full Time Equivalent (FTE) cost in euro by category of staff.

2 EUROCONTROL Recommended Values

Value	Staff function	EUROCONTROL area	SES-29
	ATCOs in OPS	139	154
	Support Staff	69	87
	Average all staff	90	110
(€000 - 2013)			
Source	EUROCONTROL (2015) - ATM Cost-Effectiveness (ACE) 2013 Benchmarking Report with 2014-2018 Outlook – Performance Review Commission, May 2015. The current and previous editions can be found at: http://www.eurocontrol.int/prb/publications		

3 Description

One Full Time Equivalent (FTE) is assumed to be the hours worked by one person on a full time basis. This working time is converted into Employment Costs. Employment costs comprise gross wage, salaries and contribution to social security schemes, taxes, pension contribution and other staff related costs.

Employment costs are one of the key performance drivers of cost-effectiveness together with productivity and support costs.

For a study on employment costs, the different categories of staff working in an ANSP have been classified into two categories:

- **ATCOs in Operations:** this category considers only ATCOs working in Operations. Under this definition, full time equivalent (FTE) ATCOs are defined as participating in an activity that is either directly related to the control of traffic or is a necessary requirement for ATCOs to be able to control traffic. Usually this category benefits from a higher salary than other staff categories and has a direct impact on productivity.
- **Support Staff** or Non-ATCOs in Operations: this category includes all staff that is not an ATCOs working in Operations. This includes staff ranging from ATCOs in other duties, trainees, ATC assistants, technical and operational support staff, administration staff and others.

The following table gives an overview of national and average European system FTE costs for the two categories.

Average cost (€'000/year) European System Cost for one FTE			
ANSP	ATCO in OPS	Support staff	All staff
Albcontrol	53	18	24
ANS CR	125	62	76
ARMATS	14	8	9
Austro control	222	136	167
Avinor (Continental)	204	137	163
Belgocontrol	191	129	148
BULATSA	68	40	46
Croatia Control	125	60	82
DCAC Cyprus	131	34	78
DFS	184	101	127
DHMI	75	20	30
DSNA	125	92	104
EANS	96	31	51
ENAIRE	196	89	142
ENAV	145	106	126
Finavia	107	92	100
HCAA	115	49	68
HungaroControl	139	53	74
IAA	154	127	139
LFV	156	105	130
LGS	50	31	36
LPS	144	57	73
LVNL	247	110	141
MATS	59	34	43
M-NAV	45	25	30
MoldATSA	28	12	15
MUAC	229	155	186
NATS (Continental)	143	75	98
NAV Portugal (Continental)	235	91	134
NAVIAIR	147	94	110
Oro Navigacija	63	40	47
PANSA	109	44	62
ROMATSA	90	66	74
Skyguide	195	128	145
Slovenia Control	111	80	93
SMATSA	54	44	48
UkSATSE	39	22	25
Average	139	69	90

Source: "ATM Cost-Effectiveness (ACE) 2013 Benchmarking Report with 2014-2018 Outlook" – EUROCONTROL Performance Review Commission, May 2015.

The values in the above table were calculated from values provided in Annex 8 – Tables 0.3 and 0.5 of the source document.

Note: Staff costs refer to gate-to-gate cost comprised of en-route and terminal cost.

4 Further Reading

EUROCONTROL Performance Review Commission (2013)

2002-2011 U.S. Europe continental comparison of ANS cost-efficiency trends

This report of the EUROCONTROL Performance Review Commission compares trends in Air Navigation Services (ANS) provision costs in Europe and the United States of America (US) between 2002 and 2011.

<http://www.eurocontrol.int/publications/2002-2011-US-europe-continental-comparison-ans-cost-efficiency-trends>

Asset Life

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading

1 Definition

The accounting period in years for a given asset used in deriving the amortisation of investment expenditure.

2 EUROCONTROL Recommended Values

Value	Asset Type		Asset Life
	Freehold buildings, including related works services		between 20 and 40 years
	Leasehold buildings		over the period of the lease
	Furniture and fittings		between 10 and 15 years
	Motor vehicles		between 4 and 10 years
	Electronic equipment (including telecommunications equipment)		between 7 and 15 years
	General equipment		between 7 and 10 years
	Computer equipment		between 3 and 10 years
	Basic software and, if appropriate, application software		between 3 and 8 years
	Aircraft		between 10 and 20 years
Source	EUROCONTROL (2011) - "Principles for Establishing the Cost-Base for Route Charges and the Calculation of the Unit Rates", EUROCONTROL Central Route Charges Office, October 2011 ³³ https://www.eurocontrol.int/sites/default/files/content/documents/route-charges/reference-documents/eurocontrol-principles-effective-01-11-2013-en.pdf		

3 Description

Asset life used in cost benefit analyses should reflect the expected operating life of the specific equipment concerned which is also the basis for calculating depreciation costs that are taken into account to determine route charges. The above data provide typical bounds for classes of equipment.

³³ An amended version of the document was adopted by the enlarged Committee at its 99th Session of 26-27 June 2013 and is available here <https://www.eurocontrol.int/sites/default/files/content/documents/route-charges/reference-documents/eurocontrol-principles-effective-01-11-2013-en.pdf>. It does not list the asset life as in the recommended source.

4 Further reading

European Commission (2014), DG Regional Policy

Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020, December 2014

European Commission's reference periods by sector are on page 42.

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

Cost of Aviation Fuel

Content

- Definition
- EUROCONTROL Recommended Source
- Description
- Other Possible Sources
- Related Standard Inputs
- Further Reading

1 Definition

Current price of aviation fuel.

2 EUROCONTROL Recommended Source

Source	IATA Jet fuel price analysis (weekly and yearly average) http://www.iata.org/publications/economics/fuel-monitor/Pages/index.aspx
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3 Description

The IATA website provides jet fuel prices for the major regions of the world, together with analysis and commentary. The values are based on Platts Energy Market Data (www.platts.com).

Information on fuel prices is available in two forms, as a spot price at a port and as a retail price at an airport. The spot price is that paid by traders for fuel delivered at the port. The airport retail price is that offered to aircraft operators and includes the costs of transport to the airport, taxes, fees and suppliers margins, etc. This may be the price paid by small aircraft operators but large operators are normally able to negotiate substantial discounts with suppliers. These discounts are commercially sensitive and not generally disclosed.

Consideration should be given to the selection of the geographical area, and hence currency, as a change in oil price can have a different effect on the jet fuel price due to currency fluctuations, i.e. downturn of the Euro in 2015.

4 Other Possible Sources

Source 1	IATA Industry financial forecast briefing notes http://www.iata.org/publications/economics/Pages/industry-performance.aspx
Description 1	The IATA Industry Financial Forecast is published quarterly and identifies trends and forecast for on-going year. An overview of the revenues and expenses (including fuel prices) for the past ten years and forecast for the current year is given at the end of each briefing.

Source 2	U.S. Energy Information Administration (EIA) Annual Energy Outlook 2015 with projections to 2040 (AEO2015) http://www.eia.gov/forecasts/aeo/
Description 2	The Annual Energy Outlook 2015 (AEO2015) presents long-term projections of energy supply, demand, and price through 2040, based on results from the EIA's National Energy Modelling System under the assumption that current U.S. laws and regulations remain generally unchanged throughout the projection period. The projection up to 2040 for the prices of crude oil Brent spot (\$2013/bbl) and jet fuel (\$2013/gal) are in Table A.12 of the source document.

5 Related Standard Inputs

[Cost of Fuel](#) (page 4) and [Cost of Delay](#) (page 14)

In the Cost of Delay calculation the following jet fuel price (US \$/US gallon) is used based on 2014 average:

Parameter	Value
Cost of fuel US \$ per US gallon	\$ 2.78

6 Further Reading

US Energy Information Administration

The US Energy Information Administration website provides kerosene-type jet fuel spot price data for the US States.

<http://www.eia.gov/>

Air Nav

The Air Nav webpage presents a summary of airport retail prices for the most recent 84 days for 9 US locations.

<http://airnav.com/fuel/report.html>

Discount Rate

Content

- Definition
- EUROCONTROL Recommended Value
- Description
- Further Reading
- Comments

1 Definition

The annual rate used to discount a stream of cash flows in order to calculate their Net Present Value (NPV).

2 EUROCONTROL Recommended Value

Value	4% (for constant price cash flows)
Source	European Commission (2014), Commission Delegated Regulation (EU) No 480/2014, Article 19 (Discounting of Cash Flow) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0480&from=EN

3 Description

A nominal discount rate has three components:

- A basic, risk free, time value of money (TVM) - traditionally of the order of 2.5%,
- Compensation for the erosion of the principal by inflation,
- A premium for risk.

The inflation element should only be included if the cash flows are expressed in 'money of the day' and should be excluded if the cash flows are expressed at constant price levels.

The recommended value is inflation free and takes only into account TVM and risk premium.

The assessment of the risk premium depends on the judgement of the investor and can only be analysed over a portfolio of investments. In the case of investment in an air traffic management system, the risk being evaluated is the risk that the system will operate successfully and generate the benefits expected. It is not related to the commercial viability of aircraft operators using the system.

The value is used as an indicative benchmark in (EUROCONTROL) business cases for ATM investments and is applied to costs incurred and benefits achieved by air navigation service providers, aircraft operators and any other parties involved.

Values differing from the 4% benchmark can, however, be justified on the grounds of local and individual conditions which impact the required risk premium.

4 Further Reading

The EUROCONTROL Recommended Value of 4% is not suitable for discounting intergenerational projects, especially the projects dealing with environmental issues. A declining long term discount rate approach may be used following the example on p. 99 of HM's Treasury's "The Green Book – Appraisal and Evaluation in Central Government", 2003 Revised 2011:
http://www.hm-treasury.gov.uk/data_greenbook_index.htm.

For a discussion of practices in the USA, see the White House Office of Management and Budgets Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs":
<http://www.whitehouse.gov/omb/circulars/a094/a094.html>.

5 Comments

Different approaches to determining discount rates can be used (Social Rate of Time Preference, Marginal Social Opportunity Cost of Capital, Weighted Average Cost of Capital, Shadow Price of Capital). A description of these approaches goes beyond the limits of this document.

The choice of an appropriate social discount rate for cost benefit analysis of public projects has long been a contentious issue and subject to intense debate among economists.

Since the choice of discount rate is a matter judgement, it is recommended that in project appraisals the sensitivity analysis should include a consideration of the effect of differing discount rates. Note that the Internal Rate of Return (IRR) is the discount rate that will give a NPV of zero and thus gives the effective overall return on an investment over the period considered.

Exchange Rate

Content

- Definition
- EUROCONTROL Recommended Source
- Description
- Other Possible Values
- Related Standard Input
- Further Reading

1 Definition

Price or rate at which the currency of a country can be exchanged for another country's currency.

2 EUROCONTROL Recommended Source

Source	European Central Bank: http://sdw.ecb.europa.eu/ (go to Economic Concepts, Exchange rates, Bilateral) The website contains information on yearly, half-yearly, quarterly, monthly and daily exchange rates of 40 currencies
--------	--

3 Description

The European Central Bank calculates daily euro foreign exchange reference rates, based on weighted averages of bilateral euro exchange rates against 22 major trading partners of the euro area.

4 Other Possible Values

Value	Monthly accounting exchange rate http://ec.europa.eu/budget/inforeuro/index.cfm?Language=en
Source	European Commission, InforEuro

5 Related Standard Input

[Cost of Delay](#) (page 14)

6 Further Reading

OANDA

Average Exchange Rates. A multilingual currency exchange converter that calculates weekly, monthly, quarterly, or yearly average exchange rates for any user-specified time horizon.

<http://www.oanda.com/currency/average>

Value of an Average Passenger Flight

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading

1 Definition

Benefits in monetary value of an average passenger flight in the EU-28.

2 EUROCONTROL Recommended Values

Value	International flight ³⁴		Domestic flight	
	Consumer benefits per flight	25 374		4 655
Airline benefits per flight (excluding fuel and labour)	762		137	
Other producer benefits ³⁵ per flight (excluding fuel and labour)	1 854		692	
Wider economic	For a 10% rise in connectivity, long term labour productivity levels improved by 0.07%			
<i>(Adjusted from 2011 prices)</i>				
Source	IATA Economic Briefing – September 2013 “The value of an Average passenger Flight in the EU-27” http://www.iata.org/whatwedo/Documents/economics/Value_of_avg_flight_EU_FI_NAL.pdf			

3 Description

There is no commonly accepted standard for the value of a flight. The value will vary over time and between routes and whether it is a marginal flight or a new scheduled flight.

The values quoted above are the result of a study on the benefits in monetary value of an average passenger flight in the EU-28.

IATA, in their briefing note, values the economic benefits of an average scheduled passenger flight from perspective of the consumer, producers and economy as a whole. Their approach to the different benefits is outlined below.

³⁴ “International passengers include all departing international passengers from each member State and inbound passengers from non-EU countries, with only origin-destination passengers counted. Passengers transiting through the EU, with origins and destinations outside the EU, are not taken into account in this analysis. Flights between member States (between Germany and France) are considered as international flights whereas flights within a member State (from Spain to Spain) are classified as domestic flights. The assessment is based on scheduled passenger flights, including scheduled charter operations.”

³⁵ Other producers along the air transport value chain are airports, ANSPs, manufacturers, lessors, GDS/CRSs, travel agents, ground services, catering, and maintenance.

Consumer benefits

- These are the benefits to passengers in the EU market. Most passengers value air services more than their expenditure. The difference between the consumer's willingness to pay (or the gross consumer benefit) and the price paid constitutes the net consumer benefit.

Producer benefits

- Producer net benefits are assessed from an investor perspective. Investors will measure profitability by what that profit represents as a return on invested capital (ROIC). That return is calculated before payments of debt interest and shows the earnings available to pay both debt and equity investors.
- This analysis draws on earlier work undertaken by McKinsey & Company for IATA on profitability and the air transport value chain, which calculates the global return on invested capital over the last business cycle 2004-2011.³⁶ The calculated global return on invested capital for each sector in the value chain is based on sample data and represents actual returns earned rather than required and/or desired returns.³⁷ Based on these figures the share of producer net benefits accrued in the EU-27³⁸ is estimated.

Wider economic benefits

- These are the benefits to the wider economy that go beyond the direct users of air transport. This may include spill-over impacts within and across economies as a result of increased competition and more efficient movement of capital and labour.
- One of the largest economic benefits of increased connectivity comes from its impact on long-term productivity of the wider economy. There are several approaches that may be used to quantify this benefit. One conservative approach that has been developed based on the statistical relationship between air connectivity and labour productivity yields an estimate that a 10% rise in connectivity, relative to a country's GDP, will boost labour productivity levels by 0.07%³⁹.

The use of these values in CBAs depends on the scope and the viewpoint for the CBA. For example, a CBA for Airlines will focus on the benefits to airlines of an additional flight, whereas a CBA for a Government or the European Commission should also include an assessment of benefits to consumers and the wider economy.

Note also that these values reflect the market conditions and the passenger demand at the time of the study. For example, changes in passengers' income, changes in their preferences for air transport or changes in airlines' market structure can impact these values.

³⁶ IATA, "Profitability and the Air Transport Value Chain" 2013, available at <http://www.iata.org/whatwedo/Documents/economics/profitability-and-the-air-transport-value-chain.pdf>

³⁷ IATA does not endorse the use of the estimated rates of return on invested capital for purposes of economic regulation or for determining the appropriate or desirable rate of return on invested capital. The figures used are based on a global assessment of the actual prevailing returns on invested capital within the air transport value chain.

³⁸ The allocation of producer benefits for airports, GDS/CRS, and travel agents is done based on the share of global passengers flown either domestically (6%) or internationally (18%) from and within the EU-27. This approach treats domestic and international passengers equally in their contribution to the producer benefit. The allocation of producer benefits for airlines, ANSPs, manufactures, lessors, ground services, catering, and maintenance is done based on the share of global available seat kilometres flown either domestically (2%) or internationally (19%) from and within the EU-27. These approaches do not account for structural differences that may exist between the EU and other regions. Nevertheless, these approaches provide a relevant estimation since they are less prone to short and medium-term shocks such as natural disasters and macroeconomic crises that can create temporary distortions in the value chain.

³⁹ IATA, "Aviation Economic Benefits" 2007, available at http://www.iata.org/whatwedo/Documents/economics/aviation_economic_benefits.pdf

4 Further Reading

Contribution of General Aviation to UK economy

The study “General Aviation Small Aerodrome Research Study” carried out in 2006 by the Bartlett School University College London, focuses on the socio-economic contribution that General Aviation brings to the UK economy and the benefits it brings to industry and direct employment.

<http://www.gaac.org.uk/gasar/gasar.htm>

Amount of Emissions Released by Fuel Burn

Content

- Definition
- EUROCONTROL Recommended Values
- Other Possible Sources

1 Definition

Amount (mass) of emissions released by the combustion of aviation fuel.

2 EUROCONTROL Recommended Values

Value		
	Emissions	Amount emitted (per kg of fuel burnt)
	CO ₂	3.15 kg
	H ₂ O	1 230 kg
	SO ₂	0.00084 kg
Source	EUROCONTROL (2001) - "Forecasting Civil Aviation Fuel Burn and Emissions in Europe, EEC Note No. 8/2001", EUROCONTROL Experimental Centre, May 2001 https://www.eurocontrol.int/eec/gallery/content/public/document/eec/report/2001/015_Forecasting_Fuel_Burn_and_Emissions_in_Europe.pdf	

3 Other Possible Sources

Source 1	European Environment Agency (2013) "EMEP/EEA air pollutant emission inventory guidebook —2013" http://www.eea.europa.eu/publications/emep-eea-guidebook-2013 Values extracted from: Part B: sectoral guidance chapters / 1. Energy / 1.A. Combustion / 1.A.3.a Aviation update August 2014.pdf / Table 3.3 http://www.eea.europa.eu/publications/emep-eea-guidebook-2013/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-a-aviation/view
Description 1	The Emission Inventory Guidebook gives values for emission factors (for CO ₂ , CH ₄ , N ₂ O, NO _x , CO, NMVOC, SO ₂ and PM _{2.5}) and fuel consumption during different phases of flight including taxi for different aircraft types using three different levels of accuracy and complexity. In the table above the emission factors for the "Very Simple" (called Tier 1) methodology are given on a representative aircraft basis, using jet kerosene as fuel.

Source 2	ICAO Aircraft Engine Emissions Databank (for TurboJet and Turbofan Aircraft) https://easa.europa.eu/document-library/icao-aircraft-engine-emissions-databank
Description 2	This Databank contains information on exhaust emissions of only those aircraft engines that have entered production. The information was provided by engine manufacturers and collected by the International Civil Aviation Organization (ICAO). The European Aviation Safety Agency (EASA) is hosting this Databank on behalf of ICAO.
Source 3	FOI, Swedish Defence Research Agency (for Turboprops Aircraft) http://www.foi.se/en/Our-Knowledge/Aeronautics/FOIs-Confidential-database-for-Turboprop-Engine-Emissions/
Description 3	FOI is the keeper of a confidential database of emission indices (EI) of NO _x , HC and CO with corresponding fuel flows for turboprop engines. Datasheets have been supplied by the turboprop engine manufacturers, originally for the purposes of calculating emissions-related landing charges. The data are presented in the same format as the ICAO (International Civil Aviation Organization) Engine Emissions Database for jet engines, but have not been endorsed by ICAO in a certification process. It should be noted that the data have many inaccuracies resulting primarily from the unregulated test methodologies. The data is however considered as being the best available and may be used for emissions inventories, emissions-related landing charges etc.
Source 4	Swiss Federal Office of Civil Aviation, FOCA - Aircraft Engine Emissions (for Piston Engine Aircraft) http://www.bazl.admin.ch/experten/regulation/03312/03419/index.html?lang=en
Description 4	Swiss FOCA has developed a measurement and calculation methodology for aircraft piston engine emissions to improve aviation emission inventories.

Cost of Noise

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Values
- Further Reading
- Comments

1 Definition

Estimation of cost of noise per person affected, taking into account both cost of annoyance and health costs due to traffic noise exposure.

2 EUROCONTROL Recommended Values

Value 1	Noise Costs (€ / person / year) for different noise levels: aviation					
	Country	Noise levels L_{den} in dB(A) ⁴⁰				
		55-59	60-64	65-69	70-74	75-79
	France	134	228	324	478	621
	Germany	122	209	296	439	571
	Italy	126	216	306	452	589
	Spain	130	223	315	461	598
United Kingdom	139	238	337	498	648	
<i>(Adjusted from 2008 prices)</i>						
Source 1	<p>“External Costs of Transport in Europe”, CE Delft, November 2011 http://www.cedelft.eu/publicatie/external_costs_of_transport_in_europe/1258</p>					
Source 2	<p>European Commission (2014) - Update of the Handbook on External Costs of Transport, Ricardo AEA, January 2014 (commissioned by European Union DG Move) http://ec.europa.eu/transport/themes/sustainable/studies/doc/2014-handbook-external-costs-transport.pdf</p>					

⁴⁰ dB (A): Levels on a decibel scale of noise measured using a frequency dependent weighting, which approximates the characteristics of human hearing. These are referred to as A-weighted sound levels.

L_{den} : Equivalent sound level of aircraft noise in dBA for the 24-hour annual day, evening, and night where the evening movements are weighted by 5 dB and night movements are weighted by 10 dB.

Source: UK CAA <https://www.caa.co.uk/docs/33/ERCD0905.pdf>

3 Description

The above table is extracted from a study carried out by CE Delft (an independent research and consultancy organisation) on the external costs of different types of transport in Europe (Table 62). It gives an overview of the noise costs used for people exposed to different noise level bands due to aviation. Two major impacts are considered in the study when assessing noise impact and cost:

- Annoyance; referring to the disturbance which individuals experience when they are exposed to noise (traffic noise in this case) e.g. discomfort, inconvenience.
- Health impacts; due to the long term exposure to noise. The most common symptoms are stress related health effects such as hypertension and myocardial infarction, insomnia, hearing damage and increased risk of cardiovascular diseases.

The values in this table are based on the HEATCO 2006; Deliverable D5 (+ Annex) (see “Further Reading”). The HEATCO values are bundled in dB ranges corresponding to the ranges for which the number of exposed people is reported. The CE Delft study contains aviation noise cost details for 27 European countries.

Comparable values for road and rail noise costs are also available in the same study.

4 Other Possible Values

Value 1	Noise Social Cost by Aircraft Category (€ / landing)						
	Cat.	Aircraft Type	Heathrow	Schiphol	Gatwick	Stansted	Maastricht
	1	Jetstream 31	37	18	1	1	18
	2	B737-300	668	347	25	14	339
	3	A310-203	1 088	564	41	22	553
	4	B747-400	2 586	1 341	97	54	1 313
	5	B747-100F/200/300	3 938	2 043	148	82	2 001
	6	B737-200QN	2 665	1 383	100	56	1 354
7	B727	2 873	1 490	107	60	1 460	
	<i>(Adjusted from 2001 prices)</i>						
Source 1	Lu, Cherie and Morrell, Peter (2006) “Determination and Applications of Environmental Costs at Different Sized Airports - Aircraft Noise and Engine Emissions”, Transportation 33(1):45-61 https://dspace.lib.cranfield.ac.uk/bitstream/1826/3151/1/Determination_and_Applications_of_Environmental_Costs_at_Different_Sized_Airports-2006.pdf						
Description 1	This table is extracted from a paper in which the authors are attempting to define the environmental costs at different airports (Table 7, page 31). The noise social costs in particular, are derived from a formula based on the hedonic price method (HPM). This method is based on revealed behaviour and on the household equilibrium marginal willingness to pay. Three British and two Dutch airports were taken as the case studies. Based on the aircraft noise classification used at Heathrow Airport, the aircraft types were split into seven categories, with a representative aircraft type being selected for each of the categories.						

Value 2	Estimated cost of noise nuisance per aircraft event (i.e. landing and take-off)																	
	<table border="1"> <thead> <tr> <th>Aircraft Type</th> <th>Marginal Damage Costs (€)</th> </tr> </thead> <tbody> <tr> <td>A310</td> <td>77</td> </tr> <tr> <td>A340</td> <td>175</td> </tr> <tr> <td>B737-400</td> <td>77</td> </tr> <tr> <td>B747-400</td> <td>383</td> </tr> <tr> <td>B757</td> <td>101</td> </tr> <tr> <td>B767-300</td> <td>123</td> </tr> <tr> <td>B777</td> <td>75</td> </tr> <tr> <td>MD82</td> <td>111</td> </tr> </tbody> </table> <p style="text-align: center;"><i>(Adjusted from GB £ 2000 prices)</i></p>	Aircraft Type	Marginal Damage Costs (€)	A310	77	A340	175	B737-400	77	B747-400	383	B757	101	B767-300	123	B777	75	MD82
Aircraft Type	Marginal Damage Costs (€)																	
A310	77																	
A340	175																	
B737-400	77																	
B747-400	383																	
B757	101																	
B767-300	123																	
B777	75																	
MD82	111																	
Source 2	“Valuing the External Costs of Aviation”, UK Department of Environment, Transport and Regions (DETR), December 2000 (scope: UK)																	
Description 2	<p>The approach, known as hedonic pricing, measures householders’ willingness to pay to reduce noise through house purchase prices. This attempts to identify the premium that, other characteristics being equal, is paid for a quieter house in terms of rent or purchase price. The results of hedonic pricing studies of noise are often summarised with “noise sensitivity depreciation index (NSDI)”, which provides a measure of the percentage change in house price associated with a unit change in noise quantity measured in dBA Leq.</p> <p>Values found for NSDI range between 0.5% and 1%. The estimates of the marginal willingness to pay (MWTP) per aircraft event for each aircraft type were derived by adopting the NSDI value of 0.6%. By applying this value to the average house price within the Heathrow airport 57 dBA daytime contour and by multiplying it by the number of resident households, an estimate was derived of overall MWTP for a 1 dBA Leq reduction in the area. This figure was converted into a daily MWTP. In order to derive estimates of MWTP for the reduction of a daily movement of each aircraft type, the impact on Leq of each aircraft type was multiplied by the daily overall MWTP.</p>																	

5 Further Reading

European Commission, EU Policy on environmental noise
<http://ec.europa.eu/environment/noise/home.htm>

World Health Organization, “Night noise guidelines for Europe”
http://www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf

HEATCO
 Developing Harmonised European Approaches for Transport Costing and Project Assessment”, 2002 – 2006
<http://heatco.ier.uni-stuttgart.de/>

ACI and CANSO (2015)
 Managing the Impacts of Aviation Noise: A Guide for Airport Operators and Air Navigation Service Providers
<http://www.aci.aero/Publications/New-Releases/ACI-and-CANSOs-Managing-the-Impacts-of-Aviation-Noise>

6 Comments

The estimates of noise damage costs are subject to significant margins of error, due to a number of sources of inaccuracy in their derivation.

Hedonic pricing analysis has to contend with a great many factors which cannot be fully identified by statistical methods. WTP values are not likely to be uniform across the population and there is likely to be an element of self-selection with people less adverse to noise (and aviation industry workers) choosing to live around airports. This means that caution should be taken in applying the results to people not currently affected by aircraft noise.

Cost of Pollutants

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Further Reading
- Comments

1 Definition

Estimation of cost of CO₂ and other aircraft emissions released by the combustion of aviation fuel.

2 EUROCONTROL Recommended Values

Source 1	Future Price of CO ₂ in € per tonne, European Emission Allowances (EEA) Futures https://www.eex.com/en/market-data/emission-allowances/derivatives-market/european-emission-allowances-futures#!/2015/10/01																														
Value 2	<p>Damage costs of main pollutants from transport, in € per tonne</p> <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">PM_{2.5}</th> <th rowspan="2">NO_x</th> <th rowspan="2">NMVOC</th> <th rowspan="2">SO₂</th> </tr> <tr> <th>Rural⁴¹</th> <th>Sub urban</th> <th>Urban</th> </tr> </thead> <tbody> <tr> <td>EU average</td> <td>30 359</td> <td>75 884</td> <td>291 813</td> <td>11 492</td> <td>1 691</td> <td>11 061</td> </tr> </tbody> </table> <p>(adjusted from €2010⁴²)</p>		PM _{2.5}			NO _x	NMVOC	SO ₂	Rural ⁴¹	Sub urban	Urban	EU average	30 359	75 884	291 813	11 492	1 691	11 061													
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	Rural ⁴¹	Sub urban	Urban																												
EU average	30 359	75 884	291 813	11 492	1 691	11 061																									
Value 3	<p>Marginal air pollution costs for passenger aviation, EU average</p> <table border="1"> <thead> <tr> <th rowspan="2">Distance group</th> <th rowspan="2">Type of aircraft</th> <th rowspan="2">Range</th> <th rowspan="2">Typical number of seats</th> <th rowspan="2">Average capacity utilisation</th> <th colspan="2">Air pollution costs</th> </tr> <tr> <th>€/LTO</th> <th>€ Cent/km</th> </tr> </thead> <tbody> <tr> <td>Short haul</td> <td>Fokker 100</td> <td>< 1 000 km</td> <td>85</td> <td>65%</td> <td>81</td> <td>0.29</td> </tr> <tr> <td>Medium haul</td> <td>Airbus A320</td> <td>< 3 700 km</td> <td>150</td> <td>70%</td> <td>145</td> <td>0.05</td> </tr> <tr> <td>Long haul</td> <td>Boeing 747-400</td> <td>> 3 700 km</td> <td>416</td> <td>80%</td> <td>700</td> <td>0.03</td> </tr> </tbody> </table> <p>(adjusted from €2010)</p>	Distance group	Type of aircraft	Range	Typical number of seats	Average capacity utilisation	Air pollution costs		€/LTO	€ Cent/km	Short haul	Fokker 100	< 1 000 km	85	65%	81	0.29	Medium haul	Airbus A320	< 3 700 km	150	70%	145	0.05	Long haul	Boeing 747-400	> 3 700 km	416	80%	700	0.03
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Source 2 and 3	Update of the Handbook on External Costs of Transport, Ricardo AEA, January 2014 (commissioned by European Union DG Move) http://ec.europa.eu/transport/themes/sustainable/studies/doc/2014-handbook-external-costs-transport.pdf																														

⁴¹ Urban: population density of 1 500 inhabitants/km²; suburban - population density of 300 inhabitants/km² and rural - population density below 150 inhabitants/km²

⁴² The original source is NEEDS (Preiss et al. 2008), Values were updated to €2010 in the Handbook, Ricardo AEA .

3 Description

Source 1: The European Energy Exchange AG (EEX), Germany's energy exchange, is the leading energy exchange in Central Europe. It develops, operates and connects secure, liquid and transparent markets for energy and related products. On the EEX spot and derivatives markets, power, natural gas, CO₂ emission allowances, coal and guarantees of origin are traded.

The EEA futures provide bidding and settle prices in €/tCO₂ for the next 5 years.

Value 2 and 3: The authors of the source document calculated the above values based on emission factors from EMEP/EEA (2010a), restricted to LTO = landing and take-off.

As in the 2008 Handbook, it is further assumed that the air quality relevant pollutant emissions of aviation are restricted to the emissions in the landing and take-off (LTO) phase. These emission factors are taken from EMEP/EEA (2010a). The damage factors applied for valuing Particulate Matter (PM) emissions are the ones for rural areas (see Table 15 of the source document).

4 Further Reading

HEATCO

"Developing Harmonised European Approaches for Transport Costing and Project Assessment", 2002 – 2006

<http://heatco.ier.uni-stuttgart.de/>

'Deliverable 5: Proposal for Harmonised Guidelines' of the HEATCO project, and in particular Table 0.16, gives shadow prices for CO₂. Due to the global scale of the damage caused, it is recommended applying the same values in all countries. However the factor proposed is dependent on when (in which year) the emission takes place.

CE Delft (2008)

"Lower NOx at Higher Altitudes Policies to Reduce the Climate Impact of Aviation NOx Emission", CE Delft, Solutions for environment, economy and technology, The Netherlands. October 2008 (Commissioned by the European Commission)

http://ec.europa.eu/transport/modes/air/studies/doc/environment/oct_2008_nox_final_report.pdf

ECAC (2011)

NOx emission classification scheme, ECAC recommendation ECAC27/4, 11 September 2011

<https://www.ecac-ceac.org/resolutions-and-recommendations>

5 Comments

With regards to the NOx charges, a LTO NOx charge is currently implemented at several European airports primarily targets local air quality. The level of the charge per kg of NOx is set at the local air quality (LAQ) damage costs of NOx local at or around airports. The charge exists today in several countries: Sweden, England, Germany, Denmark and Switzerland. Two examples are provided below.

At London Heathrow the Emissions Charge per kg of NOx for fixed wing aircraft over 8 618 kg is £8.82 (approx. € 12) – 1 July 2014.

http://www.heathrow.com/file_source/Company/Static/PDF/Partnersandsuppliers/HAL-Conditions-of-Use-Amendment-SCHEDULE5-Up_date-25April2014.pdf

In Sweden the Emissions Charge for Aircraft exceeding 5,700 kg is set at SEK 50 (approx. € 5.33) per kg of NOx (for the sum of all 4 LTO modes: approach, taxi, take-off and climb) – 1 April 2015.

https://www.swedavia.se/Global/Swedavia/Flygmarknad/Prislista_exceeding5700kg_150401.pdf

Air Traffic Delay Statistics

Content

- Definition
- EUROCONTROL Recommended Sources
- Description
- Comments

1 Definition

Statistical reports on number of flights and levels of delay.

2 EUROCONTROL Recommended Sources

Source 1

EUROCONTROL Network Operations Monitoring and Reporting
<http://www.eurocontrol.int/articles/network-operations-monitoring-and-reporting>

Source 2

EUROCONTROL (2014) - CODA Digest Annual 2014
<https://www.eurocontrol.int/publications/coda-digest-annual-2014>

3 Description

Source 1

The EUROCONTROL Network Manager produces regular, timely and accurate reports on the overall performance of the network. These help to monitor and understand how the network is performing and take action when a problem occurs. They also provide different views on the situation of the ATM network.

Information can be accessed and downloaded from the EUROCONTROL Network Operations Monitoring and Reporting web page identified in Source 1 together with access criteria for non-public reports or applications, and source/third party usage.

Partners who wish to submit ad hoc statistical data requests in support of ATM-related activities can do this via the same web page. There is also information provided there regarding access to historical data.

Source 2

This report gives an overview of the delay situation in the European Civil Aviation Conference Area. This report has been prepared by the Central Office for Delay Analysis⁴³ (CODA), a service of EUROCONTROL. It is based on the EUROCONTROL CODA database which contains delay data provided directly by airlines. This data on delays is derived by airlines comparing actual timings with the published schedule.

NOTE: Sources 1 and 2 are measuring different processes and therefore are not interchangeable.

⁴³ <http://www.eurocontrol.int/coda>

4 Comments

Delay statistics for ECAC are also presented on a regular basis in the Performance Review Reports (PRR) published annually by the Performance Review Commission:

<http://www.eurocontrol.int/articles/prc-and-prb-publications>

Air Traffic Statistics and Forecasts

Content

- Definition
- EUROCONTROL Recommended Source
- Description
- Related Standard Input

1 Definition

Actual and forecast numbers of Flights and Service Units

2 EUROCONTROL Recommended Source

Source

EUROCONTROL Statistics and Forecasts Service (STATFOR)
<http://www.eurocontrol.int/statfor/>

3 Description

The objective of the Statistics and Forecast (STATFOR) service is to provide statistics and forecasts on air traffic in Europe and to monitor and analyse the evolution of the Air Transport Industry. STATFOR publishes Short and Medium-term forecasts both of flights and of service units, and Long term forecast for Flight movements.

STATFOR produces three sets of forecasts:

- **Two-year forecasts**
Two-year forecasts capture recent trends month by month and project these into the immediate future, up to two years ahead. Two-year forecasts are published twice a year, in February with an update in September.
- **Seven-year forecasts**
Seven-year forecasts look seven years ahead and build on the two-year forecasts. The seven-year forecasts combine flight statistics with economic growth and with models of other important drivers in the industry such as costs, airport capacity, passengers, load factors, aircraft size, etc. The forecasts give a comprehensive picture of anticipated air traffic development in Europe. Using high- and low-growth scenarios, a likely range for growth is presented. The seven-year forecast is published in February and refreshed in September.
- **Twenty-year forecasts**
Twenty-year forecasts look at a range of distinct possible scenarios for how the air traffic industry might look in 20 years time. This allows a range of 'what if?' questions to be explored, for factors inside the industry (e.g. the growth of small business jets, or of point-to-point traffic) or outside (e.g. the price of oil, or environmental constraints). Twenty-year forecasts are published every two to three years.

STATFOR produces ad-hoc studies, outside the scope of the routine STATFOR products, with the aim of continually improving the statistics and forecasts. If they can be made widely available, they will be available from the STATFOR website: <http://www.eurocontrol.int/statfor/>.

The **STATFOR Industry Monitor** is a regular e-mail briefing on the air transport and related industries, produced on a subscription basis for EUROCONTROL Member States and associated organisations. It covers matters of relevance for understanding air transport statistics or preparing air transport forecasts. The Industry Monitor is produced at least monthly.

Traffic statistics and forecasts can be obtained directly from the **STATFOR Interactive Dashboard (SID)**. Due to the SID's segmented approach, users benefit from:

- customised and flexible use of the tool,
- early access to the statistics which are updated and available in the first week of each month,
- wide coverage of the statistics, and
- synchronisation with the other STATFOR products.

Access to the STATFOR Interactive Dashboard can be requested from:

<http://www.eurocontrol.int/articles/statistics>

4 Related Standard Input

[IFR Flight Distance Overall](#) (page 24)

Distance Flown by Charging Zone

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Inputs

1 Definition

Number of kilometres flown by charging zone.

2 EUROCONTROL Recommended Values

Value	Charging Areas	Distance Flown (km) in 2014	Growth 2013 to 2014	Average Growth 2010-2014
	Albania		33 270 422	0.8%
Armenia		8 595 628	-5.5%	1.0%
Austria		201 735 171	4.2%	0.6%
Belgium-Luxembourg		174 755 570	2.9%	2.2%
Serbia/Montenegro/KFOR		132 866 399	6.0%	-1.4%
Bosnia and Herzegovina		58 805 222	17.5%	4.3%
Bulgaria		174 213 663	23.5%	7.8%
Croatia		130 937 025	2.5%	4.0%
Cyprus		104 341 029	9.7%	2.7%
Czech Republic		166 648 669	2.1%	1.5%
Denmark		119 780 166	-0.9%	0.8%
Finland		57 956 699	0.5%	-0.3%
France		1 489 406 142	2.6%	1.9%
FYROM		19 226 304	35.0%	6.5%
Germany		989 660 695	1.6%	0.3%
Georgia		39 512 314	-	-
Greece		331 642 053	7.6%	0.1%
Hungary		158 494 813	10.9%	2.4%
Ireland		196 756 011	2.1%	1.5%
Italy		670 889 412	2.1%	-1.4%
Latvia		53 690 741	3.4%	-
Lithuania		35 639 407	4.9%	5.4%
Malta		41 248 694	-0.5%	9.1%
Moldova		9 446 389	-33.3%	-2.8%
Netherlands		202 161 954	2.3%	2.5%
Norway		172 070 317	4.9%	6.5%
Poland		289 293 737	1.3%	4.8%
Portugal Lisboa		215 747 417	6.8%	4.1%
Portugal Santa Maria		195 863 350	3.5%	2.8%

	Charging Areas	Distance Flown (km) in 2014	Growth 2013 to 2014	Average Growth 2010-2014
	Romania	251 457 534	10.3%	4.6%
	Slovak Republic	71 857 188	5.0%	4.1%
	Slovenia	36 536 216	9.2%	4.4%
	Spain-Canarias	101 434 437	1.5%	0.4%
	Spain-Continental	707 124 346	3.9%	-0.4%
	Sweden	256 707 446	1.3%	1.8%
	Switzerland	120 113 594	1.3%	-0.6%
	Turkey	789 466 022	16.8%	8.7%
	United Kingdom	705 763 629	1.6%	0.7%
	Total	9 515 115 825	5.0%	2.2%
	Flight messages processed	10 127 089	6.8%	1.7%
Source	EUROCONTROL Central Route Charges Office, September 2015. Data available on request. Other operational reports: https://www.eurocontrol.int/articles/operation-reports-and-estimates-cost-bases-and-tariffs			

3 Description

The Report on the Operation of the Route Charges System is published by the CRCO on an annual basis and provides data on traffic volumes and ATM costs for the states for which the CRCO collects en-route and terminal charges. Since November 2014, the CRCO has implemented a new billing software system. The information on distances was not available at the time of the production of the 'Report on the Operation of the Route Charges System in 2014'. It will be included in the 2015 report.

An "en-route charging zone" is a volume of airspace for which States establish a single cost base and a single unit rate. This "en-route charging" zone extends from the ground up to, and including, upper airspace. A Contracting State is permitted to establish a specific zone for a complex terminal area, after consultation with airspace user representatives.

Charging zones may evolve to be consistent with air traffic control operations and services, after consultation with airspace user representatives. They may extend across the airspace of several States.

In each charging zone, there is full transparency of how charges to be paid by airspace users are established and collected.

4 Related Standard Inputs

[IFR Flight Distance Overall](#) (page 24) and [Route Charges Share per Aircraft Operator Segment](#) (page 41)

Fleet Age

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Other Possible Values
- Related Standard Inputs

1 Definition

The age of the aircraft fleet operating in Europe.

2 EUROCONTROL Recommended Values

Value

Number of civil aircraft operating in EUROCONTROL Network Manager controlled airspace in Europe (ECAC), by aircraft type sorted by number of aircraft, year 2014.

Build Year	Age	Number of Aircraft	Flights in 2014
before 1974	> 40	305	9 141
1974	40	77	2 440
1975	39	85	10 628
1976	38	90	3 675
1977	37	101	6 008
1978	36	146	8 454
1979	35	206	9 782
1980	34	222	13 210
1981	33	218	14 556
1982	32	158	13 445
1983	31	87	10 454
1984	30	155	12 996
1985	29	168	22 096
1986	28	173	45 794
1987	27	201	36 913
1988	26	279	54 999
1989	25	323	100 150
1990	24	397	129 202
1991	23	502	192 091
1992	22	545	134 491
1993	21	474	154 510
1994	20	403	153 475
1995	19	374	177 222
1996	18	507	227 660
1997	17	587	228 611

	Build Year	Age	Number of Aircraft	Flights in 2014
	1998	16	745	324 990
	1999	15	933	439 981
	2000	14	821	367 482
	2001	13	884	322 826
	2002	12	646	282 424
	2003	11	644	300 323
	2004	10	644	274 926
	2005	9	819	392 466
	2006	8	1 048	491 090
	2007	7	1 334	579 658
	2008	6	1 405	666 712
	2009	5	1 216	724 208
	2010	4	1 154	592 768
	2011	3	1 036	587 839
	2012	2	1 041	516 030
	2013	1	1 198	411 989
	2014	0	1 323	187 786
	unknown	0	13 685	299 695
	not identified	0	6 611	235 053
	Grand Total		43 970	9 770 289
Source	EUROCONTROL Network Manager flight plans and PRISME Fleet data, March 2015			

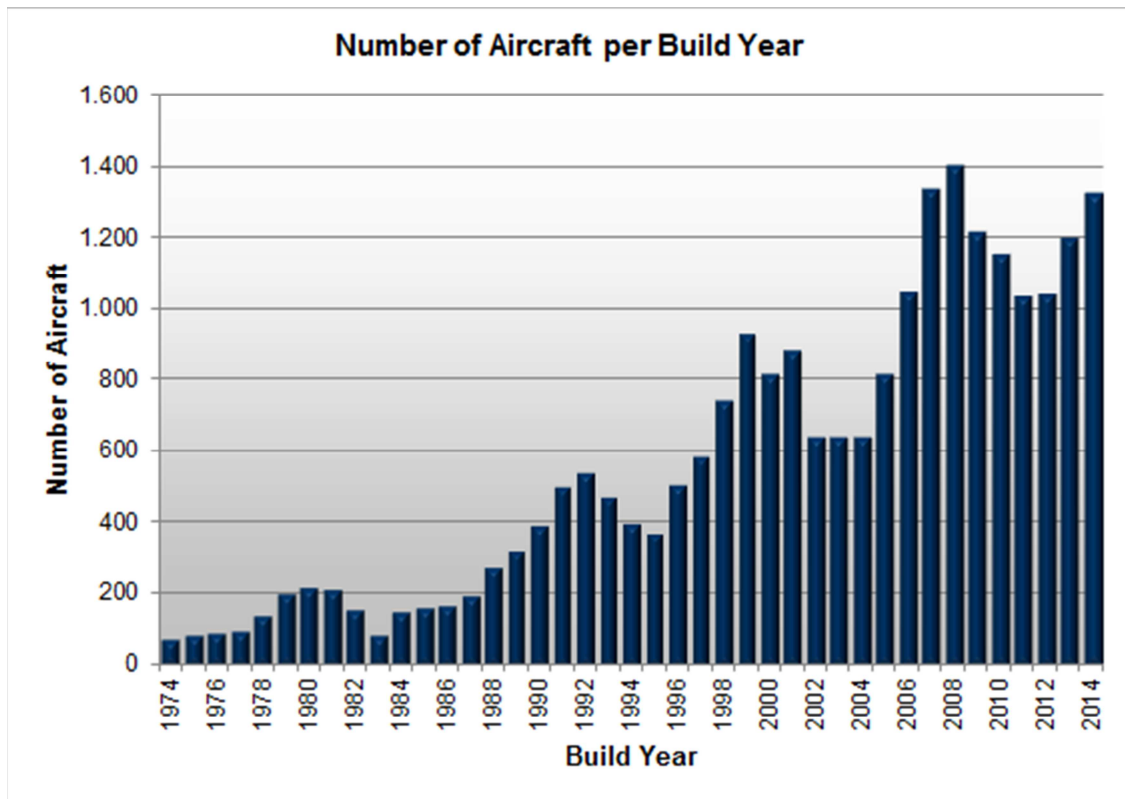
3 Description

The numbers of aircraft were derived from flight plans submitted to the EUROCONTROL Network Manager (NM) for flights in 2014. Thus these aircraft were active in European airspace at that time. From those flight plans two percent (2%) of the flight plans (235 053) were incomplete and could not be identified.

The information was analysed using the EUROCONTROL PRISME Fleet database to derive the aircraft ages. Since the numbers are based on flight plans, they exclude aircraft which do not fly in controlled airspace and therefore do not submit flight plans to the NM.

The 13 685 aircraft whose age was unknown were aircraft not recorded in the PRISME database. These were mostly military aircraft, privately owned aircraft and aircraft based outside Europe, together with some smaller aircraft not flying regularly in controlled airspace and some new aircraft not yet entered into the database.

Aircraft up to 20 years of age tend to average just over 2 flights per day but, beyond this age, the usage falls steeply. There is a significant cyclicality in the purchase of aircraft, which is illustrated in the figure below.



4 Other Possible Values

Source	AIRBUS Global Market Forecast 2015-2034 http://www.airbus.com/company/market/forecast/
Description	Airbus' Global Market Forecast for 2015-2034 offers a forward-looking view of the air transport sector's evolution – accounting for factors such as demographic and economic growth, tourism trends, oil prices, development of new and existing routes, and ultimately highlighting demand for aircraft covering the full spectrum of sizes from 100 seats to the very largest aircraft like the A380

5 Related Standard Inputs

[Fleet Size](#) (page 81) and [Number of IFR Flights](#) (page 86)

Fleet Size

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Inputs
- Comments

1 Definition

The size of the aircraft fleet operating in Europe.

2 EUROCONTROL Recommended Values

Value 1

Top 30 number of civil aircraft operating in EUROCONTROL Network Manager controlled airspace in Europe (ECAC), by aircraft type sorted by number of aircraft, year 2014.

AC Type	Number	Proportion	Cumulative
A320	2 280	5.2%	5.2%
B738	1 609	3.7%	8.8%
A319	921	2.1%	10.9%
A321	834	1.9%	12.8%
SR22	774	1.8%	14.6%
C130	767	1.7%	16.3%
GLF4	681	1.5%	17.9%
GLF5	680	1.5%	19.4%
A332	677	1.5%	21.0%
C172	628	1.4%	22.4%
B763	619	1.4%	23.8%
CL60	603	1.4%	25.2%
B77W	593	1.3%	26.5%
B744	541	1.2%	27.8%
PC12	528	1.2%	29.0%
P28A	524	1.2%	30.1%
BE20	516	1.2%	31.3%
F900	484	1.1%	32.4%
PA34	472	1.1%	33.5%
B772	463	1.1%	34.5%
K35R	459	1.0%	35.6%
DA42	449	1.0%	36.6%
GLEX	448	1.0%	37.6%
A333	447	1.0%	38.6%
B752	440	1.0%	39.7%
F2TH	432	1.0%	40.6%

AC Type	Number	Proportion	Cumulative
C30J	415	0.9%	41.6%
B737	395	0.9%	42.5%
C525	381	0.9%	43.3%
C182	333	0.8%	44.1%
others	24 458	55.6%	99.7%
not identified	126	0.3%	100.0%
Total	43 977	100.0%	

Source 1 EUROCONTROL Network Manager flight plans and PRISME Fleet data, year 2014.

Value 2 Military fleet statistics

AC Type	ECAC		USA ⁴⁴	Totals	
	2013	(2012)	2012	2013	(2012)
Combat aircraft	3 365	(3 373)	3 393	6 758	(6 766)
Large aircraft	949	(990)	2 264	3 213	(3 254)
Light aircraft	1 390	(1 429)	2 778	4 168	(4 207)
Helicopters	3 733	(3 792)	5 277	9 010	(9 069)
Total	9 437	(9 584)	13 712	23 149	(23 296)

Source 2 EUROCONTROL (2014) - Military Statistics, Edition 2014, Directorate Single Sky, Civil-Military ATM Co-ordination Division, Version 1.0, March 2014
<https://www.eurocontrol.int/sites/default/files/publication/files/2014-military-statistics.pdf>

Value 3 IFR Helicopter Fleet

	Number of Units
Europe and Eastern Europe	2 208
CIS ⁴⁵ Countries	1 312
Total	3 520

(Source: Flight Global HELICAS 2011/2012)

Source 3 European Helicopter Association (EHA) (2013)
 European Helicopter IFR Fleet Analysis
http://www.eha-heli.eu/images/docs/European_Helicopter_IFR_fleet_sito.pdf

⁴⁴ USA figures refer to the total US fleet. Main impact on European ATM comes from the AMC (Air Mobility Command) which reaches European airspace from many origins (most from US). Figures are from the previous year 2012, since 2013 figures have not been provided.

⁴⁵ CIS Countries comprise the following: Azerbaijan, Belarus, Georgia, Moldova, Russia and Ukraine.

Value 4	Estimated Numbers of Airframes operating under Visual Flight Rules (VFR) for the ECAC region											
	<table border="1"> <thead> <tr> <th>AC Type</th> <th>ECAC</th> </tr> </thead> <tbody> <tr> <td>Aeroplanes</td> <td>20 329</td> </tr> <tr> <td>Helicopter</td> <td>3 532</td> </tr> <tr> <td>Glider</td> <td>18 555</td> </tr> <tr> <td>Balloons</td> <td>6 623</td> </tr> <tr> <td>Total</td> <td>49 039</td> </tr> </tbody> </table> <p><i>(Source: International Register of Civil Aircraft (IRCA) - 2014)</i></p>	AC Type	ECAC	Aeroplanes	20 329	Helicopter	3 532	Glider	18 555	Balloons	6 623	Total
AC Type	ECAC											
Aeroplanes	20 329											
Helicopter	3 532											
Glider	18 555											
Balloons	6 623											
Total	49 039											
Source 4	Aircraft Owners and Pilot Association (AOPA), May 2015											

3 Description

The numbers of aircraft in **Value 1** were derived from flight plans submitted to the EUROCONTROL Network Manager (NM) for flights in 2014. Thus these aircraft were active in European airspace at that time.

From those flight plans two percent (2%) of the flight plans (corresponding to circa 3% of the aircraft) were incomplete and could not be identified.

4 Related Standard Inputs

[Fleet Age](#) (page 78), [IFR Flight Information per Operator Segment](#) (page 28) and [Number of IFR Flights](#) (page 86)

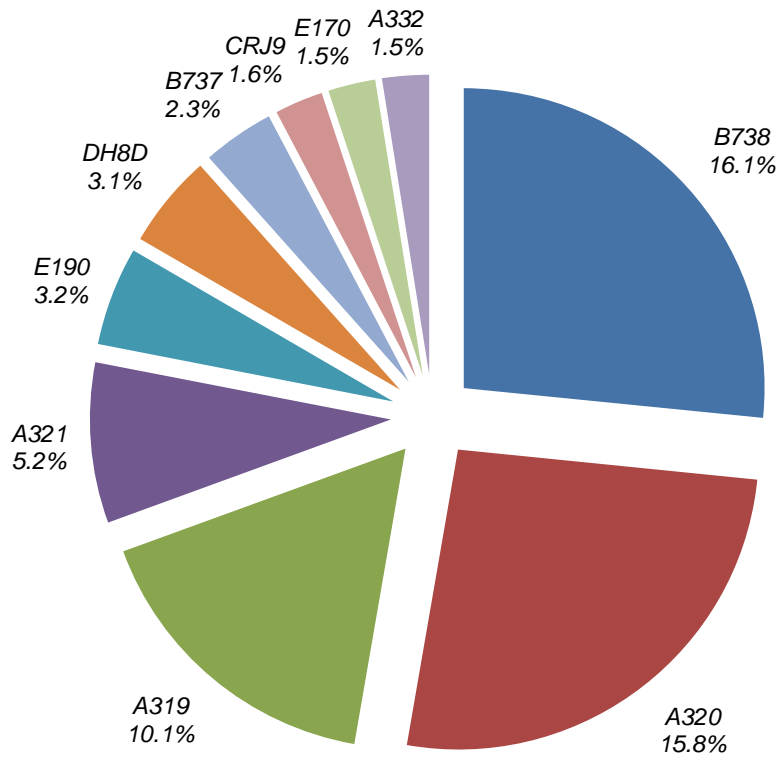
5 Comments

The numbers of aircraft presented in the EUROCONTROL Recommended Value 1 were derived from flight plans submitted to the EUROCONTROL Network Manager (NM) during 2014. Thus these aircraft were active in European airspace at that time. The information was analysed using the EUROCONTROL PRISME Fleet database to derive the aircraft types. Since these numbers are based on filed flight plans, they exclude many of the aircraft included in the “Value 2” and, particularly, “Value 3” tables which do not fly in controlled airspace and therefore do not submit flight plans to the NM.

The number of flights for “Others” aircraft types includes some flights by aircraft not identified in the PRISME database and which therefore may include additional flights by the specified aircraft types.

The 32 141 aircraft in the EUROCONTROL Recommended Values section comprise 436 different aircraft types. Of those 30 aircraft types represent approximately 50% of the fleet. 60% of the flights are carried out by 10 most used aircraft types.

Top 10 Aircraft Flying - ECAC - 2014



Medium Term Capacity Planning

Content

- Definition
- EUROCONTROL Recommended Sources
- Description

1 Definition

ATM capacity forecasts and planning targets over a specific period.

Capacity planning is the systematic determination of resource requirements for the projected output, over a specific period.

2 EUROCONTROL Recommended Sources

Source 1	European Network Operations Plan 2015-2019 http://www.eurocontrol.int/publications/european-network-operations-plan-2015-2019
Source 2	European Single Sky Implementation Plan (ESSIP) – 2014 Edition http://www.eurocontrol.int/publications/european-single-sky-implementation-essip-plan-edition-2014
Source 3	Local Single Sky Implementation (LSSIP) documents prepared for each country including capacity forecasts. http://www.eurocontrol.int/articles/lssip

3 Description

Source 1

The Network Operations Plan (NOP) 2015-2019 provides a short to medium-term outlook of how the ATM Network will operate, including expected performance at network and local level. It gives details of capacity and flight efficiency enhancement measures planned at network level and by each Area Control Centre (ACC), as well as a description of the airport performance assessment and improvement measures that are planned at those airports that generate a high level of delay.

Source 2

Source 2 explains the ESSIP planning process and describes the current set of implementation objectives in the context of the operational improvements and benefits that they bring to the European ATM network. It provides different views on the implementation progress of SES and SESAR elements across ECAC. It takes into account FAB aspects, provides insight into implementation of PCP prerequisites and evaluates the challenges that different ATM stakeholders face in SESAR implementation. It also contains the agreed capacity profiles for air traffic centres and selected terminal airspace in each of the ECAC States for the next five years.

Source 3

The ESSIP implementation objectives and stakeholder lines of action cascade down into the States' LSSIP documents, one for each state. The LSSIP documents reflect the progress made and detail the plans for each ECAC State for the next five years.

Number of IFR Flights

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Related Standard Inputs
- Further Reading

1 Definition

The number of IFR flights carried out in Europe.

2 EUROCONTROL Recommended Values

Value 1	Monthly and yearly number of flights by flight category, year 2014					
	Month	Arrivals	Departures	Internal	Overflights	Total
	January	74 667	74 605	516 325	12 103	677 700
	February	66 832	66 863	496 489	10 688	640 872
	March	76 980	76 944	572 425	12 754	739 103
	April	79 160	79 278	611 233	13 321	782 992
	May	87 259	87 192	675 215	13 089	862 755
	June	93 832	93 852	697 787	13 189	898 660
	July	98 746	98 957	724 760	13 356	935 819
	August	101 361	101 555	714 950	13 450	931 316
	September	90 734	90 874	701 128	12 636	895 372
	October	86 161	86 550	668 606	13 042	854 359
	November	74 095	74 288	547 108	11 923	707 414
December	74 159	74 391	517 513	11 534	677 597	
Total	1 003 986	1 005 349	7 443 539	151 085	9 603 959	
Source 1	EUROCONTROL (2015) - STATFOR statistics (ESRA08) Traffic statistics and forecasts can be obtained from the STATFOR Interactive Dashboard (SID). http://www.eurocontrol.int/statfor					

Value 2	Flights by type of operator year 2014			
	Operator	Number of Flights	Proportion	Evolution 2014 vs. 2013
	Traditional scheduled airlines	5 189 234	54.0%	0.4%
	Low cost airlines	2 584 649	26.9%	6.6%
	Business aviation	668 146	7.0%	-0.5%
	Charter flights	477 985	5.0%	-6.0%
	All cargo	330 880	3.4%	1.0%
	Military	120 072	1.3%	6.1%
	Other	232 993	2.4%	0.8%
Total	9 603 959	100.0%	1.7%	
Source 2	EUROCONTROL (2015) - STATFOR statistics (ESRA08)			

Value 3	Number of civil aircraft operating in EUROCONTROL Network Manager controlled airspace in Europe (ECAC) by aircraft type sorted by number of flight year 2014.			
	FPL Aircraft Type	Flights	Proportion	Cumulative
	B738	1 534 765	16.1%	16.1%
	A320	1 509 166	15.8%	31.9%
	A319	963 772	10.1%	42.0%
	A321	498 890	5.2%	47.3%
	E190	307 578	3.2%	50.5%
	DH8D	291 040	3.1%	53.5%
	B737	223 413	2.3%	55.9%
	CRJ9	150 662	1.6%	57.5%
	E170	147 590	1.5%	59.0%
	A332	145 889	1.5%	60.5%
	B733	142 796	1.5%	62.0%
	B752	133 100	1.4%	63.4%
	B763	131 715	1.4%	64.8%
	B77W	127 501	1.3%	66.2%
	A333	115 849	1.2%	67.4%
	AT75	113 621	1.2%	68.6%
	AT72	107 637	1.1%	69.7%
	B744	106 837	1.1%	70.8%
	B772	103 540	1.1%	71.9%
	DH8A	86 671	0.9%	72.8%
	B734	78 621	0.8%	73.6%
	RJ1H	77 462	0.8%	74.4%
Others	2 437 081	25.6%	100.0%	
Total	9 535 196	100.0%		
Source 3	EUROCONTROL (2015) - Network Manager flight plans and PRISME Fleet data (ECAC region)			

3 Description

Value 1 shows the typical fluctuation of traffic during the year peaking in July. The lowest level usually occurs in February.

Value 2 indicates an overall decrease of flights of 1.7% in 2014 compared to 2013. Low cost increased their operations by 6% while charters decreased by 6%. Military flights which cover only those operating as General Air Traffic (GAT) and exclude Operational Air Traffic (OAT) increased by 6.1%.

Value 3 Four hundred thirty six (436) different civil aircraft types operated in Europe in 2014. 75% of the flights were carried out by the 23 aircraft types shown. The number of flights for “Others” aircraft types includes some flights by aircraft not identified in the PRISME database and which therefore may include additional flights by the specified aircraft types. Note that the difference with

4 Related Standard Inputs

[Fleet Age](#) (page 78) and [Fleet Size](#) (page 81)

5 Further Reading

EUROCONTROL Performance Review Commission

The Performance Review Commission publishes traffic analyses in the annual Performance Review Reports: <http://www.eurocontrol.int/articles/prc-and-prb-publications>

ATM Cost Effectiveness Indicators

Content

- Definition
- EUROCONTROL Recommended Values
- Description

1 Definition

Key performance indicators of cost-effectiveness and productivity for the Air Navigation Service Providers (ANSPs).

2 EUROCONTROL Recommended Values

Values	Indicator		Value
		ATCO-hour productivity expressed as composite flight-hours per ATCO-hour	
	Employment costs per ATCO-hour		€ 108
	Support staff ratio - the ratio of Gate-to-gate ANS staff to ATCO in OPS		3.28
<i>(Average values of indicators at Pan-European ANS system level - based on 2013 data)</i>			
Source	EUROCONTROL (2015) - ATM Cost-Effectiveness (ACE) 2013 Benchmarking Report PRC May 2015 http://www.eurocontrol.int/prb/publications		

3 Description

The ACE Benchmarking reports comprise factual data about and analysis of cost-effectiveness and productivity for the ANSPs within EUROCONTROL member states. The report describes a framework for the analysis of cost-effectiveness.

The key performance drivers of cost-effectiveness are:

- productivity
- employment costs
- support costs comprising non-ATCO in OPS employment costs non-staff operating costs, exceptional costs and depreciation and capital-related costs.

The above values are the European system averages for ATCO productivity employment costs and support costs.

The 2013 key performance drivers of financial cost-effectiveness for each ANSP are illustrated in Figures 2.16 and 2.19 of the source document. There is a wide variation in each of the components:

- productivity ranges from 0.16 (0.19 in 2011) to 1.99 (1.95 in 2011).
- employment costs vary from a minimum of € 10 (€ 12 in 2011) to a maximum of € 202 (€ 164 in 2011) per ATCO-hour.
- Support cost ratios vary from 2.3 to 7.5. Figures are obtained by dividing the gate-to-gate ANS staff by the number of ATCOs in OPS (Table 2.1 of the source document).

ATM Operational Units

Content

- Definition
- EUROCONTROL Recommended Values
- Description
- Comments

1 Definition

Number of ATC units (Air Traffic Centres) providing ATC services for the purpose of:

1. preventing collisions between aircraft and on the manoeuvring area between aircraft and obstructions and
2. expediting and maintaining an orderly flow of air traffic.

2 EUROCONTROL Recommended Values

Value	Number of units						
	2008	2009	2010	2011	2012	2013	
ANSPs	36	37	37	37	37	37	
Area Control Centres (ACCs)	64	65	64	63	63	63	
Approach Units (APPs)	246	246	247	257	260	261	
Towers (TWRs)	440	451	441	433	425	422	
Airport/Aerodrome Flight Information Services (AFIS) units	87	96	93	73	81	82	
ATC sectors	-	-	-	705	716	724	

Source: ATM Cost-Effectiveness (ACE) Benchmarking Reports Performance Review Committee
<https://www.eurocontrol.int/prb/publications>

3 Description

The air traffic control airspace management and air traffic flow management services which make up ATM are in the main provided by national ANSPs. Generally there is one per state except in a few cases where one ANSP provides ATC services for several states⁴⁶.

Through the ATM Cost-Effectiveness (ACE) Benchmarking Report factual data about and analysis of cost-effectiveness and productivity for ANSPs is collected. It presents a review and comparison of ATM cost-effectiveness for the 37 Air Navigation Service Providers (ANSPs) in Europe which provide coverage for the 39 member states of EUROCONTROL in 2013⁴⁷. It excludes however elements

⁴⁶ Belgocontrol for Belgium and Luxembourg, SMATSA for Serbia and Montenegro, DSNA for France and Monaco and MUAC for the upper air of Benelux and northern Germany

⁴⁷ In 2015 EUROCONTROL has 41 member states: Georgia joined 1st of January 2014 and Estonia 1st of January 2015.

related to services provided to military operational air traffic (OAT) oceanic ANS and landside airport management operations.

Definitions relating to what a services unit contains can be found in the 2012 EUROCONTROL Specifications for Economic Information Disclosure⁴⁸.

The service unit data per ANSP is generally available in the Annexes of the ATM Cost-Effectiveness (ACE) Benchmarking Reports.

4 Comments

Under the second Single European Sky legislative package (SES II)⁴⁹ the focus is on increasing the economic financial and environmental performance of the provisions of the Air Navigation Services in Europe.

With this in mind one of the initiatives is the establishment of Functional Airspace Blocks (FABs) which is a bottom-up initiative led by the States. The FABs aim at enhanced cooperation between the air navigation service providers (ANSPs) and the national supervisory authorities (NSAs) to defragment the airspace and achieve operational efficiency gains through such strategies as common procurement training and optimisation of air traffic controllers (ATCOs) resources.

As of 20 April 2012 nine FAB initiatives have been declared to the European Commission⁵⁰ of which two (shown in bold) have been declared established:

- **UK-Ireland FAB**
- **Danish-Swedish FAB**
- Baltic FAB (Lithuania, Poland)
- BLUE MED FAB (Cyprus, Greece, Italy, Malta)
- Danube FAB (Bulgaria, Romania)
- FAB CE (Austria, Bosnia & Herzegovina, Croatia, Czech Republic, Hungary, Slovak Republic, Slovenia)
- FABEC (Belgium, France, Germany, Luxembourg, the Netherlands, Switzerland)
- North European FAB (Estonia, Finland, Latvia, Norway)

⁴⁸ <http://www.eurocontrol.int/documents/economic-information-disclosure-specification>

⁴⁹ http://ec.europa.eu/transport/modes/air/single_european_sky/ses_2_en.htm

⁵⁰ http://ec.europa.eu/transport/modes/air/single_european_sky/fab/

CNS Infrastructure

Content

- Definition
- EUROCONTROL Recommended Values
- Description

1 Definition

The number of installed systems devoted to communication navigation and surveillance functions in Europe⁵¹.

2 EUROCONTROL Recommended Values

Value 1

Navigation aids in the ECAC countries:

ECAC Countries	NDB	VOR		DME	VOR/DME		TACAN	VORTAC	
		C	D		C	D		C	D
Albania	1					1			
Armenia	8				1	1			
Austria	17			5	2	9			
Azerbaijan	16					3			
Belgium - Luxembourg	16		1		1	13	3	1	
Bosnia & Herzegovina	8				5	1			
Bulgaria	8			1	3	4			
Croatia	17			2	7				
Cyprus	3				2				
Czech Republic	7			2	9				
Denmark	20	1		3	7		1		
Estonia	10			1	3	1		3	0
Finland	61			5	1	20			1
France - Monaco	144	1	28	1	13	45	21		2
FYROM	3			1	2	1			
Georgia	9				1	1			
Germany	67	7	5	37	11	25		3	7
Greece	44	1			19	26	24		
Hungary	10					9			
Iceland	42			2	2			1	
Ireland	15			2		6			
Italy - San Marino	82		1	3		54	21		11
Latvia					4	2			
Lithuania	3			1	1	3	1		
Malta	1				1				
Moldova	4					1			
Netherlands	5	1		2	4	5	1		
Norway	55			14	10	25	15		

⁵¹ ECAC and EUROCONTROL countries for navigation aids and surveillance aids respectively.

ECAC Countries	NDB	VOR		DME	VOR/DME		TACAN	VORTAC	
		C	D		C	D		C	D
Poland	16	1		2	9	10			
Portugal	19	1		7	10	2	5	3	2
Romania	26			2	3	13			
Serbia-Montenegro	35				10	1			
Slovak Republic	9				5				
Slovenia	4			2	2	2			
Spain	75	1		3	30	52	13	2	0
Sweden	101	2	3	19	12	14			
Switzerland	3			3	3	8			
Turkey	61	1		5	53	3	27		1
Ukraine	144			8	8	1			
United Kingdom	88		2			44			
Total	1 257	17	40	133	254	406	132	13	24

ECAC countries	ILS		ILS/DME	MLS	GLS	
	Cat I	Cat II/III			Cat I	Cat II/III
Albania						
Armenia	1	1	1			
Austria	3	8	11			
Azerbaijan	7	5	10			
Belgium - Luxembourg	7	7	9			
Bosnia & Herzegovina	3		3			
Bulgaria	4	1	2			
Croatia	7	1	1			
Cyprus	2		2			
Czech Republic	8	2	10			
Denmark	18	7	21			
Estonia	2	2	4			
Finland	26	4	15			
France - Monaco	95	27	108			
FYROM	1	1	1			
Georgia	3		3			
Germany	55	39	13			
Greece	4	5	8			
Hungary	7	4	7			
Iceland	7	2	9			
Ireland	8	4	9			
Italy - San Marino	38	12	39			
Latvia	3		3			
Lithuania	5	2	4			
Malta	2		2			
Moldova	2	1	2			
Netherlands	6	7	13			
Norway	65	3	60		8	
Poland	9	2	11			
Portugal	8	2	6			

ECAC countries	ILS		ILS/DME	MLS	GLS	
	Cat I	Cat II/III			Cat I	Cat II/III
Romania	2	17	19			
Serbia-Montenegro	5	1	1			
Slovak Republic	4	2	5			
Slovenia	1	1	2			
Spain	46	17	61			
Sweden	61	9	31			
Switzerland	8	3	9			
Turkey	34	9	40			
Ukraine	30	8	6			
United Kingdom	55	25	66	4		
Total	652	241	627	4	8	0

Source 1

SESAR Project 15.03.02
D05 - Infrastructure assessment of individual ECAC states
Ed. 00.01.00 of 18-12-2012

Value 2

Surveillance Aids in EUROCONTROL countries:

EUROCONTROL countries	PSR	SSR	Mode-S	WAM/ADS-B	ADS-B
Albania		1			
Armenia	3	3		tbc	
Austria	4	5	8	68	
Belgium	6	3	7		
Bosnia & Herzegovina	1		2		
Bulgaria	5	4	2	11	
Croatia			8		
Cyprus	2		3		
Czech Republic	2	1	5	25	
Denmark	4	5	1	25	12
Estonia		2	2	tbc	
Finland	1	11		113	
France	10	1	24	tbc	16
FYROM	1	3			
Germany	20	17	52	37	
Greece	7	13			
Hungary	4	1	5		
Iceland		6		5	8
Ireland	4	1	9		
Italy	25	1	36		14
Latvia	1		3	6	
Lithuania	3	1	3		
Luxembourg	1	1	2		
Malta	2	2	1		
Moldova	2	2	1		
Netherlands	2	6	6	19	

	EUROCONTROL countries	PSR	SSR	Mode-S	WAM/ADS-B	ADS-B
	Norway	6	13	6	20	10
	Poland	6	8	5		
	Portugal	1	7	4	60	tbc
	Romania	1	5	3	17	
	Serbia- Montenegro			3		
	Slovak Republic	2		3		
	Slovenia	2	1	5		
	Spain	7	16	12	8	
	Sweden	1	12		71	
	Switzerland	2		7		
	Turkey			24		
	Ukraine		10	14	tbc	
	United Kingdom	14	6	43	38	
	Total	Not applicable				
Source 2	1. EUROCONTROL Surveillance Unit Surveillance Database 2. ADS-B & WAM Deployment Plan EUROCONTROL					

3 Description

Value 1

The report identified in Source 1 presents an overall summary of the assessment of ground navaid infrastructure in individual ECAC countries. Table 3 on pp. 31 to 34 gives an overview of the current navaid infrastructure. The data reflects the number of operational navaid at the time the information was collected by the project (mid 2012).

Value 2

The Mode-S PSR (Primary Surveillance Radar) and SSR (Secondary Surveillance Radar) numbers are extracted from the Surveillance database of the EUROCONTROL Surveillance and Code Coordination Unit (formerly the Surveillance Unit).

The goal of the Unit is to continuously improve ATM network operations within the Single European Sky contributing to the achievement of European Union-wide performance targets. Their role is to support ANSPs in providing the required surveillance functionality and performance to enable a safe efficient and cost-effective air traffic management service.

According to the most recent figures there are ca. 500 radar sites in Europe with 309 Mode-S radars 152 PSR and 168 SSR either combined or stand-alone. As the allocation and implementation of Mode-S interrogator codes (IC) requires a coordinated approach, every installation of a Mode-S radar is officially registered. The numbers of PSR and SSR radars reported above are not necessarily accurate as they are based on voluntary reports by the Member States regarding updates and changes to their surveillance infrastructure.

The WAM/ADS-B (Wide Area Multilateration/ Automatic Dependent Surveillance Broadcast) and ADS-B data originate from the database that is maintained by the EUROCONTROL ADS-B & WAM Section and is based on inputs from stakeholders.

The ADS-B & WAM Section co-ordinates the deployment of initial ADS-B applications and WAM in Europe.

Acronyms

AAGR	Annual Average Growth Rate
ACE	ATM Cost Effectiveness
ACI	Airports Council International
ACMG	IATA Airline Cost Management group
ADREP	Aircraft Accident/Incident Reporting System
ADS-B	Automatic Dependent Surveillance - Broadcast
AEA	Association of European Airlines
AEM	EUROCONTROL Advanced Emission Model
AFIS	Airport/Aerodrome Flight Information
AIS	Abbreviated Injury Scale
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
AOCTF	Airline Operational Cost Task Force
AOPA	Aircraft Owners and Pilots Association
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
BADA	Base of Aircraft Data
BBL	barrel
CAA	Civil Aviation Authority
CANSO	Civil Air Navigation Service Organisation
CARE INO	Innovative Cooperative Actions of R&D in EUROCONTROL Programme
CBA	Cost Benefit Analysis
CDM	Collaborative Decision Making
CH ₄	Methane (Chemical Compound)
CNS	Communications Navigation and Surveillance
CO	Carbon monoxide (Chemical Compound)
CODA	Central Office for Delay Analysis
CRCO	Central Route Charges Office
CRS	Central Reservation System
dBa Leq	Equivalent Continuous Level
DETR	Department of the Environment Transport and the Regions (UK)
DFS	Deutsche Flugsicherung (German ANSP)
DGAC	Direction Générale de l'Aviation Civile (FR)
DME	Distance Measuring Equipment
DSNA	Direction des services de la navigation aérienne (FR)
EASA	European Aviation Safety Agency
ECAC	European Civil Aviation Conference
EEA	European Environment Agency
EEA	European Emission Allowance
EEC	EUROCONTROL Experimental Centre
EEX	European Energy Exchange
EHA	European Helicopter Association
EIA	Energy Information Administration (US)
ELFAA	European Low Fares Airlines Association
EMEP	European Monitoring and Evaluation Programme
ERA	European Regional Airline Association
ESRA08	EUROCONTROL Statistical Reference Area
ESSIP	European Single Sky Implementation Plan
ETS	Emissions Trading Scheme (of the European Union)
EU	European Union
EU-28	28 EU Member States on 31 December 2013
EUA	European Emission Allowance
EUR	Europe / European

EUROSTAT	Statistical Office of the European Union
EVAIR	EUROCONTROL Voluntary ATM Incident Reporting
FAA	Federal Aviation Administration
FAB	Functional Airspace Block
FIR	Flight Information region
FLP	Flight Plan
FOCA	Swiss Federal Office of Civil Aviation
FOI	Swedish Defence research Agency
FTE	Full Time Equivalent
GA	General Aviation
GAT	General Air Traffic
GDP	Gross Domestic Products
GDS	Global Distribution System
GLS	GNSS Landing System
H ₂ O	Water (Chemical Compound)
HEAT	Economic Assessment Tool
HEATCO	Developing Harmonised European Approaches for Transport Costing and Project Assessment
HICP	Harmonised Index of Consumer Price
HPM	Hedonic Price Method
IATA	International Air Transport Association
IC	Interrogator Codes
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMF	International Monetary Fund
IRCA	International register of Civil Aircraft
IRR	Internal Rate of Return
ITA	Institut du Transport Aérien (FR)
Kg	kilogramme
KPA	Key Performance Ares (Safety, Environment, Capacity and Cost efficiency)
KPI	Key Performance Indicators
l	litre
lb	pound
Lden	Perceived noise level weighted over day evening night
LSSIP	Local Single Sky Implementation
LTO	Landing/Take-off Cycle
MLS	Microwave Landing System
MUAC	Maastricht Upper Area Control Centre
MWTP	Marginal Willingness to Pay
N ₂ O	Nitrogen dioxide (Chemical Compound)
NDB	Non-Directional Beacon
NM	EUROCONTROL Network Manager
NM	Nautical Miles
NMVOC	Non-methane volatile organic compound (Chemical Compound)
NOP	Network Operations Plan
NPV	Net Present Value
NSDI	Noise Sensitivity Depreciation Index
OAT	Operational Air Traffic
OECD	Organisation for Economic Co-operation and Development
OST	Office of the Secretary of Transportation (USA)
PAX	Passengers
PCP	Pilot Common Project
PI	Performance Indicators
PM _{2.5}	(Atmospheric) particulate matters
PMR	Performance Monitoring Reports
PRB	Performance Review Board
PRC	Performance Review Commission
PRISME	Pan-European Repository of Information Supporting the Management of EATM
PRR	Performance Review Report

PRU	Performance Review Unit
PSR	Primary Surveillance Radar
ROIC	Return on Invested Capital
SDR	Special Drawing Rights
SES	Single European Sky
SESAR	Single European Sky ATM Research (Programme)
SESAR JU	SESAR Joint Undertaking
SID	STATFOR Interactive Dashboard
SMATSA	Serbia and Montenegro Air Traffic Services Agency
SO ₂	Sulphur dioxide (Chemical Compound)
SPIs	Safety Performance Indicators
SRC	Safety Regulation Commission
SSR	Secondary Surveillance Radar
STATFOR	Air Traffic Statistics and Forecasts
SU	Service Unit
TACAN	Tactical Air Navigation
TDD	Technical Discussion Document
TVM	Time Value of Money
TWR	Tower
UIR	Upper Information Region
UK CAA	UK Civil Aviation Authority
UNWTO	United Nations World Tourism Organization
US DOT	U.S. Department of Transportation
US gal	US gallon
VFR	Visual Flight Rules
VOR	VHF Omni-directional Ranging
VOR C	Very High Frequency Omnidirectional Radio Range Conventional
VOR D	Very High Frequency Omnidirectional Radio Range Doppler
VOR/DME	VHF Omni-directional Ranging / Distance Measurement Equipment
VORTAC	Combined VOR and TACAN
VOT	Value of Time
VSL	Value of Statistical Life
WAM	Wide Area Multilateration
WTP	Willingness to Pay

A comprehensive glossary of acronyms and abbreviations is available at EUROCONTROL Air Navigation Inter-Site Acronym List

http://www.eurocontrol.int/webf_airial/definitionListInIt.do?skipLogon=true&glossaryUId=AIRIAL



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