
PAPUA NEW GUINEA**AIC**

TELEPHONE	22 5200
TELEGRAPHIC	ADDRESS
AFTN	AYPYYO
Telegram/Telex	NE 23291

AERONAUTICAL INFORMATION SERVICE
OFFICE OF CIVIL AVIATION
P. O. BOX 684, BOROKO

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**DEMONSTRATIONS OF REDUCED SEPARATION MINIMA FOR USE BETWEEN RNAV
APPROVED AIRCRAFT IN THE ASIA AND PACIFIC REGION****1 - INTRODUCTION**

1.1 – The purpose of this AIC is to introduce demonstrations of Mack Number Technique and reduced separation minima for use between RNAV approved aircraft in the Asia and Pacific Region. These demonstrations are to be conducted on ATS routes, refer to Attachment, in accordance with the attached schedule, refer to Attachment B.

2 – BACKGROUND

2.1 – The prime charter of Air Traffic Control is to provide safe, orderly and expeditious flow of Air Traffic. Safety is paramount and is achieved, in part, by the application of predetermined separation standards. With the current focus on economy in aircraft time and fuel, if separation can be reduced without a reduction in safety standards, the greater the benefit to industry.

2.2 – Contracting States of ICAO are able to determine specific standards and procedures within territorial limits without recourse to ICAO. However, when developing standards and procedures for application over the high seas, the rules specified in the ICAO documentation must “apply without exception” (ICAO Annex 2, chapter 2). Additionally, agreement must be reached between adjoining States.

2.3 – Discussions were held during the period 6-8 August 1991, between ICAO, Australia, Fiji, Indonesia, Malaysia, New Zealand, Papua New Guinea, Singapore, Thailand, United State of America, IATA, IFALPA and IFATCA, to reduce the separation minima applied over the high seas. The proposed RNAV demonstrations, outlined in paragraph 1.1, were one of the positive outcomes resulting from this meeting.

3 – DEMONSTRATION ROUTES

3.1 – The demonstrations will be conducted on the route segments shown at Attachment A.

4 – CERTIFICATION AND APPROVAL OF OPERATORS AND AIRBORNE NAVIGATION SYSTEMS

4.1 – For the purpose of these demonstrations, only those aircraft and operators meeting the RNAV equipment and operating standards, as specified in the Australia Manual of Operational Standards chapters 8, 9 and 10, here after referred to as AUSEP and the Australian Aeronautical Information Publication, are accepted for the application of the standards detailed in this AIC.

5 – MACH NUMBER TECHNIQUE

5.1 – The term is used to describe the technique of clearing the successive turbo-jet aircraft operating along the same track to maintain specific Mach numbers in order to maintain adequate longitudinal separation between successive aircraft at, climbing or descending to, the same level.

5.2 – The principle objectives of the Mach Number Technique are:

- (a) to ensure continued longitudinal separation exists between successive aircraft on long route segments with a minimum of ATC intervention.
- (b) to obtain improved utilisation of such routes, thus contributing to the economy of flight operations of traffic concerned.

5.3 – To achieve these objectives the speeds of aircraft operating along the same track at the same level are stabilised (through the assignment of specific Mach numbers). This stability permits reasonably accurate projections of the expected longitudinal separation between aircraft to points well beyond the point where separation is first confirmed

5.4 –It has been found that successive aircraft operating along the same track at the same level as another aircraft and maintaining the same Mach number also maintain a reasonably constant time interval between each other, when checked by position reports over the same point. This is due to the fact that the aircraft concerned are normally subject to approximately the same wind and temperature conditions. Minor variations in speed which might temporarily increase or decrease the spacing between aircraft tend to be neutralised over prolonged periods of flight.

5.5 –Further guidance material relating to the application of Mach Number Technique is contained within the ICAO Air Traffic Services Planning Manual (Document 9426).

5.6 –Application of longitude separation between aircraft, when the Mach Number Technique is used is based on the assumption that the last assigned Mach Number will be maintained at all times, including during any climbs or descents. In the even, that for operational reasons it is not feasible to do so, the pilot must inform ATC at the time of the initial clearance or subsequent climb/descent request or clearance.

6 – SEPARATION MINIMA

6.1 –As outlined in Attachment B **Phase One** of these demonstrations will involve (the application of the Mach Number Technique, with a fifteen (15) minute longitude separation minima).

6.2 –Subject to ratification by the ICAO Air Navigation Commission (ANC) of an amendment to the ICAO Regional Supplementary Procedures (Document 7030), Phase Two and Three will then be introduced.

6.2.1 –During Phase Two, the minimum longitudinal separation minima to be applied between turbo-jet aircraft using INS/IRS or VLF OMEGA, (that is NAV/AUSEP approved, as per paragraph 4):

- operating on ATS Routes, refer to Attachment a
- when the Mach Number Technique is applied; and
- whether in level, climbing or descending flight, shall involve the application of (the Mach Number Technique, with a ten (10) minute longitudinal separation minima).

6.2.2 –During Phase Three, the minima and conditions outlined in paragraph 6.2.1 will continue to apply, but “Mach Number Different (MND)”, will also be demonstrated when appropriate. MND involves the use of Mach Number Technique and the following reduced longitudinal time separation minima, as applicable:

between **NINE (9) and FIVE (5) minutes inclusive**, provided:

- i) the preceding aircraft is maintaining a greater Mach number than the following aircraft, in accordance with the following table:
 - 9 minutes, if the preceding aircraft is Mach 0.02 faster than the following aircraft;
 - 8 minutes, if the preceding aircraft is Mach 0.03 faster than the following aircraft;
 - 7 minutes, if the preceding aircraft is Mach 0.04 faster than the following aircraft;
 - 6 minutes, if the preceding aircraft is Mach 0.05 faster than the following aircraft;
 - 5 minutes, if the preceding aircraft is Mach 0.06 faster than the following aircraft.

6.2.3 –Also during Phase Three “Operations with Closing Speed” will also be demonstrated, when appropriate.

6.2.3.1 –Overseas experience has shown that through the use of Mach Number Technique, it is possible to predict the rate of closure accurately enough to allow operations with closing speed.

6.2.3.2 –The method used is that for every 600nm travelled, add 1 minute to the basic time separation for each 0.01 Mach closing.

EXAMPLE

1200nm route segment

Mach 0.04 closing

10 min. Minimum time separation required at the exit gate

Required multiplier 2 (1200/600 = 2)

Mach 0.04/0.01 = 4

2 x 4 = 8 minutes

Minimum Time required at the entry gate to ensure 10 minutes at the exit gate 8 + 10 = 18 minutes

6.2.3.3 –For the routes included in this trial the following table of minimum time intervals required at the entry gate is applicable;

DIFFERENCE IN MACH	DISTANCE TO FLY AND SEPARATION (IN MINUTES) REQUIRED AT ENTRY POINT					
	001 – 600 NM	601 – 1200 NM	1201 – 1800 NM	1801 – 2400 NM	2401 – 3000 NM	
0.01	11	12	13	14	15	
0.02	12	14	16	18	20	
0.03	13	16	19	22	25	
0.04	14	18	22	26	30	
0.05	15	20	25	30	35	
0.06	16	22	28	34	40	
0.07	17	24	31	38	45	
0.08	18	26	34	42	50	
0.09	19	28	37	46	55	
0.10	20	30	40	50	60	

6.2.3.4 –The use of this method does not alter in any way the requirement for ATC to check and update the aircraft estimates for further positions to ensure that separation minima is not infringed.

6.2.3.5 –It is very important the estimates for the entry gate is as accurate as possible since this forms the basis for the advanced planning of longitudinal separation between aircraft.

6.3 – CONDITIONS

6.3.1 –Separation of 10 minutes between aircraft flying the same or diverging tracks in the same direction may apply within controlled airspace provided that:

- (a) for aircraft equipped with single ONS or INS/IRS, the average ground speed on a route section is not less than:
 - i) 240 knots where the update interval does not exceed three hours;
 - ii) 330 knots where the update interval does not exceed five hours; and
- (b) for aircraft with two or more ONS or INS/IRS, the average ground speed on a route section is not less than 240 knots and the time between updates does not exceed five hours.

6.3.2 –The minima are only to be applied between NAV/AUSEP approved aircraft.

6.3.3 –The minima shall not be applied when ATC is aware that the time since the last opportunity to update the RNAV system's present position exceeds the limit, or after pilot advice of:

- (a) navigation equipment failure; or
- (b) continuous operation of ONS in the DR mode for one minute or more from the last update; or
- (c) operation of the equipment outside the approved tolerances.

Note: In the case of (b) the separation minima may re-apply following advice of further update.

6.3.4 –For the application of this minima the Mach Number Technique shall be applied to both aircraft.

6.3.5 –Each route has a defined entry and exit gate between which the reduced minima shall be applied; refer to Attachment A.

7 –PILOT REQUIREMENT

7.1 –As from 12 December 1991, pilots of participating NAV/AUSEP approved aircraft shall:

- (a) indicate in field 15 of flight plans the planned cruising Mach Number and any changes to this speed;
- (b) indicate in field 18 of flight plans the abbreviation NAV/AUSEP if so approved by the appropriate State of registry;
- (c) readback and maintain any assigned Mach Number, and report any changes to cruising Mach Number exceeding 0.01;
- (d) notify ATC as soon as possible, of any variations of \pm M.01 to the cleared (filed) Mach number
e.g. "...REQUEST INCREASE TO MACH POINT..."
"...REDUCING TO MACH POINT..."

- (e) include the current true Mach number in routine position reports, after the flight level;
- (f) advise any of the participating authorities details of any problems that may be encountered with these demonstration; this may be done through ATS Units.

8-ATS REQUIREMENTS

8.1-ATC units not currently employing Mach Number Technique on the demonstration routes, shall clear all NAV/AUSEP approved aircraft at their filed Mach number prior to the appropriate entry point. Where no Mach number has been filed, the controller shall ask the aircraft its planned Mach number, this advised speed shall then be assigned to the aircraft.

E.g. "...FROM APAVO MAINTAIN MACH POINT EIGHT FOUR TIL CAPRICORN..."

8.2-States will nominate which of their ATS units will collect statistical data on Mach Number Technique and Navigation System Error, during the conduct of these demonstrations. Full instructions will be provided to relevant personnel by local instructions.

9-SUMMARY

9.1-The demonstrations are an attempt to reduce separation minima commensurate with the higher accuracy of aircraft RNAV equipment.

9.2-Changes to ATC procedures will be involved, however, the end result should be increased flexibility in traffic management and increased use of optimum levels.

10 – CANCELLATION

10.1 – This AIC will remain current until further notice.

DISTRIBUTION: Normal

CURRENT AIC:

1985:	5, 8
1989	3, 4, 8
1990	1, 2
1991	1, 2, 3, 4, 5, 6

ATTACHMENT A

* Data Collection Provider/User ** Data Collection User Only

	ROUTE	ENTRY POINT	EXIT POINT
*	A579 EASTBOUND	LOTRA/PUKOP (B450) KABAR	SUKBA NIEMO
*	A579 WESTBOUND	SUKBA NIEMO	LOTRA KABAR
*	B580 EASTBOUND	LOTRA/APORA (R223)	SHILA
*	B474 EASTBOUND	OPEDO	SHILA
*	B474 WESTBOUND	SHILA	OPEDO
*	B462/B586 NORTHBOUND	ROCKHAMPTON VOR	ERVIN (En-route)
*	B462 NORTHBOUND	ROCKHAMPTON VOR	APAVO (Destination Port Moresby)
*	B856	NADZAB VOR	ERVIN (Port Moresby Departure and En-route)
**	A337 NORTHBOUND	ROCKHAMPTON VOR	JUNIE
*	B586/B462 SOUTHBOUND	ERVIN	CAPRICORN (En-route)
*	B462 SOUTHBOUND	APAVO	CAPRICORN (Departure Port Moresby)
*	B586 SOUTHBOUND	ERVIN	NADZAB VOR (Destination Port Moresby and En-route)
**	A337 SOUTHBOUND	JUNIE	ROCKHAMPTON VOR
**	A597 NORTHBOUND	KAKOP	JUNIE
**	A597 SOUTHBOUND	JUNIE	KAKOP
**	B452 NORTHBOUND	PONOK	ATIGO
**	B452 SOUTHBOUND	ATIGO	PONOK

Note: *CAPRICORN shall be a compulsory reporting point Southbound, during the conduct of these demonstrations.*

SCHEDULE OF ICAO RNAV DEMONSTRATIONS

Documentation:

Letter of Agreement between the States concerned, joint NOTAM and AIC regarding ATS and pilot procedures. Survey data collection procedures.

PHASE 1 – INTRODUCTION OF THE MACH NUMBER TECHNIQUE

Start Date: 12 December 1991
Duration: Until Further Notice
Analysis: 5 March – after 8 weeks operation.

PHASE 1 – INTRODUCTION OF 10 MINUTES LONGITUDINAL SEPARATION MINIMA, WITH MACH NUMBER TECHNIQUE BEING APPLIED

Start Date: Proposed 3 March 1992 (Subject to ANC approval of an amendment to ICAO doc 7030)
Duration: 3 March – 2 June 1992
Analysis: 29 April – after 8 weeks operation.

PHASE 1 – INTRODUCTION OF THE MACH NUMBER DIFFERENTIAL AND OPERATIONS WITH CLOSING SPEED – 10 minutes longitudinal separation minima, with MNT, also to be applied during this phase as required.

Start Date: 2 June
Duration: 2 June – 4 August 1992
Analysis: 28 July – after 8 weeks operation.