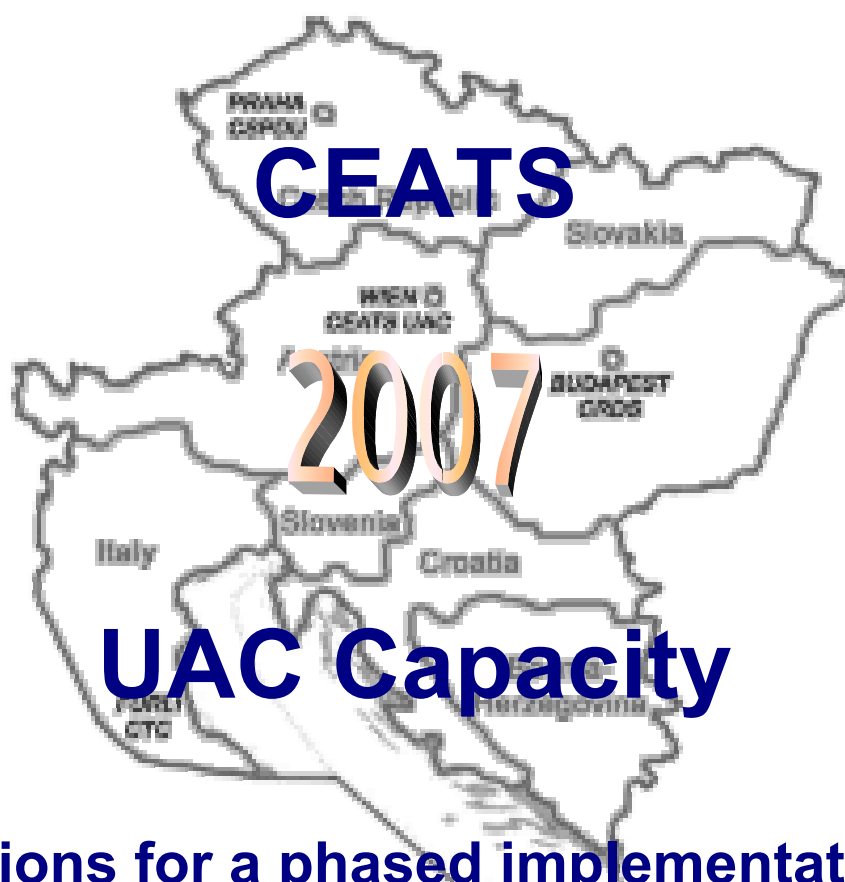


EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION



EUROCONTROL EXPERIMENTAL CENTRE



EEC Note No 05/03

Project PFE- F-EN



Issued: May 2003

REPORT DOCUMENTATION PAGE

Reference EEC Note No 05/03		Security Classification Unclassified				
Originator EEC - NCD (Network Capacity and Demand management)		Originator (Corporate author) Name/Location : EUROCONTROL Experimental Centre B.P.15 F-91222 Brétigny-sur-Orge CEDEX France. Telephone: +33 (0) 1 69 88 75 00				
Sponsor		Sponsor (Contract Authority) Name/Location EUROCONTROL Agency Rue de la Fusée, 96 B-1130 BRUXELLES Telephone: +32 (0) 2 729 90 11				
Title : CEATS 2007 UAC Capacity - Options for a phased implementation						
Authors S. Vincent M. Dalichampt	Date 05/03	Pages v + 31	Figs 28	Tables 32	Annex	References
		Project PFE-F-EN	Sponsor Task No. -		Period Feb.-March 2003	
Distribution Statement : (a) Controlled by : Head of NCD (b) Special Limitations (if any) : None (c) Copy to NTIS : No						
Descriptors (keywords) : CEATS, FAP, 2007, STATFOR, PACT, SAAM, capacity.						
Abstract : The study aimed at assessing the capacity of the future CEATS Centre when it opens in 2007. Several scenarios were proposed, to handle the possibility of a phased implementation of CEATS. The different options were a vertical split at FL345, four CEATS geographical sector and two sets of sector capacities (test with reduced capacities). Assumptions: STATFOR baseline traffic growth Shortest routes on ARNV4 RAMS FTS3 Sector Capacities Methodology: Future ATM Profile (FAP) Results: Sector C10, above FL 345, will be overloaded in 2007. This bottleneck would lead to a CEATS hourly capacity of 267 for a demand of 278. Should a solution to the C10 area problem be found, the CEATS capacity could reach 377. As it is planned today, the MID-SOUTH group cannot be a candidate for initial implementation. The temporary use of the proposed reduced sector capacities would lead to significant delay.						

This document has been collated by mechanical means. Should there be missing pages,
please report to:

EUROCONTROL Experimental Centre
Publications Office
B.P. 15
91222 - BRETIGNY-SUR-ORGE CEDEX
France

Table of Contents

ABBREVIATIONS	V
1 INTRODUCTION	1
1.1 Objective	1
1.2 Last year results	1
2 METHODOLOGY AND TOOLS	2
2.1 STATFOR	2
2.2 SAAM	2
2.3 FIPS	3
2.4 PACT	3
3 CEATS OPENING SCENARIOS	5
3.1 Inputs	5
3.1.1 Traffic	5
3.1.2 Sector capacities	5
3.1.3 Sectorisation	5
3.1.4 Scenarios	6
3.2 CEATS, FL285+, 70%	7
3.2.1 Capacities	7
3.2.2 Results	8
3.2.3 Bottlenecks	8
3.3 CEATS, FL285+, 40%	10
3.3.1 Capacities	10
3.3.2 Results	11
3.3.3 Bottlenecks	11
3.4 CEATS, FL345+, 70%	13
3.4.1 Capacities	13
3.4.2 Results	13
3.4.3 Bottlenecks	14
3.5 CEATS, FL345+, 40%	15
3.5.1 Capacities	15
3.5.2 Results	15
3.5.3 Bottlenecks	16
3.6 North, FL285+, 70%	17
3.6.1 Capacities	17
3.6.2 Results	17
3.7 North, FL285+, 40%	18
3.7.1 Capacities	18
3.7.2 Results	18
3.7.3 Bottleneck	19
3.8 MID, FL285+, 70%	20
3.8.1 Capacities	20
3.8.2 Results	20

3.9	MID, FL285+, 40%	21
3.9.1	Capacities	21
3.9.2	Results	21
3.9.3	Bottlenecks	22
3.10	MID-SOUTH, FL285+, 70%	23
	Capacities	23
3.10.2	Results	23
3.10.3	Bottlenecks	24
3.11	MID-SOUTH, FL285+, 40%	25
3.11.1	Capacities	25
3.11.2	Results	25
3.11.3	Bottlenecks	26
3.12	MID-WEST, FL285+, 70%	27
3.12.1	Capacities	27
3.12.2	Results	27
3.13	MID-WEST, FL285+, 40%	28
3.13.1	Capacities	28
3.13.2	Results	28
3.13.3	Bottlenecks	29
3.14	Sector C10, FL345+	30
4	CONCLUSIONS	31

Abbreviations

ACC	Area Control Centre
ARN	Area Route Network
AMOC	ATFM Modelling Capability
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Service
ANSP	Air Navigation Service Provider
CASA	Computer Assisted Slot Allocation
CEATS	Central European Air Traffic Services
CFMU	Central Flow Management Unit
CIP	Convergence and Implementation Programme
CRCO	Central Route Charges Office
CRDS	CEATS Research Development and Simulations Centre
c/d	Capacity demand ratio
EAM	EUROCONTROL Airspace Model
EATMP	European Air Traffic Management Programme
ECAC	European Civil Aviation Conference
FACET	Fast ACC Capacity Evaluation Tool
FAP	Future ATM Profile
FIPS	Flight Increase Process Software
FTS	Fast Time Simulation
GDP	Gross Domestic Product
HST	High Speed Train
MECA	Model for the Economic Evaluation of Capacities in the ATM System
PACT	Portable ACC Capacity evaluation Tool
RAMS	Reorganised ATC Mathematical Simulator
ROI	Return on Investment
SAAM	System for air traffic Assignment and Analysis at a Macroscopic level
STATFOR	Specialist Panel on Air Traffic Statistics and Forecast

1 Introduction

1.1 Objective

This document presents the results of a preliminary assessment of the capacity of the future CEATS Centre when it opens in 2007.

The main purpose of this study, sponsored by the Capacity Enhancement Function, was to define the 2007 baseline for capacity planning for CEATS. An additional objective was to examine the phased implementation of CEATS by simulating a vertical split at FL 345 and 4 CEATS geographical sector groups in the transition scenarios based on the scenario proposals for the CEATS Initial Operations. Two sets of capacity were also simulated, to measure the impact of a progressive opening of CEATS at the beginning (possible reduced capacities).

The study was conducted using the Portable ACC Capacity Tool (PACT), one of the FAP (Future ATM Profile) tools and used the results of the CEATS Fast Time (RAMS) Simulation (CEATS FTS3) as entry capacities. The traffic growth was assumed to be the one given by STATFOR for 2007, in the baseline scenario. The routes used were the shortest on ARNV4, with the use of SAAM tool.

1.2 Last year results

A capacity of **365 flights/hour** was proposed in 2002 as baseline for CEATS capacity planning in 2007. This compared to a peak demand (average of peak 3 hours) of **298 flights/hours** in 2007, giving a capacity/demand ratio of $c/d=1.22$.

This result was obtained with the assumption that C10 problem would be resolved by splitting the sector into C10 and C10a. Therefore an infinite capacity was set to this sector (otherwise CEATS Capacity would have been 248).

2 Methodology and tools

2.1 STATFOR

The Medium Term traffic forecast is prepared by the EUROCONTROL Statistics and Forecast Service (STATFOR) and revised in the light of comments by the STATFOR User Group.

The main parameters input in the model are the GDP forecast, price of travel, development of High Speed Train links and restricted capacity at airports.

Three scenarios are simulated as follows:

- Baseline air traffic growth: Gross domestic product (GDP) growth following recent estimates.
- High air traffic growth: An optimistic economic recovery scenario, with limited impact from high-speed train (HST), with continued recovery from the 2001-2002 downturn, and with continuing price reductions as a result of industry consolidation and growth of low-cost carriers.
- Low air traffic growth: A pessimistic economic growth scenario. More persistent and larger impact of HST and no further recovery from the effects of 11/9/2001.

In this study the baseline air traffic growth scenario was used to assess the CEATS traffic in 2007.

2.2 SAAM

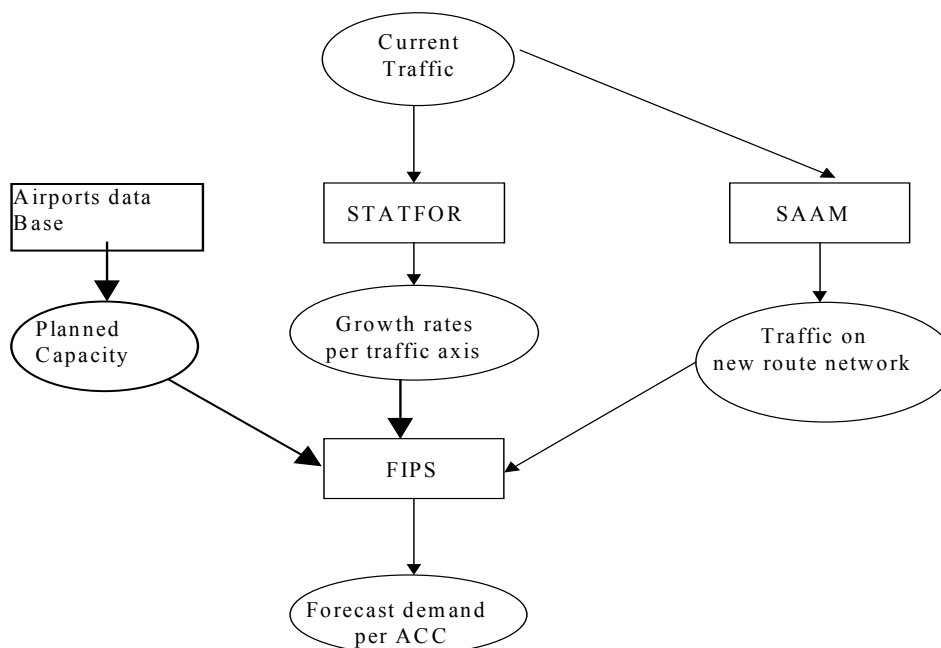
To assess the future demand for individual ACCs, simulations are performed to show how the traffic currently handled by the CFMU would be distributed over the future route network (e.g. the Air Route Network-Version 4 (ARN.V4) which supported the introduction of Reduced Vertical Separation Minima in January 2002). This implies following the user's preference for the shortest routes along that future network, without vertical profile constraints.

The simulations of the new route network are made using the System for air traffic Assignment and Analysis at a Macroscopic Level tool (SAAM) used to support the work of the EATMP Airspace Management and Navigation Unit. The input data is the current traffic. The flights are assigned on shortest routes and optimum profiles by SAAM. The output is re-routed traffic on the future network.

2.3 FIPS

The future air traffic demand at ACC level is assessed by the FIPS tool, using as inputs:

- the overall traffic growth rates per origin-destination zones, established by the STATFOR process;
- traffic re-routed on shortest routes by SAAM;
- Airports capacities from the Eurocontrol Airports Database.



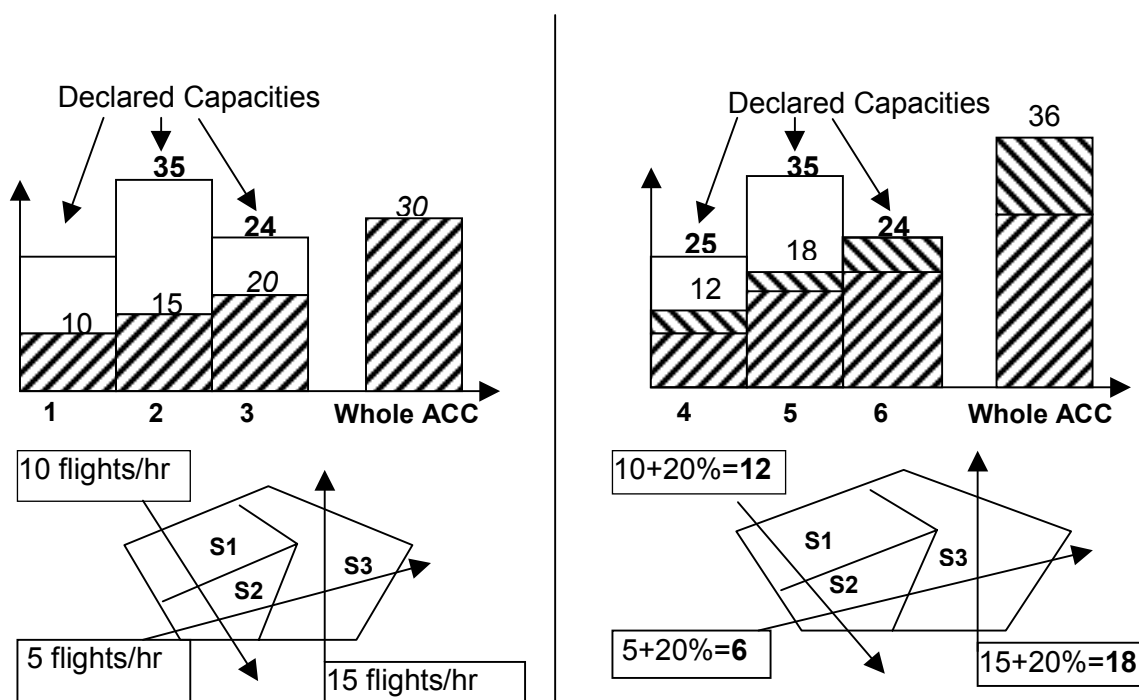
2.4 PACT

A Portable ACC Capacity evaluation Tool (PACT) has been developed by the EUROCONTROL Experimental Centre, and is now available to ANSPs. PACT enables ANSPs to calculate the Nominal ACC capacity indicator (zero delay) for their ACC, using the FACET methodology.

As illustrated in the following example, the FACET (Fast ACC Capacity Evaluation Tool) simulation homogeneously increases the traffic volume from its current level until one of the sectors is saturated (meaning the traffic in this sector has reached the sector declared capacity). At this point, the traffic flow throughout the whole ACC is the maximum which can be handled without causing ATFM delays (assuming the current traffic pattern); it is considered to be the Nominal Capacity with zero delay.

Example of ACC Nominal “zero delay” Capacity Assessment

The tool simulates a traffic increase of the same amplitude (in percentage) for each route going through the ACC. The example below features an ACC composed of 3 sectors and crossed by 3 traffic flows. Sector S3 is crossed by 2 flows giving traffic of $5 + 15 = 20$ flights/hr. It reaches its declared capacity (24 flights/hr) when the flows increase by 20%. As soon as one sector reaches its declared capacity the ACC capacity is considered to be equal to the traffic going through the ACC at this point (e.g. $30 + 20\% = 36$ flights/hr).



3 CEATS opening scenarios

3.1 Inputs

3.1.1 Traffic

CEATS capacity has been computed based on a 14 days sample, representative of summer 2002 traffic (07/05/2002 to 07/18/2002). This period was also used for the preparation of the ECIP for all the ECAC area.

The traffic samples were extracted from CFMU archives for these 14 days. Then the flights were re-routed on ARNV4 shortest routes and optimal profiles by SAAM. Finally, this traffic was augmented by FIPS to the 2007 level, based on STATFOR baseline scenario (February 2002).

3.1.2 Sector capacities

Sector capacities were provided by FTS3 (Fast Time Simulation 3), made by CRDS, using RAAMS including its capacity module.

RAAMS defines sector capacities as a certain percentage of controller workload, usually 70% of the simulation duration (e.g. 42 minutes of work within an hour, by adding the execution times required to perform all the controller tasks). FTS3 also provided figures based on "40%" workload which could be used as reduced capacities during the first days of implementation.

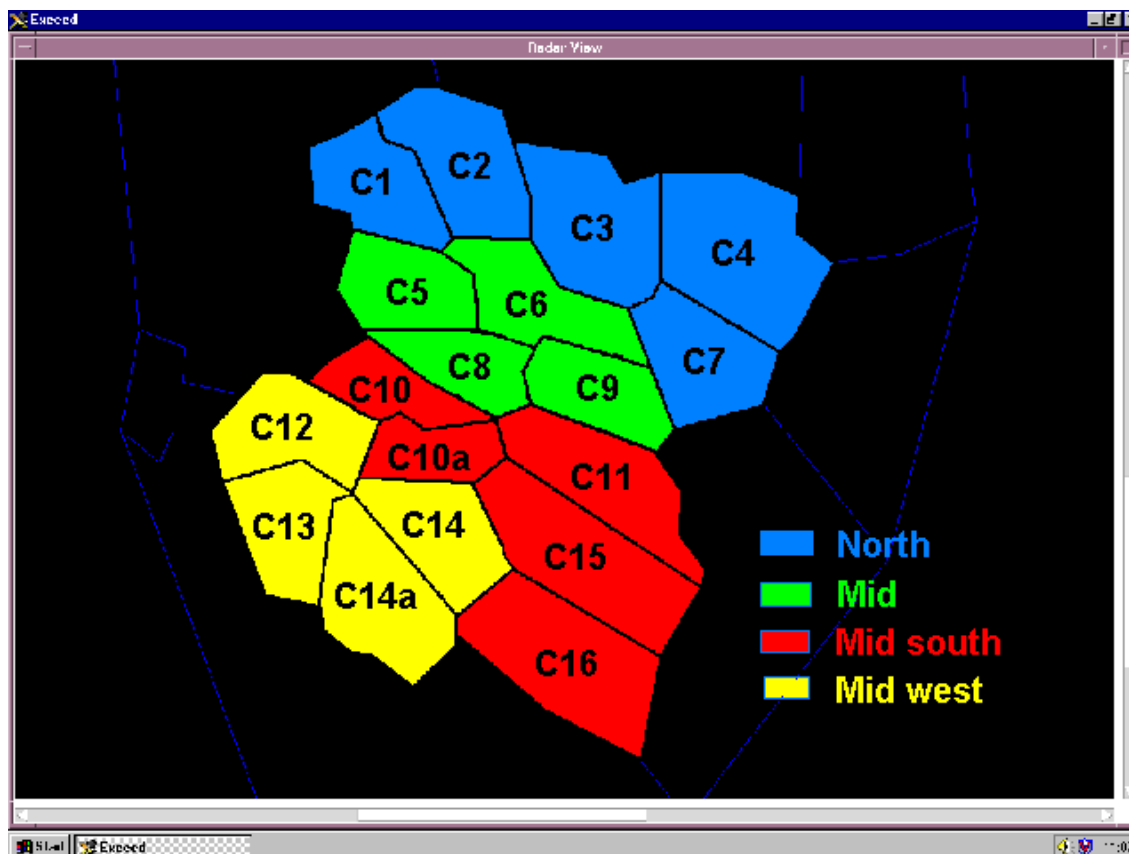
3.1.3 Sectorisation

The sectorisation was derived from FTS2 and FTS3, from FL 285 to unlimited with a general vertical split at FL 345.

In addition to the all CEATS (FL285+) airspace, 5 groups of sectors were simulated to prepare a possible phased implementation, with a vertical split at FL 345 and four geographical groups:

- All geographical CEATS, FL 345+.
- North: C1+C2+C3+C4+C7, FL 285+.
- Mid: C5+C6+C8+C9, FL 285+.
- Mid-South: C10+C10a+C11+C15+C16, FL285+.
- Mid-West: C12+C13+C14+C14a, FL 285+.

The following map represents CEATS and the four geographical groups that were simulated.



3.1.4 Scenarios

Twelve scenarios were defined, depending upon geographical boundaries, lower flight level and sector capacities. For each scenario, the hypotheses and results are detailed in the following sections.

Geographical boundaries	Lower flight level	Sector capacities
CEATS	285+	70%
CEATS	285+	40%
CEATS	345+	70%
CEATS	345+	40%
North	285+	70%
North	285+	40%
Mid	285+	70%
Mid	285+	40%
Mid south	285+	70%
Mid south	285+	40%
Mid west	285+	70%
Mid west	285+	40%

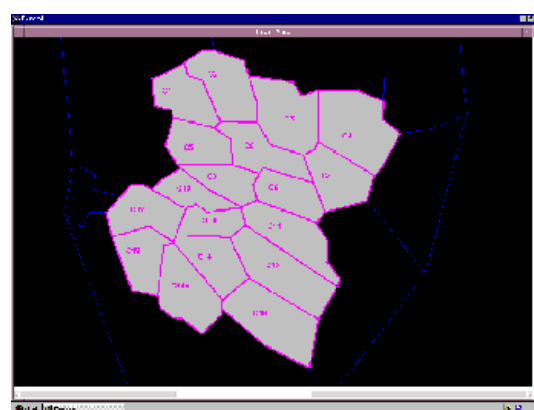
3.2 CEATS, FL285+, 70%

3.2.1 Capacities

In this scenario, the capacity was calculated for total opening of CEATS centre, with “70%” capacities.

The following table presents the sector capacities that were used as input data in PACT, in a 31 sectors configuration.

Geographical boundaries see MAP	lower FL	upper FL	70% capacity
C1	285	345	50
C1	345	unlimited	51
C2	285	345	53
C2	345	unlimited	54
C3	285	345	54
C3	345	unlimited	58
C4	285	unlimited	54
C5	285	345	50
C5	345	unlimited	50
C6	285	345	49
C6	345	unlimited	46
C7	285	unlimited	57
C8	285	345	50
C8	345	unlimited	49
C9	285	345	50
C9	345	unlimited	61
C10	285	345	50
C10	345	unlimited	47
C10a	285	345	53
C10a	345	unlimited	56
C11	285	345	51
C11	345	unlimited	53
C12	285	345	49
C12	345	unlimited	52
C13	285	345	60
C13	345	unlimited	58
C14	285	unlimited	67
C14a	285	unlimited	58
C15	285	345	45
C15	345	unlimited	42
C16	285	unlimited	47



3.2.2 Results

The following table presents CEATS capacity given by PACT, as well as the demand (peak1 and peak3).

	Week day	Week-end	Average 14 days
Capacity (PACT)	261	281	267
Peak 1*	292	310	298
Peak 3**	271	295	278

* Peak 1 : Maximum hourly demand of the day

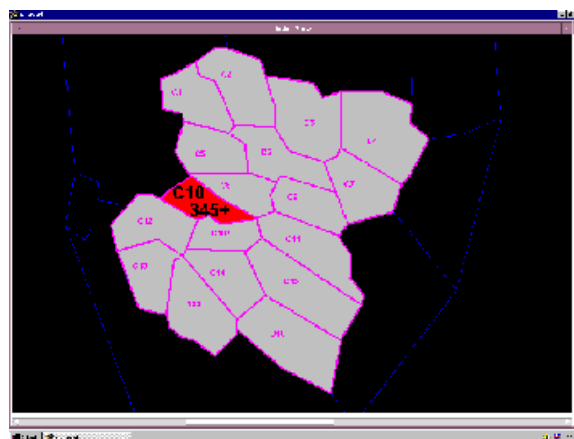
** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

There will be a capacity shortfall in 2007, with a capacity demand ratio of 0.96. If the sector capacities remain unchanged, CEATS will produce delay in 2007.

3.2.3 Bottlenecks

The identification of the bottlenecks can explain the lack of capacity found for CEATS in 2007.

There is only one sector with insufficient capacity. This sector, C10 FL345+, has a capacity of 47 for an average demand (peak3) of 50.



This sector was already the one overloaded in the study last year. It seems that the split into C10 and C10a was not sufficient to resolve the problem.

Unlimited capacity in C10, FL 345+

To see the impact of the capacity shortfall in C10 sector, a simulation was run with an infinite capacity for sector C10, FL345+. The results of this simulation are presented in the following table.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	382	365	377
Peak 1*	292	310	298
Peak 3**	271	295	278

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

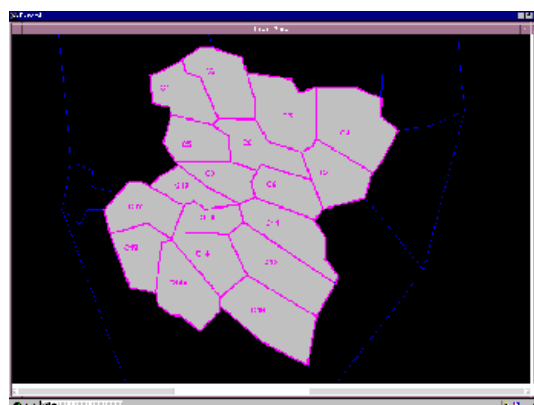
Taking the hypothesis that C10, FL 345+ has infinite capacity, the capacity of CEATS centre would be well above the demand level, and there should be no delay issue for CEATS in 2007. The capacity demand ratio would attain 1.36. This shows how critical it is to resolve the problem of this sector for CEATS.

3.3 CEATS, FL285+, 40%

3.3.1 Capacities

The geographical boundaries are the same as in section 3.2, but the capacities are reduced to the “40%” level.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C1	285	345	27
C1	345	unlimited	31
C2	285	345	32
C2	345	unlimited	31
C3	285	345	31
C3	345	unlimited	32
C4	285	unlimited	30
C5	285	345	29
C5	345	unlimited	31
C6	285	345	28
C6	345	unlimited	26
C7	285	unlimited	32
C8	285	345	29
C8	345	unlimited	30
C9	285	345	29
C9	345	unlimited	33
C10	285	345	30
C10	345	unlimited	27
C10a	285	345	31
C10a	345	unlimited	31
C11	285	345	29
C11	345	unlimited	31
C12	285	345	28
C12	345	unlimited	30
C13	285	345	33
C13	345	unlimited	34
C14	285	unlimited	33
C14a	285	unlimited	34
C15	285	345	28
C15	345	unlimited	23
C16	285	unlimited	25



3.3.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	150	161	153
Peak 1*	292	310	298
Peak 3**	271	295	278

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

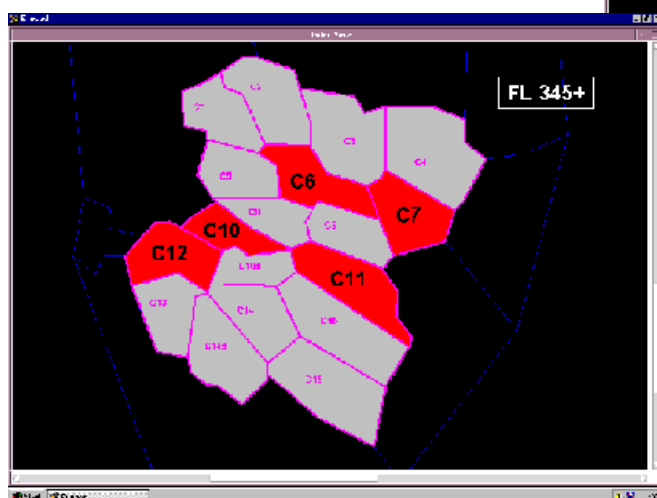
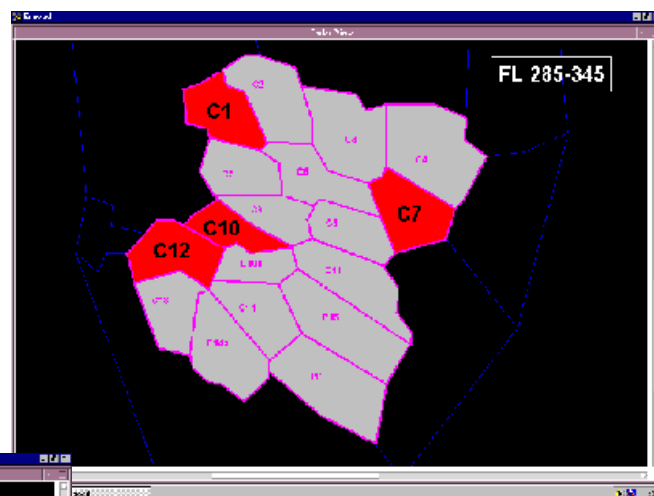
The scenario is identical to the preceding one, with reduced capacities for each sector. As a consequence, CEATS capacity is lower, and far from being sufficient to capture the demand. The capacity demand ratio is equal to 0.55.

3.3.3 Bottlenecks

With these reduced capacities, several sectors have insufficient capacity to handle the demand in 2007.

FL 285-345

- C1: Capacity 27, demand 36
- C7: Capacity 32, demand 41
- C10: Capacity 30, demand 35
- C12: Capacity 28, demand 37



FL 345+

- C6: Capacity 26, demand 30
- C7: Capacity 32, demand 41
- C10: Capacity 27, demand 50
- C11: Capacity 31, demand 33
- C12: Capacity 30, demand 33

Four sectors would also present some lack of capacity some of the 14 days simulated.
These sectors are:

- C6, FL 285-345: Capacity 28, average demand 27
- C13, FL285-345: Capacity 33, average demand 30
- C14a, FL 285+: Capacity 34, average demand 33
- C15, FL 345+:Capacity 23, average demand 22

Unlimited capacity in C10, FL 345+

The most overloaded sector is still C10 sector, FL 345+. If the capacity of this sector is set to infinite, the following results are found.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	216	211	214
Peak 1*	292	310	298
Peak 3**	271	295	278

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

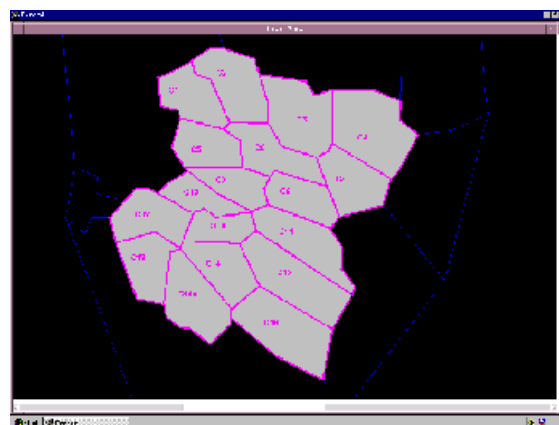
This is much better than with the C10. However, this is not sufficient to handle the demand.
The capacity demand ratio is 0.77.

3.4 CEATS, FL345+, 70%

3.4.1 Capacities

In this scenario, CEATS geographical boundaries are the same as in sections 3.2 and 3.3, but the centre is only defined above flight level 345. A configuration with 18 sectors was defined as entry in PACT.

Geographical boundaries see MAP	lower FL	upper FL	70% capacity
C1	345	unlimited	50
C2	345	unlimited	51
C3	345	unlimited	54
C4	345	unlimited	53
C5	345	unlimited	49
C6	345	unlimited	47
C7	345	unlimited	52
C8	345	unlimited	48
C9	345	unlimited	60
C10	345	unlimited	48
C10a	345	unlimited	54
C11	345	unlimited	53
C12	345	unlimited	51
C13	345	unlimited	58
C14	345	unlimited	71
C14a	345	unlimited	31
C15	345	unlimited	42
C16	345	unlimited	43



3.4.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	158	163	159
Peak 1*	182	182	182
Peak 3**	161	168	163

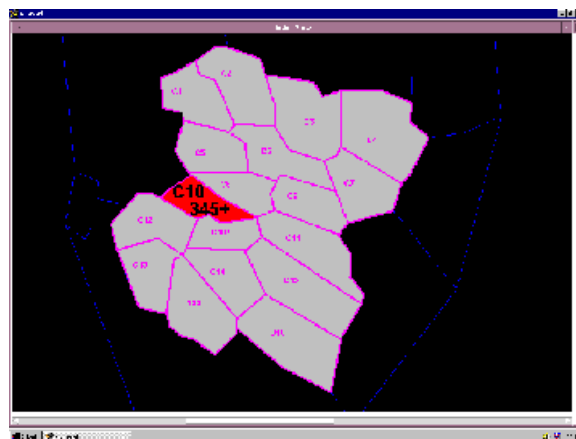
* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

The capacity is not sufficient to handle the demand, with a capacity demand ratio of 0.98.

3.4.3 Bottlenecks

The only bottleneck is still the same sector C10, FL345+. Its capacity is set to 48 for a demand of 50.



Unlimited capacity in C10, FL 345+

To see the impact of the capacity shortfall in C10 sector, a simulation was run with an infinite capacity for sector C10, FL345+.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	243	239	242
Peak 1*	182	182	182
Peak 3**	161	168	163

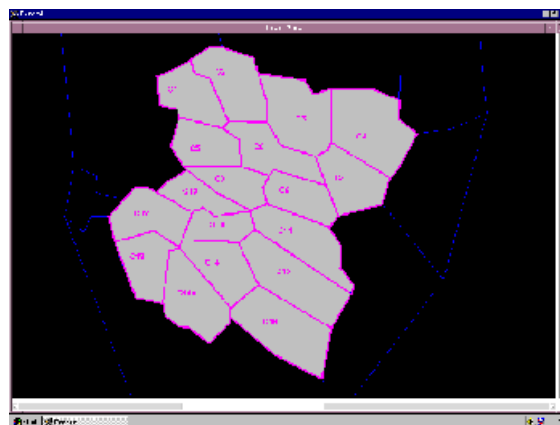
If the problem of C10 were resolved, the capacity of CEATS, FL345+ would be sufficient. The capacity demand ratio would be 1.48. There would be no delay in 2007.

3.5 CEATS, FL345+, 40%

3.5.1 Capacities

The scenario is the same as in section 3.4, with reduced capacities to level “40%”.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C1	345	unlimited	28
C2	345	unlimited	31
C3	345	unlimited	30
C4	345	unlimited	29
C5	345	unlimited	30
C6	345	unlimited	27
C7	345	unlimited	28
C8	345	unlimited	29
C9	345	unlimited	32
C10	345	unlimited	26
C10a	345	unlimited	31
C11	345	unlimited	30
C12	345	unlimited	29
C13	345	unlimited	32
C14	345	unlimited	34
C14a	345	unlimited	32
C15	345	unlimited	24
C16	345	unlimited	25



3.5.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	85	89	86
Peak 1*	182	182	182
Peak 3**	161	168	163

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

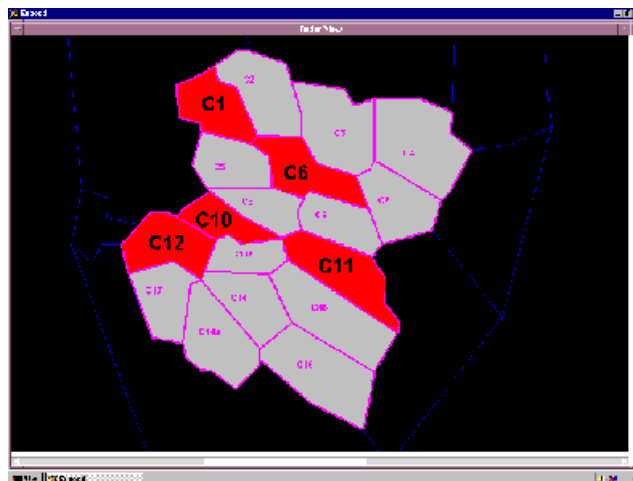
The capacity is not sufficient to handle the demand, with a capacity demand ratio of 0.53.

3.5.3 Bottlenecks

With these reduced capacities, several sectors have insufficient capacity to handle the demand in 2007.

FL 345+

- C1: Capacity 28, demand 28
- C6: Capacity 27, demand 30
- C10: Capacity 26, demand 50
- C11: Capacity 30, demand 33
- C12: Capacity 29, demand 33



Some sectors don't have sufficient capacities for a few days, even if the average demand is under the capacity.

- C7: Capacity 28, average demand 27
- C15: Capacity 24, average demand 22

Unlimited capacity in C10, FL 345+

To see the impact of the capacity shortfall in C10 sector, a simulation was run with an infinite capacity for sector C10, FL345+. The results of this simulation are presented in the following table.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	138	136	137
Peak 1*	182	182	182
Peak 3**	161	168	163

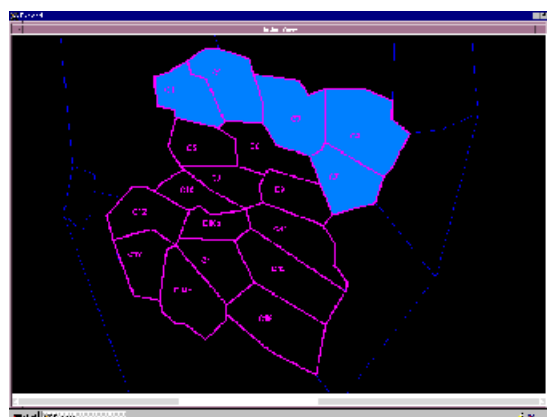
Even if the problem of C10 were resolved, the capacity of CEATS with reduced sector capacities would not be sufficient. The capacity demand ratio would be 0.84.

3.6 North, FL285+, 70%

3.6.1 Capacities

Only the north part of CEATS is taken into account in this scenario. A configuration with 8 sectors was created for PACT.

Geographical boundaries see MAP	lower FL	upper FL	70% capacity
C1	285	345	50
C1	345	unlimited	51
C2	285	345	53
C2	345	unlimited	54
C3	285	345	54
C3	345	unlimited	58
C4	285	unlimited	54
C7	285	unlimited	57



3.6.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	149	167	154
Peak 1*	119	126	121
Peak 3**	107	114	109

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

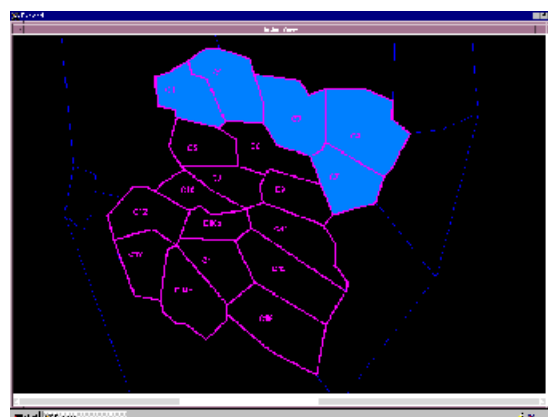
The north part of CEATS could open without any capacity and delay issues. The capacity demand ratio is equal to 1.41.

3.7 North, FL285+, 40%

3.7.1 Capacities

The scenario is the same that the one presented in section 3.6, with reduced capacities.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C1	285	345	27
C1	345	unlimited	31
C2	285	345	32
C2	345	unlimited	31
C3	285	345	31
C3	345	unlimited	32
C4	285	unlimited	30
C7	285	unlimited	32



3.7.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	83	93	86
Peak 1*	119	126	121
Peak 3**	107	114	109

* Peak 1 : Maximum hourly demand of the day

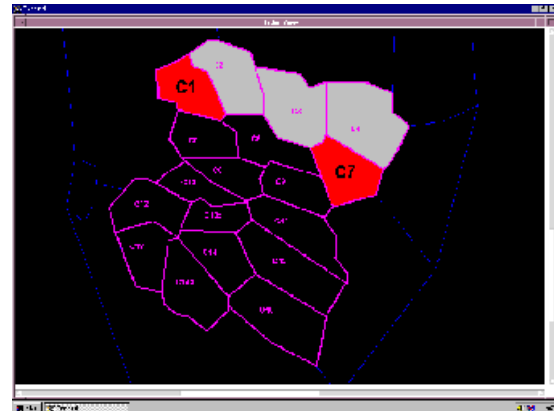
** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

These reduced capacities lead to a shortfall for CEATS north, with a capacity demand ratio of 0.79.

3.7.3 Bottleneck

Two sectors do not have sufficient capacity to handle the demand with the reduced capacity.

- C1, FL 285-345: Capacity 27, demand 36
- C7, FL 285+: Capacity 32, demand 41

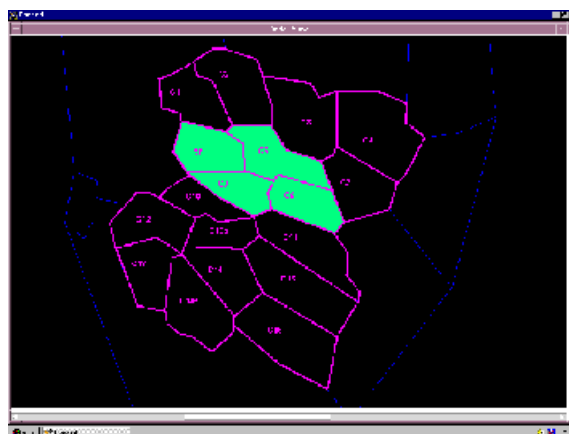


3.8 MID, FL285+, 70%

3.8.1 Capacities

This scenario is considering the opening of CEATS Mid part, as shown on the following map. A configuration with 8 sectors was created in PACT.

Geographical boundaries see MAP	lower FL	upper FL	70% capacity
C5	285	345	50
C5	345	unlimited	50
C6	285	345	49
C6	345	unlimited	46
C8	285	345	50
C8	345	unlimited	49
C9	285	345	50
C9	345	unlimited	61



3.8.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	140	151	143
Peak 1*	103	109	105
Peak 3**	89	94	91

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

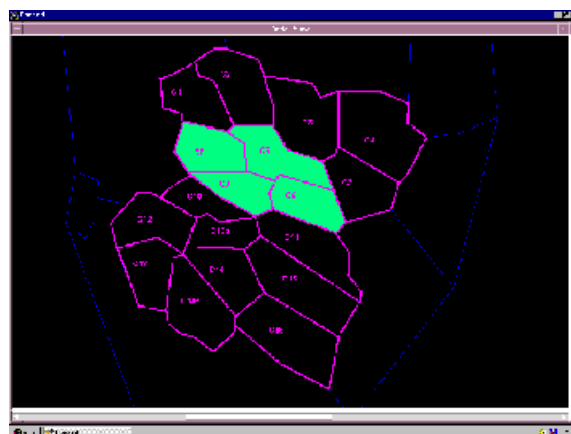
The capacity found for this part of CEATS is sufficient to handle the demand, with a capacity demand ratio of 1.57.

3.9 MID, FL285+, 40%

3.9.1 Capacities

This scenario is using the reduced 40% capacities.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C5	285	345	29
C5	345	unlimited	31
C6	285	345	28
C6	345	unlimited	26
C8	285	345	29
C8	345	unlimited	30
C9	285	345	29
C9	345	unlimited	33



3.9.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	79	86	81
Peak 1*	103	109	105
Peak 3**	89	94	91

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

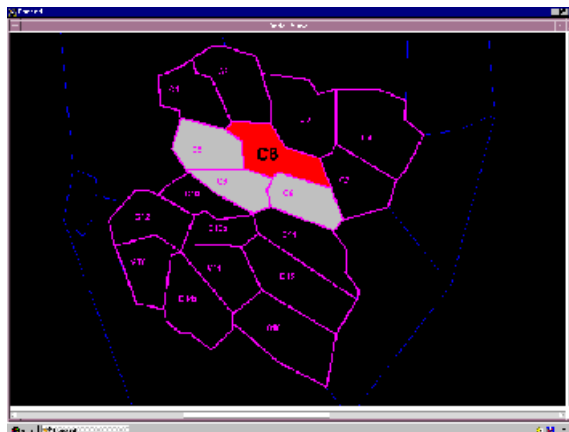
With the reduced capacity, there would be a shortfall and delays in 2007 (capacity demand ratio equal to 0.89).

3.9.3 Bottlenecks

One sector has insufficient capacity, C6, FL345+ (Capacity 26, Demand 30).

Two other sectors have a lack of capacity for some of the days simulated:

- C5, FL285-345, capacity 29, average demand 28
- C6, FL285-345, capacity 28, average demand 27

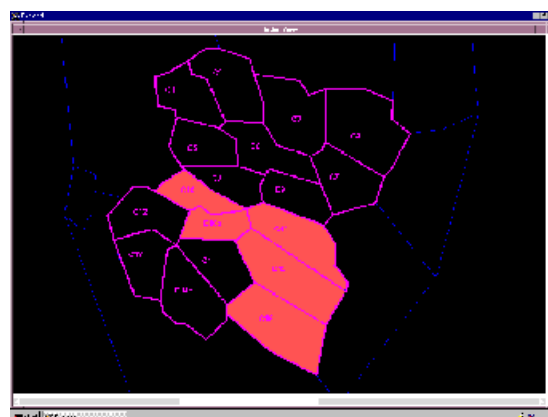


3.10 MID-SOUTH, FL285+, 70%

3.10.1 Capacities

The Mid south part of CEATS, with geographical boundaries presented below, has been simulated by creating a configuration with 9 sectors in PACT.

Geographical boundaries see MAP	lower FL	upper FL	70% capacity
C10	285	345	50
C10	345	unlimited	47
C10a	285	345	53
C10a	345	unlimited	56
C11	285	345	51
C11	345	unlimited	53
C15	285	345	45
C15	345	unlimited	42
C16	285	unlimited	47



3.10.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	97	101	98
Peak 1*	112	113	112
Peak 3**	100	106	102

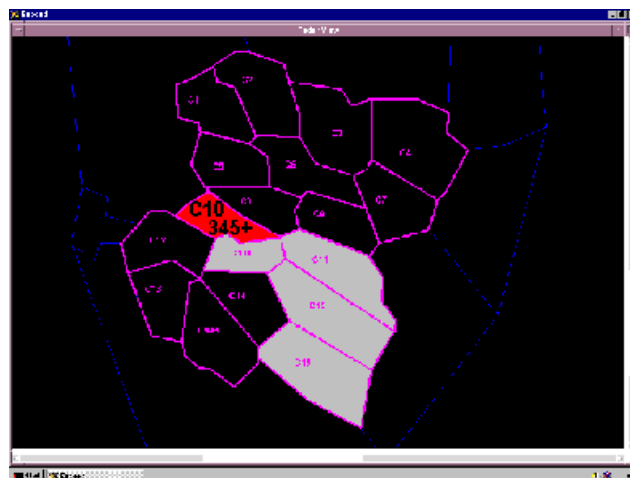
* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

For this part of CEATS, the sector capacities planned lead to a shortfall in 2007. The capacity demand ratio is 0.96.

3.10.3 Bottlenecks

There is one sector with insufficient Capacity, which is, as in other scenarios, C10 sector above FL345+ (Capacity 47, demand 50).



Unlimited capacity in C10, FL 345+

To see the impact of the capacity shortfall in C10 sector, a simulation was run with an infinite capacity for sector C10, FL345+. The results of this simulation are presented in the following table.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	154	135	148
Peak 1*	112	113	112
Peak 3**	100	106	102

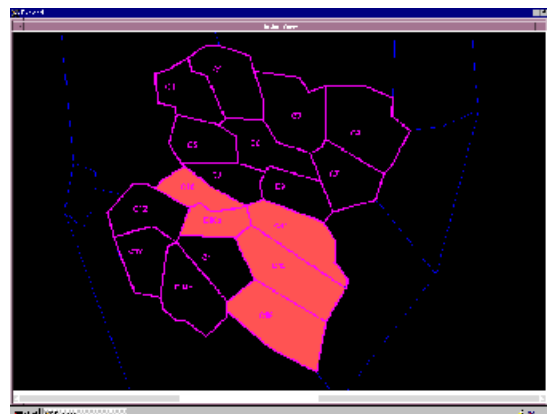
Solving the C10 problem would be sufficient to handle the demand (capacity demand ratio of 1.45).

3.11 MID-SOUTH, FL285+, 40%

3.11.1 Capacities

This scenario is the same as in section 3.10, with lower capacities.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C10	285	345	30
C10	345	unlimited	27
C10a	285	345	31
C10a	345	unlimited	31
C11	285	345	29
C11	345	unlimited	31
C15	285	345	28
C15	345	unlimited	23
C16	285	unlimited	25



3.11.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	56	58	57
Peak 1*	112	113	112
Peak 3**	100	106	102

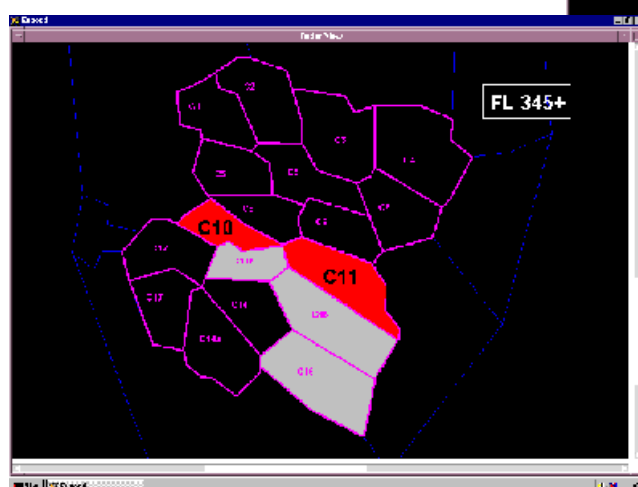
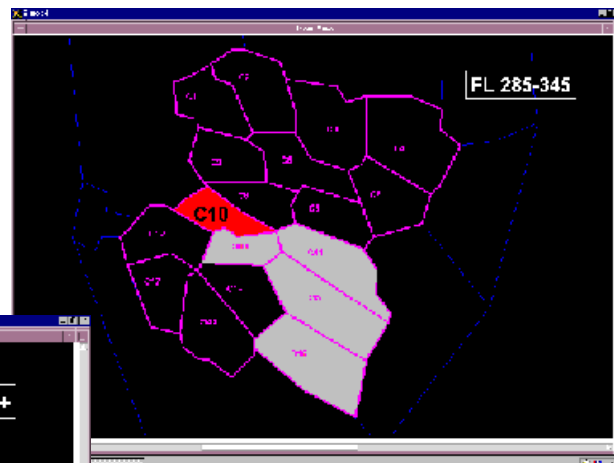
* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

With a capacity demand ratio of 0.56, the opening of CEATS Mid South with reduced capacities will present a lack of capacity and delays. This was predictable, knowing that this centre with 70% capacities already had capacity problems.

3.11.3 Bottlenecks

Between flight levels 285 and 345, one sector has not enough capacity:
C10, Capacity 30, demand 35.



Above FL 345, two sectors have capacity issues:

- C10, capacity 27, demand 50
- C11, capacity 31, demand 33

Sector 15 above FL345 also has capacity issues some days of the simulation run (capacity 23, average demand 22).

Unlimited capacity in C10, FL 345+

The most overloaded sector is still C10 sector, FL 345+. If the capacity of this sector is set to infinite, the following results are found.

Unlimited C10 capacity	Week day	Week-end	Average 14 days
Capacity (PACT)	91	81	88
Peak 1*	112	113	112
Peak 3**	100	106	102

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

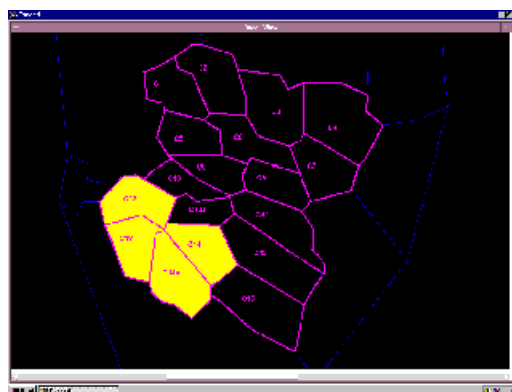
This is much better than with the C10. However, this is not sufficient to handle the demand. The capacity demand ratio is 0.86.

3.12 MID-WEST, FL285+, 70%

3.12.1 Capacities

Finally, the Mid West part of CEATS was studied. A configuration with six sectors, defined below, was created.

boundaries see MAP	lower FL	upper FL	70% capacity
C12	285	345	49
C12	345	unlimited	52
C13	285	345	60
C13	345	unlimited	58
C14	285	unlimited	67
C14a	285	unlimited	58



3.12.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	125	127	125
Peak 1*	91	113	97
Peak 3**	85	108	92

* Peak 1 : Maximum hourly demand of the day

** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

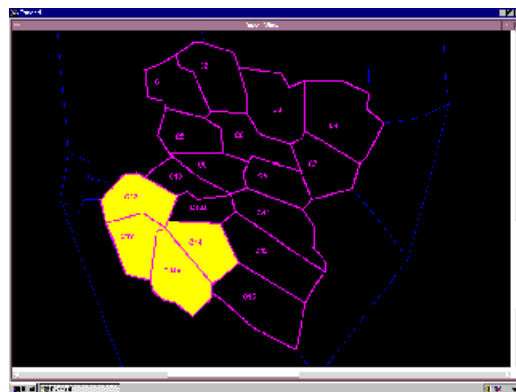
The capacity is sufficient to handle the demand, with a capacity demand ratio of 1.36.

3.13 MID-WEST, FL285+, 40%

3.13.1 Capacities

This scenario is the one with reduced capacities, for mid west part of CEATS.

Geographical boundaries see MAP	lower FL	upper FL	40% capacity
C12	285	345	28
C12	345	unlimited	30
C13	285	345	33
C13	345	unlimited	34
C14	285	unlimited	33
C14a	285	unlimited	34



3.13.2 Results

	Week day	Week-end	Average 14 days
Capacity (PACT)	71	73	72
Peak 1*	91	113	97
Peak 3**	85	108	92

* Peak 1 : Maximum hourly demand of the day

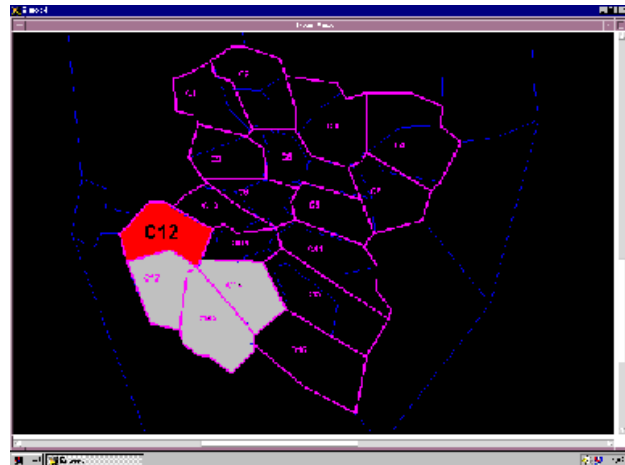
** Peak 3 : Average hourly demand of the three consecutive busiest hours in the day

With reduced capacities, there is a capacity shortfall for the opening of this part of CEATS.

3.13.3 Bottlenecks

Two sectors are overloaded:

- C12, FL 285-345: capacity 28, demand 37
- C12, FL345+: capacity 30, demand 33

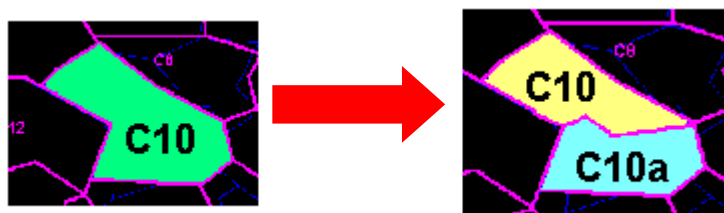


Two sectors also have capacity issues some days of the simulation run:

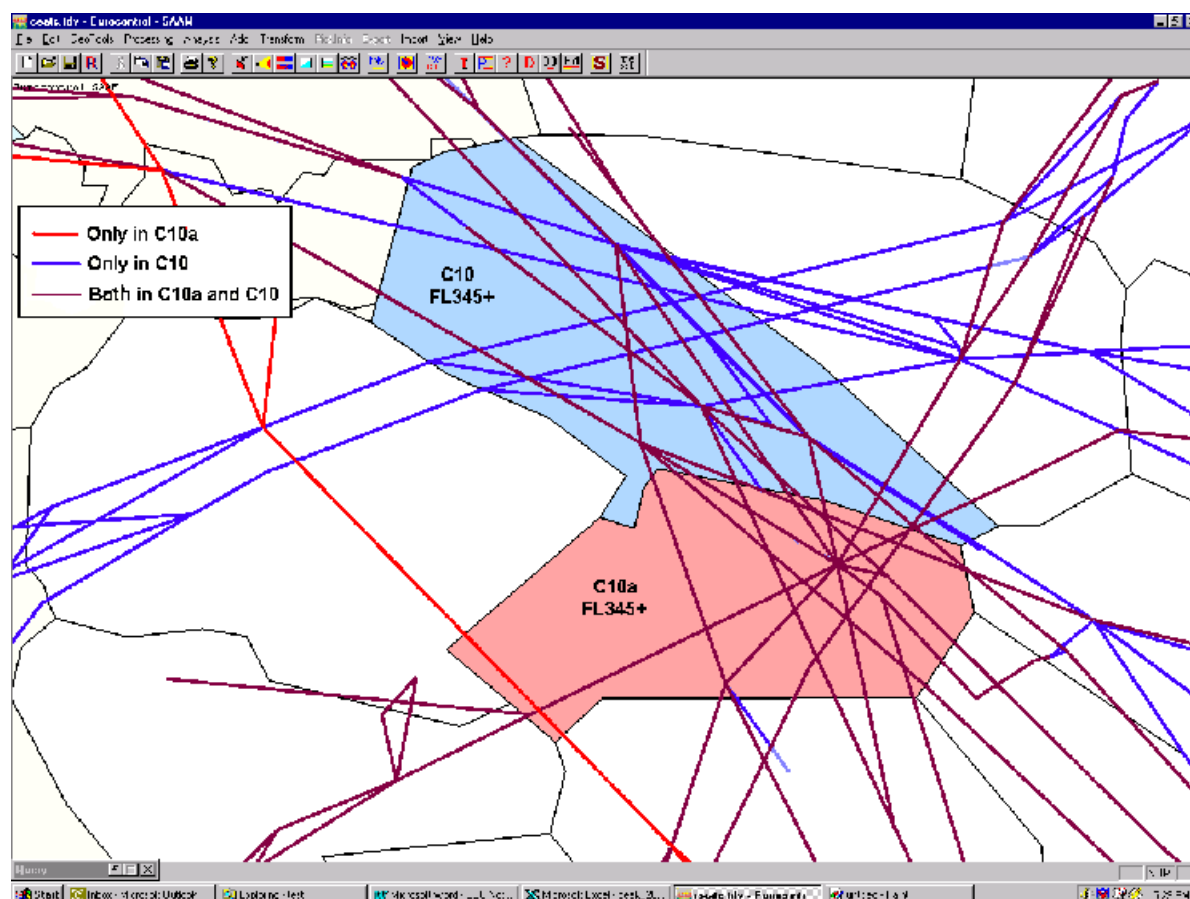
- C13, FL 285-345 : capacity 33, average demand 30
- C14a, FL 285+, capacity 34, average demand 33

3.14 Sector C10, FL345+

The sector C10 above FL 345 is the most overloaded sector found in every scenario where this sector is present. It was already the case last year. A potential solution worthy of assessment was to split the sector in two different sectors, C10 and C10a.



The following map is presenting the demand in C10 and C10a sectors in details for one day (07/17/2002). The separation into these two sectors is not significantly decreasing the number of flights passing through sector 10, as the majority of flights passing through C10a are also passing through C10.



This particular sector split did not solve the capacity issues of CEATS because most of the flights passing through the “old” C10 (i.e. C10 and C10a) are also passing through C10 (the new one).

A solution still needs to be found for this sector before the opening of CEATS, as this problem is seriously reducing CEATS capacity.

4 Conclusions

Scenario	Hourly demand (peak3)	UAC Capacity	Capacity Demand ratio (c/d)	c/d C10, FL345+ Infinite capacity
CEATS, 2001 study	298	248	0.83	1.22
CEATS, FL285+, 70%	278	267	0.96	1.36
CEATS, FL285+, 40%	278	153	0.55	0.77
CEATS, FL345+, 70%	163	159	0.98	1.48
CEATS, FL345+, 40%	163	86	0.53	0.84
North, FL285+, 70%	109	154	1.41	
North, FL285+, 40%	109	86	0.79	
Mid, FL285+, 70%	91	143	1.57	
Mid, FL285+, 40%	91	81	0.89	
Mid-south, FL285+, 70%	102	98	0.96	1.45
Mid-south, FL285+, 40%	102	57	0.56	0.86
Mid-west, FL285+, 70%	92	125	1.36	
Mid-west, FL285+, 40%	92	72	0.78	

Reduced capacities to the "40%" level lead to delay for CEATS in all cases ($c/d < 1$). They should therefore only be used for a short implementation period.

The sector C10, FL345+ problem needs to be solved before the opening of CEATS, as it is critically limiting the capacity of the centre. A study still needs to be conducted to avoid having this sector reducing the overall capacity.

If the capacity problem of sector C10 above flight level 345 is solved, "70%" capacities are sufficient in all cases. The capacity demand ratio is even better than the one found last year.

A CEATS capacity of 377 (in line with previous year figure) could be proposed as 2007 capacity to be input in the ECIP and LCIP with the assumption that the problem of MID-SOUTH will find a solution before transfer to CEATS.

Follow up: a delay prediction study could be conducted if reduced capacities (e.g. "40%") are to be used during the implementation period.

2008 CEATS required capacity will be included in the all ECAC Medium Term FAP study and in the 2004-2008 ECIP.