*International Civil Aviation Organization* 23/11/06
NORTH AMERICAN, CENTRAL AMERICAN AND CARIBBEAN OFFICE
**Twentieth 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**

# AERODROME ACCEPTANCE RATE

(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 the aerodrome acceptance rate.

The development of an effective ATFM system depends, in part, on the establishment of numerical arrival values for aerodrome capacity. Establishing these values assists traffic managers by identifying optimum 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 aerodrome acceptance rate 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 an aerodrome acceptance rate.

**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 the aerodrome acceptance rate. Establishing these values assists traffic managers by identifying optimum aerodrome 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 aerodrome acceptance rate. It includes a list of key definitions and provides the steps necessary to compute an aerodrome acceptance rate.

## 2. Definitions

2.1 Aerodrome acceptance rate (AAR) - The number of arrival aircraft that an aerodrome -- in conjunction with weather conditions, terminal airspace, ramp space, parking space, and facilities -- can accept per hour.

2.2 Aerodrome runway configuration - Each aerodrome configuration which handles 3 percent or more of the annual operations.

2.3 Potential AAR - The theoretical acceptance rate at the runway threshold – before taking other factors into consideration.

2.4 Actual AAR - The Potential AAR at the runway threshold adjusted for other factors. These factors include:

a) Weather conditions
b) Runway conditions
c) Taxiway layout
d) Ramp space
e) Terminal facilities

## 3. Discussion: Steps for computing the AAR

3.1 For any runway configuration, the Potential AAR minus the adjustment factors equals the Actual AAR. Thus,

POTENTIAL AAR
minus ADJUSTMENT FACTORS

equals ACTUAL AAR

3.2 It is suggested that the Actual AAR value be calculated for each aerodrome runway configuration for the following weather conditions:

a) Visual Meteorological Conditions (VMC) – weather allows vectoring for visual approaches.

b) Marginal VMC – weather does not allow vectoring for visual approaches, but visual approaches on final are possible.

c) Instrument Meteorological Conditions (IMC) – neither visual approaches nor visual separation on final are possible.

3.3 To calculate the Potential AAR:

a) Determine the average ground speed crossing the runway threshold and the spacing interval required between successive arrivals.

b) Divide the ground speed by the spacing interval to determine the Potential AAR.

3.4 Formula method for calculating the Potential AAR:

a) Divide the ground speed at the runway threshold in knots by the spacing interval at the runway threshold in nautical miles.

b) When the quotient is a fraction, round *down* to the next whole number.

c) Example 1: The typical arrival aircraft crosses the runway threshold at 130 knots. The required spacing interval at the runway threshold is 5 nautical miles (NM).

$$\frac{\text{130 knots}}{\text{5 NM}} = 26$$

In this example, the Potential AAR equals 26 arrivals per hour.

d) Example 2: The typical arrival aircraft crosses the runway threshold at 120 knots. The required spacing interval at the runway threshold is 7 NM.

$$\frac{\text{120 knots}}{\text{7 NM}} = 17.14 \text{ (round } \textit{down} \text{ to 17)}$$

In this example, the Potential AAR equals 17 arrivals per hour.

3.5 A table method has also been developed for computing the Potential AAR.

| | Nautical miles between aircraft at the Runway Threshold | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 3.5 | 4 | 4.5 | 5 | 6 | 7 | 8 | 9 | 10 |
| | Potential AAR | | | | | | | | | |
| Ground Speed at the Runway Threshold | | | | | | | | | | |
| 140 knots | 46 | 40 | 35 | 31 | 28 | 23 | 20 | 17 | 15 | 14 |
| 130 knots | 43 | 37 | 32 | 28 | 26 | 21 | 18 | 16 | 14 | 13 |
| 120 knots | 40 | 34 | 30 | 25 | 24 | 20 | 17 | 15 | 13 | 12 |
| 110 knots | 36 | 31 | 27 | 24 | 22 | 18 | 15 | 13 | 12 | 11 |
| | | | | | | | | | | |

3.6 After calculating the value of the Potential AAR, it must be adjusted for factors unique to the aerodrome. Adjustment factors include:

a) Intersecting arrival and departure runways
b) Lateral distance between arrival runways
c) Dual-use runways; i.e., runways that are used for both arrivals and departures
d) Land and hold short operations
e) Availability of high speed taxiways
f) Procedural limitations such as noise abatement procedures and missed approach procedures
g) Taxiway layouts
h) Meteorological conditions

3.7 Here is an example of the Actual AARs for an aerodrome:

| RUNWAY CONFIGURATION | AAR for VMC | AAR for MARGINAL VMC | AAR for IMC |
|---|---|---|---|
| RWY 13 | 24 | 21 | 19 |
| RWY 31 | 23 | 20 | 17 |

a) Example: The Potential AAR at an aerodrome for Runway (RWY) 13 is 28. However, when adjusted for the taxiway layout and ramp limitations, the Actual AAR for VMC conditions is 24 arrivals per hour.

b) Example: When the RWY 13 Actual AAR is adjusted for Marginal VMC conditions, the value is reduced to 21 arrivals per hour.

c) Example: When the RWY 13 Actual AAR is reduced for IMC conditions, the value is further reduced to 19 arrivals per hour.

**4. Conclusion**

4.1 Based on this information, the Meeting is invited to:

a) Note the information presented in this paper and the presentation included as **Appendix** to this working paper.

b) Provide information and questions or input to Joe Hof via email at joe.hof@faa.gov - Phone number: (703) 925 3113.

- - - - -

TRAFFIC MANAGEMENT MODEL FOR DETERMINING AERODROME ACCEPTANCE RATE (AAR)

## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

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



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Definitions

- **Aerodrome Acceptance Rate (AAR):**

The number of arrival aircraft that an aerodrome -- in conjunction with weather conditions, terminal airspace, ramp space, parking space, and facilities -- can accept per hour



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Definitions

- **Aerodrome Runway Configuration**:

Each aerodrome configuration which handles 3 percent or more of the annual operations



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Definitions

- **Potential AAR**:

The theoretical acceptance rate at the runway threshold – before taking other factors into consideration

## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Definitions

- **Actual AAR**:

The Potential AAR at the runway threshold *adjusted for* other factors



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Definitions

- **AAR adjustment factors**:

The factors that must be considered when establishing the actual AAR. These include:

- Weather conditions
- Runway conditions
- Taxiway layout
- Ramp space
- Facilities



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

For any runway configuration:

POTENTIAL AAR

– ADJUSTMENT FACTORS

ACTUAL AAR



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Suggestion:

- Calculate the Actual AAR value for each aerodrome runway configuration for the following weather conditions:
  - Visual Meteorological Conditions (VMC) - weather allows vectoring for visual approaches
  - Marginal VMC - weather does not allow vectoring for visual approaches, but visual
  - Instrument Meteorological Conditions (IMC) – Visual approaches and visual separation on final are not possible

## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

To calculate the Potential AAR:

- Determine the average ground speed crossing the runway threshold and the spacing interval required between successive arrivals
- Divide the groundspeed by the spacing interval to determine the potential AAR



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Formula method for calculating the Potential AAR:

- Formula: Ground speed in knots at the runway threshold divided by spacing interval at the runway threshold in nautical miles
  - NOTE: when the quotient is a fraction, round *down* to the next whole number



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Formula method for calculating the Potential AAR:

- Example: 130 KTS / 3.25 nm = 40
  - Potential AAR = 40 arrivals per hour
- 125 KTS / 3.0 nm = 41.66 (round *down* to 41)
  - Potential AAR = 41 arrivals per hour



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Table method for calculating the Potential AAR:

| | Nautical miles between aircraft at the Runway Threshold | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 3.5 | 4 | 4.5 | 5 | 6 | 7 | 8 | 9 | 10 |
| | Potential AAR | | | | | | | | | |
| Ground Speed at the Runway Threshold | | | | | | | | | | |
| 140 knots | 46 | 40 | 35 | 31 | 28 | 23 | 20 | 17 | 15 | 14 |
| 130 knots | 43 | 37 | 32 | 28 | 26 | 21 | 18 | 16 | 14 | 13 |
| 120 knots | 40 | 34 | 30 | 26 | 24 | 20 | 17 | 15 | 13 | 12 |
| 110 knots | 36 | 31 | 27 | 24 | 22 | 18 | 15 | 13 | 12 | 11 |

## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Identify any conditions that may reduce the Potential AAR. Conditions may include:

- Intersecting arrival and departure runways
- Lateral distance between arrival runways
- Dual use runways – runways that share arrivals and departures
- Land and Hold Short operations



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

Conditions may include (continued):

- Availability of high speed taxiways
- Airspace limitations and constraints
- Procedural limitations (noise abatement, missed approach procedures)
- Taxiway layouts
- Meteorological conditions



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

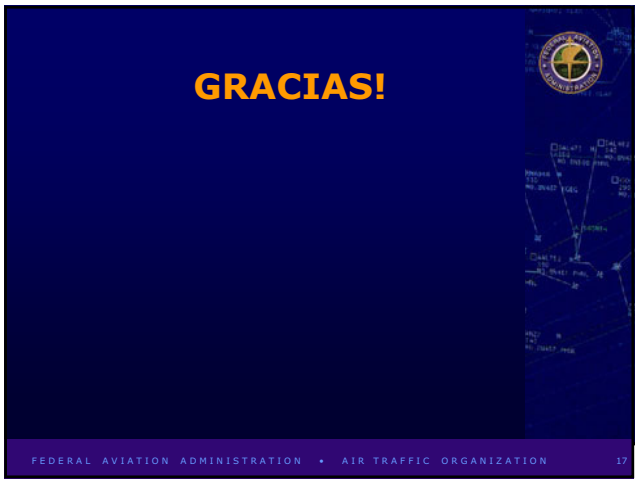
Example of Actual AAR

| RUNWAY CONFIGURATION | AAR for VMC | AAR for MARGINAL VMC | AAR for IMC |
|---|---|---|---|
| RWY 13 | 24 | 21 | 19 |
| RWY 31 | 23 | 20 | 17 |



## Traffic Management Model for Determining Aerodrome Acceptance Rate (AAR)

- Administrative considerations:
- Identify who is responsible for the establishment and implementation of AARs at the aerodromes
- Establish a table of actual AARs for the aerodrome runway configuration(s)
- Review and validate the aerodrome runway configurations and associated AARs at least once each year


GRACIAS!
FEDERAL AVIATION ADMINISTRATION • AIR TRAFFIC ORGANIZATION
17