P-RNAV GENERAL INFO NOTICE

1. BACKGROUND

Precision-RNAV (P-RNAV) is the natural progression from Basic RNAV (B-RNAV) which became mandatory in European Airspace in April 1998 for en-route operations.

Initial application is in the Terminal Area and P-RNAV track keeping equates to cross track accuracy of RNP 1 (±1NM).

P-RNAV procedures are designed to a common set of design principles specific to RNAV equipped aircraft. These P-RNAV procedures will replace the wide variation of RNAV procedures in European ECAC Terminal Airspace that do not have a common basis. It has been recognised that a large variation of principles and requirements in RNAV operations is not without safety implications.

2. WHAT IS RNAV?

A method of navigation which permits aircraft operation on any desired flight path within the coverage of referenced navigation aids or within prescribed limits of self contained aids.

RNAV operations support navigation in any airspace without the need to fly directly over ground based aids.

Aircraft P-RNAV equipment automatically determines aircraft desired flight path by a series of waypoints held in a database.

3. WHAT IS THE DIFFERENCE BETWEEN B-RNAV AND P-RNAV?

Basic Area Navigation (B-RNAV) was the forerunner of the RNAV implementation in ECAC. It was introduced to enable en route capacity gains to be achieved with minimal aircraft capability. It requires aircraft conformance to a track-keeping accuracy of ±5NM for at least 95% of flight time to ensure that benefits are achieved whilst meeting the required safety targets. B-RNAV can be achieved using inputs from VOR/DME, DME/DME or GNSS and/or INS. B-RNAV is generally not sufficient for Terminal Airspace RNAV operations.

Precision Area Navigation (P-RNAV) is being introduced for RNAV applications in terminal airspace. It requires aircraft conformance to a track-keeping accuracy of ±1NM for at least 95% of flight time, together with advanced functionality, high integrity navigation databases. P-RNAV capability can be achieved using inputs from DME/DME or GNSS. Many existing aircraft can achieve P-RNAV capability without additional onboard equipment.

P-RNAV procedures are designed, validated and flight checked to a common standard. All P-RNAV approved aircraft meet the criteria and have the minimum functional capability as required to operate the P-RNAV procedures. In addition ATC procedures and RTF phraseology will be standard. This harmonised approach will enable all aircraft to fly accurate and consistent flight paths in theTerminal area.

4. IS THERE A MANDATE FOR P-RNAV?

An ECAC wide mandate for the carriage of P-RNAV is not foreseen. However European States will progressively introduce P-RNAV requirements for Terminal Area RNAV procedures. By November 2004, RNAV procedures in major European Terminal airspace are expected to require P-RNAV. This will extend to all Terminal Airspace by April 2005. Conventional Terminal Area procedures will continue to be provided although there may be operational imitations at some airports. Basic RNAV will be limited to RNAV procedures above MSA that are designed according to en-route principles.

5. WHERE WILL P-RNAV BE USED?

Initial use of RNAV equipment approved for P-RNAV operations will be in the Terminal area of European ECAC States.

6. WHAT IS RNP-RNAV?

RNP-RNAV will be the next major step toward achieving a total RNAV environment enabling maximum use to be made of RNAV capability. Track keeping accuracy will be applicable to prescribed RNP values, typically RNP 0.3 NM and RNP 0.1 NM.

No mandate for RNP-RNAV is foreseen before 2010.

7. AIRCRAFT EQUIPMENT

Many existing aircraft can achieve P-RNAV capability without additional onboard equipment. All aircraft are to be certified to the same criteria and will have the same minimum functional capability. The authoritative guidance material for achieving aircraft airworthiness is provided in the **JAA Temporary Guidance Leaflet 10** known as TGL10.

8. HEADLINE BENEFITS

P-RNAV will make a significant contribution to safety by introducing predictable and repeatable flight paths for all aircraft types with:

- approach procedures designed to common set of parameters
- aircraft flying consistently to those parameters
- pilots and controllers with same knowledge of intended flight path

9. OPERATORS' COURSES OF ACTION

Both airworthiness and operational approval must be obtained before commencing P-RNAV operations.

As part of operational approval, operators will need to:

- provide **pilot training**
- review **SOPs**
- eventually update aircraft **MELs**
- get the **database** from a P-RNAV approved supplier or implement approved navigation database integrity checks.

Operators' approval requirements are detailed in the **P-RNAV JAA TGL10** and **EUROCONTROL P-RNAV Operators' Approval Guidance.**

10. FUTURE DEVELOPMENTS

P-RNAV is currently an ECAC specific application but is seen as a logical step towards the adoption of global RNP-RNAV standards in the year following 2010.

Navigation Strategy for ECAC States

En route & connection to Terminal Areas	Terminal Areas	En route & Terminal Areas including approaches
B-RNAV 1998	P-RNAV 2004-2010	RNP-RNAV 2010-2020

Notes

P-RNAV approval must be obtained before commencing P-RNAV operations.

It should be noted that the procedures detailed in the following paragraphs include those of a generic nature, to be carried out as part of operator SOPs. Those which are particularly ***relevant or specific to P-RNAV operations are highlighted in bold.***

1. PRE-FLIGHT PLANNING

1.1. Crew Qualification

The crew must be trained, qualified and current for the intended route.

The crew must be qualified and current for P-RNAV operations.

1.2. Flight Planning

For an aircraft with P-RNAV approval, a **'P'** shall be inserted in the **FPL Item 10**, **in addition** to the 'R' for B-RNAV approval.

1.3. Notams

The NOTAMS must advise lack of availability of any **navigation aid that might affect the navigation infrastructure** required for the intended operation, including any non-RNAV contingencies and must be confirmed for the period of intended operation.

GNSS specific: if a stand-alone GPS is to be used for P-RNAV, the **availability of RAIM** must be confirmed with account taken of the latest information from the US Coastguard or from the EUROCONTROL AUGUR website which give details of satellite non-availability.

1.4. Minimum Equipment List (MEL)

Any Navigation equipment unserviceability must be checked against MEL for effect on RNAV operations. Availability of the **onboard navigation equipment necessary** for the route to be flown must be confirmed. In certain areas, this may include the availability of an autopilot and/or a flight director to maintain track keeping accuracy.

Where the responsible airspace authority **has specified in the AIP that dual P-RNAV systems are required for a specific Terminal Area P-RNAV procedure**, the availability of **dual P-RNAV systems** must be confirmed. This typically will apply where procedures are effective below the applicable minimum obstacle clearance altitude or where radar coverage is inadequate for the purposes of supporting P-RNAV. This will also take into account the particular hazards of a Terminal Area and the feasibility of **contingency procedures following loss of P-RNAV capability**.

1.5. Database

The onboard navigation database must be current and appropriate for the intended operation and include the relevant navigation aids, waypoints, and coded Terminal Area procedures for the **departure, arrival and alternate** airfields**.**

The database must be provided by an **approved supplier** or be checked via an **approved company procedure.**

2. BEFORE START

2.1. System Initialisation

At system initialisation, the flight crew must confirm that the **navigation database is current** and verify that the aircraft position has been entered correctly.

2.2. Check of the Active Flight Plan

The active flight plan should be checked by comparing the charts, SID or other applicable documents, with the map display (if applicable) and the MCDU. This includes:

- confirmation of the correct waypoint sequence,
- reasonableness of track angles and distances,
- any altitude or speed constraints, and
- correct identification, where possible, of waypoints as **fly-by** or **fly-over** waypoints.

Pilots shall particularly focus on any segment of the P-RNAV procedure which is below MSA.

If required by a procedure, a check will need to be made to confirm that position updating will use a specific navigation aid, or to confirm exclusion of a **specific navigation aid.**

A procedure shall not be used if doubt exists as to the validity of the procedure in the navigation database

Note: As a minimum, the departure checks could be a simple inspection of a suitable display to achieve the objectives of this paragraph.

2.3. Route Modifications

Route modifications in the Terminal Area may take the form of **radar headings or 'direct to'** clearances and the flight crew must be ready to react promptly. This may include the

insertion in the flight plan of a waypoint sequence loaded **solely from the database as part of an alternative procedure.**

The creation of new waypoints by manual entry into the RNAV system by the flight crew is not permitted as it would invalidate the affected P-RNAV procedure.

3. TAKE OFF

3.1. Prior to Take Off

Prior to commencing take off, the flight crew must verify that the **RNAV system is available** and operating correctly and, when available, the correct airport and runway data have been loaded.

3.2. Line Up

Unless automatic updating of the actual departure point is provided, the flight crew must ensure **initialisation on the runway** either by means of a manual runway threshold or intersection update, as applicable. This is to preclude any inappropriate or inadvertent position shift after take-off.

GNSS specific: **the signal must be acquired before the take-off** roll commences and GNSS position then may be used in place of the runway update.

4. DEPARTURE

4.1. Flight Plan Monitoring

During the procedure and where feasible, flight progress should be monitored for navigational reasonableness, by cross-checks, with conventional navigation aids using the primary displays in conjunction with the MCDU.

If P-RNAV capability is <u>not</u> based on GNSS equipage, transition to the P-RNAV structure shall only be made from the point where the aircraft has entered DME/DME coverage.

Note: When a procedure is designed to be started conventionally, then the first point of the P-RNAV procedure will be identified on the charts.

4.2. Track Keeping Monitoring

When using autopilot and/or flight director, particular attention should be paid to the **selected/armed mode** as the resultant track keeping accuracy may vary.

Track keeping monitoring of a P-RNAV procedure below MSA will also require particular attention in degraded conditions such as engine failure, as both the vertical and the lateral obstacle clearance are more critical.

5. DESCENT AND ARRIVAL

5.1. Check of the Active Flight Plan

As for departure, prior to the arrival phase, the flight crew should verify that the correct terminal procedure has been loaded.

The active flight plan should be checked by comparing the charts with the map display (if applicable) and the MCDU. This includes again:

- confirmation of the waypoint sequence,
- reasonableness of track angles and distances,
- any altitude or speed constraints,
- Where possible, which waypoints are **fly-by** and which are **fly-over**.

Some P-RNAV procedures called **open procedures** are terminated by means of a heading segment to assist sequencing and to prevent automatic turns onto final approach.

Again, pilots shall particularly focus on the segment of P-RNAV procedures which are below MSA.

If required, a check will need to be made to confirm that updating will include or exclude a **particular navigation aid** as appropriate.

A procedure shall not be used if doubt exists as to the validity of the procedure in the navigation database.

Note: As a minimum, the arrival checks could be a simple inspection of a suitable display to achieve the objectives of this paragraph.

The crew briefing shall include **reversion to a conventional procedure** and the go around procedure.

As for departure, the creation of new waypoints by manual entry into the RNAV system by the flight crew is not permitted as it would invalidate the P-RNAV procedure.

5.2. System Accuracy Check

For RNAV systems without GNSS updating, a **reasonableness** check is required during the descent

phase before reaching the Initial Approach Waypoint (IAWP).

For example, where feasible, display bearing/range to a VOR/DME on the RNAV system and compare it to the actual RMI reading of that particular navaid.

It should be noted that:

- For some systems the accuracy may be derived from the navigation mode or accuracy mode.
- Where the MCDU is not capable of displaying accuracy in decimal units, then an approved alternative means of checking will have to be followed.

GNSS specific: for GNSS based systems, absence of a triggered alarm is considered sufficient

If the check fails, a conventional procedure must then be flown.

Where the contingency to revert to a conventional arrival procedure might be required, the flight crew must make the necessary preparation and **briefing**.

5.3. Route Modifications

Route modifications in the Terminal Area may take the form of **radar headings or 'direct to' ATC clearances** and the flight crew must be ready to react promptly. This may include the insertion in the flight plan of a waypoint sequence **loaded solely from the database as part of an alternative procedure.**

Manual entry or modification by the flight crew of the loaded procedure, using temporary waypoints or fixes not provided in the database, is not permitted.

Any published altitude and speed constraints must be observed, unless otherwise instructed by ATC.

5.4. Track Keeping Monitoring

As for departure, when using autopilot and/or flight director, particular attention should be paid to the **selected/armed mode** as the response to the track keeping demand may vary.

P-RNAV web site:
www.ecacnav.com/p-rnav

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Notes

Notes

P-RNAV ATC Information Notice

1. GENERAL

Precision-RNAV (P-RNAV) is the natural progression from Basic RNAV (B-RNAV) which became mandatory in European airspace in April 1998.

Aircraft P-RNAV equipment automatically determines aircraft desired flight path by a series of waypoints held in a database.
Initial application is in the Terminal Area and P-RNAV track keeping equates to cross track accuracy of RNP 1 (±1NM).
P-RNAV procedures are designed to a common set of design principles specific to RNAV equipped aircraft. These P-RNAV procedures will replace the current multitude of overlay Procedures many of which are unsuitable for a wide range of aircraft types.

The most important aspect that P-RNAV offers is the consistency in RNAV procedure design and execution. This in itself provides a safety benefit, and is the main driver for the introduction of P-RNAV procedures in ECAC Terminal Airspace.
In addition ATC procedures and R/T phraseology will be standard. This harmonised approach will enable all aircraft to fly accurate and consistent flight paths in the Terminal Area.

2. OPTIMISATION OF SID/STARs WITH RNAV

RNAV procedure design permits flight in any airspace without the need to fly directly over classic ground based aids. P-RNAV offers the ability to use RNAV functionality in all phases of flight except final approach and missed approach. This allows the routes in the terminal airspace to be defined to best meet the needs of the airport, the air traffic controller and the pilot. This often means shorter, more direct routes with simple connections to the en-route structure.

However, where environmental issues play a major role, the route can be designed to make best advantage of the airspace available and, where possible, by-pass densely populated areas. As such, capacity and environmental benefits can be obtained e.g. specific SIDs/STARs can be designed to accommodate different environmental requirements for night and day operations.
Careful design can also result in appropriately segregated arrival and departure streams, thereby reducing the need for radar vectors and hence the workload for both the pilot and the controller.
Fewer radar vectors also means less uncertainty on the flight deck with regard to the anticipated tactical route and the distance to go.
Finally, the enhanced accuracy capability of P-RNAV approved aircraft means that less airspace is required to accommodate P-RNAV terminal area procedures.

3. IMPLEMENTATION

Design and time scale
P-RNAV procedures are designed, validated and flight checked to a common standard.
By November 2004, RNAV procedures in major European Terminal Airspace are expected to require P-RNAV.
This will extend to all ECAC Terminal Airspace by April 2005.

Conventional/RNAV mix
The carriage and operation of P-RNAV equipment is not mandatory.
Therefore, conventional (non-RNAV) Terminal Area Procedures will continue to be provided allowing aircraft not appropriately approved for Terminal Airspace RNAV operations to continue operating.
In Terminal Airspace where RNAV procedures have been introduced to handle traffic more effectively, the application of conventional procedures and radar vectoring by Air Traffic Service Providers to accommodate non-P-RNAV approved flights in a mixed-mode operation may adversely affect airport capacity and increase delays. Aircraft operators are therefore being actively encouraged to gain P-RNAV approvals for their aircraft so as to optimise benefits for all users, as well as ATC.

Finally, some published Terminal Airspace RNAV procedures with minimum flight altitudes at or above MSA/MRVA may require only B-RNAV approval, but those procedures will be based on en-route design principles and have associated limitations.

4. AIRCRAFT RNAV REQUIREMENTS

FPL item 10 will show the individual aircraft RNAV capability:

- **SR** for B-RNAV capability only
- **SRP** for P-RNAV capability
- **No S, R, or P** for the case of non-RNAV capability.

These flight planning provisions are intended to support the ANSP, so as to permit individual aircraft RNAV capability to be displayed to relevant control positions.

5. SID/STAR ASSIGNMENT

ATC will assign a P-RNAV, B-RNAV or conventional SID/STAR to aircraft according to its individual RNAV capability status.

The RNAV capability status can be displayed at relevant control positions.
However, the capability status of an aircraft may be amended by aircrew at any moment due to contingency or loss of equipment capability.

6. P-RNAV OPERATIONS, PROCEDURES AND REQUIREMENTS

ATC procedures
The requirements are detailed in an Amendment to ICAO Doc. 7030, ICAO EUR Region Supplementary Procedures.
P-RNAV related ATC procedures and phraseology must be incorporated into local ATC operations manuals.
P-RNAV procedures must be consistent with those already existing for SIDs/STARs.

Radio transmissions
If a RNAV arrival or departure procedure, which has been assigned, cannot be accepted by the pilot, for reasons of either the RNAV equipment or circumstances associated with its operational use, the pilot shall inform ATC immediately by use of the phrase:
*"***UNABLE** *(designator)* **DEPARTURE** *[or* **ARRIVAL***]* **DUE RNAV TYPE***"*

If for any other reason, the pilot is unable to comply with an assigned Terminal Area Procedure, the pilot shall inform ATC immediately by use of the phrase:
*"***UNABLE** *(designator)* **DEPARTURE** *[or* **ARRIVAL***] (reasons)".*

If ATC is unable to assign a RNAV arrival or departure procedure requested by a pilot, for reasons associated with the type of on-board RNAV equipment indicated in the FPL/CPL, ATC shall inform the pilot by use of the phrase:
*"***UNABLE TO ISSUE** *(designator)* **DEPARTURE** *[or* **ARRIVAL***]* **DUE RNAV TYPE***".*

If for any other reason, ATC is unable to assign an arrival or departure procedure requested by the pilot, ATC shall inform the pilot by use of the phrase:
*"***UNABLE TO ISSUE** *(designator)* **DEPARTURE** *[or* **ARRIVAL***] (reasons)".*

As a means for ATC to confirm the ability of a pilot to accept a specific RNAV arrival or departure procedure, ATC shall use the phrase:
"**ADVISE IF ABLE** *(designator)* **DEPARTURE** *[or* **ARRIVAL***]".*

Responsibilities for Obstacle Clearance
The use of RNAV does not change existing responsibilities with respect to avoidance of terrain. RNAV SIDs/STARs may consist of route segments with minimum flight altitudes below MSA/AMA of other surrounding airspace.
Consequently, the use of RNAV does not relieve pilots of their responsibility to ensure aircraft operations are safe with respect to obstacle clearance.
On the same hand, the use of RNAV does not change the existing ATC responsibilities of ensuring that assigned levels are at or above established minimum flight altitudes.
Pilot must ensure that the assigned level is not below a published minimum flight altitude for the area of operation. Otherwise, the pilot must refuse the clearance and/or request a higher level.

7. SID/STAR DESIGN

The ATC design team can influence the optimal position of waypoints of RNAV SIDs/STARs, so as to optimise the use of waypoints in conjunction with **DIRECT-TO** instructions in the overall management of TMA traffic.
Indeed **DIRECT-TO**s provide better situational awareness for pilots, better aircraft operating efficiencies as compared to radar vectors.
However radar vectoring may be initiated by ATC at any time for specific reasons such as traffic.

8. ATC TRAINING

ATC training on use of RNAV in the TMA should be organised locally.
EUROCONTROL will make available generic RNAV TMA training material through the EUROCONTROL web-site. Details will be communicated to all ECAC ANSPs.

9. FUTURE DEVELOPMENTS

P-RNAV will enable future implementation of RNP-RNAV/4-D RNAV, AMAN, DMAN, CDM, etc.

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P-RNAV APPROVAL BRIEF

The following table highlights some of the main approval aspects regarding P-RNAV.

However, for the complete guide to P-RNAV approval, operators are directed to JAA TGL 10 - Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace.

AIRWORTHINESS REQUIREMENTS	OPERATIONAL REQUIREMENT
Airworthiness Compliance Statement *Action:* *The AFM may contain a statement confirming P-RNAV compliance* *- or Manufacturer Customer Service letter confirming aircraft type with delivered navigation system is compliant.* *- or contact aircraft manufacturer/Installer for compliance statement.*	**Operational procedures for pre-departure, departure, arrival, & contingency conditions** *Action:* *Develop SOPs for these phases of flight for normal & non RNAV contingencies.*
Integrity of Navigation Database *Action :* *Provide evidence that your supplier of aeronautical & navigation data has product approval in accordance with ED76/DO-200A.* ***If not approved, checks must be undertaken by Operators. (also see EUROCONTROL P-RNAV Approval Guidance Information, page 9)***	**Procedure for Incident Reporting** *Action:* *Show how incidents are reported by crews to the company for remedial action.*
MEL amendments as part of airworthiness requirements *Action :* *Review current MEL & amend as required to ensure safe operation under all phases of* • *normal operations* • *non P-RNAV contingency conditions*	**Crew Training** *Action :* *Develop P-RNAV training material:* • *comprising briefings & guidance material for departure & arrival* • *covering normal & contingency procedures.* **MEL to account for P-RNAV operations** *Review any unserviceability against MEL limitations*
Applicants shall compile documentation showing P-RNAV airworthiness compliance together with additions/changes to operational procedures and amendments to MEL.	
Database integrity checks as per TGL10 paragraph 10.6	

REFERENCE DOCUMENTATION

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Plus a complete document library in PDF format including:

JAA Guidance Leaflet TGL-10, Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace
JAA TGL-10 Frequently Asked Questions
P-RNAV Approval Guidance Information, Edition 1, July 2003

All the above can also be obtained from the EUROCONTROL AFN Support Cell:

Email: prnav@eurocontrol.int

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