

20th E/CAR DCA-WP/21International Civil Aviation Organization21/11/06NORTH AMERICAN, CENTRAL AMERICAN AND CARIBBEAN OFFICETwentieth Meeting of Directors of Civil Aviation of the Eastern Caribbean(20th E/CAR DCA)Miami, Florida, United States 4 to 7 December 2006

Agenda Item 3:

Air Navigation Matters 3.6 Other Air Navigation issues

SECTOR CAPACITY

(Presented by the United States of America)

SUMMARY

In support of ATFM for Cricket World Cup activities, this Working Paper presents for the Meeting's consideration a model for computing sector capacity.

The development of an effective ATFM system depends, in part, on the establishment of numerical values for sector capacity. Establishing these values assists traffic managers by identifying optimum sector throughput rates and by providing a basis for traffic management initiatives designed to ensure a safe and efficient flow of traffic.

This Working Paper presents a model for determining sector capacity that is based on the experience the FAA has gained in this area.

It includes a list of key definitions and provides the steps necessary to compute sector capacity.

References:

- Report of the Twelfth Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/12).
- Report of the ATFM Task Forces/1 and 2.
- Working Paper, ATFM, Agenda Item 7 of E/CAR/DCA/20

1. Introduction

1.1 In support of ATFM for Cricket World Cup activities, this Working Paper presents for the Meeting's consideration a model for computing sector capacity. Establishing these values assists traffic managers by identifying optimum sector throughput rates and by providing a basis for traffic management initiatives designed to ensure a safe and efficient flow of traffic. Based on the experience the FAA has gained in this area, this Working Paper presents a model for determining sector capacity. It includes a key definition, lists the factors that affect sector capacity, and provides the steps necessary to compute sector capacity.

2. Definition

2.1 Sector capacity - The optimum number of flights in a given sector, for a specified period of time that can be managed safely and efficiently.

3. Discussion: Factors that affect sector capacity

- 3.1 The following factors can all have an impact on sector capacity.
 - a) Airway structure in the sector.
 - b) Airspace volume of the sector.
 - 1) Vertically
 - 2) Horizontally
 - c) Complexity of operations in the sector.
 - 1) Number of adjoining sectors
 - 2) Amount of climbing/descending traffic
 - 3) Terrain
 - 4) Military operations
 - 5) Special use airspace

4. Discussion: Steps for determining sector capacity

- 4.1 For each 15-minute time period:
 - a) Determine the average time a flight spends in a sector.
 - b) In most cases, this will be measured from 7am to 7pm, Monday through Friday.
 - c) Example:

20 flights are observed in the sector in 15 minutes

Add the flights individual sector times together

120 minutes

Divide 120 minutes by the 20 flights to obtain the average

 $\frac{120 \text{ minutes}}{20 \text{ flights}} = 6 \text{ minutes / flight}$

The quotient is the average sector flight time, in minutes

6 minutes

- 4.2 Next, multiply the average sector flight time by 60 seconds.
 - a) Example:

(6 minutes / flight) X (60 seconds) = 360 seconds / flight

The product is the average sector flight time, in seconds

- 4.3 Next, divide the average sector flight time, in seconds, by 36 seconds.
 - a) 36 seconds is a value established for use in the United States by human factor experts.
 - b) It represents the average time a controller interacts with a flight while it is in the sector.
 - c) Example:

The average sector flight time from above is 360 seconds per flight

Divide 360 seconds per flight by 36 seconds (the time a controller interacts with a flight)

<u>360 seconds per flight = 10 flights</u> 36 seconds

The quotient, 10, is the optimum sector capacity value for the 15 minute period.

- 4.4 Next, adjust the optimum sector capacity value for operational factors.
 - a) The value may be adjusted up or down, as appropriate, after taking into account the factors that affect the sector.
 - b) The factors include, but are not limited to:
 - 1) Airway structure in the sector
 - 2) Airspace volume of the sector -- vertically and horizontally
 - 3) Complexity of operations in the sector
 - 4) Number of adjoining sectors
 - 5) Amount of climbing and descending traffic
 - 6) Terrain
 - 7) Military operations and special use airspace
 - c) Apply local, professional judgment and adjust the optimum sector capacity value up, or down, as necessary.

4.5 The optimum sector capacity adjusted for operational considerations is the sector capacity value.

plus/minus +/-	OPTIMUM SECTOR CAPACITY VALUE ADJUSTMENT FACTORS
equals	SECTOR CAPACITY VALUE

A table method has also been developed for computing the Optimum Sector Capacity 4.6 Value.

Average Sector Flight Time (in minutes)	Optimum Sector Capacity Value (aircraft count)	
· · · · · ·		
3 minutes	5 aircraft	
4	7	
5	8	
6	10	
7	12	
8	13	
9	15	
10	17	
11	18	
12 minutes or more	18	

5. Conclusion

- a) Take note of the information in this paper and the presentation included in the Appendix to this working paper;
- b) Provide information and questions or input to Joe Hof via email at joe.hof@faa.gov Phone: 703 925 3113

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TRAFFIC MANAGEMENT MODEL FOR DETERMINING SECTOR CAPACITY

Traffic Management Model for Determining Sector Capacity



Joe Hof joe.hof@faa.gov 703 925 3113

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Traffic Management Model for Determining Sector Capacity

Definition



- The optimum number of flights
 - in a given sector
 - for a specified period of time
 - that can be managed safely and efficiently

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Traffic Management Model for Determining Sector Capacity

Definition

- Factors that affect sector capacity:
 Airway structure in the sector
 - Airway structure in the sector
 Airspace volume of the sector
 - Vertically and horizontally
 - Complexity of operations in the sector
 - Number of adjoining sectors
 - Amount of climbing/descending traffic
 - Terrain
 - Military operations and special use airspace



Determining sector capacity

- > For each 15-minute time period:
 - Determine the average time a flight spends in a sector
 - In most cases, this will be measured
 - from 7am to 7pm
 - Monday through Friday





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Traffic Management Model for Determining Sector Capacity

Determining sector capacity

- > For each 15-minute period, determine: The average sector flight time, in minutes
- For example:
 - You observe 20 flights in the sector in 15 minutes
 - Add their individual sector times together 120 minutes, for example
 - Divide by 20 (flights)
 - To obtain the average
 - The quotient is the average sector flight time, in minutes
 - 6 minutes, in this example

Traffic Management Model for Determining Sector Capacity

Determining sector capacity

Multiply the average sector flight time in minutes by 60 seconds

For example:

- The average sector flight time is 6 minutes
- Multiply 6 minutes by 60 seconds
- The quotient, 360 seconds, is the average sector flight time -- in seconds



Traffic Management Model for Determining Sector Capacity



For example:

Divide the average sector flight time in seconds by 36 seconds

The average sector flight time is 360 seconds

Divide 360 seconds by 36 seconds The quotient, 10, is the optimum sector capacity value for 15 minutes

36 seconds is a value established for use in the United States by human factor experts It represents the average time a controller interacts with a flight while in a sector



- **Traffic Management Model for Determining Sector Capacity** Determining sector capacity Adjust the optimum sector capacity value May be adjusted up or down Take into consideration the factors that affect the sector • Airway structure in the sector Airspace volume of the sector

 - Vertically and horizontally · Complexity of operations in the sector
 - Number of adjoining sectors
 - Amount of climbing/descending traffic
 - Terrain
 - Military operations and special use airspace

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Traffic Management Model for Determining Sector Capacity

Determining sector capacity

- > Adjust the optimum sector capacity value
- After taking into consideration the factors that affect the sector:
 - Apply local, professional judgment and adjust the optimum sector capacity value up or down, as necessary

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Traffic Management Model for Determining Sector Capacity

Determining sector capacity

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Traffic Management Model for Determining Sector Capacity

Table method for determining the Optimum Sector Capacity Value

Average Sector Flight Time	Optimum Sector Capacity Value	$\sqrt{\sqrt{1}}$
(in minutes)	(aircraft count)	Anna
		# 1
3 minutes	5 aircraft	Distance of
4	7	- 10 Well Par II
5	8	10. 10
6	10	
7	12	
8	13	11177 H
9	15	POLICIALITY, INCO.
10	17	
11	18	
12 minutes or more	18	

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