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*Transmittal Note*

**MANUAL ON TESTING OF RADIO NAVIGATION AIDS**  
**VOLUME I**  
**TESTING OF GROUND-BASED RADIO NAVIGATION SYSTEMS**

**Fourth Edition — 2000**

**Amendment No. 1**

1. To incorporate Amendment No. 1:
  - a) replace page (v) by the attached new page dated 31/10/02;
  - b) replace page (vii) by the attached new page dated 31/10/02;
  - c) replace pages 1-2 to 1-7 by the attached new pages dated 31/10/02;
  - d) replace page 1-17 by the attached new page dated 31/10/02;
  - e) replace page 2-3 by the attached new page dated 31/10/02;
  - f) replace pages 3-3 to 3-10 by the attached new pages dated 31/10/02;
  - g) replace pages 4-1 to 4-23 by the attached new pages dated 31/10/02;
  - h) replace page 4-36 by the attached new page dated 31/10/02;
  - i) replace pages 5-6 to 5-8 by the attached new pages dated 31/10/02;
  - j) replace page 6-3 by the attached new page dated 31/10/02;
  - k) replace pages 6-5 to 6-7 by the attached new pages dated 31/10/02;
  - l) replace pages 7-8 and 7-9 by the attached new pages dated 31/10/02;
2. Record the entry of this amendment on page (ii).



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*Approved by the Secretary General  
and published under his authority*

Fourth Edition — 2000

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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Volume I  
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INTERNATIONAL CIVIL AVIATION ORGANIZATION

## AMENDMENTS

The issue of amendments is announced regularly in the *ICAO Journal* and in the monthly *Supplement to the Catalogue of ICAO Publications and Audio-visual Training Aids*, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

## RECORD OF AMENDMENTS AND CORRIGENDA

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## Foreword

The need for uniform navigational guidance signals and consistent system performance for radio navigation aids used in the international aeronautical services has been recognized as an important adjunct to safety and regularity in civil aviation. ICAO continuing air navigation policies, and associated practices of the Organization in their part concerning ground and flight testing of radio navigation aids, call attention to this need and encourage improvements in radio navigation ground equipment, including associated testing and monitoring facilities, with the view to minimizing, to the extent practicable, the more demanding requirements of flight testing. Annex 10, Volume I, 2.7, provides an international Standard on the ground and flight testing of radio navigation aids.

This new edition of Doc 8071 comprises three Volumes as follows:

Volume I (fourth edition) — *Testing of Ground-Based Radio Navigation Systems*

Volume II (fourth edition) — *Testing of Satellite-based Radio Navigation Systems* (under development)

Volume III (first edition) — *Testing of Surveillance Radar Systems*

Volume I, *Testing of Ground-based Radio Navigation Systems*, was developed by the Testing of Radio Navigation Study Group (TRNSG) and replaces the previous Volumes I and II of the third edition except the testing of surveillance radars which is addressed in Volume III.

The purpose of this document is to provide general guidance on the extent of testing and inspection normally carried out to ensure that radio navigation systems meet the Standards and Recommended Practices (SARPs) in Annex 10. The guidance is representative of practices existing in a number of States with considerable experience in the operation and maintenance of these systems.

This document describes the ground and flight testing to be accomplished for a specific radio navigation aid, and provides relevant information about special equipment required to carry out certain major tests. It is not intended to recommend certain models of equipment, but rather to provide general details relative to the systems under consideration.

Throughout this document, measurements have been given in SI units and non-SI approximate equivalents, the accuracy of conversion depends upon the general requirements of each specific stage.

Comments on this volume would be appreciated from States and other parties outside ICAO concerned with radio navigation systems development and provision of services. Comments, if any, should be addressed to:

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International Civil Aviation Organization  
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Montreal, Quebec  
Canada H3C 5H7

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## List of Acronyms

ADF	Automatic direction finder	MHA	Minimum holding altitude
AFC	Automatic frequency control	MLS	Microwave landing system
AGC	Automatic gain control	MOCA	Minimum obstacle clearance altitude
AM	Amplitude modulation	MRA	Minimum reception altitude
ATC	Air traffic control	MSL	Mean sea level
ATIS	Automatic terminal information service	MTBF	Mean time between failures
CATV	Cable television	MTBO	Mean time between outages
CVOR	Conventional VOR	NDB	Non directional beacon
CW	Continuous wave	PAR	Precision approach radar
DDM	Difference in depth of modulation	PLC	Power line carrier
DME	Distance measuring equipment	PM	Phase modulation
DVOR	Doppler VOR	POP	Proof of performance
EIRP	Equivalent isotropic radiated power	PRF	Pulse repetition frequency
EMI/EMC	Electromagnetic interference/compatibility	RDH	Recommended datum height
FM	Frequency modulation	RF	Radio frequency
FMS	Flight management system	RMS	Root mean square
GNSS	Global navigation satellite system	RNAV	Area Navigation
IAP	Instrument approach procedure	ROC/MOC	Required or minimum obstacle clearance
IF	Intermediate frequency	SARPs	Standards and recommended practices
IFR	Instrument flight rules	SDM	Sum of modulation depths
ILS	Instrument landing system	SID	Standard instrument departure
IM/MM/OM	Inner/middle/outer marker	SRE	Surveillance radar element
INS	Inertial navigation system	STAR	Standard arrival route
ISM	Industrial scientific medical	VFR	Visual flight rules
ITE	Information technology equipment	VMC	Visual meteorological conditions
LF/MF/HF	Low/medium/high frequency	VOR	VHF omnidirectional radio range
MDS	Minimum discernible signal	VSWR	Voltage standing wave ratio
MEA	Minimum en-route altitude		

# Chapter 1

## GENERAL

### 1.1 INTRODUCTION

1.1.1 Annex 10, Volume I, Chapter 2, 2.7 states, “Radio navigation aids of the types covered by the specifications in Chapter 3 and available for use by aircraft engaged in international air navigation shall be the subject of periodic ground and flight tests”.

1.1.2 Volume I of the *Manual on Testing of Radio Navigation Aids* (Doc 8071, Fourth Edition) addresses ground-based radio navigation systems. This document contains “guidance material” only. The texts and procedures outlined do not have the status of Standards and Recommended Practices (SARPs) except for identified quotations from Annex 10.

### 1.2 PURPOSE OF THE DOCUMENT

This document is intended to provide general guidance on the extent of testing and inspection normally carried out to ensure that radio navigation systems meet the SARPs in Annex 10. The guidance is representative of practices existing in a number of States with considerable experience in the operation and maintenance of these systems.

### 1.3 SCOPE OF THE DOCUMENT

1.3.1 This document describes the ground and flight testing to be accomplished for a specific radio navigation aid, and provides relevant information about special equipment required to carry out certain major tests. It is not intended to recommend certain models of equipment, but rather to provide general details relative to the systems under consideration.

1.3.2 System testing is addressed in this document in general terms. System testing is normally done as part of design and development activities, prior to volume

production and individual site installations. System testing includes design qualification testing, operational testing and evaluation, and “shakedown” tests.

1.3.3 In this document, the terms “testing” and “inspection” have the following meanings:

- *Testing*: A specific measurement or check of facility performance that may form a part of an inspection when integrated with other tests.
- *Inspection*: A series of tests carried out by a State authority or an organization as authorized by the State to establish the operational classification of the facility.

### 1.4 GROUND VERSUS FLIGHT TESTING/INSPECTION

1.4.1 Ground tests are carried out by a trained specialist using appropriate test equipment at the facility or at a point on the ground remote from the site. Flight tests are those carried out in the air by a trained flight crew using a suitably equipped aircraft. Serious consideration should be given to the relative merits of these two methods taking into account both technical and economic factors.

1.4.2 Ground tests are usually more appropriate and less costly for accurate and quick evaluation of the facility performance. Flight tests are required to examine the signals-in-space as received at the aircraft after being influenced by external factors such as site conditions, ground conductivity, terrain irregularities, metallic structures, propagation effects, etc. Certain tests that appear to be ground-based may be more appropriate as flight tests or vice versa.

1.4.3 Ground tests are normally carried out more frequently because they are less expensive and can be used as indicators to determine when flight inspection is required. It is important to establish correlation between