

ANS 1.7.027	 CAAI	CNS Inspector Handbook
Precision Approach Radar System (PAR) approval		Revision 0
		June 1, 2017

1. Objective

- 1.1. This directive is part of the CNS inspector handbook.
- 1.2. This directive provides guidance for evaluating and approving all categories of for precision approach radar system.

2. General

- 2.1. The precision approach radar system shall comprise the following elements:
 - 2.1.1. The precision approach radar element (PAR).
 - 2.1.2. The surveillance radar element (SRE).
- 2.2. When the PAR only is used, the installation shall be identified by the term PAR or precision approach radar and not by the term “precision approach radar system
 Under article 35(a) to the Israeli Air Navigation Law 2011 any navigation aid is required to have CAAI approval before being established or used and shall be installed, constructed , maintained and operated in accordance with the terms of the approval.
- 2.3. Precision approach radar system is specifically included in the definition of navigation aid in Article 1 to the ANL, 2011.
- 2.4. This document sets out the requirements for approval of precision approach radar system established or used within Israel to provide air traffic services.
- 2.5. Abbreviations

ANL	-	Air Navigation Law
ANR	-	Air Navigation Regulations
ATC	-	Air Traffic Control
ANS	-	Air Navigation Service
ATS	-	Air Traffic Service
DOC	-	Designated Operational Coverage
PAR	-	Precision Approach Radar element
SRE	-	Surveillance Radar Element

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3. Reference Material ,Form& Job-Aids

3.1. Law & Regulation

- 3.1.1. ANL 2011 articles 35(a) & 27(a) & 29
- 3.1.2. ANR (Operation of Aircraft and Rules of Flight) 1981 – Reg. 66(c).
- 3.1.3. ANR (Safety at Aerodromes of the Airports Authority) 1992 – Reg. 3.

3.2. CAAI AP & Directives

- 3.2.1. ANS 4.0.005 – CNS Inspector Handbook Manual
- 3.2.2. AP 1.7.005 / 2.7.005 - ATS equipment installation, maintenance, operation & approval

3.3. ICAO Annexes & documents

- 3.3.1. ICAO Annex 10 Aeronautical Telecommunications Volume I- Radio Navigation Aids.
- 3.3.2. ICAO Annex 10 Aeronautical Telecommunications Volume V (Aeronautical Radio Frequency Spectrum Utilization).
- 3.3.3. ICAO Annex 11 Air Traffic Services.
- 3.3.4. ICAO Doc 8071 Volume III – Testing of Surveillance Radar Systems
- 3.3.5. ICAO Doc 7192 - Training Manual Part E-2 Air Traffic Safety Electronics Personnel (ATSEP)

Note: This document incorporates the relevant SARPs from ICAO Annex 10 and Annex 11 together.

3.4. Forms & Job-Aids – none

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4. Process

4.1. Technical Requirements

This section sets out the Engineering Requirements for the precision approach radar system intended for use in the provision of an ATS.

4.1.1. General Requirements

4.1.1.1 Safety objective

To ensure the surveillance system achieves the required level of performance and safety for the intended application independent of the type of surveillance technique or the architecture used

4.1.1.2 Required Performance of surveillance systems

- 4.1.1.2.1. In order to support a selected ATM application, the surveillance system shall meet a minimum level of performance suitable for the operational requirements of the selected application defined herein as the Required Performance of a surveillance system. These performance criteria shall be appropriate to the chosen application and the air traffic services provided in the airspace concerned.

Note: ICAO has introduced a concept called "RSP-Required Surveillance Performance" for the minimum level of performance of a surveillance system defined above.

- 4.1.1.2.2. The chosen application and the operational requirements necessary for the application shall be clearly defined.
- 4.1.1.2.3. The required performance shall be specified and justified for the chosen application and the air traffic service provided in the airspace concerned.

Note: This shall be derived by the ANSP themselves.

- 4.1.1.2.4. Where such minimum required performance is already defined in ICAO SARPs by means of RSP criteria for an application or mandated by law, the system shall meet the performance criteria defined therein.
- 4.1.1.2.5. Where minimum performance criteria is not mandated in SARPs the ANSP shall define and justify their own required performance.
- 4.1.1.2.6. The required performance criteria shall be measurable and verifiable.
- 4.1.1.2.7. Required performance shall be met throughout the coverage volume where the service is provided.

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4.1.1.3 **General Requirements**

All non-co-operative and co-operative surveillance systems shall deliver the minimum required data items as defined below:

4.1.1.3.1. 2D positional data (aircraft horizontal position);

4.1.1.3.2. Surveillance data status:

- Cooperative/non-cooperative/combined;
- Time of applicability of 2D positional data.

4.1.1.3.3. In addition, all cooperative surveillance systems shall provide as a minimum the following surveillance data:

- Vertical positional data (based upon pressure altitude received from the aircraft);
- Operational identification data (aircraft identity received from the aircraft like aircraft identification and/or Mode A code);
- Supplemental indicators:
 - Emergency indicators (i.e. unlawful interference, radio failure and general emergency);
 - Special Position Indicator;
- Surveillance data status (time of applicability of vertical position data).

4.1.1.4 **PAR Technical Requirements**

4.1.1.4.1. Coverage

The PAR shall be capable of detecting and indicating the position of an aircraft of 15 m² echoing area or larger, which is within a space bounded by a 20-degree azimuth sector and a 7-degree elevation sector, to a distance of at least 16.7 km (9 NM) from its respective antenna.

4.1.1.4.2. Siting

The PAR shall be sited and adjusted so that it gives complete coverage of a sector with its apex at a point 150 m (500 ft) from the touchdown in the direction of the stop end of the runway and extending plus or minus 5 degrees about the runway center line in azimuth and from minus 1 degree to plus 6 degrees in elevation.

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4.1.1.4.3. Azimuth accuracy

Azimuth information shall be displayed in such a manner that left-right deviation from the on-course line shall be easily observable. The maximum permissible error with respect to the deviation from the on-course line shall be either 0.6 per cent of the distance from the PAR antenna plus 10 per cent of the deviation from the on-course line or 9 m (30 ft), whichever is greater. The equipment shall be so sited that the error at the touchdown shall not exceed 9 m (30 ft). The equipment shall be so aligned and adjusted that the displayed error at the touchdown shall be a minimum and shall not exceed 0.3 per cent of the distance from the PAR antenna or 4.5 m (15 ft), whichever is greater. It shall be possible to resolve the positions of two aircraft which are at 1.2 degrees in azimuth of one another.

4.1.1.4.4. Elevation accuracy.

Elevation information shall be displayed in such a manner that up-down deviation from the descent path for which the equipment is set shall be easily observable. The maximum permissible error with respect to the deviation from the on-course line shall be 0.4 per cent of the distance from the PAR antenna plus 10 per cent of the actual linear displacement from the chosen descent path or 6 m (20 ft), whichever is greater. The equipment shall be so sited that the error at the touchdown shall not exceed 6 m (20 ft). The equipment shall be so aligned and adjusted that the displayed error at the touchdown shall be a minimum and shall not exceed 0.2 per cent of the distance from the PAR antenna or 3 m (10 ft), whichever is greater. It shall be possible to resolve the positions of two aircraft that are at 0.6 degree in elevation of one another.

4.1.1.4.5. Distance accuracy.

The error in indication of the distance from the touchdown shall not exceed 30 m (100 ft) plus 3 per cent of the distance from the touchdown. It shall be possible to resolve the positions of two aircraft which are at 120 m (400 ft) of one another on the same azimuth.

4.1.1.4.6. Information shall be made available to permit the position of the controlled aircraft to be established with respect to other aircraft and obstructions. Indications shall also permit appreciation of ground speed and rate of departure from or approach to the desired flight path.

4.1.1.4.7. Information shall be completely renewed at least once every second.

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4.1.1.5 SRE Technical Requirements

A surveillance radar used as the SRE of a precision approach radar system shall satisfy at least the following broad performance requirements

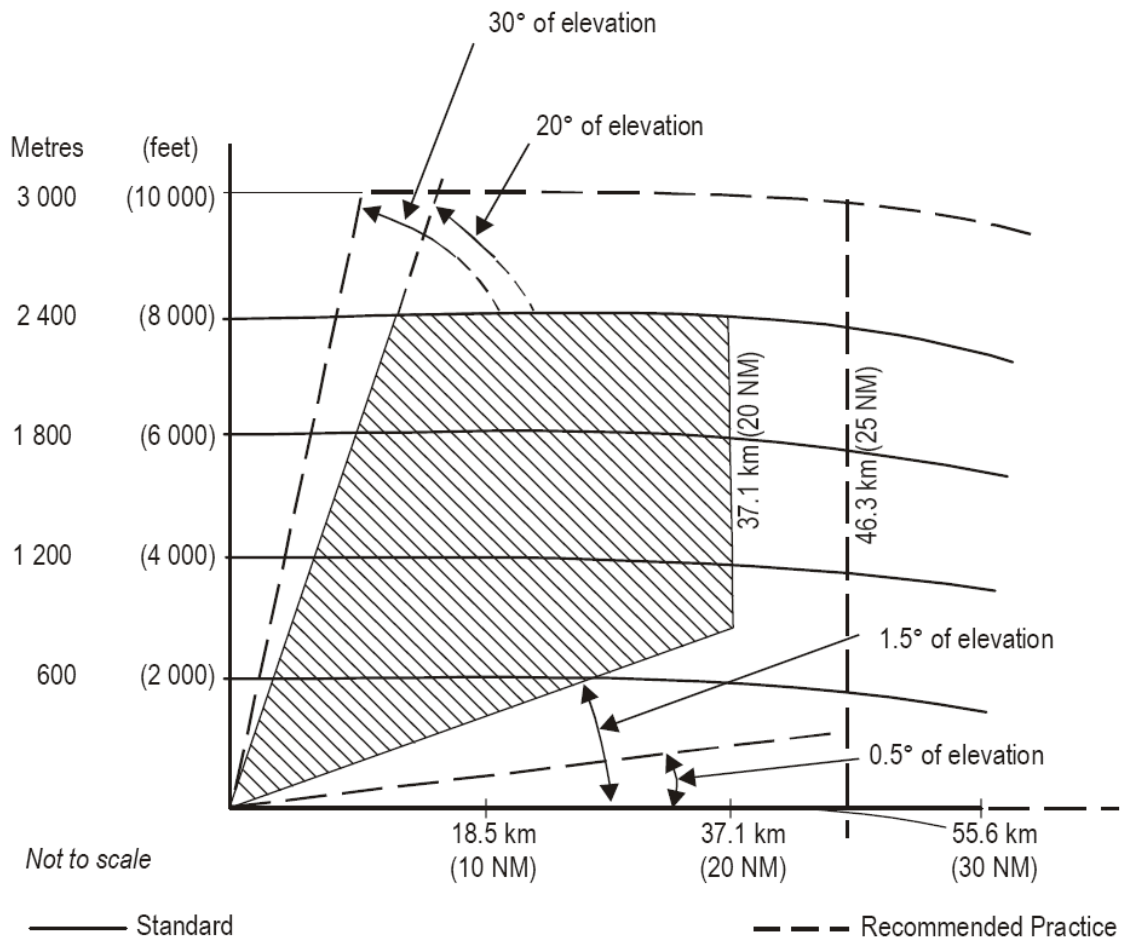
4.1.1.5.1. Coverage

The SRE shall be capable of detecting aircraft of 15 m² echoing area and larger, which are in line of sight of the antenna within a volume described as follows:

The rotation through 360 degrees about the antenna of a vertical plane surface bounded by a line at an angle of 1.5 degrees above the horizontal plane of the antenna, extending from the antenna to 37 km (20 NM); by a vertical line at 37 km (20 NM) from the intersection with the 1.5-degree line up to 2400 m (8000 ft) above the level of the antenna; by a horizontal line at 2 400 m (8 000 ft) from 37 km (20 NM) back towards the antenna to the intersection with a line from the antenna at 20 degrees above the horizontal plane of the antenna, and by a 20-degree line from the intersection with the 2400 m (8000 ft) line to the antenna.

4.1.1.5.2. *Efforts should be made in development to increase the coverage on an aircraft of 15 m² echoing area to at least the volume obtained by amending 4.1.1.5.1 above with the following substitutions:*

- for 1.5 degrees, read 0.5 degree;
- for 37 km (20 NM), read 46.3 km (25 NM);
- for 2 400 m (8 000 ft), read 3 000 m (10 000 ft);
- for 20 degrees, read 30 degrees;



SRE of precision approach radar system —
vertical coverage on a 15 m² echoing area aircraft

4.1.1.5.3. Azimuth accuracy.

The indication of position in azimuth shall be within plus or minus 2 degrees of the true position. It shall be possible to resolve the positions of two aircraft which are at 4 degrees of azimuth of one another.

4.1.1.5.4. Distance Accuracy

The error in distance indication shall not exceed 3 per cent of true distance or 150 m (500 ft), whichever is the greater. It shall be possible to resolve the positions of two aircraft that are separated by a distance of 1 per cent of the true distance from the point of observation or 230 m (750 ft), whichever is the greater

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4.1.1.5.5. The equipment shall be capable of completely renewing the information concerning the distance and azimuth of any aircraft within the coverage of the equipment at least once every 4 seconds

4.1.1.5.6. *Efforts should be made to reduce, as far as possible, the disturbance caused by ground echoes or echoes from clouds and precipitation*

4.1.1.6 **Radio Spectrum Management**

4.1.1.6.1. The equipment and systems shall be installed, operated and maintained in compliance with the terms of specific location dependent or general frequency assignment(s) and the terms and conditions of the Approval granted in respect of the ATS being provided.

4.1.1.6.2. All Aeronautical Radio Stations shall be suitably licensed by the ministry of communication.

4.1.1.6.3. Failure to renew the ministry of communication radio license will invalidate the associated CAAI Approval and the associated frequency assignment will be withdrawn. Renewal after the withdrawal of the ministry of communication radio license will be treated as a new application.

4.1.1.6.4. For new installations that operate on aeronautical frequency assignments, initial applications to establish an Aeronautical Radio Station shall be made to the CAAI, which will trigger the process with the ministry of communication.

4.1.1.6.5. Inspection of Aeronautical Radio Stations - The equipment and systems at aeronautical radio stations and associated records shall be inspected by CAAI Inspector.

4.1.1.6.6. Demonstration of compliance will be required. This may include measurements to verify transmitter frequency, modulation depth, transmitter output power and a determination of effective radiated power. The ATS Provider is expected to provide this information.

4.1.1.6.7. The equipment shall transmit only on the frequency assigned and as appears in the schedule to the radio license issued under the Wireless Telegraphy order (1972).

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4.2. Maintenance of Precision Approach Radar System

4.2.1. General Requirements

- 4.2.1.1 Maintenance arrangements shall be established to ensure the continued availability and reliability of the Precision Approach Radar System, associated with the provision of an ATC service.
- 4.2.1.2 In addition to the requirements below, the Precision Approach Radar System shall comply with ICAO Doc 8071 Volume III – Testing of Ground-Based Radio Navigation System
- 4.2.1.3 All the technicians will be properly trained on the Precision Approach Radar System.
- 4.2.1.4 A record of any functional test, flight checks and particulars of any maintenance, repair, overhaul, replacement or modification shall be kept in respect of the equipment and systems at of the Precision Approach Radar System Stations, for at least period of two years.
- 4.2.1.5 Provision is made in the certificates for a record of an individual's proficiency. This may be used to record how often an individual performs maintenance duties on specific equipment and/or lapses in competency on specific equipment.

4.2.2. Training

- 4.2.2.1 A training program ensuring that the employees shall execute their positions and the activities laid upon them in an appropriate professional level according to the service provider procedures;
- 4.2.2.2 The training will be according to ICAO Doc 7192.
- 4.2.2.3 The training program will be accepted by the CAAI.
- 4.2.2.4 The training program shall include separate parts according to these details:
 - 4.2.2.4.1. Initial training;
 - 4.2.2.4.2. Periodic training;
 - 4.2.2.4.3. Special training;
 - 4.2.2.4.4. Human factor training;
 - 4.2.2.4.5. Work safety;

4.2.3. Maintenance program

- 4.2.3.1 A maintenance program is the source of scheduled inspections, relevant controls and supporting data. The Maintenance Program should always be active (subject to review and amendment) and utilized such as to enable effective maintenance to be carried out in a logical, concise, clear and controllable manner.

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- 4.2.3.2 The CAAI approval of the Maintenance Program provides a mechanism to record minimum standards that the service provider must comply with.
- 4.2.3.3 The maintenance program may be applicable to more than one of the Precision Approach Radar System of the same type.
- 4.2.3.4 The inspector will review the maintenance program according to applicable supporting information provided by the service provider.
- 4.2.3.5 The maintenance program will be design to meet Human Factors principles.
- 4.2.3.6 Consideration should be given to routinely monitoring equipment at adverse weather conditions (i.e. salt laden atmosphere, high humidity, extreme heat etc). These considerations should include increasing maintenance inputs for cleaning, lubrication and inspection of protective finishes as an example.
- 4.2.3.7 The maintenance program should include:
- 4.2.3.7.1. Preface that include the following:
- The type/model of the equipment and, where applicable, power systems.
 - A list of the manuals (reference, revision numbers) that were used to prepare the maintenance manual (supporting information).
 - A statement signed by the service provider accountable manager that:
 - The specified equipment will be maintained according to the maintenance program; and
 - The program will be reviewed and updated as required; and
 - Practices and procedures to satisfy the maintenance program will be to the standards specified in the manufacture Maintenance Instructions. In the case of approved practices and procedures that differ, the statement should refer to them.
- 4.2.3.7.2. List of scheduled inspections that include for each task the following information:
- Task description
 - Interval
 - Reference to manufacturer manual or other supporting information.
 - Skill of technician – if required.

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- Applicability – if the maintenance program is used for more than one facility.
- List of items with life limitation (including the life limitation for each item).

4.2.3.7.3. Forms

- All the forms/log books that are going to be used will be part of the maintenance program.

4.2.3.7.4. Additional procedures if required.

4.2.3.7.5. Permitted variations to maintenance periods (Due Date window).

4.3. Additional information

The inspector will review all the other documents required by CAAI AP 1.7.005 / 2.7.005 (ATS equipment installation, maintenance, operation & approval).

4.4. Demonstration and Inspection Phase

4.4.1. CAAI requires service providers to demonstrate their ability to comply with regulations and safe operating practices before issuing approval to the air navigation aid.

4.4.2. These demonstrations include actual performance of activities and/or operations while being observed by the inspector.

4.4.3. The demonstration will include:

4.4.3.1 Compliance checklist of ground test requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume III, including all the supporting documents (if applicable):

- 4.4.3.1.1. Manufacture compliance checklist to ICAO documents.
- 4.4.3.1.2. Compliance for the specific Model and S/N
- 4.4.3.1.3. Factory Acceptance Test (FAT)
- 4.4.3.1.4. Customer Acceptance Test (CAT)
- 4.4.3.1.5. Site Acceptance Test (SAT)
- 4.4.3.1.6. Any other document that supporting the compliance.

4.4.3.2 Compliance checklist of flight test requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume III, including all the supporting documents

4.4.3.3 Compliance checklist of maintenance program requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume III

4.4.4. The demonstration will include on-site evaluations of equipment maintenance and support facilities.

4.4.5. During these demonstrations and inspections, the inspector will evaluate the effectiveness of the policies, methods, procedures, and instructions as described in the Service provider manuals and other documents.

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4.4.6. Deficiencies will be brought to the attention of the service provider and corrective action must be taken before an approval is issued.

5. Task Outcomes

- 5.1. After the document compliance and the demonstration and inspection phases have been completed satisfactorily, the inspector will prepare the Navigation Aid Approval that include all the provisions, limitations and information (equipment model, frequencies, identification, location, limitations etc..).
- 5.2. The service provider must acknowledge receipt of these documents.
- 5.3. The process above should be documented in the Sharedocs/Saar system.