NORTH EUROPEAN FUNCTIONAL AIRSPACE BLOCK – NEFAB

Socio-Economic Study

Volume 1: Main Report

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Contents

1. EXECUTIVE SUMMARY

Based on legal and regulatory requirements from the EU/EC regarding the implementation of the Single European Sky (SES) as well as business opportunities, in 2008 the four ANSPs Avinor (Norway), EANS (Estonia), Finavia (Finland) and LGS (Latvia), together with Naviair, LFV and Isavia (Denmark/Sweden/Iceland) who later withdrew from the project, initiated the NEFAB project with the aim to declare and establish a North European Functional Airspace Block (NEFAB). The objective is to have the NEFAB declared and established by 2012.

This report, the "NEFAB Socio-Economic Study", is an analysis of the overall added values of NEFAB for the society at large. Furthermore the socio-economic analysis summarises the internal and external effects expressed in a quantifiable manner and in monetary terms.

The key stakeholder in the socio-economic analysis includes the following parties:

- Airline operators (national, regional and foreign), which are the first level customers of the ANSPs.
- Passengers, who are dependent and influenced by the service and performance level of the ANSPs.
- The society in the NEFAB region and the society worldwide influenced by the environmental impacts (emissions) from all types of air traffic.

The methodology used for the analysis is based on EU and EUROCONTROL standards and practices for socio-economic studies.

The estimation of the time savings in the NEFAB region has been calculated by EUROCONTROL based on the same methodology as used for estimation of time and distance savings in other European FAB initiatives.

The values for airline savings are based on EUROCONTROL standards and have been verified by the major airlines in the NEFAB region.

The values for passenger time savings are based on estimates from the Norwegian TØI institute.

The values of emissions are in compliance with EUROCONTROL standards.

The overall result of the socio-economic analysis including internal and external effects looks as follows:

	Minimum scenario		Performance scenario	
External cash effects per year (in mill. Euro)	2015	53,7	2015	53,7
	2020	73,0	2020	76,8
	2025	92,8	2025	97,6
Internal cash effects per year (in mill. Euro)	2015	0,6	2015	-1,9
	2020	4,3	2020	12,6
	2025	4,3	2025	12,6
Total external and internal cash effects per year (in mill. Euro)	2015	54,3	2015	51,7
	2020	77,3	2020	89,4
	2025	97,1	2025	110,2
NPV of internal and external effects	2012-2025	304,0	2012-2025	341,3

Table 1: Overview of external and internal effects

As can be seen from the table, the expected internal and external cash value of the NEFAB initiative amounts to approximately mill. Euro 50 in 2015. In this case the gains are quite similar in the Minimum and in the Performance scenario.

In 2020 the larger benefits from the implementation of Free Route Airspace above FL195 is clearly seen as the total benefits amount to mill. Euro 89 in the Performance scenario versus the total value of mill. Euro 77 in the Minimum scenario.

In 2025 even greater benefits from the implementation of Free Route Airspace above FL195, in conjunction with the calculated traffic increase, is seen as the total benefits amount to mill. Euro 110 in the Performance scenario versus the total value of mill. Euro 97 in the Minimum scenario.

Finally the NPV for the period 2012 to 2025 amounts to mill. Euro 341 for the Performance scenario and mill. Euro 304 for the Minimum scenario. A discount factor of 10% is used for the NPV calculation.

The distribution of benefits from internal and external sources can be illustrated as follows:

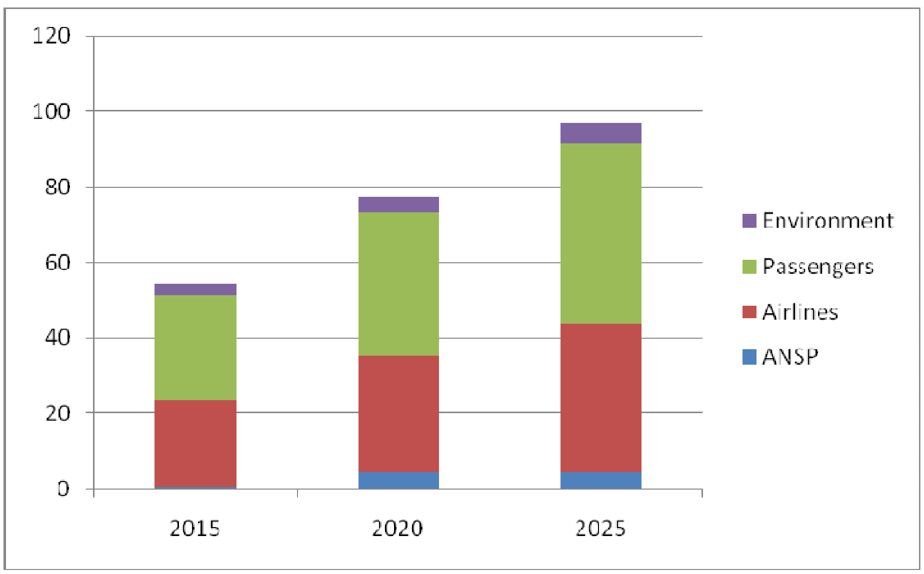

Figure 1: Distribution of internal and external benefits in the Minimum scenario

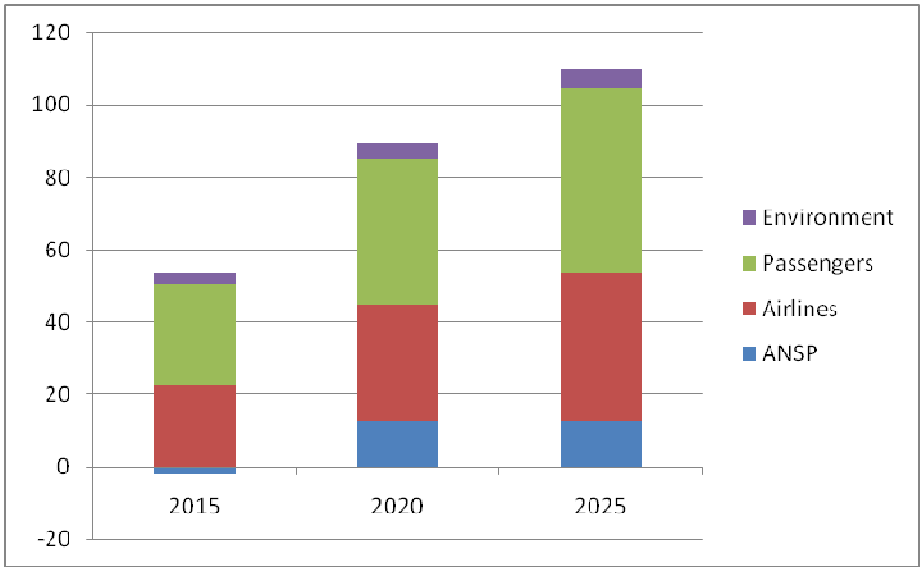

Figure 2: Distribution of internal and external benefits in the Performance scenario

Looking at the Performance scenario the internal net benefit is slightly negative in 2015 due to implementation costs and investments while the external benefits increase to mill. Euro 53,7 already in 2015. The main benefits are related to saved passenger time and airline savings.

In 2020 the internal benefits reach mill. Euro 12,6 or about one seventh of the total benefits. The main benefit remains with the airlines and the passengers.

2. INTRODUCTION

Based on legal and regulatory requirements as well as business opportunities, the four ANSPs Avinor, EANS, Finavia and LGS initiated the project with the aim to declare and establish a North European Functional Airspace Block (NEFAB). The declaration and establishment of NEFAB will be based on a feasibility study report, which will provide the necessary evidence required from Article 9a in the SES regulation 550/2004, Service Provision Regulation.

The feasibility study shall provide evidence justifying overall added values for declaring NEFAB, on the basis of the present Socio-Economic Study and a Cost Benefit Analysis (CBA).

This report, the NEFAB Socio-Economic Study, is an analysis providing an estimate of the overall added values of NEFAB for the society at large. The socio-economic analysis summarises all the internal and external effects expressed in a quantifiable manner and in monetary terms.

Volume I is the main report with all assumptions, methodology, key results and comments to the results while the technical simulations and calculations are presented in Volume II, Technical Annexes.

3. THE REGULATORY FRAMEWORK

3.1 The SES initiative

The Single European Sky (SES) is an ambitious initiative, launched by the European Commission in 1999, to reform the architecture of European air traffic management (ATM). It puts forward a legislative approach to meet future capacity and safety needs at a European rather than at local level.

Key objectives of this initiative are:

1. to restructure European airspace as a function of air traffic flows;
2. to create additional capacity; and
3. to increase the overall efficiency of the European air traffic management system.

An original Single European Sky (SES I) package came into force in 2004. At the time the greatest problem in air traffic management was congestion in the air and subsequent delays hence it also became the main focus of SES I, together with safety. During the past years the ATM (Air Traffic Management) situation has changed somewhat and whilst safety and capacity are still major issues, the picture has become more varied with a greater emphasis on environment and more recently due to the fuel price crisis, on cost efficiency.

Additionally, the regulatory approach has been changed due to requests from Member States and stakeholders for a less prescriptive approach ("better regulation").

The updated Single European Sky (SES II) package will tackle all these challenges. The background, objectives and rationales of SES I and II are fully observed and recognized in the present NEFAB project.

4. THE AIMS AND STAKEHOLDERS

4.1 Aims

The aims of the NEFAB project are defined as follows:

- To reduce costs for provision of the Air Traffic Service
- To increase efficiency of the management and operation of the airspace
- To increase safety
- To reduce the environmental impact

These aims are closely linked to the SES aims and objectives. The aims shall be achieved through an optimization, harmonization and possible integration of the services and the technical infrastructure in the NEFAB countries.

4.2 Stakeholders

The ANSPs are basically non-profit organisations providing service to airlines and indirectly to travellers. However, the ANSPs have a wide range of stakeholders in addition to the airlines and passengers. These stakeholders are more or less involved in and influenced by the business performance of the ANSPs, and have an interest in the performance of the ANSPs in relation to the implementation of the SES and the aims for the regional FAB initiatives.

Figure 3: Stakeholders for the NEFAB ANSPs

The key stakeholder in the socio-economic analysis includes the following parties:

- Airline operators, which are the first level customers of the ANSPs.

- Passengers, who are dependent and influenced by the service and performance level of the ANSPs. The passengers will be travellers on the national airlines in the NEFAB region as well as on foreign airlines servicing NEFAB destinations and finally passengers who will be en-route in the NEFAB airspace.

- The society in the NEFAB region and the society worldwide influenced by the environmental impacts (emissions) from all types of air traffic. The environmental issues and effects are of special importance to the society as the emissions and greenhouse effect of air transportation is heavily debated and focussed on in these years.

The effects of the NEFAB project to these stakeholders will be presented in the following chapters of this report.

The military is also one of the major operators in the NEFAB area, with specific requirements and needs for cost efficient operations and airspace for monitoring of national sovereignty. However, the military is not included in this analysis and will be dealt with in a later phase.

5. METHODOLOGY

5.1 Introduction to the applied Socio-Economic models

5.1.1 EU/EC models for Socio-Economic studies

The socio-economic analysis for the NEFAB project takes into consideration the principles of the EU Manual regarding performance of Cost-Benefit analysis and Socio-Economic analysis (EU: Guide to Cost-Benefit analysis of Investment Projects, July 2008).

The Manual was developed especially for projects funded by the EC Cohesion Fund and has turned out to be useful for all sorts of transport investment projects. The methodological structure and considerations regarding accounting prices or shadow prices has been useful for the present project work.

The Manual gives guidelines for the structuring of the relationship between CBA and Socio-Economic issues and particularly regarding calculation of financial key ratios and figures.

5.1.2 EUROCONTROL standards for Cost-benefit analysis

Furthermore it should be mentioned that EUROCONTROL provides a yearly report – "Standard Inputs for EUROCONTROL Cost-Benefit analysis" which presents the results from different international studies regarding values, performance indicators and benchmarks for aviation related issues.

The report shows that there is a considerable uncertainty regarding the values related to passenger time and the values of environmental emissions while the key performance figures related to airline flying time, fuel consumption and other airline costs are of a more uniform nature.

Especially with respect to the value of passenger time the EUROCONTROL manual presents the findings regarding the TØI (Transport Økonomisk Institut, Norway) values for passenger time, which have been used in the present Socio-Economic Study as input values for passenger time.

The EUROCONTROL report has been used as input in other FAB studies and the input figures are to some extent used in this study for the NEFAB initiative.

5.2 Data collection

The input data for the Socio-Economic Study have been gathered from the following sources:

5.2.1 The SAAM simulations

The EUROCONTROL "*System for Traffic Assignment and Analysis on Macroscopic level"*, or the so called SAAM modelling and simulation, has been the key source for all calculations of the effects of a more optimized airspace, taking into consideration the expected traffic growth as forecasted by EUROCONTROL.

The SAAM simulations for the NEFAB region have generated time and distance savings and have provided data on reduced fuel consumption and reduced CO2 emissions due to the more optimized airspace.

The EUROCONTROL simulations of time and distance gains have been carried out for 2015 with more direct routings. In 2020 two sets of simulations have been provided with even more direct routings above FL 245 and FL 195 respectively. These scenarios are called the "Minimum" and "Performance" scenarios.

The simulated input data are provided by EUROCONTROL through a simulation carried out for a particular representative day 23 June 2008. This day was identified by EUROCONTROL as a typical day taking into consideration weekly and daily peaks and a day of no major delays.

More precisely the following set of data was used in the 2020 minimum scenario:

- Route network: VST (RNDSG Very Short Term) 1003, including Oslo ASAP project and full Free Route Airspace in the whole NEFAB area above FL245. The VST model was validated and corrected to represent the current operations.
- Traffic sample: based on 27.6.2008 and artificially adjusted for the year 2020 (based on 2015 model with 50% traffic increase in comparison to 2008).
- Military areas activated according to a "typical day" scenario as agreed with the military partners.

Data from the representative day has been used in other EUROCONTROL simulations for other FAB initiatives, which make it possible to benchmark the effect in the NEFAB project with other FAB projects in Europe.

A detailed description of the simulations are found in the NEFAB Feasibility Study report: "*North European Functional Airspace Block, Initiative no. 1, ATS-Routes and sectorisation*"

5.2.2 EUROCONTROL standard input

The above mentioned EUROCONTROL report "*Standard Inputs for EUROCONTROL Cost-Benefit analysis*" has provided input regarding monetary values of

- Operational and fixed costs for aircraft operations
- Values of passenger time
- Values of environmental impacts

5.2.3 Airline consultations

Consultations have been carried out with the main carriers in the NEFAB region including:

- SAS
- Finnair
- Air Baltic
- Norwegian

All carriers have contributed to the input for the study and have participated in fruitful consultations.

The input from the airlines have included information regarding future fleet structure, estimates of direct and fixed operational costs and particular problems related to the operation in the NEFAB airspace.

5.2.4 The Cost-Benefit analysis

A separate cost benefit analysis (CBA) has been developed for the internal effects for the ANSPs in the NEFAB initiative. The result from the CBA is an input to the socio-economic analysis.

5.3 Definitions and assumptions

5.3.1 Key dates

The NEFAB project is planned for successive phased implementation towards the 2015 vision year.

The period from 2012 to 2015 will be a transition period from a national based air traffic management system to a flexible and more dynamic airspace based on traffic flows unconstrained by national borders. Subsequently this includes cross-border sectors instead of delegated airspace, and a transition from a fixed route network to a more direct and free route airspace environment. Furthermore there will be a more flexible use of the airspace for the benefit of both civil and military traffic.

Due to the transitionary nature of the period from 2012 to 2015, the external benefits gained in this period by airlines, passengers and the environment have not been included in the analysis. However, in reality it is expected that some external benefits would start to occur during this period, hence in this way the results of the analysis can be considered conservative.

The period from 2015 to 2020 will take the initiatives from 2015 further with expansions of the free route airspace to lower levels and increased flexibility in the use of the airspace. Both internal and external costs and benefits have been included in the analysis during this period.

The following key dates/years have been defined:

- 2012: Reference year for the calculations
- 2015: The first year of an optimised common NEFAB airspace with free routes above FL 285
- 2020: Minimum scenario with free routes above FL 245 or
- 2020: Performance scenario with free routes above FL 195

5.3.2 The types of traffic included in the study

The socio-economic analysis and simulations include all traffic in the NEFAB airspace including all en-route traffic, regional traffic within and to and from the FAB, and domestic traffic.

The traffic includes national and international carriers and all types of passengers irrespective of travel purposes and nationality.

Only TMA traffic within 30 NM from the airport is not included in the simulations of reduced travel time and distance.

5.3.3 Forecast and statistics

The simulated effects for the particular representative days have been projected to an annual basis and have been projected further to 2015 and 2020 by use of the EUROCONTROL forecast for the future air traffic in Europe. The forecast foresees a growth of 24.2% from 2008 to 2015 and a growth of 54,7% from 2008 to 2020 in the NEFAB area.

Thus the estimated savings are calculated on the basis of a considerably higher traffic volume than we see today in the NEFAB region.

5.3.4 Fleet structure

The air traffic in the NEFAB region is carried out with a wide range of aircraft types ranging from older and newer turbo-prop aircraft to aged and brand-new short, medium and long haul jet aircraft.

All Nordic and Baltic carriers have planned for a major renewal of the fleet in order to gain increased fuel efficiency, lower maintenance costs and reduced emissions. The present aging MD aircraft will be substituted by newer aircraft, the present classic Boeing 737s and A 320s will be substituted by New Generation (NG) aircraft and new A 350 and B 787 Dreamliners will to some extent substitute the present long-range aircraft. This renewal of the fleets goes both for the Nordic and Baltic carriers as well as for foreign airlines using the NEFAB airspace. This factor is not included in the EUROCONTROL simulations but there will no doubt be an upside with respect to fuel burn and emissions. It is estimated that this factor may reduce fuel consumption and emissions by 2-5% over the next decade.

5.3.5 Safety

It is assumed that flight safety will never be compromised in any new airspace configuration and that safety issues will always be dealt with in accordance with ICAO, EU and national standards and recommended practices.

Thus the flight safety will as a minimum remain the same (despite increased traffic volumes and new airspace structures with free routes) or will be improved due to new technologies and procedures and optimised airspace design.

Thus no changes are foreseen with respect to the level of flight safety.

5.3.6 Currency

All monetary figures in this report are stated in Euro.

5.3.7 Discount rate

A discount rate of 10% has been used for the NPV calculation.

6. THE RESULTS OF THE SOCIO-ECONOMIC ANALYSIS

6.1 Introduction to results

The methodological approach was presented in Chapter 5 including discussions of

- Socio-economic models
- Definitions
- Assumptions
- Input data and
- General discussions of values

Based on these assumptions and framework conditions the total socio-economic effects of the gradually optimised airspace in the NEFAB region with the years 2012, 2015 and 2020 as the focus years has been calculated.

The components of the calculations can be illustrated as follows:

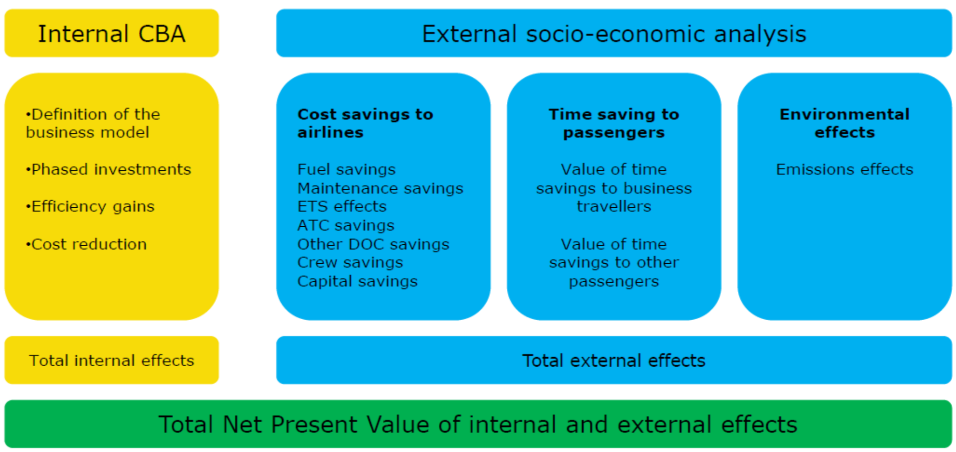

Figure 4: Overview of the Socio-Economic Study

The main result of the calculations will be presented in the following chapters. Furthermore all calculations are shown in details in Volume 2: Technical Annexes for a more in-depth study.

6.2 The time gains

The SAAM simulations have provided a set of estimates for the expected time gains with the implementation of Free Route Airspace above FL 285 in 2015 and optimisation of the ATS-route network. For 2020 two scenarios are calculated based on FL 245 and 195 respectively for Free Route Airspace. Furthermore the EUROCONTROL forecast has been applied to estimate the total effects of an optimised airspace in a growing market for air traffic.

The forecast for the air traffic in the NEFAB rim looks as follows:

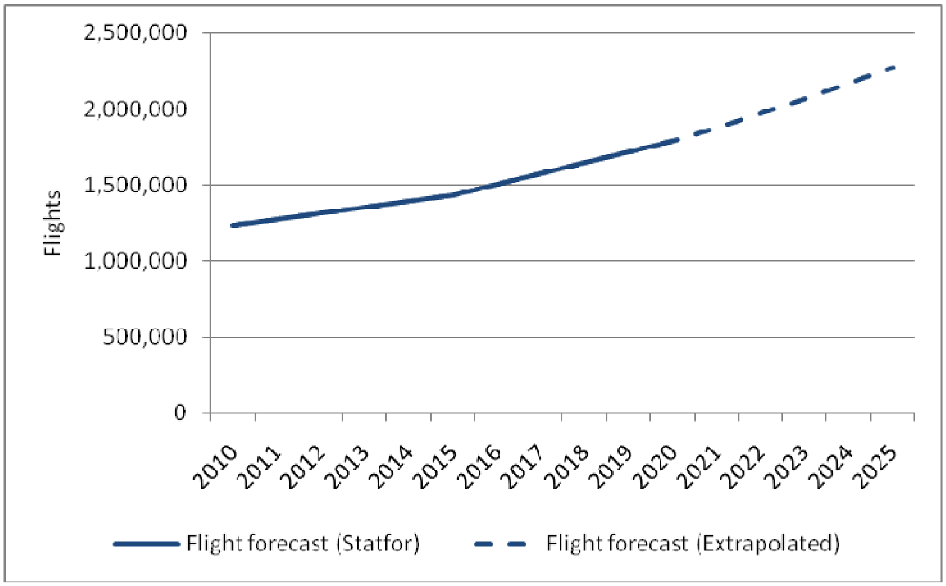

Figure 5: Forecast for number of flights 2010-2020 (2025)

The flight time savings in the different scenarios can be summarized as follows (for details see Volume II: Technical Annexes):

	Minimum scenario		Performance scenario	
Time savings in hours	2015	6.202	2015	6.202
	2020	8.423	2020	8.940
	2025	10.699	2025	11.357

Table 2: Yearly time savings in hours

The Performance scenario has marginally higher time saving than the Minimum scenario due to the lower limit for Free Route Airspace.

Airspace development is very complex in nature as it has to take into account civil and military requirements, efficiency, environmental and regulatory issues, and at the same time ensure safety levels.

In order to reduce risks related to Free Route Airspace in complex lower airspace the NEFAB project proposes a phased introduction of Free Route Airspace.

The phased implementation of Free Route Airspace means that differences between the proposed NEFAB scenarios (Minimum and Performance) does not indicate substantial differences due to the fact that most of the time savings are utilized above FL 245 (which is covered by both scenarios). The benefits gained in the level bands of FL 245/FL195 is marginal.

6.3 The ANSP cost-benefit analysis

6.3.1 The Cost Benefit analysis

The NEFAB project has carried out a separate Cost Benefit Analysis for the internal ANSP effects. The CBA is an attachment to the NEFAB Feasibility Study report together with this Socio-Economic Study. As this Socio-Economic Study is providing overall benefits of NEFAB, the result from the CBA is included.

Thus it is logical to include the internal savings in the overall socio-Economic assessment of the NEFAB initiative.

The CBA has been carried out as a separate analysis. For a more detailed description and understanding of the CBA we refer the reader to: NEFAB Cost-benefits Analysis report 2011.

The net key results from the CBA can be summarized as follows:

	Minimum scenario		Performance scenario	
Internal net effect (in mill. Euro)	2015	0,6	2015	-1,9
	2020	4,3	2020	12,6
	2025	4,3	2025	12,6

Table 3: Internal net effects

6.4 Cost savings to airlines

6.4.1 Fuel savings

The reduced flying time and reduced distances (which in this study are considered 100% correlated) will at an overall level reduce the fuel consumption proportionally to the time and distance savings.

The reduced fuel consumption will also marginally reduce the required fuel upload which again will reduce the fuel burn. However, this is effect is considered so small that it is not considered in the calculations.

The fuel savings have been calculated directly in the SAAM simulation based on the actual fuel consumption by the different types of aircraft travelling in the NEFAB airspace. As mentioned before these figures for fuel consumption have not been adjusted in order to take into account more fuel efficient hulls and engines in the future.

The fuel price is fluctuating over time following the world supply and demand for jet-fuel and oil in general. Furthermore fuel prices differ from country to country and even from airport to airport. Some airlines buy at world market spot prices while other airlines hedge some part of the expected fuel consumption.

Based on figures reported by IATA (22.07.2011) a fuel price of Euro 740 per tonne is used for the calculations in the socio-economic analysis. This is an average global price paid at the refinery for aviation jet fuel, at the time of writing this report, and is rather high compared to the average over the last 3-5 years.

The fuel savings in the different scenarios can be summarized as follows (for details see Volume II: Technical Annexes):

	Minimum scenario		Performance scenario	
Fuel savings in tonnes	2015	14.527	2015	14.527
	2020	19.870	2020	20.375
	2025	25.263	2025	25.906

Table 4: Yearly fuel savings in tonnes

The Performance scenario has marginally higher fuel saving than the Minimum scenario due to the lower limit for Free Route Airspace.

6.4.2 Maintenance costs

Airlines put aside maintenance reserves for each flight hour, cycle and calendar days. Most maintenance work is time related to FH (Flight Hours), while a minor part is related to calendar days and cycles (landing gear). The maintenance costs include reserves for maintenance of hull, engines, landing gear and avionics.

If flying time is reduced due to a more optimised airspace there will be a proportional saving with respect to the maintenance reserves. The airlines have not been able to provide input data on this issue. Instead the average maintenance reserve for European airlines has been used as stated in the "Standard Inputs for EUROCONTROL Cost-Benefit analysis". The maintenance reserve per FH is estimated to Euro 250 per FH.

6.4.3 Emissions costs

From 2012 the EU/EC has introduced an Emissions Trading Scheme for all air traffic in the EU area. The new environmental penalty means that the airlines must deliver an "emission allowance" for each tonne of CO2 emissions. However, airlines are granted a free allowance equal to 80% of the emissions in 2004-2006. For each tonne above this level the airlines will be charged a tax of Euro 30 per tonne of CO2.

The traffic volume in 2015 and 2020 will no doubt be considerably above the 80% level of the 2004 – 2006 traffic, which means that all effects coming from an improved airspace configuration will have a monetary effect equal to the saved CO2 emission in tonnes times the tax of Euro 30 per tonne. Thus the airline savings of emission costs is estimated at Euro 30 per tonnes.

6.4.4 Navigational charges

The airlines pay for the navigational services based on a cost coverage principle related to the costs of running the ANSPs.

The Cost Benefit analysis carried out for the NEFAB shows that there will be long-term savings with respect to the operational costs of the ANSPs in the NEFAB area. This is caused by volume of scale, flexibility in the management and control of the sectors, reduced R&D costs, volume of scale in relation to training and finally less fixed administrative costs. However, the possible reduction of navigational charges has not yet been calculated.

6.4.5 Fixed operational costs

The Fixed Operational Costs (FOC) includes mainly crew costs, overheads for administration and capital costs. Logically these costs are fixed for a particular flight and aircraft but to some extent these costs will also become variable over a longer time period and taking into consideration volume of scale.

Theoretically a reduced flying time reduces the required crew and aircraft capacity (capital costs) and in the long term, this reduces the FOCs proportionally to the time savings.

An amount of Euro 1465 per hour has been used for FOCs.

6.4.6 Change of fleet structure

All airlines in the NEFAB region are in the process of renewing the fleet in order to reduce fuel consumption and emissions. Thus it is expected that the Boeing 737 First Generation aircraft and the aging MD aircraft will be substituted by newer and/or brand-new Boeing New Generation aircraft and by fuel efficient long-haul aircraft like the A 350 and Boeing 787 Dreamliner aircraft.

The cost effects of less fuel consumption by new aircraft have not been taken into consideration but there is assumed to be a cost efficiency upside due to the modernization of the fleet.

It is assumed that the structure of aircraft size will remain unchanged.

6.4.7 Total airline savings

Based on the above assumptions and calculations the following yearly savings have been calculated for the airlines:

	Minimum scenario (FL 285 / 245)		Performance scenario (FL 285 / 195)	
Airline savings (in mill. Euro)	2015	22,7	2015	22,7
	2020	31,0	2020	32,3
	2025	39,4	2025	41,1

Table 5: Airline savings

In the Performance scenario the annual savings for fuel, maintenance costs, ETS and FOC will amount to 22,7 to 41,1 M€ in 2015 and 2025 respectively. In the Minimum scenario the potential savings range from 22,7 M€ in 2015 to 39,4 M€ in 2025

6.5 Time saving to passengers

6.5.1 Calculation of time savings

The benefit of shorter flying time has a benefit to the passengers depending on the purpose of the trip. Obviously time has in general a higher value for a business traveller than for a holiday traveller or a student traveller.

However, the actual value of time savings is much debated and the value of, for instance, one hour for a business traveller varies from Euro 21 to Euro 80 depending on the type of study and assumptions.

A reasonable average figure from the different studies seems to be Euro 50 per hour for business travellers and Euro 26 per hour for other passengers. These values are proposed by the Norwegian TØI and presented in the EUROCONTROL manual as reasonable values of travelling time. A more detailed description is provided in Volume 2.

It should be noted that business travellers are not travellers travelling in business-class only, but all travellers who are travelling for business purposes.

The distribution of business travellers and other travellers is estimated to be 49% business travellers and 51% other travellers. This is a European average figure and a figure confirmed by the airlines.

6.5.2 Total value of time savings for passengers

The key results of the simulations for the value passenger time savings per year can be summarized as follows:

	Minimum scenario (FL 285 / 245)		Performance scenario (FL 285 / 195)	
Savings based on NEFAB values (in mill. Euro)	2015	27,8	2015	27,8
	2020	37,8	2020	40,1
	2025	48,0	2025	50,9

Table 6: Value of time savings to passengers

When using the before mentioned values a saving from 27,8, 40,1 to 50,9 M€ per year can be achieved in the Performance scenario when looking at the years 2015, 2020 and 2025 respectively.

6.6 Environmental benefits to the society

6.6.1 The emissions

The environmental effects from the airline sector include both noise and emissions. However, the noise effect is very limited when talking about flights outside the TMA area. Consequently the noise impacts are not considered in this analysis.

The emissions from aircraft include:

- CO_2 Carbon dioxide
- H_2O Water
- SO_2 Sulfur dioxide
- NOX Nitrous oxide
- HC Hydrocarbon

The most important type of emission is CO_2, which as mentioned earlier is subject to the special ETS tax imposed on the airlines from 2012.

The "Standard Inputs for EUROCONTROL Cost-Benefit analysis" gives a comprehensive set of values for the different types of emissions presented in different scientific studies. These studies do not provide a set of unique values for the emissions. On the contrary the values differ considerably from study to study. The values in the different studies are shown in Volume 2: Technical Annexes.

The figures used in this study are as follows:

Value of reduced emissions (in Euro)		
	Tonnes per hour	Value pr. Tonne
CO2	9,4	56
H2O	3,7	18
SO2	3,0	6,5
NOX	38,0	6,6
HC	4,0	0,6

Table 7: Value of different types of emissions

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6.6.2 Total emission savings

The key results of the simulations for the emissions savings can be summarized as follows:

	Minimum scenario (FL 285 / 245)		Performance scenario (FL 285 / 195)	
Emission savings (in mill. Euro)	2015	3,1	2015	3,1
	2020	4,2	2020	4,4
	2025	5,4	2025	5,6

Table 8: Value of reduced emissions

There is slightly higher long-term savings in the Performance scenario than in the Minimum scenario.

6.7 Total internal and external effects

Referring to the above chapters regarding the internal and external effects of an optimised airspace the following total yearly and total NPV effects have been calculated:

	Minimum scenario		Performance scenario	
External cash effects per year (in mill. Euro)	2015	53,7	2015	53,7
	2020	73,0	2020	76,8
	2025	92,8	2025	97,6
Internal cash effects per year (in mill. Euro)	2015	0,6	2015	-1,9
	2020	4,3	2020	12,6
	2025	4,3	2025	12,6
Total external and internal cash effects per year (in mill. Euro)	2015	54,3	2015	51,7
	2020	77,3	2020	89,4
	2025	97,1	2025	110,2
NPV of internal and external effects	2012-2025	304,0	2012-2025	341,3

Table 9: Overview of external and internal effects

As can be seen from the table, the expected internal and external cash value of the NEFAB initiative amounts to approximately mill. Euro 50 in 2015. In this case the gains are quite similar in the Minimum and in the Performance scenario.

In 2020 the larger benefits from the implementation of Free Route Airspace above FL195 is clearly seen as the total benefits amount to mill. Euro 89 in the Performance scenario versus the total value of mill. Euro 77 in the Minimum scenario.

In 2025 even greater benefits from the implementation of Free Route Airspace above FL195, in conjunction with the calculated traffic increase, is seen as the total benefits amount to mill. Euro 110 in the Performance scenario versus the total value of mill. Euro 97 in the Minimum scenario.

Finally the NPV for the period 2012 to 2025 amounts to mill. Euro 341 for the Performance scenario and mill. Euro 304 for the Minimum scenario. A discount factor of 10% is used for the NPV calculation.

The distribution of benefits from internal and external sources can be illustrated as follows:

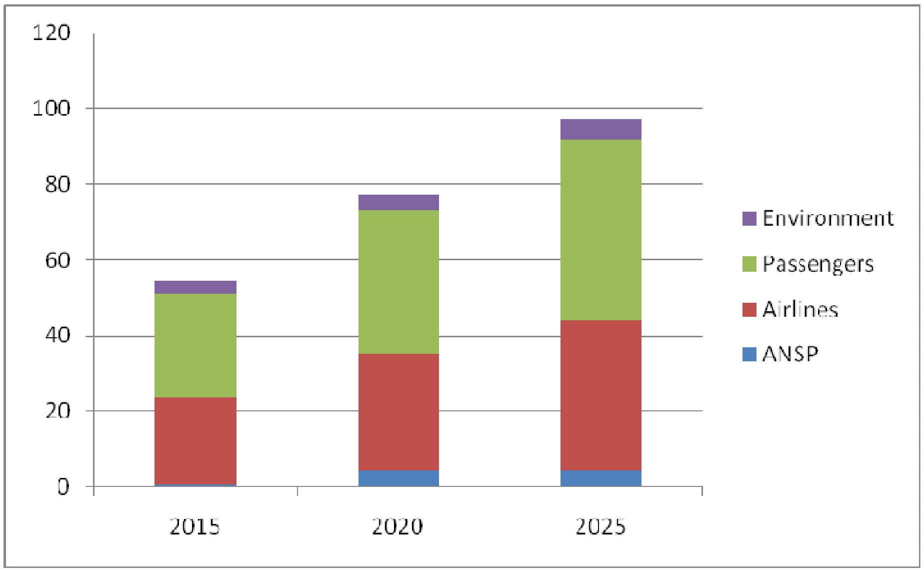

Figure 6: Distribution of internal and external benefits in the Minimum scenario

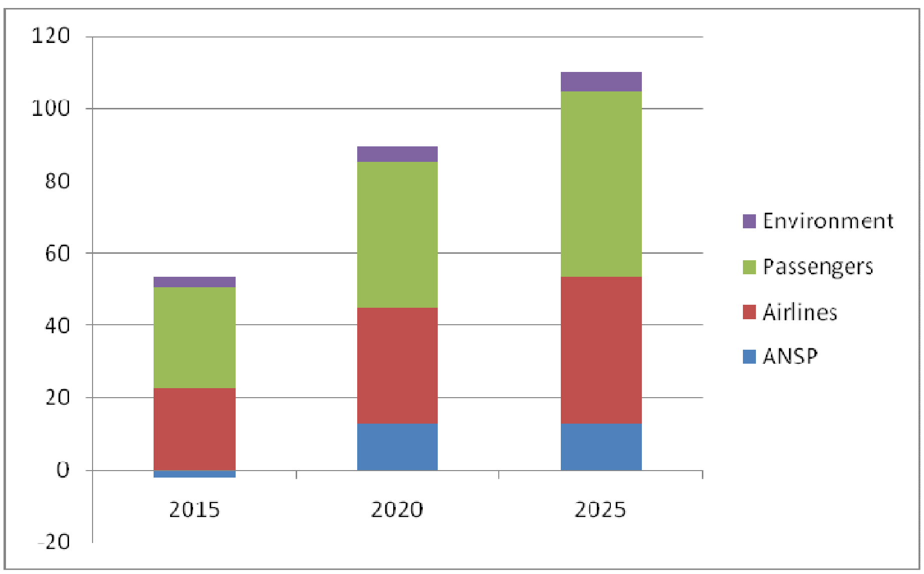

Figure 7: Distribution of internal and external benefits in the Performance scenario

Looking at the Performance scenario the internal net benefit is slightly negative in 2015 due to implementation costs and investments while the external benefits increase to mill. Euro 53,7 already in 2015. The main benefits are related to saved passenger time and airline savings.

In 2020 the internal benefits reach mill. Euro 12,6 or about one seventh of the total benefits. The main benefit remains with the airlines and the passengers.

ANNEX 1: BIBLIOGRAPHY

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ANNEX 2: ABBREVIATIONS

A 330-300	Airbus 330-300, long haul aircraft
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATCO	Air Traffic Controller
ATM	Air Traffic Management
B 737-800	Boeing 737-800, medium haul aircraft
CBA	Cost-Benefit analysis
CO_2	Carbon Dioxide
DOC	Direct Operational Costs
FAB	Functional Airspace Blocks
FH	Flight hour
FOC	Fixed Operational Costs
H_2O	Water
HC	Hydrocarbon
IATA	International Air Traffic Association
NM	Nautical Mile
NOX	Nitrous Oxide
NPV	Net Present Value
PAX	Passenger
R&D	Research and Development
SAAM	System for Airspace Analysis at Macroscopic Level
SES	Single European Sky
SLV	Statens Luftfartsvæsen
SO_2	Sulfurdioxide
TERESA	Transport- og Energiministeriets Regnearksmodel til Samfunds-økonomisk Analyse