NUAC Programme
Definition Phase Final Report

Appendix 8
Fast-time Simulation

Simulation analysis for optimisation of Swedish and Danish airspace

FEBRUARY 2007

Table of Contents

1 Introduction

The overall aim of the NUAC Programme definition phase is to analyse means to make best use of available resources to reduce costs with sufficient safety and capacity. As part of the definition phase of the NUAC Programme, meeting the purpose of elaborating an efficient airspace solution with regards to staffing, traffic demands etc, the NUAC Airspace Design Report has been produced as aid to the development of a consolidated Business Case for 3 different scenarios.

The study was a high level study of the possible layout of Danish and Swedish airspace, including aspects of use of the three Control Centres in Stockholm, Malmö and Copenhagen.

The three different scenarios are described as follows:

Merger Scenario
The merger scenario is a consolidation of the Danish/Swedish airspace with optimum use of the three Control Centres.
The area is designed with en-route sectors and with two TRACON's.
TRACON's will have the responsibility for Terminal and Approach Control for several aerodromes, one TRACON handling the airspace surrounding Kastrup/Sturup and the other TRACON handling the airspace surrounding Arlanda.
Both en-route and approach sectors are a part of the TRACON design.
The airspace outside the two TRACON's and other local approach units, will be handled by en-route sectors.

NUAC/Skaane Scenario:
The original NUAC/Skaane project as described in the NUAC Phase 1 Report and in the Skaane Project Feasibility Phase Final Report January 2004 and connected documents.

Virtual Scenario:
A virtual possibility including the use of the three above mentioned Control Centres and the airspace, with a joint data distribution/sharing

1.1 General

After the development of the NUAC Airspace Design Team Report a decision of conducting a Fast Time Simulation was made.
The simulation is to be regarded as the first step in order to "operationalise" the airspace within the NUAC Programme.

1.1.1 Objective

The objective of the simulation is to show the varieties in the traffic flow as described in the simulation scenarios below, in order to discover any possibilities for optimising the airspace.

This will encompass both operational, safety and socio-economical regards.

This will be done for the concerned area as a whole, and specifically for flights from Stockholm to Copenhagen and back and the NE – SW/SW – NE traffic flow through the areas.

1.1.2 Simulations

The fast time simulation will be performed in three different simulations, all three including Swedish and Danish airspace.

For each simulation the three different airspace designs, as described in NUAC Airspace Design Report, will be compared with the traffic flow.

The three simulations follow as Simulation A, B and C:

Simulation A
Traffic following flight planned route in Swedish and Danish airspace.

Simulation B
Swedish and Danish airspace divided in three areas; these three areas are similar to the Area of Responsibility for the three existing control centres ATCC Stockholm, ATCC Malmö and Copenhagen ACC.
Traffic is, in each of the three areas, routed via area entry and exit points.

Simulation C
Swedish and Danish airspace will be regarded as a single airspace.
Traffic in the area is routed via entry and exit points only.

City pair simulation
To kinds of city pairing is done for the en route and terminal areas as a study and analysis concerning the possibility for fuel and time saving.

The first city pair analysis concerns the traffic flow between the city pairs Copenhagen and Stockholm v.v.

Second analysis covers the traffic flow between Helsinki and the cities Amsterdam, Brussels and Paris and v.v.

1.1.3 Prerequisites

The simulation is performed by Anders Nyberg LFV/ASD.

Traffic data is from the 20th of April 2006.

Traffic data used has been delivered by CFMU.

Traffic data has been corrected in order to follow flight planned route. This has been done by the NUAC Airspace Design Team.

The sectors used in the simulation, is the sectors described in the NUAC Airspace Design Team Report for airspace design Merger scenario, NUAC/Skåne scenario and Virtual Scenario. Single sector data is available for further analysis, which is being carried out.

2 Simulation A

2.1 General

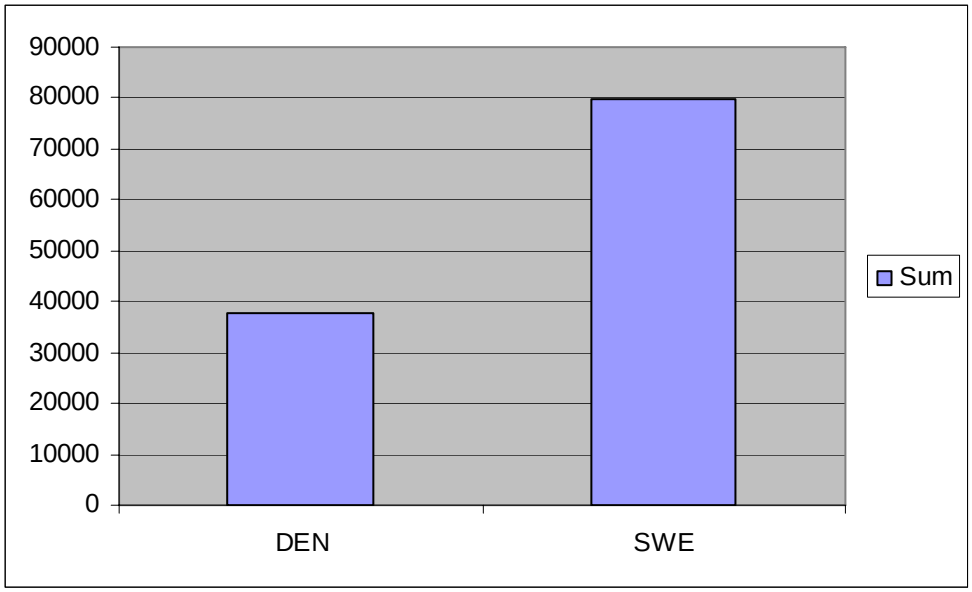
Traffic follows the original flight planned route in Swedish and Danish airspace based on the actual traffic on the 20 April 2006 as obtained from the CFMU. This simulation is the the baseline for the two other simulations B and C.

2.1.1 Traffic flow

The traffic flow in this simulation follows the original flight plan routes.

2.1.1.1 Traffic flying time

The traffic flow in this simulation follows the original flight plan routes and the total time is calculated and graphically displayed in minutes for EKDK and ESMS/ESOS FIR and as a total number for the areas.

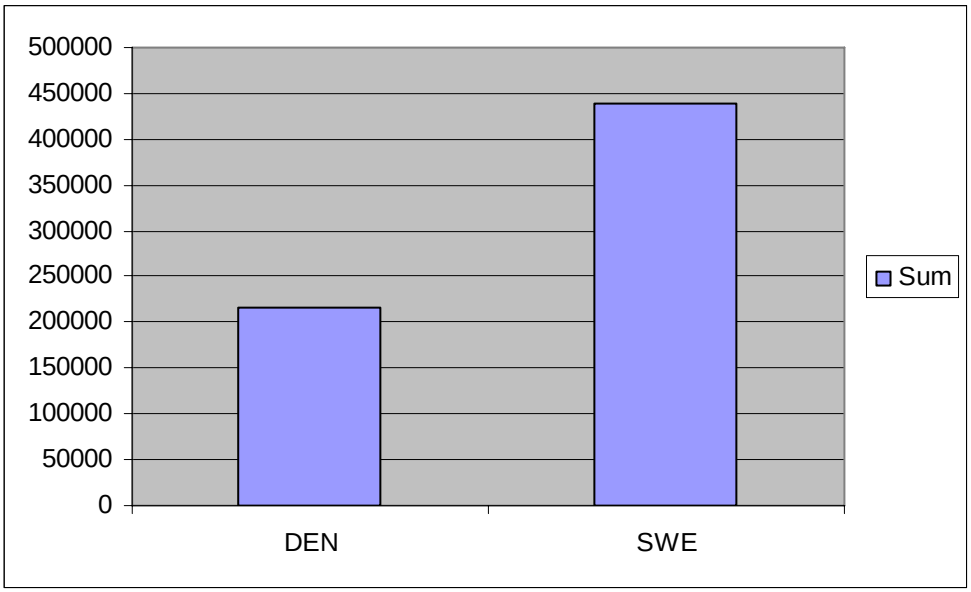


Minutes:

EKDK	37.543 min.
ESMM + ESOS	79.856 min.
TOTAL	117.399 min.

2.1.1.2 Traffic flying distance

The traffic flow in this simulation follows the original flight plan routes and the total flying distance is calculated and graphically displayed in NM for EKDK and ESMS/ESOS FIR and as a total distance for the areas.



NM

EKDK	216.845 NM
ESMM + ESOS	438.629 NM
TOTAL	655.474 NM

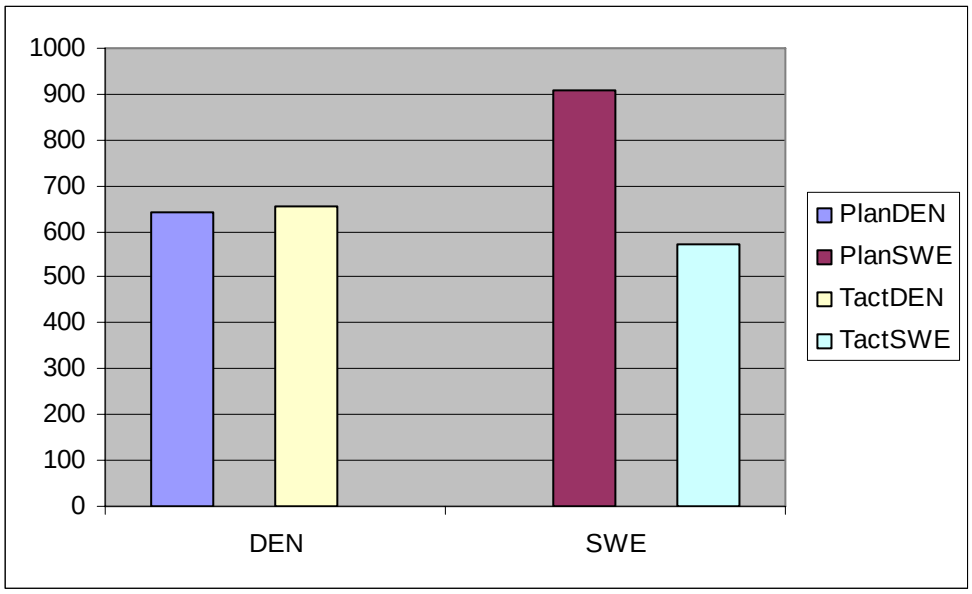
2.1.1.3 Traffic conflicts

A tactical conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet and/or 5 NM, thus requiring operational intervention on a tactical level.

A planner conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet and/or 5 NM, but can be calculated and solved before traffic is actually in the area in question.

Both can be seen as a measurement for complexity in the simulated airspace areas and few conflicts will require less operational intervention.

Both types of conflicts for Danish and Swedish areas are calculated and graphically displayed.



Planner conflicts

EKDK	642
ESMM + ESOS	910
TOTAL	1.552

Tactical conflicts

EKDK	656
ESMM + ESOS	570
TOTAL	1.226

Total conflicts

Planner	1.552
Tactical	1.226
TOTAL	2.778

2.1.2 City pair Stockholm/Copenhagen

The traffic flow between the city pairs Stockholm and Copenhagen v.v. in the simulation A routes via Arlanda – Dunker – Sveda – Kastrup and returns via Kastrup – Kemax – Trosa – Arlanda.

This description holds the simulated route from take-off to TMA exit point, the en-route phase and the route from TMA entry point to landing. More studies regarding optimum departure and arrival profiles are antissipated for next phase study.

2.1.2.1 Traffic flying distance

The direct track between Kastrup and Arlanda is 297 NM.
The track Kastrup – Kemax – Trosa – Arlanda is 301 NM.
The track Arlanda – Dunker – Sveda – Kastrup is 304 NM.
The maximum savings potential is 7 + 4 NM = 11 NM for a return flight.

The total flying distance on the simulation A without SID and STAR gives a total distance of 605 return flights NM for the following flights derived from CFMU database from the 20 April 2006:

Citypairs	Callsign	Distance NM	Flying time minutes
ESSA-EKCH	FDX5059	301	48,25
ESSA-EKCH	NDC301	301	48,25
ESSA-EKCH	NDC309	301	48,25
ESSA-EKCH	NDC311	301	48,25
ESSA-EKCH	NDC313	301	48,25
ESSA-EKCH	NVR9171	301	48,25
ESSA-EKCH	SAS1415	301	48,25
ESSA-EKCH	SAS1417	301	48,25
ESSA-EKCH	SAS1423	301	48,25
ESSA-EKCH	SAS1425	301	48,25
ESSA-EKCH	SAS1427	301	48,25
ESSA-EKCH	SAS401	301	48,25
ESSA-EKCH	SAS403	301	48,25
ESSA-EKCH	SAS407	301	48,25
ESSA-EKCH	SAS409	301	48,25
ESSA-EKCH	SAS411	301	48,25
ESSA-EKCH	SAS411	301	48,25
ESSA-EKCH	SNB797	301	48,25
EKCH-ESSA	FDX5082	304	48,25
EKCH-ESSA	NDC302	304	48,25
EKCH-ESSA	NDC304	304	48,25
EKCH-ESSA	NDC312	304	48,25
EKCH-ESSA	NDC314	304	48,25
EKCH-ESSA	NDC316	304	48,25
EKCH-ESSA	NFA134	304	48,25
EKCH-ESSA	NVR9509	304	48,25
EKCH-ESSA	SAS1416	304	48,25
EKCH-ESSA	SAS1418	304	48,25
EKCH-ESSA	SAS1424	304	48,25
EKCH-ESSA	SAS1426	304	48,25
EKCH-ESSA	SAS1428	304	48,25
EKCH-ESSA	SAS400	304	48,25
EKCH-ESSA	SAS402	304	48,25
EKCH-ESSA	SAS406	304	48,25
EKCH-ESSA	SAS408	304	48,25
EKCH-ESSA	SAS410	304	48,25
EKCH-ESSA	SAS412	304	48,25
EKCH-ESSA	SNB798	304	48,25
EKCH-ESSA	VKG502	304	48,25
TOTAL/day		11.802	1.881,75

The flying time for the distances between TMA exit point and TMA entry point is calculated as an average of 6, 3 NM/minut for all flights.

2.1.3 City pair Helsinki – Brussels/Amsterdam/Paris and v.v.

The table's below displays the flying time and distance in the Danish and Swedish airspace in minutes/NM as derived from the CFMU from the 20 April 2006 and following flight plan route.

SW to NE

Citypairs	Callsign	Distance NM	Flying time minutes
EBBR-EFHK	BCS3669	483	72
EBBR-EFHK	FIN812N	483	76
EBBR-EFHK	FIN814N	483	76
EBBR-EFHK	FIN818N	483	72
EHAM-EFHK	BLF832	483	80
EHAM-EFHK	FIN842Q	483	73
EHAM-EFHK	KLM1167	483	76
EHAM-EFHK	KLM1169	483	76
EHAM-EFHK	KLM1171	486	81
LFPG-EFHK	FIN872P	483	77
LFPG-EFHK	FIN874P	483	72
LFPG-EFHK	FIN876P	486	81
LFPG-EFHK	FIN880	483	76
TOTAL		6285	988

NE to SW

City Pair	Callsign	Distance NM	Flying time minutes
EFHK-EBBR	DAT42T	424	69
EFHK-EBBR	DAT42U	424	69
EFHK-EBBR	FIN811N	513	81
EFHK-EBBR	FIN813N	513	81
EFHK-EBBR	FIN817N	513	77
EFHK-EHAM	BLF831	513	85
EFHK-EHAM	FIN841Q	513	77
EFHK-EHAM	FIN845Q	513	81
EFHK-EHAM	KLM1164	513	81
EFHK-EHAM	KLM1168	513	81
EFHK-EHAM	KLM1170	513	81
EFHK-LFPG	FIN871P	513	77
EFHK-LFPG	FIN873P	513	77
EFHK-LFPG	FIN875P	513	81
EFHK-LFPG	FIN879	513	81
TOTAL/day		7.517	1.179

3 Simulation B

3.1 General

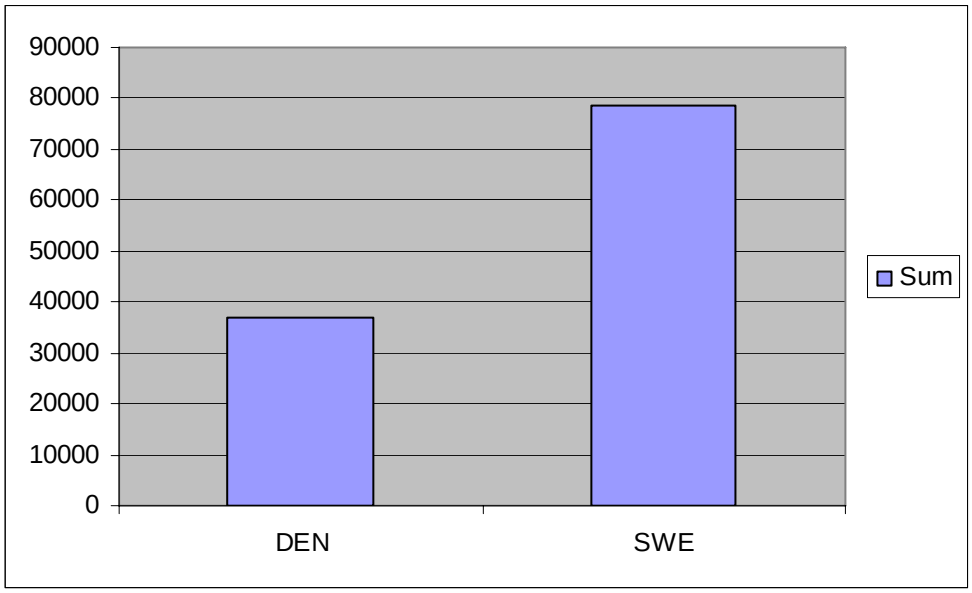
Swedish and Danish airspace is divided in three areas; these three areas are similar to the Area of Responsibility for the three existing control centres ATCC Stockholm, ATCC Malmö and Copenhagen ACC.

3.1.1 Traffic flow

The traffic flow in this simulation routes via the entry and exit points in the three areas and is based on the traffic flight plans obtained from the CFMU regarding the 20 April 2006.

3.1.1.1 Traffic flying time

The traffic follows more direct routes than the original flight plan routes and the total time is calculated and graphically displayed in minutes for EKDK and ESMS/ESOS FIR and as a total number for the areas.



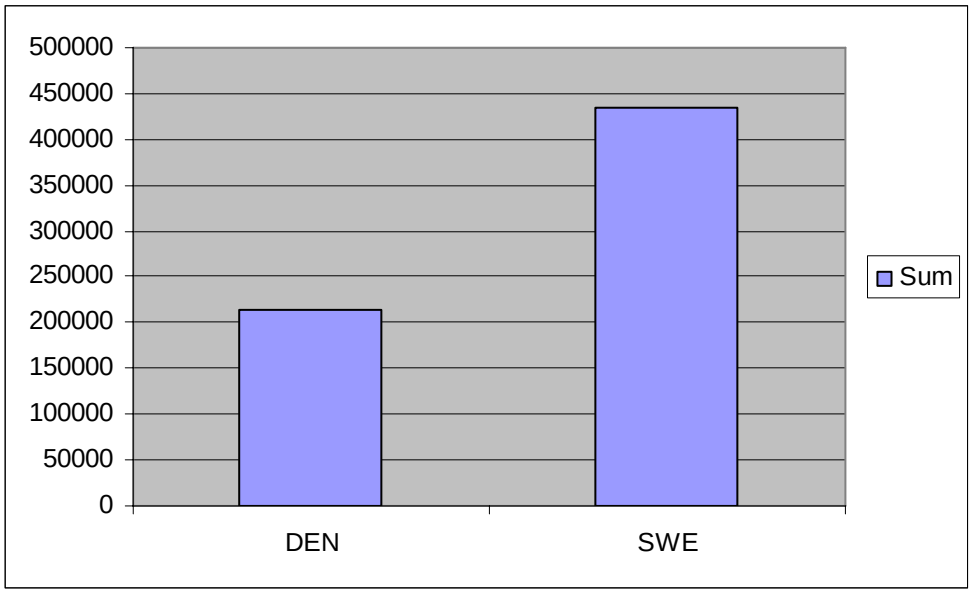
Minutes:

EKDK	37.082 min.
ESMM + ESOS	78.703 min.
TOTAL	115.785 min

3.1.1.2 Traffic flying distance

The traffic flow in this simulation follows the flight plan routes between entry and exit points in the three above mentioned areas, and the total flying distance is calculated

and graphically displayed in NM for EKDK and ESMS/ESOS FIR and as a total distance for the areas.



NM

EKDK	214.297 NM
ESMM + ESOS	434.706 NM
TOTAL	649.003 NM

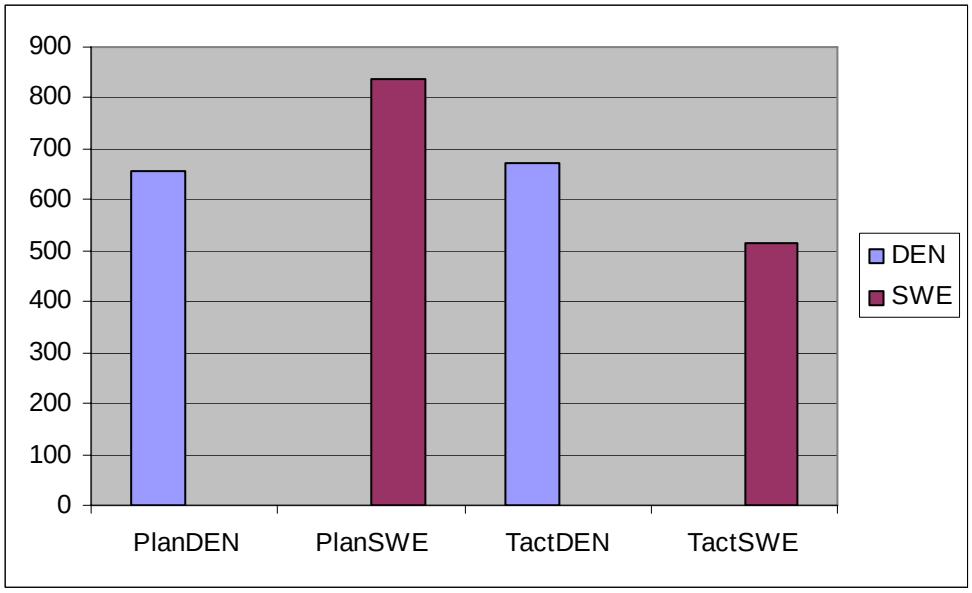
3.1.1.3 Traffic conflicts

A tactical conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet and/or 5 NM, thus requiring operational intervention on a tactical level.

A planner conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet and/or 5 NM, but can be calculated and solved before traffic is actually in the area in question.

Both can be seen as a measurement for complexity in the simulated airspace areas and few conflicts will require less operational intervention.

Both types of conflicts for Danish and Swedish areas are calculated and graphically displayed.



Conflicts planner

EKDK	657
ESMM + ESOS	838
TOTAL	1.495

Conflicts tactical

EKDK	673
ESMM + ESOS	516
TOTAL	1.189

Total conflicts

Planner	1.495
Tactical	1.189
TOTAL	2.684

3.1.2 City pair Stockholm/Copenhagen

The traffic flow between the city pairs Stockholm and Copenhagen v.v. in the simulation B routes via Arlanda – Dunker – Sveda – Kastrup and returns via Kastrup – Kemax – Trosa – Arlanda.

This description holds the simulated route from take-off to TMA exit point, the en-route phase and the route from TMA entry point to landing. More studies regarding optimum departure and arrival profiles are antissipated for next phase study.

3.1.2.1 Traffic flying distance

The direct track between Kastrup and Arlanda is 297 NM.
The track Kastrup – Kemax – Trosa – Arlanda is 301 NM.
The track Arlanda – Dunker – Sveda – Kastrup is 304 NM.
The maximum savings potential is 4 + 7 NM = 11 NM for a return flight.

The total flying distance on the simulation B without SID and STAR gives a total distance of 601 return flight NM for the same flights from the CFMU as of 20 april 2006 as shown in the table in the A simulation.

3.1.3 City pair Helsinki – Brussels/Amsterdam/Paris and v.v.

The table's below displays the flying time and and distance in the Danish and Swedish airspace in minutes/NM as derived from the CFMU from the 20 April 2006. Traffic is adjusted and following a route from entry to exit points in EKDK, ESMS and ESOS FIR.

SW to NE

City pair	Callsign	Distance NM	Flying time minutes
EBBR-EFHK	BCS3669	478	71
EBBR-EFHK	DAT42H	481	93
EBBR-EFHK	DAT42L	419	76
EBBR-EFHK	FIN812N	478	75
EBBR-EFHK	FIN814N	478	75
EBBR-EFHK	FIN818N	478	72
EHAM-EFHK	BLF832	478	79
EHAM-EFHK	FIN842Q	478	72
EHAM-EFHK	KLM1167	478	75
EHAM-EFHK	KLM1169	478	75
EHAM-EFHK	KLM1171	484	81
LFPG-EFHK	FIN872P	478	76
LFPG-EFHK	FIN874P	478	72
LFPG-EFHK	FIN876P	484	81
LFPG-EFHK	FIN880	478	75
TOTAL/day		6226	979

NE to SW

City pair	Callsign	Distance NM	Flying time minutes
EFHK-EBBR	DAT42T	420	69
EFHK-EBBR	DAT42U	420	69
EFHK-EBBR	FIN811N	513	80
EFHK-EBBR	FIN813N	513	80
EFHK-EBBR	FIN817N	513	77
EFHK-EHAM	BLF831	513	85
EFHK-EHAM	FIN841Q	513	77
EFHK-EHAM	FIN845Q	513	80
EFHK-EHAM	KLM1164	513	80
EFHK-EHAM	KLM1168	513	81
EFHK-EHAM	KLM1170	513	80
EFHK-LFPG	FIN871P	513	77

EFHK-LFPG	FIN873P	513	77
EFHK-LFPG	FIN875P	513	80
EFHK-LFPG	FIN879	513	81
TOTAL/day		7.509	1.173

4 Simulation C

4.1 General

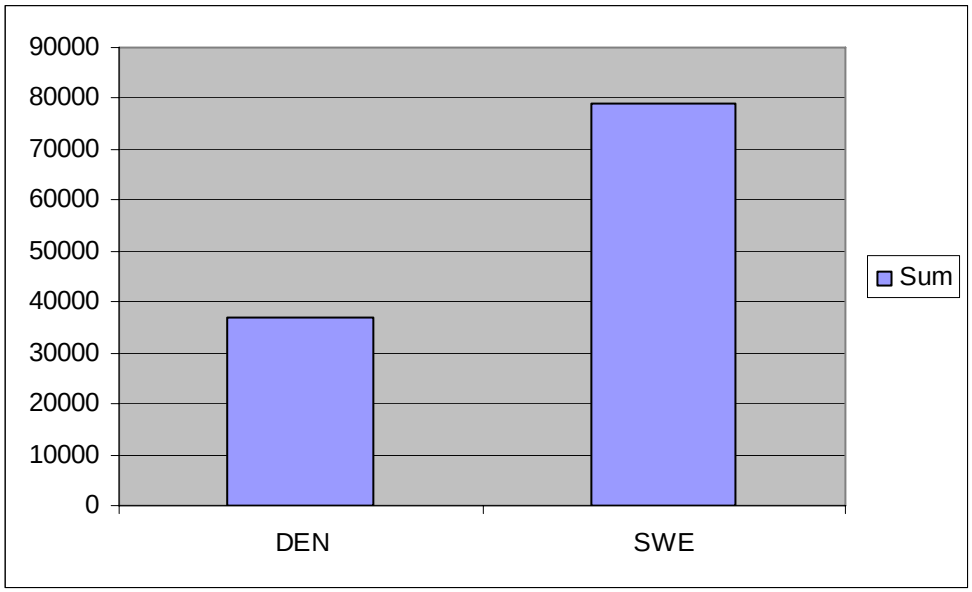
Swedish and Danish airspace is regarded as a single airspace.

4.1.1 Traffic flow

Traffic in the area, is routed via entry and exit points and based on the flight plans obtained from the CFMU regarding the 20 April 2006.

4.1.1.1 Traffic flying time

The traffic follows the most direct route that can be achieved in the single combined area and the total time is calculated and graphically displayed in minutes for the combined Danish and Swedish area.

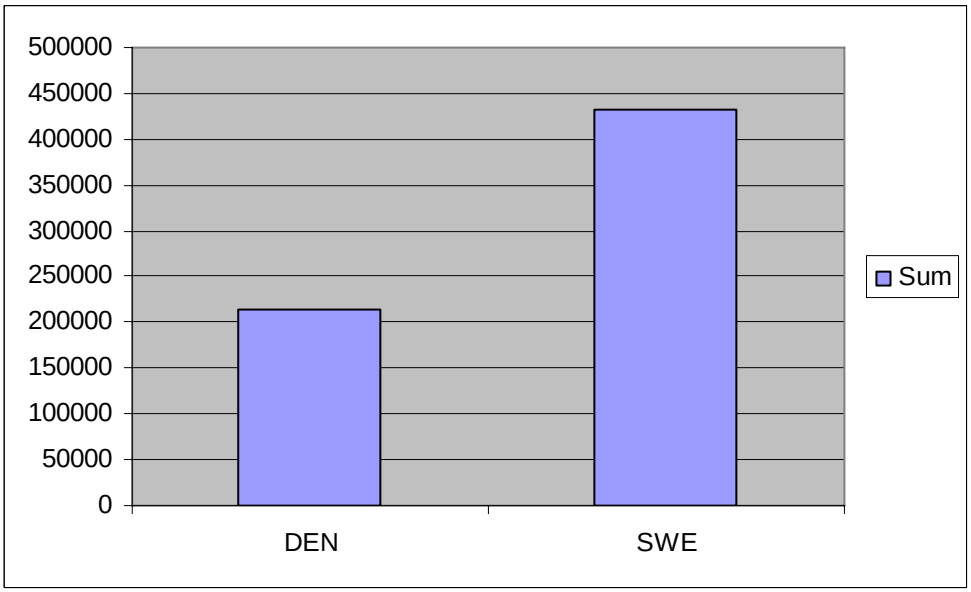


Minutes:

EKDK	36.998
ESMM + ESOS	78.991
TOTAL	115.989

4.1.1.2 Traffic flying distance

The traffic flow in this simulation follows the flight plan routes between entry and exit points in the single area and the total flying distance is calculated and graphically displayed in NM for the combined Danish and Swedish area.



NM

EKDK	213.904 NM
ESMM + ESOS	432.613 NM
TOTAL	648.808 NM

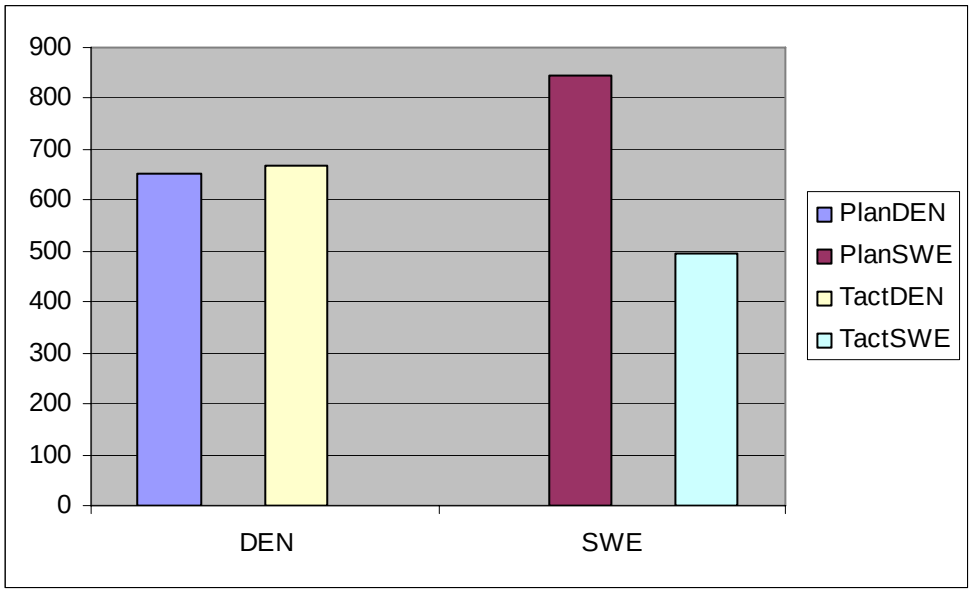
4.1.1.3 Traffic conflicts

A tactical conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet or 5 NM, thus requiring operational intervention on a tactical level.

A planner conflict is defined as a traffic situation where the flight plan route will bring two aircrafts closer to each other than 1000 feet and/or 5 NM, but can be calculated and solved before traffic is actually in the area in question.

Both can be seen as a measurement for complexity in the simulated airspace areas and few conflicts will require less operational intervention.

Both types of conflicts for Danish and Swedish areas are calculated and graphically displayed.



Conflict planner

EKDK	652
ESMM +ESOS	845
TOTAL	1.497

Conflicts tactical

EKDK	667
ESMM + ESOS	494
TOTAL	1.161

4.1.2 City pair Stockholm/Copenhagen

The traffic flow between the city pairs Stockholm and Copenhagen v.v. in the simulation C routes directly on track Arlanda - exit point TMA – Kastrup and returns on a direct track.

This description holds the simulated route from take-off to TMA exit point, the en-route phase and the route from TMA entry point to landing. More studies regarding optimum departure and arrival profiles are antissipated for next phase study.

4.1.2.1 Traffic flying miles

The total flying distance on the simulation C without SID and STAR gives a total distance of 594 NM on a direct/direct return flight, for the flights derived from the CFMU database from 20 April 2006.

The direct track between Kastrup and Arlanda is 297 NM.
The track Kastrup – Kemax – Trosa – Arlanda is 301 NM.
The track Arlanda – Dunker – Sveda – Kastrup is 304 NM.

The maximum savings on the direct/direct route potential is 4 + 7 NM = 11 NM for a return flight.

Citypairs	Callsign	Distance NM	Flying time minutes
ESSA-EKCH	FDX5059	297	47,14
ESSA-EKCH	NDC301	297	47,14
ESSA-EKCH	NDC309	297	47,14
ESSA-EKCH	NDC311	297	47,14
ESSA-EKCH	NDC313	297	47,14
ESSA-EKCH	NVR9171	297	47,14
ESSA-EKCH	SAS1415	297	47,14
ESSA-EKCH	SAS1417	297	47,14
ESSA-EKCH	SAS1423	297	47,14
ESSA-EKCH	SAS1425	297	47,14
ESSA-EKCH	SAS1427	297	47,14
ESSA-EKCH	SAS401	297	47,14
ESSA-EKCH	SAS403	297	47,14
ESSA-EKCH	SAS407	297	47,14
ESSA-EKCH	SAS409	297	47,14
ESSA-EKCH	SAS411	297	47,14
ESSA-EKCH	SAS411	297	47,14
ESSA-EKCH	SNB797	297	47,14
EKCH-ESSA	FDX5082	297	47,14
EKCH-ESSA	NDC302	297	47,14
EKCH-ESSA	NDC304	297	47,14
EKCH-ESSA	NDC312	297	47,14
EKCH-ESSA	NDC314	297	47,14
EKCH-ESSA	NDC316	297	47,14
EKCH-ESSA	NFA134	297	47,14
EKCH-ESSA	NVR9509	297	47,14
EKCH-ESSA	SAS1416	297	47,14
EKCH-ESSA	SAS1418	297	47,14
EKCH-ESSA	SAS1424	297	47,14
EKCH-ESSA	SAS1426	297	47,14
EKCH-ESSA	SAS1428	297	47,14
EKCH-ESSA	SAS400	297	47,14
EKCH-ESSA	SAS402	297	47,14
EKCH-ESSA	SAS406	297	47,14
EKCH-ESSA	SAS408	297	47,14
EKCH-ESSA	SAS410	297	47,14
EKCH-ESSA	SAS412	297	47,14
EKCH-ESSA	SNB798	297	47,14
EKCH-ESSA	VKG502	297	47,14
TOTAL/day		11.583	1.838,46

The flying time for the distances between TMA exit point and TMA entry point is calculated as an average of 6, 3 NM/minut for all flights.

4.1.3 City pair Helsinki – Brussels/Amsterdam/Paris v.v.

The table's below displays the flying time and distance in the Danish and Swedish airspace in minutes/NM as derived from the CFMU from the 20 April 2006. Traffic is adjusted and following a route from entry to exit points in EKDK, ESMS and ESOS FIR.

SW to NE

Citypairs	Callsign	Distance NM	Flying time minutes
EBBR-EFHK	BCS3669	475	71
EBBR-EFHK	FIN812N	475	75
EBBR-EFHK	FIN814N	475	75
EBBR-EFHK	FIN818N	475	71
EHAM-EFHK	BLF832	475	79
EHAM-EFHK	FIN842Q	475	72
EHAM-EFHK	KLM1167	475	75
EHAM-EFHK	KLM1169	475	75
EHAM-EFHK	KLM1171	482	80
LFPG-EFHK	FIN872P	475	76
LFPG-EFHK	FIN874P	475	72
LFPG-EFHK	FIN876P	475	75
LFPG-EFHK	FIN880	475	75
TOTAL/day		6.182	971

NE to SW

Citypairs	Callsign	Distance NM	Flying time minutes
EFHK-EBBR	DAT42T	420	69
EFHK-EBBR	DAT42U	420	69
EFHK-EBBR	FIN811N	505	79
EFHK-EBBR	FIN813N	505	79
EFHK-EBBR	FIN817N	505	76
EFHK-EHAM	BLF831	505	83
EFHK-EHAM	FIN841Q	505	76
EFHK-EHAM	FIN845Q	505	79
EFHK-EHAM	KLM1164	505	79
EFHK-EHAM	KLM1168	505	79
EFHK-EHAM	KLM1170	505	79
EFHK-LFPG	FIN871P	505	76
EFHK-LFPG	FIN873P	505	76
EFHK-LFPG	FIN875P	505	79
EFHK-LFPG	FIN879	505	79
TOTAL/day		7.405	1.157

5 Conclusions and rationale

5.1 General

The findings in this high level analysis report from the RAMS Fast Time Simulation are showing the specific overall differences between the routes in the entire areas in EKDK, ESMS and ESOS as carried by the three simulations described to be used for the business cases in the NUAC Programme definition phase.

A further study regarding the single sectors described in the Airspace Design Report will cover three scenarios and three simulations giving a comprehensive document for elaborating the feasibility of the specifics of the individual sectors and its operability value.

5.1.1 Specific Cases

Four cases have been described.

The baseline case – Simulation A - is used for comparison with present use of the airspace and the two optimised use of airspace. The city pair analyses and describes specific routes, for reasons of showing possible specific gains on high density routes.

5.2 Socio-economics

Economic development, increasing global linkages, and steadily declining airfares have made air travel the sector of fastest growth amongst all transportation modes. As a result, emissions of carbon dioxide and other greenhouse gases and precursors have continued to increase and thus the savings on flight minutes and miles will be a benefit for the environment and a strong incentive to carry the most time and distance saving method into reality.

The fuel savings related to the above will be seen as a further enhancement by the airlines as cost of fuel is steadily becoming a higher part of the cost per passenger with rising fuel prices and is the major cost for airlines today.

Outside economics and emissions the total amount of noise imposed upon society by aircraft will be reduced by shorter flight time/distance.

5.2.1 Further research

The indication found initially shows an approximate social and economical savings potential of 1.5 % and proves a necessity for improved awareness of the impact of Air traffic Management on society.

These indications have lead to the realisation that it will be prudent to perform a robust socio-economical study in the next part of the programme.

- to understand the public perception of ATM,
- to explain the “reason” for Air Traffic Management and its challenges to the public,
- to better understand society’s expectations on air transport, and

- to contribute to ATM capacity to adapt.

In the continued NUAC programme process there is a clear need to address and research the links between Air Transport, Air Traffic Management and Society and the impact of fuel consumption and its impact on the environment.

5.3 Comparison

5.3.1 Overall traffic flying time

Calculated differences between the flying times in minutes and percent compared for simulation A, B and C. Minus (-) means savings on a flight and plus (+) means negative effect on the flight.

Simulation A: 117.399 min.

Simulation B: 115.785 min.

Simulation C: 115.989 min.

Minutes	B v A min.	B v A pct.	C v A min.	C v A pct.	C v B min.	C v B pct.
Differences	-1614	-1,37	-1410	-1,20	+204	+0,18

5.3.2 Overall traffic flying distance

Calculated differences between the flying times in NM and percent compared for simulation A, B and C. Minus (-) means savings on a flight and plus (+) means negative effect on the flight.

Simulation A: 655.474 NM

Simulation B: 649.003 NM

Simulation C: 648.808 NM

NM	B v A NM.	B v A pct.	C v A NM.	C v A pct.	C v B NM.	C v B pct.
Differences	-6471	-0.99	-6666	-1.02	-195	-0.03

5.3.3 Overall traffic conflicts

Calculated differences between the traffic complexity measured in number of conflicts and percent compared for simulation A, B and C. Minus (-) means less complex traffic and plus (+) means more complex traffic.

Simulation A:	Planner	1.552
	Tactical	1.226
	Total	2.778
Simulation B:	Planner	1.495
	Tactical	1.189
	Total	2.684

Simulation C:
Planner 1.497
Tactical 1.161
Total 2.658

Conflicts	B v A con	B v A pct	C v A con	C v A pct	C v B con	C v B pct
Differences planner	-57	-3,67	-55	-3,54	+2	+0,13
Differences tactical	-37	-3,02	-65	-5,30	-28	-2,35
Differences total	-94	-3,38	-120	-4,32	-26	-0,97

5.3.4 City pair Stockholm/Copenhagen v.v.

As shown in chapter 5.2 the analysis the simulations show a saving potential for 11 NM/day/returnflight giving a daily total reduction of 219 NM/day/returnflight.
The saving potential of 11 NM is deemed not to be possible in full extent, but indicates a possible saving potential, mostly in Stockholm and Copenhagen TMA. This will have to be further elaborated.

5.3.5 City Pairs Helsinki – Amsterdam/Brussels/Paris v.v.

The analysis of the route between Helsinki – Amsterdam, Brussels and Paris city pair's that show the gains on these high density routes.

Minutes:

Simulation A:
SW to NE 988
NE to SW 1.179
TOTAL 2.167

Simulation B:
SW to NE 979
NE to SW 1.173
TOTAL 2.152

Simulation C:
SW to NE 971
NE to SW 1.157
TOTAL 2.128

The maximum total time savings per year will then calculate to amount to 14.235 minutes using same method as in the Stockhom – Copenhagen citypair method.

Calc in pct	B v A min.	B v A pct.	C v A min.	C v A pct.	C v B min.	C v B pct.
Differences	-15	-0,69	-39	-1,80	-24	-1,12

NM's:

Simulation A:
SW to NE 6.285
NE to SW 7.517
TOTAL 13.802

Simulation B:
SW to NE 6.226
NE to SW 7.509
TOTAL 13.735

Simulation C:
SW to NE 6.128
NE to SW 7.405
TOTAL 13.533

The maximum total distance savings per year will then calculate to amount to 98.185 NM using same method as in the Stockhom – Copenhagen citypair method.

Calc in pct	B v A NM.	B v A pct.	C v A NM.	C v A pct.	C v B NM.	C v B pct.
Differences	-67	-0,49	-269	-1,95	-202	-1,47

5.4 Final conclusion

The analysis and the simulations in the mapping table below show scoring from 1 to 3 in respect to the overall findings:

Mapping	A	B	C
Time	3	1	2
NM	3	2	1
Conflict	3	2	1
Score	**9**	**5**	**4**

The above table can be used as a measuring tool of the optimum airspace configuration with regards to time, distance and conflicts.

The C simulation – one single combined airspace - shows the most efficient route design and although the city pairing is not included in the table this will also have the highest added value as the three denominators will count for city pairing as well as all other traffic.

B and C can be seen as very close regarding time and distance; however the conflict comparison shows a significant lower complexity in simulation C.

The city comparison is also showing most benefits in the C simulation, and can be seen as an indicator for optimizing the route structure for the high density routes.