CHANGE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

8260.3B CHG 19

5/15/02

ARMY .... TM 95-226
NAVY .... OPNAV INST 3722.16C
USAF .... AFMAN 11-226(1)
USCG .... CG 318

SUBJ: UNITED STATES STANDARD FOR TERMINAL INSTRUMENT PROCEDURES (TERPS)

1. PURPOSE. Change 19 divides Order 8260.3B into five volumes to aid in the efficiency of its use. The conversion from one volume in revision B to five volumes will be completed in four steps consisting of Changes 19 through 22. Change 22 will complete the conversion process, and the document will then be identified as revision "C." Cross referencing between volumes will be minimal. This change also transmits new and revised sections of this order (Volume 1).

2. DISTRIBUTION: This change is distributed in Washington Headquarters to the branch level in the Offices of Airport Safety and Standards; and Communications, Navigation, and Surveillance Systems; to Flight Standards, Air Traffic, and Airway Facilities Services; to the National Flight Procedures Office and the Regulatory Standards Division at the Mike Monroney Aeronautical Center; to the branch level in the regional Flight Standards, Airway Facilities, Air Traffic, and Airports Divisions; special mailing list ZVS-827, and to special Military and Public Addressees.

3. CANCELLATION. With the publication of Change 19, the following orders will be canceled: Orders 8260.36A, Civil Utilization of Microwave Landing System (MLS), dated January 19, 1996; 8260.39A, Close Parallel ILS/MLS Approaches, dated December 29, 1999; 8260.41, Obstacle Assessment Surface Evaluation for Independent Simultaneous Parallel Precision Operations, dated September 15, 1995; and 8260.47, Barometric Vertical Navigation (VNAV) Instrument Procedures Development, dated May 26, 1998.

4. EFFECTIVE DATE: June 14, 2002

5. EXPLANATION OF CHANGES. This is the first change to Order 8260.3B that contains volumes. The volume and paragraph numbers are identified on the inside bottom corner of the page and chapter and page numbers (example 1-1) are on the outside bottom corner of the page. Significant areas of new direction, guidance, and policy included in this change are as follows:

a. VOLUME 1, General Criteria (current TERPS order). Installs the current TERPS Manual as Volume 1 (insert all changes to this portion of the order before adding the other volumes). This volume contains information and criteria applicable to any instrument approach

Distribution: A-W(AS/ND/FS/AT/AF)-3; AVN-100(150CYS); AMA-200 (80 CYS) A-X(FS/AF/AT/AS)-3; ZVS-827; Special Military and Public Addressees

Initiated By: AFS-420

procedure; e.g. administrative, en route, initial, intermediate, terminal fixes, holding, etc. Volume 1 will be completed with the implementation of Change 21.

(1) **Chapter 1.**

(a) **Paragraph 6a.** Adds the word "must" to convey that application of the criteria is mandatory.

(b) **Paragraph 122a.** Includes appendix number to the reference.

(c) **Paragraph 161a.** Clarifies directions for adding the suffix "DME" and noting the chart accordingly.

(d) **Paragraph 173.** Adds guidance for TERPS mathematics.

(e) **Paragragh 174.** Includes information for providing directive feedback.

(2) **Chapter 2.**

(a) **Paragraphs 201, 202, and 203.** Adds information and drawings concerning the TERPS concept of primary required obstacle clearance (ROC) and sloping and level obstacle clearance surfaces (OCS).

(b) **Paragraph 234e(1).** Provides guidance for establishing the minimum published holding altitude.

(c) **Table 3 in Paragraph 242b(2).** Changes minimum intermediate course lengths.

(d) **Paragraph 251a(2)(b).** Corrects information in this paragraph.

(e) **Paragraph 253.** Changes application of the visual descent point (VDP).

(f) **Paragraph 274d.** Brings up to date figures 17 and 18.

(g) **Paragraph 275.** Adds requirement for construction of turning or combination straight and turning missed approach areas. Adds note for clarification.

(h) **Paragraph 287b(4)(b).** Deletes example and figure 30 which is no longer required.

(i) **Paragraph 287c(2).** Changes figure 31-2 to reflect the current fix displacement calculations.

(3) **Chapter 3.**

(a) **Paragraph 324.** Adds current guidance concerning decision altitude (DA).

(b) **Paragraph 325.** Explains decision height (DH) as it relates to DA.

(c) **Paragraph 350.** Changes the title of table 9. TERPS Volume 3 now contains information for PRECISION minimums.

(4) **Chapter 8, paragraph 813c(1).** Updates reference to paragraph 523b(3) as all charts and explanations for solving secondary area obstacle problems have been deleted from appendix 2.

(5) **Chapter 9.** This change deletes chapter 9 with the exception of section 5 which becomes chapter 9, Localizer and Localizer Type Directional Aids (LDA). Paragraphs 951 through 957 become paragraphs 900 through 907. Volume 3 replaces most of chapter 9.

(6) **Chapter 10.** Volume 3 provides guidance that supersedes information in sections 2 and 3 of this chapter.

(7) **Chapter 11, Paragraph 1105.** Clarifies procedure identification of helicopter-only procedures.

(8) **Chapter 12.** This chapter becomes Volume 4 with four chapters; therefore, chapter 12 in this volume is reserved.

(9) **Chapter 15.**

(a) **Paragraph 1513d(2).** Updates reference to 1413d(1) as the ROC applied for this circling approach should be the same as the criteria applied to other chapters.

(b) **Paragraph 1513f.** Updates reference to chapter 2, section 8 as section 2 no longer contains criteria for the use of radio fixes.

(10) **Chapter 17, paragraph 1731b.** Updates reference to paragraph 1721 as all charts and explanations for solving secondary area obstacle problems have been deleted from appendix 2.

(11) **Appendix 1.** Adds title to appendix and an alphabetical listing of all the acronyms and abbreviations for old and new aviation terms used frequently throughout this order.

(12) **Appendix 2.** Deletes appendix 2 as this information is now in Volume 3, appendix 5.

(13) **This change also provides guidance** that supersedes chapter 3, section 1 of Order 8260.48, Area Navigation (RNAV) Approach Construction Criteria, dated April 8, 1999. The direction and guidance published in this change supersedes RELATED information in Order 8260.48. A major portion of Order 8260.48 remains in effect.

b. **VOLUME 2, Nonprecision Approach Procedure (NPA) Construction**, is reserved for Change 21. It will contain criteria central to nonprecision final approach segment construction. VHF omnidirectional range (VOR), VOR/distance measuring equipment (DME), nondirectional beacon (NDB), tactical air navigation (TACAN), airport surveillance radar (ASR), airborne radar approaches (ARA), localizer, simplified directional facility (SDF), localizer directional aid (LDA), direction finder (DF), area navigation (RNAV), and lateral navigation (LNAV) systems are supported. Criteria applicable to the initial missed approach climb unique to nonprecision approaches will be included in this volume.

c. VOLUME 3, Precision Approach (PA) and Barometric Vertical Navigation (Baro VNAV) Approach Procedure Construction. Replaces criteria originally located in chapter 9 and guidance from Orders 8260.36A, 8260.39A, 8260.41, and 8260.48, chapter 2, paragraphs 2.1, 2.3, 2.5-2.10, 2.12, and chapter 3, sections 1 and 2. This volume contains the final segment construction criteria for navigational systems that provide vertical guidance, instrument landing system (ILS), microwave landing system (MLS), transponder landing system (TLS), precision approach radar (PAR), Global Navigation Satellite landing system (GLS), wide area augmentation system (WAAS), local area augmentation system (LAAS), and Baro-VNAV. Obstruction clearance criteria applicable to simultaneous parallel, simultaneous converging, and Category II/III operations are included. Intermediate segment requirements and initial missed approach climb criteria unique to precision and Baro VNAV approaches are also contained in this volume.

d. VOLUME 4, Departure Procedure Construction. Replaces criteria originally located in chapter 12 of the TERPS order. This volume contains criteria departure obstruction supporting VOR, NDB, TACAN, ASR, localizer, and RNAV (in Change 21) navigation systems. Diverse departure, climb visually over the airport, and Air Traffic Control diverse vector areas are also covered. These criteria will be amended for use in the missed approach segment in Change 21.

e. VOLUME 5, Helicopter and Powered Lift Instrument Procedure Construction, is reserved for Change 21. It will contain all guidance for instrument procedure construction (en route, departure, approach) criteria.

6. PUBLICATION FORMAT. The double column, traditional paragraph numbering scheme of the TERPS document is changing to a single column, decimal number system more consistent with RTCA and the International Civil Aviation Organization (ICAO). The print is clear and illustrations are larger.

7. DISPOSITION OF TRANSMITTAL. The transmittal must be RETAINED AND FILED IN THE BACK OF THIS MANUAL until it is superseded by a revised order.

PAGE CONTROL CHART

REMOVE PAGES	DATED	INSERT PAGES	DATED
vii thru xix (and xx)	2/13/98	vii thru x	5/15/02
xxi	7/26/90		
xxii thru xxiii	9/10/93		
xxiv	3/12/93		
xxv	5/7/92		
xxvi	9/10/93		
xxvii thru xxviii	7/26/90		
xxix thru xxx	9/10/93		

PAGE CONTROL CHART

REMOVE PAGES	DATED	INSERT PAGES	DATED
		VOLUME 1	
		i thru xiv	5/15/02
1	2/13/98	1	5/15/02
2 thru 5	11/12/99	2	5/15/02
		3	11/12/99
		4 thru 6-1 (and 6-2)	5/15/02
7 thru 8	2/13/98	7-1 thru 7-4	5/15/02
		8	5/15/02
13 (and 14)	11/12/99	13 (and 14)	5/15/02
17 thru 18	2/13/98	17 thru 18	5/15/02
21	2/13/98	21	2/13/98
22 thru 26	11/12/99	22 thru 23	5/15/02
		24	11/12/99
		25 thru 26	5/15/02
27 thru 28	2/13/98	27	2/13/98
		28	5/15/02
33	11/12/99	33	5/15/02
34	2/13/98	34	2/13/98
35 thru 36	2/13/98	35 thru 36	5/15/02
38-1	11/12/99	38-1	5/15/02
38-2	2/18/94	38-2	2/18/94
41	2/13/98	41 thru 44	5/15/02
42	11/12/99		
43	2/13/98		
44	5/21/92		
69 thru 70	7/76		
71 thru 73 (and 74)	7/76	71 thru 73 (and 74)	5/15/02
75	2/18/94	9-1 (and 9-2)	5/15/02
76	2/79		
77 thru 85	2/13/98		
86 thru 86-1 (and 86-2)	9/10/93		
99 thru 100	4/1/83	99	5/15/02
		100	4/1/83
137 thru 138	4/1/83	137	4/1/83
		138	5/15/02
183 thru 184	6/80	183	5/15/02
		184	6/80
APPENDIX 1		APPENDIX 1	
1 thru 3	7/76	1 thru 6	5/15/02
APPENDIX 2			
1 thru 6	2/13/98 (Information from Appendix 2 can be found in Volume 3, Appendix 5)		

VOLUME 2 - RESERVED

PAGE CONTROL CHART

REMOVE PAGES	DATED	INSERT PAGES	DATED
		VOLUME 3	
		Table of Contents, (i thru vi)	5/15/02
		Chapter 1, 1-1 thru 1-8	5/15/02
		Chapter 2, 2-1 thru 2-15 (and 16)	5/15/02
		Chapter 3, 3-1 thru 3-18	5/15/02
		Chapter 4, 4-1 thru 4-13 (and 14)	5/15/02
		APPENDIX 1 - RESERVED	
		APPENDIX 2, 1 thru 5 (and 6)	5/15/02
		APPENDIX 3, 1 thru 8	5/15/02
		APPENDIX 4, 1 thru 9 (and 10)	5/15/02
		APPENDIX 5, 1 thru 5 (and 6)	5/15/02
		VOLUME 4	
		Table of Contents (i thru iii)	5/15/02
		Chapter 1, 1-1 thru 1-10	5/15/02
		Chapter 2, 2-1 thru 2-7 (and 8)	5/15/02
		Chapter 3, 3-1 thru 3-18	5/15/02
		Chapter 4, 4-1 thru 4-5 (and 6)	5/15/02
		VOLUME 5 Page - RESERVED	

James J. Ballough
Director, Flight Standards Service

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Page No.

VOLUME 3. PRECISION APPROACH (PA) AND BAROMETRIC VERTICAL NAVIGATION (BARO VNAV) APPROACH PROCEDURE CONSTRUCTION

VOLUME 4. DEPARTURE PROCEDURE CONSTRUCTION

VOLUME 5. HELICOPTER AND POWER LIFT INSTRUMENT PROCEDURE CONSTRUCTION

RESERVED

FAA ORDER 8260.3B

Army
Navy
Coast Guard
Air Force

TM 95-226
OPNAV Inst. 3722.16C
CG 318
AFMAN 11-226(I)

UNITED STATES STANDARD FOR TERMINAL INSTRUMENT PROCEDURES (TERPS)

VOLUME 1

GENERAL CRITERIA

U. S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

VOLUME 1. TABLE OF CONTENTS

GENERAL CRITERIA

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

Page

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

VOLUME 1. TABLE OF CONTENTS (Continued)

CHAPTER 1. ADMINISTRATIVE

SECTION 1. SCOPE

1. PURPOSE. This order contains criteria that shall be used to formulate, review, approve, and publish procedures for instrument approach and departure of aircraft to and from civil and military airports. These criteria are for application at any location over which an appropriate United States agency exercises jurisdiction.

2. DISTRIBUTION. This order is distributed to selected Federal Aviation Administration (FAA) addressees. For distribution within the Department of Defense, see pages v and vi.

3. CANCELLATION. Order 8260.34, Glide Slope Threshold Crossing Height Requirements, dated 10/26/83, is canceled. This change also incorporates criteria contained in VN Supplements 2 and 3 to Order 8260.3B; therefore, VN SUP 2, dated 10/8/92, and VN SUP 3, dated 1/11/93, are canceled.

4. EXISTING PROCEDURES. Existing procedures shall comply with these standards. Approval of nonstandard procedures as required is specified in paragraph 141.

5. TYPES OF PROCEDURES. Criteria are provided for the following types of authorized instrument procedures:

a. Precision Approach (PA).

(1) Straight-In. A descent in an approved procedure where the navigation facility alignment is normally on the runway centerline, and glide slope (GS) information is provided. For example, Precision Approach Radar (PAR), Instrument Lnding System (ILS), and Microwave Landing System (MLS) procedures are precision approaches.

(2) Simultaneous. A procedure that provides for approaches to parallel runways. This procedure uses two or more ILS-equipped parallel runways. Simultaneous approaches, when authorized, shall be radar monitored. Military commanders may approve simultaneous approaches based upon dual precision radar.

b. Nonprecision Approach (NPA).

(1) Straight-In. A descent in an approved procedure in which the final approach course (FAC) alignment and descent gradient permits authorization of straight-in landing minimums.

c. Departure Procedures. Procedures designed to provide obstacle clearance during instrument departures.

6. WORD MEANINGS. Word meanings as used in this manual:

a. Shall or Must means that application of the criteria is mandatory.

b. Should means that application of the criteria is recommended.

c. May means that application of the criteria is optional.

7.-119. RESERVED.

SECTION 2. ELIGIBILITY, APPROVAL, AND RETENTION

120. ELIGIBILITY.

a. Military Airports. Procedures at military airports shall be established as required by the directives of the appropriate military service.

b. Civil Airports. Instrument procedures shall be provided at civil airports open to the aviation public whenever a reasonable need is shown. No minimum number of potential instrument approaches is specified; however, the responsible FAA office must determine that a public procedure will be beneficial to more than a single user or interest. Private procedures, for the exclusive use of a single interest, may be provided on a reimbursable basis under Title 14 of the Code of Federal Regulations (14 CFR) Part 171, where applicable, if they do not unduly conflict with the public use of airspace. Reasonable need is deemed to exist when the instrument flight procedure will be used by:

(1) A certificated air carrier, air taxi, or commercial operator; or

(2) Two or more aircraft operators whose activities are directly related to the commerce of the community; or

(3) Military aircraft.

121. REQUESTS FOR PROCEDURES. Requests for military procedures are processed as described by the appropriate military service. No special form is required for requesting civil procedures. Civil requests may be made by letter to the appropriate Regional Office. Requests for civil procedures shall be accepted from any aviation source, provided the request shows that the airport owner/operator has been advised of this request. (This advice is necessary only when the request is for an original procedure to an airport not already served by an approach procedure.) The FAA will advise airport owners/operators of additional requests for procedures as soon as possible after receipt thereof.

122. APPROVAL. Where a military requirement or reasonable civil need has been established, a request for an instrument approach procedure (IAP) and/or instrument departure procedure for an airport shall be approved if the following minimum standards are met:

a. Airport. The airport landing surfaces must be adequate to accommodate the aircraft that can be reasonably expected to use the procedure. Appropriate runway markings, hold position markings, and signs, required by AC 150/5340-1, Marking of Paved Areas on Airports, shall be established and in place; and all runway design standards in appendix 16 of AC 150/5300-13, Airport Design, must be met. Runway lighting is required for approval of night instrument operations. EXCEPTION: Do NOT deny takeoff and departure procedures at night due solely to the absence of runway edge lights. The airport must have been found acceptable for instrument flight rules (IFR) operations as a result of an airport airspace analysis conducted pursuant to Order 7400.2, Procedures for Handling Airspace Matters, and/or appropriate military directives, as applicable. Only circling minimums shall be approved to airports where the runways are not clearly defined.

b. Navigation Facility. All instrument and visual navigation facilities used must successfully pass flight inspection.

c. Obstacle Marking and Lighting. Obstacles which penetrate 14 CFR Part 77 imaginary surfaces are obstructions and, therefore, should be marked and lighted, insofar as is reasonably possible under FAA Advisory Circular AC 70/7460.1, Obstruction Marking and Lighting. Those penetrating the 14 CFR Part 77 approach and transitional surfaces should be removed or made conspicuous under that AC. Normally, objects which are shielded need not be removed or made conspicuous.

***NOTE:** In military procedures, the appropriate military directives apply.*

d. Weather Information. Terminal weather observation and reporting facilities must be available for the airport to serve as an alternate airport. Destination minimums may be approved when a general area weather report is available prior to commencing the approach and approved altimeter settings are available to the pilot prior to and during the approach consistent with communications capability.

e. Communications. Air-to-ground communications must be available at the initial approach fix (IAF) minimum altitude and when the aircraft executing the missed approach reaches the missed approach altitude. At lower altitudes, communications shall be required where essential for the safe and efficient use of airspace. Air-to-ground communication normally consists of ultra high frequency (UHF) or very high frequency (VHF) radio, but high frequency (HF) communication may be approved at locations which have a special need and capability. Other suitable means of point-to-point communication, such as commercial telephone, are also required to file and close flight plans.

123. RETENTION AND CANCELLATION. Civil instrument procedures shall be canceled when a re-evaluation of the usefulness of an IAP indicates that the benefits derived are not commensurate with the costs of retaining the procedure. This determination will be based upon an individual evaluation of requirements peculiar to each specific location, and will consider airport complexity, military requirements, planned airport expansion, and the need for a backup or supplement to the primary instrument approach system. Certain special procedures exist, generally based on privately operated navigation facilities. When a procedure based on a public facility is published, special procedures for that airport shall be canceled unless retention provides an operational advantage to the user. Before an instrument procedure is canceled, coordination with civil and military users shall be effected. Care shall be taken not to cancel procedures required by the military or required by air carrier operators at provisional or alternate airports. Military procedures shall be retained or canceled as required by the appropriate military authority.

124.-129. RESERVED.

SECTION 3. RESPONSIBILITY AND JURISDICTION

130. RESPONSIBILITY.

a. Military Airports. The United States Army, Navy, Air Force, and Coast Guard, shall establish and approve instrument procedures for airports under their respective jurisdictions. The FAA will accept responsibility for the development and/or publication of military procedures when requested to do so by the appropriate military service through an interagency agreement. Military instrument procedures are official procedures. The FAA (AVN-100 Regional FPO) shall be informed when military procedures are canceled.

b. Civil Airports. The FAA shall establish and approve instrument procedures for civil airports.

c. Military Procedures at Civil Airports. Where existing FAA approach or departure procedures at civil airports do not suffice, the military shall request the FAA to develop procedures to meet military requirements. Modification of an existing FAA procedure or development of a new procedure may meet these requirements. The FAA shall formulate, coordinate with the military and industry, and publish and maintain such procedures. The military shall inform the FAA when such procedures are no longer required.

131. JURISDICTION. The United States Army, Navy, Air Force, Coast Guard, and Marine Corps Commanding Officers, or FAA Regional Directors having jurisdiction over airports are responsible for initiating action under these criteria to establish or revise TERPS when a reasonable need is identified, or where:

a. New facilities are installed.

b. Changes to existing facilities necessitate a change to an approved procedure.

c. Additional procedures are necessary.

d. New obstacles or operational uses require a revision to the existing procedure.

132.-139. RESERVED.

SECTION 4. ESTABLISHMENT

140. FORMULATION. Proposed procedures shall be prepared under the applicable portion of this publication as determined by the type and location of navigation facility and procedure to be used. To permit use by aircraft with limited navigational equipment, the complete procedure should be formulated on the basis of a single navigation facility whenever possible. However, the use of an additional facility of the same or different type in the procedure to gain an operational advantage is permitted.

141. NONSTANDARD PROCEDURES. The standards contained in this manual are based on reasonable assessment of the factors which contribute to errors in aircraft navigation and maneuvering. They are designed primarily to assure that safe flight operations for all users result from their application. The dimensions of the obstacle clearance areas are influenced by the need to provide for a smooth, simply computed progression to and from the en route system. Every effort shall be made to formulate procedures in accordance with these standards; however, peculiarities of terrain, navigation information, obstacles, or traffic congestion may require special consideration where justified by operational requirements. In such cases, nonstandard procedures that deviate from these criteria may be approved, provided they are fully documented and an equivalent level of safety exists. A nonstandard procedure is not a substandard procedure, but is one that has been approved after special study of the local problems has demonstrated that no derogation of safety is involved. The FAA, Flight Technologies and Procedures Division, AFS-400, is the approving authority for nonstandard civil procedures. Military procedures which deviate from standards because of operational necessity, and in which an equivalent level of safety is not achieved, shall include a cautionary note to identify the hazard and shall be marked "not for civil use."

142. CHANGES. Changes in instrument procedures shall be prepared and forwarded for approval in the same manner as in the case of new procedures. Changes so processed will not be made solely to include minor corrections necessitated by changes in facility frequencies, variation changes, etc., or by other minor changes not affecting the actual instrument procedure. Changes that require reprocessing are those that affect fix, course, altitude, or published minimums.

143.-149. RESERVED.

SECTION 5. COORDINATION

150. COORDINATION. It is necessary to coordinate instrument procedures to protect the rights of all users of airspace.

a. Military Airports. All instrument procedures established or revised by military activities for military airports shall be coordinated with the FAA or appropriate agency or an overseas host nation. When a procedure may conflict with other military or civil activities, the procedure shall also be coordinated with those activities.

b. Civil Airports. Prior to establishing or revising instrument procedures for civil airports, the FAA shall, as required, coordinate such procedures with the appropriate civil aviation organizations. Coordination with military activities is required when a military operating unit is based at the airport or when the proximity of a military airport may cause procedures conflicts.

c. Air Traffic Control (ATC). Prior to establishing or revising instrument procedures for a military or civil airport, the initiating office shall coordinate with the appropriate FAA Air Traffic office to ensure compatibility with air traffic flow and to assess the impact of the proposed procedure on current or future air traffic programs.

d. Airspace Actions. Where action to designate controlled airspace for a procedure is planned, the airspace action should be initiated sufficiently in advance so that effective dates of the procedure and the airspace action will coincide.

e. Notice to Airmen (NOTAM). A NOTAM to **RAISE** minimums may be issued in case of emergencies; i.e., facility outages, facility out-of-tolerance conditions, new construction that penetrates critical surfaces, etc. NOTAM's may also be issued to **LOWER** minimums when a supporting facility is added and a significant change in minimums (60 feet in MDA/DH or a reduction in visibility) will result. A NOTAM may be issued to **RAISE OR LOWER** minimums as appropriate on a no-FAF procedure when a procedure turn (PT) altitude is modified as the result of construction or terrain, or when a facility restriction is removed. However, a complete new procedure may not be issued by NOTAM, except where military requirements dictate. ATC shall be advised of the required NOTAM action prior to issuance and normal coordination shall be effected as soon as practical.

151. COORDINATION CONFLICTS. In areas under the FAA jurisdiction, coordination conflicts that cannot be resolved at the field level shall be submitted to the appropriate FAA region for additional coordination and resolution. Problems that are unresolved at the regional level shall be forwarded to the FAA, AFS-400, for action. If the problem involves a military procedure, parallel action through military channels shall be taken to expedite coordination at the appropriate level.

152.-159. RESERVED.

SECTION 6. IDENTIFICATION OF PROCEDURES

160. IDENTIFICATION OF PROCEDURES. Instrument procedures shall be identified to be meaningful to the pilot, and to permit ready identification in ATC phraseology.

161. STRAIGHT-IN PROCEDURE IDENTIFICATION. Instrument procedures that meet criteria for authorization of straight-in landing minima shall be identified by a prefix describing the navigational system providing the final approach guidance and the runway to which the final approach course is aligned:

a. Non-RNAV. ILS runway (RWY) 18R, localizer (LOC) back course (BC) RWY 7, tactical air navigational aid (TACAN) RWY 36, localizer type directional aid (LDA) RWY 4, nondirectional radio beacon (NDB) RWY 21, VHF omnidirectional radio range (VOR) RWY 15, VOR/distance measuring equipment (DME) RWY 6, ILS or TACAN RWY 9, etc. A slash (/) indicates more than one type of equipment is required to execute the final approach; e.g., VOR/DME, etc. ILS procedures do not require DME to fly the final approach, even if a DME fix has been substituted for one of the marker beacons, therefore, ILS procedures shall not be named ILS/DME. If a procedure requires DME to fly the final approach, the suffix "DME" shall be added; e.g., LOC/DME RWY (number). A chart shall be noted to indicate RADAR is required for approach minima. When a LOC procedure is published on an ILS chart, it is a combined procedure. When procedures are combined, the word "or" shall indicate either type of equipment may be be used to execute the final approach; e.g., ILS or LOC/DME, ILS or TACAN, VOR/DME or TACAN, etc. Where more than one approach using the same final approach guidance is developed to the same runway, identify each for the runway/navigational aid combination with alphabetical suffix beginning at the end of the alphabet; e.g., ILS Z RWY 28L (first procedure), ILS Y RWY 28L (second procedure), ILS X RWY 28L (third procedure), etc.

b. RNAV. Identify WAAS, Baro VNAV, and GPS approach procedures as RNAV (sensor) RWY (Number); e.g., RNAV (GPS) RWY 21, RNAV (GPS, DME/DME) RWY 15.

NOTE: The published minima lines will identify required RNAV sensors; e.g., LPV, LNAV/VNAV (includes degraded WAAS and Baro VNAV), or LNAV (includes GPS and WAAS without glidepath). A single RNAV approach will be *published depicting LPV and/or LNAV/VNAV, and/or LNAV minimums where they share the same courses and altitudes.*

c. OTHER RNAV. Identify VOR/DME and LORAN based RNAV procedures as (system) RNAV RWY (number); e.g., VOR/DME RNAV RWY 13, LORAN RNAV RWY 31.

162. CIRCLING PROCEDURE IDENTIFICATION. When an approach procedure does not meet criteria for straight-in landing minimums authorization, it shall be identified by the type of navigational aid (NAVAID) which provides final approach guidance, and an alphabetical suffix starting with the beginning of the alphabet. The first procedure formulated shall bear the suffix "A" even though there may be no intention to formulate additional procedures. If additional procedures are formulated, they shall be identified alphabetically in sequence, e.g., VOR-A, VOR/ DME-B, NDB-C, NDB-D, LDA-E, RNAV-A, etc. A revised procedure will bear its original identification.

163. DIFFERENTIATION. Where high altitude procedures are required, the procedure identification shall be prefixed with the letters "HI" e.g., HI-VOR RWY 5.

164.-169. RESERVED.

SECTION 7. PUBLICATION

170. SUBMISSION. Instrument procedures shall be submitted by the approving authority on forms provided by the originating agency. A record of coordination shall be maintained by the originating agency. Procedures shall be routed under current orders or directives of the originating agency.

171. ISSUANCE. The following are designated as responsible offices for the release of approved instrument procedures for each agency.

a. Army. Director, U.S. Army Aeronautical Services Agency.

b. Navy and Marine Corps. Chief of Naval Operations (CNO), Naval Flight Information Group.

c. Air Force. Headquarters, Air Force Flight Standards Agency, Instrument Standards Division.

d. Coast Guard. Commandant, U.S. Coast Guard.

e. Civil. Administrator, FAA.

172. EFFECTIVE DATE. TERPS and revisions thereto shall be processed in sufficient time to permit publication and distribution in advance of the effective date. Effective dates should normally coincide with scheduled airspace changes except when safety or operational effectiveness is jeopardized. In case of emergency, or when operational effectiveness dictates, approved procedures may be disseminated by NOTAM (see paragraph 150e). Procedures disseminated by NOTAM must also be processed promptly in the normal fashion and published in appropriate instrument procedures charts and in the Federal Register when required.

173. MATHEMATICS CONVENTION.

a. Definition of Mathmatical Functions.

$a+b$ indicates addition

$a-b$ indicates subtraction

$a \times b$ indicates multiplication

$\frac{a}{b}$ indicates division

$(a \times b)$ indicates the result of the process within the parethesis

$|a-b|$ indicates absolute value {the result of the process between the vertical lines is assigned a positive sign}

$\approx$ indicates approximate equality

$\sqrt{a}$ indicates the square root of quantity "a"

a^2 indicates $a \times a$

$\tan(a)$ indicates the tangent of "a" degrees

$\tan^{-1}(a)$ indicates the arc tangent of "a"

$\sin(a)$ indicates the sine of "a" degrees

$\sin^{-1}(a)$ indicates the arc sine of "a"

$\cos(a)$ indicates the cosine of "a" degrees

$\cos^{-1}(a)$ indicates the arc cosine of "a"

b. Operational Precedence (Order of Operations).

First:	**Grouping Symbols: parentheses, brackets, braces, fraction bars, etc.**
Second:	**Functions: tangent, sine, cosine, arcsine and other defined functions**
Third:	**Exponentiation: powers and roots**
Fourth:	**Multiplication and Division: products and quotients**
Fifth:	**Addition and Subtraction: sums and differences**

e.g.,

$5-3\times2=-1$ because multiplication takes precedence over subtraction

$(5-3)\times2=4$ because parentheses take precedence over multiplication

$\frac{6^2}{3}=12$ because exponentiation takes precedence over division

$\sqrt{9+16}=5$ because the square root sign is a grouping symbol

$\sqrt{9}+\sqrt{16}=7$ because roots take precedence over addition

$\frac{\sin(30°)}{0.5}=1$ because functions take precedence over division

$\sin\left(\frac{30°}{0.5}\right)=0.8660254$ because parentheses take precedence over functions

NOTES ON CALCULATOR USAGE:

1. *Most calculators are programmed with these rules of precedence.*
2. *When possible, let the calculator maintain all of the available digits of a number in memory rather than re-entering a rounded number. For highest accuracy from a calculator, any rounding that is necessary should be done at the latest opportunity.*

174. INFORMATION UPDATE. For your convenience, FAA Form 1320-19, Directive Feedback Information, is included at the end of this order to provide any comments on deficiencies found, clarifications needed, or suggested improvements regarding the contents to this order. When forwarding comments to the originating office for consideration, please provide a complete explanation of why the suggested change is necessary.

175.-199. RESERVED

CHAPTER 2. GENERAL CRITERIA

200. SCOPE. This chapter contains only that information common to all types of TERPS. Criteria, which do not have general application, are located in the individual chapters concerned with the specific types of facilities.

SECTION 1. COMMON INFORMATION

201. TERPS. Concept of Primary Required Obstacle Clearance (ROC). The title of this order, United States Standard for Terminal Instrument Procedures (TERPS), contains a key word in defining the order's content. The word is "STANDARD;" something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality.

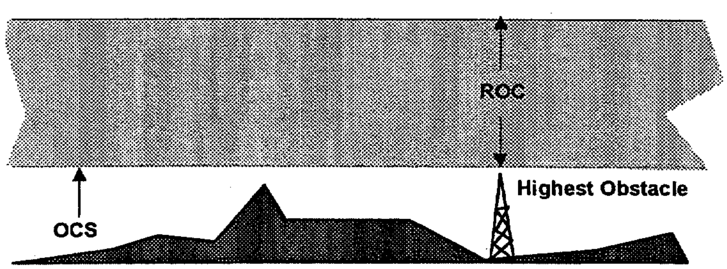
a. The TERPS document specifies the minimum measure of obstacle clearance that is considered by the FAA (the Federal authority) to supply a satisfactory level of vertical protection. The validity of the protection is dependent, in part, on assumed aircraft performance. In the case of TERPS, it is assumed that aircraft will perform within certification requirements.

b. The following is an excerpt from the foreword of this order: "These criteria are predicated on normal aircraft operations for considering obstacle clearance requirements." Normal aircraft operation means all aircraft systems are functioning normally, all required navigational aids (NAVAID's) are performing within flight inspection parameters, and the pilot is conducting instrument operations utilizing instrument procedures based on the TERPS standard to provide ROC. While the application of TERPS criteria indirectly addresses issues of flyability and efficient use of NAVAID's, the major safety contribution is the provision of obstacle clearance standards. This facet of TERPS allows aeronautical navigation in instrument meteorological conditions (IMC) without fear of collision with unseen obstacles. ROC is provided through application of level and sloping OCS.

202. Level OCS. The level OCS concept is applicable to "level flight" segments. These segments are level flight operations intended for en route, initial, intermediate segments, and nonprecision final approaches. A single ROC value is applied over the length of the segment. These values were determined through testing and observation of aircraft and pilot performance in various flight conditions. Typical ROC values are: for en route procedure segments, 1,000 feet (2,000 over designated mountainous terrain); and for initial segments, 1,000 feet, 500 feet in intermediate segments, and 350/300/250 feet in final segments.

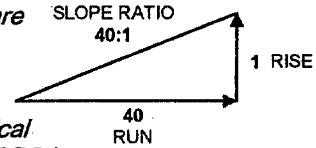
a. This method of applying ROC results in a horizontal band of airspace that cannot be penetrated by obstacles. Since obstacles always extend upward from the ground, the bottom surface of the ROC band is mathematically placed on top of the highest obstacle within the segment. The depth (ROC value) of the band is added to the obstacle height to determine the minimum altitude authorized for the segment. The bottom surface of the ROC band is referred to as the level OCS. Therefore, level flight segments are evaluated by the level OCS application standard (see figure 1-1).

Figure 1-1. Minimum Segment Altitude. Par 202a



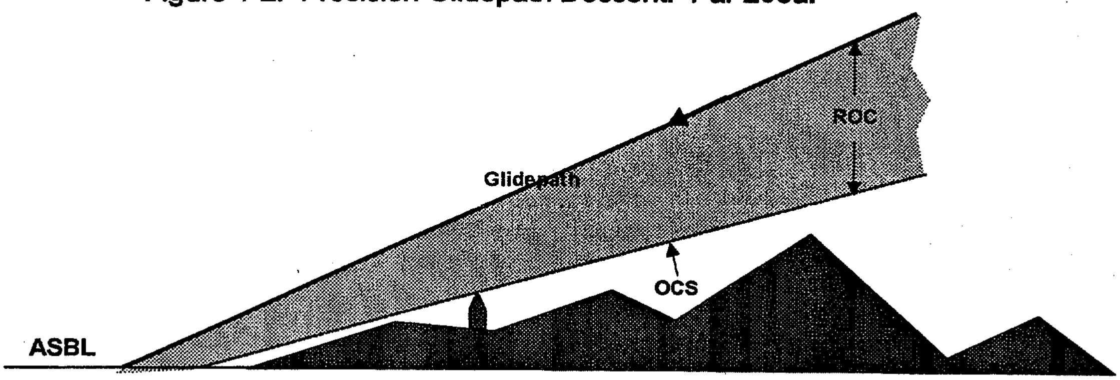
203. Sloping Obstacle Clearance Surfaces (OCS). The method of applying ROC, in segments dedicated to descending on a glidepath or climbing in a departure or missed approach segment, requires a different obstacle clearance concept than the level OCS because the ROC value must vary throughout the segment. The value of ROC near the runway is relatively small, and the value at the opposite end of the segment is sufficient to satisfy one of the level surface standards above. It follows then, that a sloping OCS is a more appropriate method of ROC application.

NOTE: Slope ratios are normally expressed in terms of rise over run in engineering and professional technical jargon. However, TERPS has traditionally expressed slope ratios in terms of run over rise; e.g., 34:1, 40:1.



a. Descending on a Precision Glidepath. The obstacle evaluation method for descent on a glidepath is the application of a descending OCS below the glidepath. The vertical distance between the glidepath and the OCS is ROC; i.e., ROC = (glidepath height) - (OCS height). The ROC decreases with distance from the final approach fix as the OCS and glidepath converge on the approach surface baseline (ASBL) height (see figure 1-2). The OCS slope and glidepath angle values are interdependent: OCS Slope = 102 ÷ glidepath angle; or glidepath angle = 102 ÷ OCS slope. This relationship is the standard that determines the ROC value since $ROC = (\text{glidepath height}) - (\text{OCS height})$.

Figure 1-2. Precision Glidepath Descent. Par 203a.



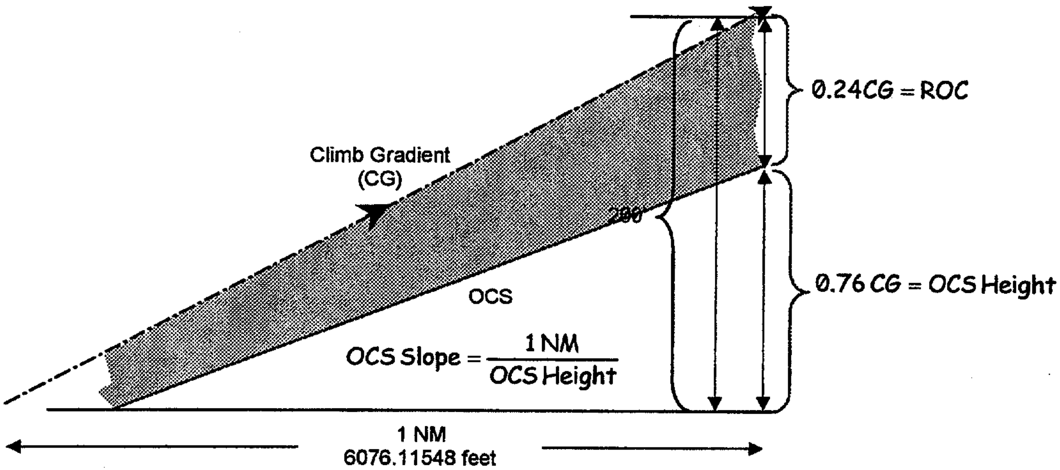
(1) **If the OCS is penetrated**, the OCS slope may be adjusted upward, thereby increasing the glidepath angle. The glidepath angle would increase because it is dependent on the required slope.

(2) **Descent on a glidepath** generated by systems that do not meet the system precision requirements of ICAO PANS-OPs, Annex 10, such as barometric vertical navigation (Baro-VNAV), provide ROC through application of a descending sloping surface based on standards using differing formulas, but the concept is the same.

b. Climbing on departure or missed approach. The concept of providing obstacle clearance in the climb segment, in instrument procedures, is based on the aircraft maintaining a minimum climb gradient. The climb gradient must be sufficient to increase obstacle clearance along the flightpath so that the minimum ROC for the subsequent segment is achieved prior to leaving the climb segment (see figure 1-3). For TERPS purposes, the MINIMUM climb gradient that will provide adequate ROC in the climb segment is 200 ft/NM.

(1) **The obstacle evaluation method** for a climb segment is the application of a rising OCS below the minimum climbing flightpath. Whether the climb is for departure or missed approach is immaterial. The vertical distance between the climbing flightpath and the OCS is ROC. ROC for a climbing segment is defined as $ROC = 0.24\ CG$. This concept is often called the 24% rule. Altitude gained is dependent on climb gradient (CG) expressed in feet per NM. The minimum ROC supplied by the 200 ft/NM CG is 48 ft/NM $(0.24 \times 200 = 48)$. Since 48 of the 200 feet gained in 1 NM is ROC, the OCS height at that point must be 152 feet $(200 - 48 = 152)$, or 76% of the CG $(152 \div 200 = 0.76)$. The slope of a surface that rises 152 over 1 NM is 40 (6076.11548 ÷ 152 = 39.97 = 40).

Figure 1-3. Climb Segment. Par 202b.



(2) **Where an obstruction penetrates the OCS,** a nonstandard climb gradient (greater than 200 ft/NM) is required to provide adequate ROC. Since the climb gradient will be greater than 200 ft/NM, ROC will be greater than 48 ft/NM $(0.24 \times CG > 200 = ROC > 48)$. The nonstandard ROC expressed in ft/NM can be calculated using the formula: $(0.24\,h) \div (0.76\,d)$ where "h" is the height of the obstacle above the altitude from which the climb is initiated, and "d" is the distance in NM from the initiation of climb to the obstacle. Normally, instead of calculating the nonstandard ROC value, the required climb gradient is calculated directly using the formula: $h \div (0.76d)$.

c. **In the case of an instrument departure,** the OCS is applied during the climb until at least the minimum en route value of ROC is attained. The OCS begins at the departure end of runway, at the elevation of the runway end. It is assumed aircraft will cross the departure end-of-runway at a height of at least 35 feet. However, for TERPS purposes, aircraft are assumed to lift off at the runway end (unless the procedures state otherwise). The ROC value is zero at the runway end, and increases along the departure route until the appropriate ROC value is attained to allow en route flight to commence.

d. **In the case of a missed approach procedure,** the climbing flightpath starts at the height of MDA or DA minus height loss. The OCS starts approximately at the MAP/DA point at an altitude of MDA/DA minus the final segment ROC and adjustments. Therefore, the final segment ROC is assured at the beginning of the OCS, and increases as the missed approach route progresses. The OCS is applied until at least the minimum initial or en route value of ROC is attained, as appropriate.

e. **Extraordinary circumstances, such as a mechanical or electrical malfunction,** may prevent an aircraft from achieving the 200 ft/NM minimum climb gradient assumed by TERPS. In these cases, adequate obstacle clearance may not be provided by published instrument procedures. Operational procedures contained outside TERPS guidelines are required to cope with these abnormal scenarios.

204.-209. RESERVED.

210. UNITS OF MEASUREMENT. Units of measurement shall be expressed as set forth below:

a. **Bearings, Courses, and Radials.** Bearings and courses shall be expressed in degrees magnetic. Radials shall also be expressed in degrees magnetic, and shall further be identified as radials by prefixing the letter "R" to the magnetic bearing FROM the facility. For example, R-027 or R-010.

b. **Altitudes.** The unit of measure for altitude in this publication is feet. Published heights below the transition level (18,000 feet) shall be expressed in feet above mean sea level (MSL); e.g. 17,900 feet. Published heights at and above the transition level (18,000 feet) shall be expressed as flight levels (FL); e.g., FL 180, FL 190, etc. Reference Title 14 of the Code of Federal Regulations (14 CFR) Part 91.81, and Order 7110.65, Air Traffic Control, paragraph 85.

c. Distances. Develop all distances in nautical miles (NM) (6076.11548 feet or 1852 meters per NM) and hundredths thereof, except where feet are required. Use the following formulas for feet and meter conversions:

$$\text{feet} = \frac{\text{meters}}{0.3048} \qquad \text{meters} = \text{feet} \times 0.3048$$

When applied to visibilities, distances shall be expressed in statute miles (SM) (5,280 feet per SM) and the appropriate fractions thereof. Expression of visibility values in NM is permitted in overseas areas where it coincides with the host nation practice. Runway visual range (RVR) must be expressed in feet.

d. Speeds. Aircraft speeds must be expressed in knots indicated airspeed (KIAS).

e. Determination of Correctness of Distance and Bearing Information. The approving agency is the authority for correctness of distance and bearing information, except that within the United States, its territories, and possessions, the National Oceanic and Atmospheric Administration is the authority for measurements between all civil navigation aids and between those facilities incorporated as part of the National Airspace System (NAS).

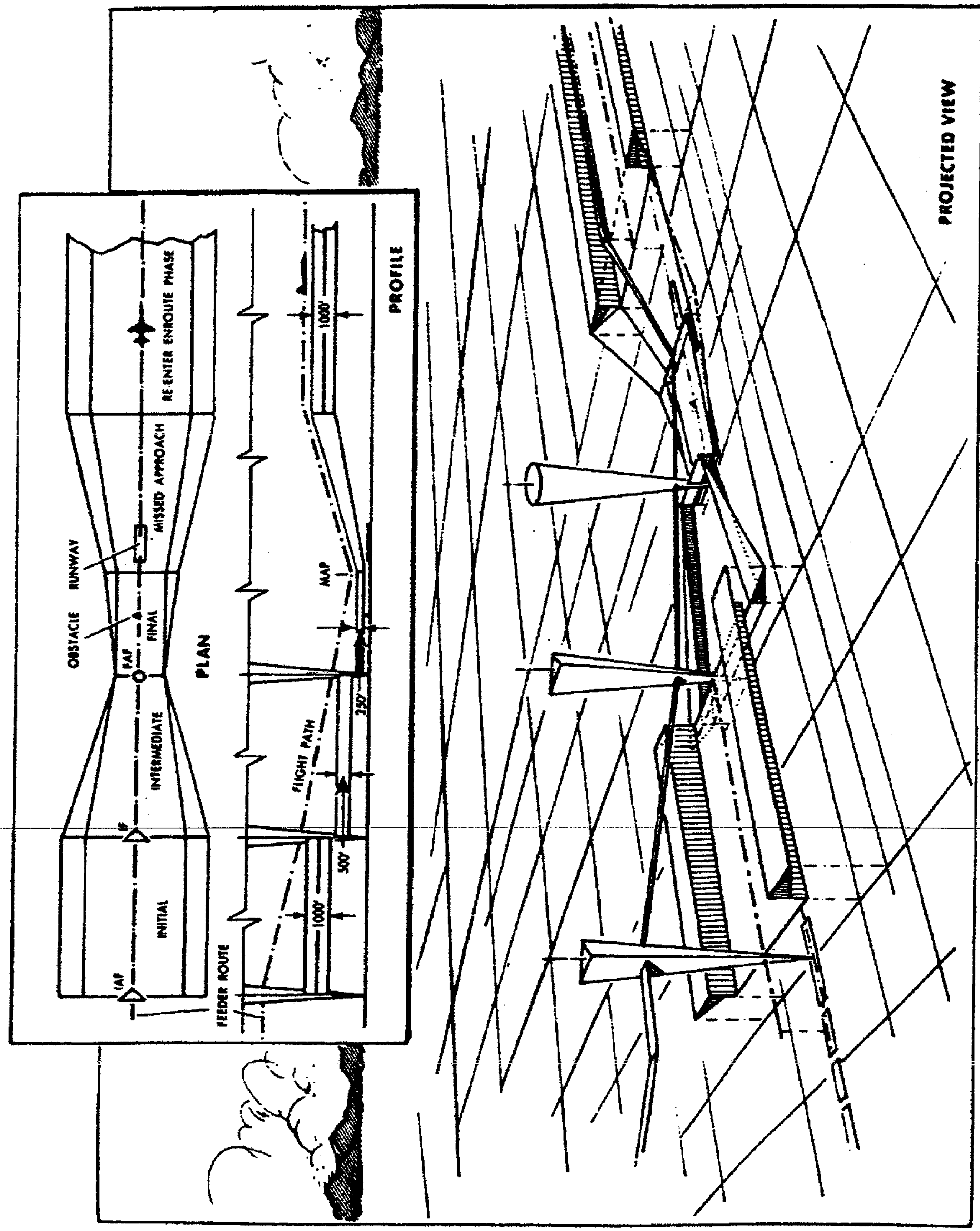
211. POSITIVE COURSE GUIDANCE (PCG). PCG must be provided for feeder routes, initial (except as provided for in paragraph 233b), intermediate, and final approach segments. The segments of a procedure wherein PCG is provided should be within the service volume of the facility(ies) used, except where Expanded Service Volume (ESV) has been authorized. PCG may be provided by one or more of the navigation systems for which criteria has been published.

212. APPROACH CATEGORIES (CAT). Aircraft performance differences have an effect on the airspace and visibility needed to perform certain maneuvers. Because of these differences, aircraft manufacturer/operational directives assign an alphabetical category to each aircraft so that the appropriate obstacle clearance areas and landing and departure minimums can be established in accordance with the criteria in this order. The categories used and referenced throughout this order are Category A, B, C, D, and/or E. Aircraft categories are defined in Part 97.

213. APPROACH CATEGORY APPLICATION. The approach category operating characteristics must be used to determine turning radii minimums and obstacle clearance areas for circling and missed approaches.

214. PROCEDURE CONSTRUCTION. An IAP may have four separate segments. They are the initial, intermediate, final, and missed approach segments. In addition, an area for circling the airport under visual conditions shall be considered. An approach segment begins and ends at the plotted position of the fix; however, under some circumstances certain segments may begin at specified points where no fixes are available. The fixes are named to coincide with the associated segment. For example, the intermediate segment begins at the intermediate fix (IF) and ends at the final approach fix (FAF). The order in which this chapter discusses the segments is the same order in which the pilot would fly them in a completed procedure; that is from an initial, through an intermediate, to a final approach. In constructing the procedure, the FAC should be identified first because it is the least flexible and most critical of all the segments. When the final approach has been determined, the other segments should be blended with it to produce an orderly maneuvering pattern, which is responsive to the local traffic flow. Consideration must also be given to any accompanying controlled airspace requirements in order to conserve airspace to the extent it is feasible (see figure 1-4).

Figure 1-4. SEGMENTS OF AN APPROACH PROCEDURE. Par 214.



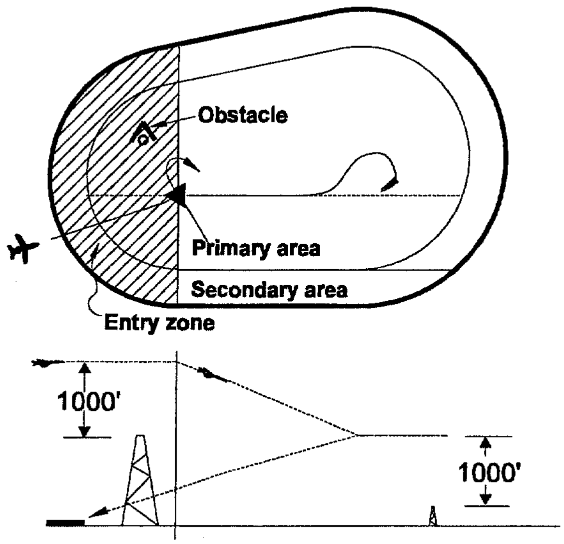


Figure 6. PT INITIAL APPROACH AREA. Par 234c.

e. Elimination of PT. A PT is NOT required when an approach can be made direct from a specified IF to the FAF. A PT NEED NOT be established when an approach can be made from a properly aligned holding pattern. See paragraph 291. In this case, the holding pattern in lieu of a PT, shall be established over a final or intermediate approach fix and the following conditions apply:

(1) If the holding pattern is established over the FAF (not applicable to RNAV procedures), an intermediate segment is not constructed. Ideally, establish the minimum holding altitude at the FAF altitude. In any case, the published holding altitude shall not be more than 300 feet above the FAF altitude.

(2) If the holding pattern is established over the IF, the MHA shall permit descent to the FAF altitude within the descent gradient tolerances prescribed for the intermediate segment (see paragraph 242d).

Table 1B. PT COMPLETION ALTITUDE DIFFERENCE. Par 234d.

TYPE OF PT	ALTITUDE DIFFERENCE
15 Mile PT from FAF	Within 3,000 Ft of Alt. over FAF
10 Mile PT from FAF	Within 2,000 Ft of Alt. over FAF
5 Mile PT from FAF	Within 1,000 Ft of Alt. over FAF
15 Mile PT, no FAF	Not Authorized
10 Mile PT, no FAF	Within 1,500 Ft of MDA on Final
5 Mile PT, no FAF	Within 1,000 Ft of MDA on Final

235. INITIAL APPROACH BASED ON HIGH ALTITUDE TEARDROP PENETRATION. A teardrop penetration consists of departure from an IAF on an outbound course, followed by a turn toward and intercepting the inbound course at or prior to the IF or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no IF is available to mark the beginning of the intermediate segment, it shall be assumed to commence at a point 10 miles prior to the FAF. When the facility is located on the airport, and no fix is available to mark the beginning of the final approach segment, the criteria in paragraph 423 apply.

a. Alignment. The outbound penetration course shall be between 18° and 26° to the left or right of the reciprocal of the inbound course. The actual angular divergence between the courses will vary inversely with the distance from the facility at which the turn is made (see table 2).

b. Area.

(1) Size. The size of the penetration turn area must be sufficient to accommodate both the turn and the altitude loss required by the procedure. The penetration turn distance shall not be less than 20 miles from the facility. The penetration turn distance depends on the altitude to be lost in the procedure and the point at which the descent is started (see table 2). The aircraft should lose half the total altitude or 5,000 feet, whichever is greater, outbound prior to starting the turn. The penetration turn area has a width of 6 miles on both sides of the flight track up to the IF or point, and shall encompass all the areas within the turn (see figure 7).

Table 2. PENETRATION TURN DISTANCE/DIVERGENCE. Par 235a.

ALT TO BE LOST PRIOR TO COM-MENCING TURN	DISTANCE TURN COM-MENCES (NM)	COURSE DIVER-GENCE (DEGREES)	SPECIFIED PENETRA-TION TURN DIST-ANCE (NM)
12,000 Ft	24	18	28
11,000 Ft	23	19	27
10,000 Ft	22	20	26
9,000 Ft	21	21	25
8,000 Ft	20	22	24
7,000 Ft	19	23	23
6,000 Ft	18	24	22
5,000 Ft	17	25	21
5,000 Ft	16	26	20

(2) Penetration Turn Table. Table 2 should be used to compute the desired course divergence and penetration turn distances which apply when a specific

THIS PAGE INTENTIONALLY LEFT BLANK

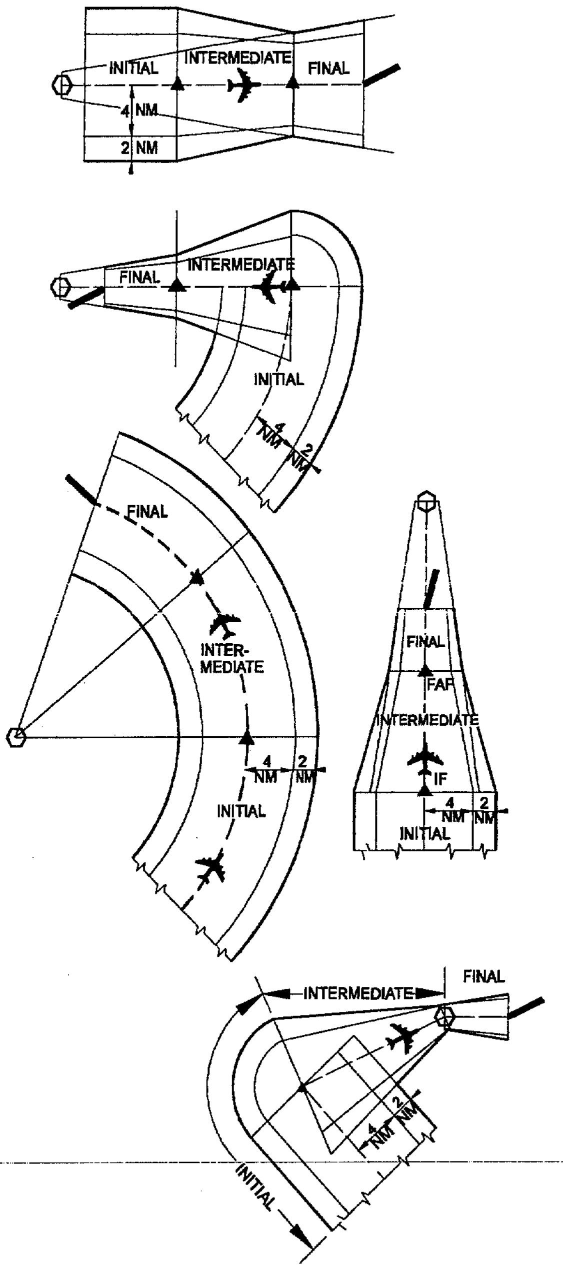


Figure 10. TYPICAL APPROACH SEGMENTS. Par 232b and 240.

242. INTERMEDIATE APPROACH SEGMENT BASED ON STRAIGHT COURSES.

a. Alignment. The course to be flown in the intermediate segment shall be the same as the FAC, except when the FAF is the navigation facility and it is not practical for the courses to be identical. In such cases, the intermediate course shall not differ from the FAC by more than 30°.

b. Area.

(1) Length. The length of the intermediate segment is measured along the course to be flown. Where the initital segment joins the intermediate segment at angles up to 90 degrees, the MINIMUM length is 5 NM for CAT A/B, and 6 NM for CAT C/D/E (except as specified in Volume 1, chapters 9 and 10, and Volume 3, chapter 2). Table 3 lists the minimum segment length where the intial approach course joins the intermediate course at an angle greater than 90 degrees (see figure 3). The MAXIMUM segment length is 15 NM. The OPTIMUM length is 10 NM. A distance greater than 10 NM should not be used unless an operational requirement justifies a greater distance.

(2) Width. The width of the intermediate segment is the same as the width of the segment it joins. When the intermediate segment is aligned with initial or final approach segments, the width of the intermediate segment is determined by joining the outer edges of the initial segment with the outer edges of the final segment. When the intermediate segment is not aligned with the initial or final approach segments, the resulting gap on the outside of the turn is a part of the preceding segment and is closed by the appropriate arc (See figure 10). For obstacle clearance purposes, the intermediate segment is divided into a primary and a secondary area.

Table 3. MINIMUM INTERMEDIATE COURSE LENGTH. Par 242b(1).

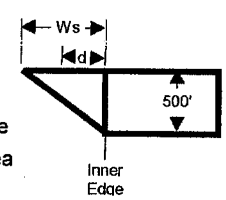
ANGLE (DEGREES)	MINIMUM LENGTH (MILES) Cat A/B	C/D/E
>90 - 96	5	6
>96 - 102	6	7
>102 - 108	6	8
>108 - 114	6	9
>114 - 120	7	10

c. Obstacle Clearance. A MINIMUM of 500 feet of obstacle clearance shall be provided in the primary area of the intermediate approach segment. In the secondary area, 500 feet of obstacle clearance shall be provided at the inner edge, tapering to zero feet at the outer edge.

$$\text{Secondary ROC} = 500 \times \frac{Ws - d}{Ws}$$

Where d = distance from inner edge

Ws = Width of secondary area



Allowance for precipitous terrain should be considered as specified in paragraph 323a. The altitudes selected by application of the obstacle clearance specified in this paragraph may be rounded to the nearest 100 feet (see paragraph 241).

d. Descent Gradients. Because the intermediate segment is used to prepare the aircraft speed and configuration for entry into the final approach segment, the gradient should be as flat as possible. The OPTIMUM descent gradient is 150 feet per mile. The MAXIMUM gradient is 318 feet per mile, except for a localizer approach published in conjunction with an ILS procedure. In this case, a higher descent gradient equal to the commissioned GS angle (provided it does not exceed 3°) is permissible. Higher gradients resulting from arithmetic rounding are also permissible.

NOTE: When the descent gradient exceeds 318 feet per mile, the procedure specialist should assure a segment is provided prior to the intermediate segment to prepare the aircraft speed and configuration for entry into the final segment. This segment should be a minimum length of 5 miles and its descent gradient should not exceed 318 feet per mile.

243. INTERMEDIATE APPROACH SEGMENT BASED ON AN ARC. Arcs with a radius of less than 7 miles or more than 30 miles from the navigation facility shall NOT be used. DME arc courses shall be predicated on DME collocated with a facility providing omnidirectional course information.

a. Alignment. The same arc shall be used for the intermediate and the final approach segments. No turns shall be required over the FAF.

b. Area.

(1) Length. The intermediate segment shall NOT be less than 5 miles nor more than 15 miles in length, measured along the arc. The OPTIMUM length is 10 miles. A distance greater than 10 miles should not be used unless an operational requirement justifies the greater distance.

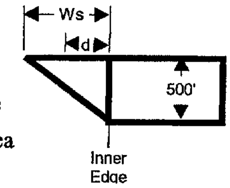
(2) Width. The total width of an arc intermediate segment is 6 miles on each side of the arc. For obstacle clearance purposes, this width is divided into a primary and a secondary area. The primary area extends 4 miles laterally on each side of the arc segment. The secondary areas extend 2 miles laterally on each side of the primary area (see figure 10).

c. Obstacle Clearance. A MINIMUM of 500 feet of obstacle clearance shall be provided in the primary area. In the secondary area, 500 feet of obstacle clearance shall be provided at the inner edge, tapering to zero feet at the outer edge.

$$\text{Secondary ROC} = 500 \times \frac{Ws - d}{Ws}$$

Where d = distance from inner edge

Ws = Width of secondary area



Allowance for precipitous terrain should be considered as specified in paragraph 323a. The altitudes selected by application of the obstacle clearance specified in this paragraph may be rounded to the nearest 100 feet (see paragraph 241).

d. Descent Gradients. Criteria specified in paragraph 242d shall apply.

244. INTERMEDIATE APPROACH SEGMENT WITHIN A PT.

a. PT Over a FAF. When the FAF is a facility (see figure 11).

(1) The MAXIMUM intermediate length is 15 NM, the OPTIMUM is 10 NM, and the MINIMUM is 5 NM. Its width is the same as the final segment at the facility and expanding uniformly to 6 NM on each side of the course at 15 NM from the facility.

(2) The intermediate segment considered for obstacle clearance shall be the same length as the PT distance; e.g., if the procedure requires a PT to be completed within 5 NM, the intermediate segment shall be only 5 NM long, and the intermediate approach shall begin on the intermediate course 5 NM from the FAF.

(3) When establishing a stepdown fix within an intermediate/initial segment underlying a PT area:

(a) Table 1A shall be applied.

(b) Only one stepdown fix is authorized within the intermediate segment that underlies the PT maneuvering area.

(c) The distance between the PT fix/facility and a stepdown fix underlying the PT area shall not exceed 4 NM.

(d) The MAXIMUM descent gradient from the IF point to the stepdown fix is 200 feet/NM. The MAXIMUM descent gradient from the stepdown fix to the FAF is 318 feet/NM.

(3) **Intermediate Segment Area.**

(a) PT Over a Facility. The intermediate segment starts 15 NM from the facility at a width of 6 NM each side of the inbound course and connects to the width of the final segment at the FAF. The area considered for obstacle clearance is from the start of the PT distance to the FAF.

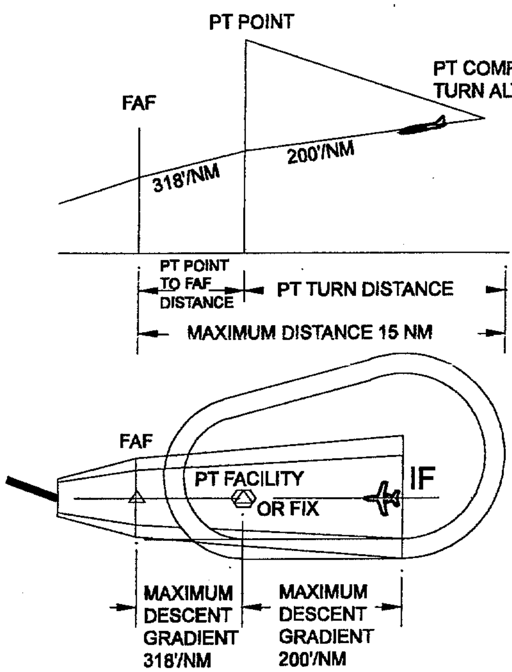


Figure 14-2. INTERMEDIATE AREA WITHIN PT AREA. PT Facility/Fix Used as a Stepdown Fix. Par 244d(4).

(b) PT Over a Fix (NOT a Facility). The intermediate segment starts at the PT distance at a width of 6 NM each side of the inbound course and connects to the width of the final segment at the FAF. The area considered for obstacle clearance is from the start of the PT distance to the FAF.

(4) **The MAXIMUM descent gradient** is 200 feet/NM. If the PT facility/fix is a stepdown fix, the descent gradient from the stepdown fix to the FAF may be increased to a maximum of 318 feet/NM (see figure 14-2). The PT distance may be increased in 1 NM increments up to 15 NM to meet descent limitations.

(5) **When establishing a stepdown fix** within an intermediate/initial segment underlying a PT area:

(a) When the PT fix is over a facility/fix prior to the FAF, the facility/fix is the stepdown fix in the intermediate/initial area, and another stepdown fix within this segment is not authorized.

(b) The MAXIMUM descent gradient from the IF point to the stepdown fix is 200 feet/NM. The MAXIMUM descent gradient from the stepdown fix to the FAF is 318 feet/NM.

e. **PT Facility Fix Used as an IF.** See figure 14-3.

(1) **When the PT inbound course** is the same as the intermediate course, either paragraph 244d may be used, or a straight initial segment may be used from the start of the PT distance to the PT fix.

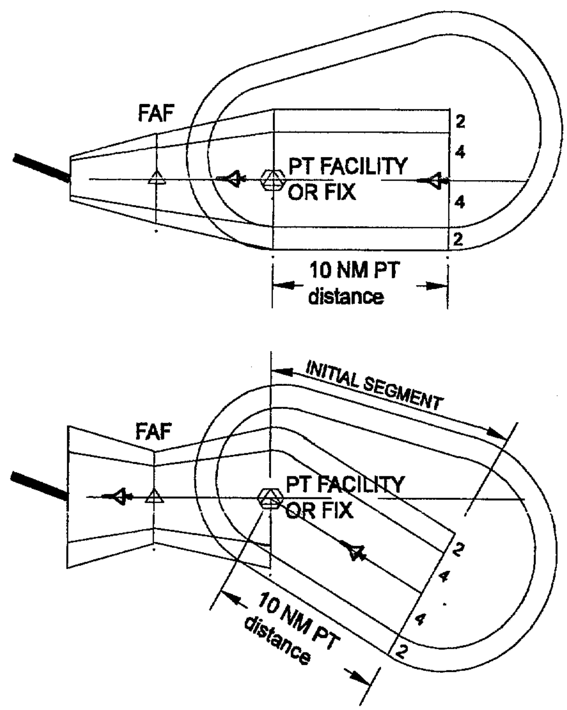


Figure 14-3. USE OF PT FIX FOR IF. Par 244e.

(2) **When the PT inbound course** is NOT the same as the intermediate course, an intermediate segment within the PT area is NOT authorized; ONLY a straight initial segment shall be used from the start of the PT distance to the PT fix.

(3) **When a straight initial segment** is used, the MAXIMUM descent gradient within the PT distance is 318 feet/NM, the PT distance may be increased in 1 NM increments up to 15 NM to meet descent limitations.

(4) **When establishing a stepdown fix** within an intermediate/initial segment underlying a PT area:

(a) Only one stepdown fix is authorized within the initial segment that underlies the PT maneuvering area.

(b) The distance from the PT facility/fix and a stepdown fix underlying the PT area shall not exceed 4 NM.

(c) The MAXIMUM descent gradient from the PT completion point (turn distance) to the stepdown fix, and from the stepdown fix to the IF, is 318 feet/NM.

f. When a PT from a facility is required to intercept a localizer course, the PT facility is considered on the localizer course when it is located within the commissioned localizer course width.

245.-249. RESERVED.

SECTION 5. FINAL APPROACH

250. FINAL APPROACH SEGMENT. This is the segment in which alignment and descent for landing are accomplished. The final approach segment considered for obstacle clearance begins at the FAF or points and ends at the runway or missed approach point (MAP), whichever is encountered last. A visual portion within the final approach segment may be included for straight-in nonprecision approaches (see paragraph 251). Final approach may be made to a runway for a straight-in landing or to an airport for a circling approach. Since the alignment and dimensions of the non-visual portions of the final approach segment vary with the location and type of navigation facility, applicable criteria are contained in chapters designated for specific navigation facilities.

251. VISUAL PORTION OF THE FINAL APPROACH SEGMENT. Evaluate the visual area associated with each usable runway at an airport. Apply the STANDARD visual area described in paragraph 251a(1) to runways to which an aircraft is authorized to circle. Apply the STRAIGHT-IN area described in paragraph 251a(2) to runways with approach procedures aligned with the runway centerline. Apply the OFFSET visual area described in para-graph 251a(3) to evaluate the visual portion of a straight-in approach that is not aligned with the runway centerline. These evaluations determine if night operations must be prohibited because of close-in unlighted obstacles or if visibility minimums must be restricted.

NOTE: If a runway is served by an approach procedure not aligned with the runway centerline, and is authorized for landing from a circling maneuver on an approach procedure to a different runway, it will receive both standard and offset evaluations.

a. Area.

(1) Standard.

(a) Alignment. Align the visual area with the runway centerline extended.

(b) Length. The visual area begins 200 feet from the threshold (THR) at THR elevation and extends 10,000 feet out the runway centerline (see figure 14-4).

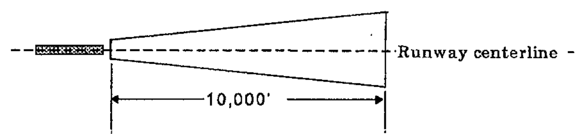


Figure 14-4. VISUAL AREA, Par. 251a(1)(b)

(c) Width. The beginning width of the visual area is 400 feet (200 feet either side of runway centerline) (see figure 14-5). The sides splay outward relative to runway centerline. Calculate the width of the area at any distance "d" from its origin using the following formula:

$$\tfrac{1}{2}W = (0.15 \times d) + 200'$$

where ½W = Perpendicular distance from centerline to edge of area
d = Distance (ft) measured along centerline from area origin

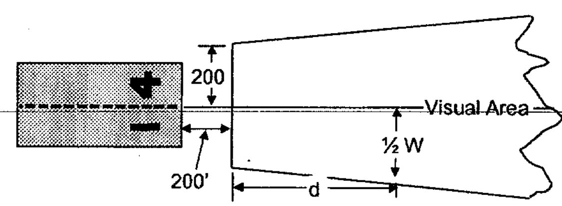


Figure 14-5. VISUAL AREA ORIGIN, Par 251a(1)(c).

(2) Straight-in. (Need not meet straight-in descent criteria.)

(a) Alignment. Align the visual area with the runway centerline extended.

(b) Length. The visual area begins 200 feet from the threshold (THR) at THR elevation, and extends to the DH point for precision procedures or to the VDP location (even if one is not published) for nonprecision procedures (see paragraph 253).

NOTE: When more than one set of minimums are published, use the lowest MDA to determine VDP location.

(c) Width. The beginning width of the visual area is 800 feet (400 feet either side of runway centerline). The sides splay outward relative to runway centerline (see figure 14-6). Calculate the width of the area at any distance "d" from its origin using the following formula:

$$\frac{1}{2}W = (0.138 \times d) + 400$$

Where ½W = Perpendicular distance in feet from centerline to edge of area

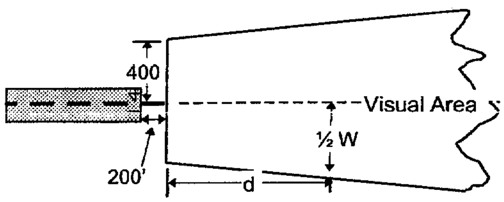


Figure 14-6 VISUAL AREA ORIGIN, Par 251a(2).

(3) Offset. When the final course does not coincide with the runway centerline extended (± 0.05°), modify the visual area as follows: (See figure 14-6A)

(a) STEP 1. Draw the area aligned with the runway centerline as described in paragraph 251a(2).

(b) STEP 2. Extend a line perpendicular to the final approach course (FAC) from the visual descent point (VDP) (even if one is not published) to the point it crosses the runway centerline (RCL) extended .

(c) STEP 3. Extend a line from this point perpendicular to the RCL to the outer edge of the visual area, noting the length (L) of this extension.

(d) STEP 4. Extend a line in the opposite direction than the line in Step 2 from the VDP perpendicular to the FAC for the distance (L).

(e) STEP 5. Connect the end of the line constructed in Step 4 to the end of the inner edge of the area origin line 200 feet from runway threshold.

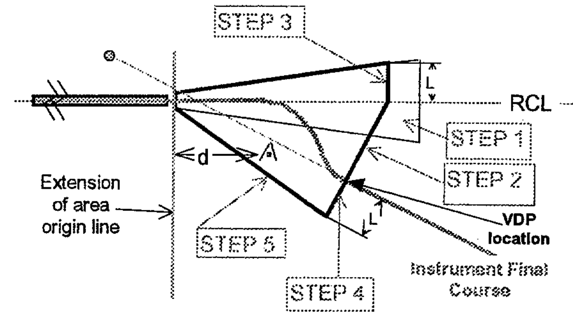


Figure 14-6A. VISUAL SEGMENT FOR OFFSET COURSE, Par 251a(3).

b. Obstacle Clearance. Two obstacle identification surfaces (OIS) overlie the visual area with slopes of 20:1 and 34:1, respectively. When evaluating a runway for circling, apply the 20:1 surface. When evaluating a runway for an approach procedure satisfying straight-in alignment criteria, apply the 20:1 and 34:1 surfaces. Calculate the surface height above threshold at any distance "d" from an extension of the area origin line using the following formulae:

$$20{:}1 \text{ Surface Height} = \frac{d}{20}$$

$$34{:}1 \text{ Surface Height} = \frac{d}{34}$$

(1) If the 34:1 surface is penetrated, take **ONE** of the following actions:

(a) Adjust the obstacle height below the surface or remove the penetrating obstacles.

(b) Limit minimum visibility to ¾ mile.

(2) In addition to the 34:1 evaluation, if the straight-in runway's 20:1 surface is penetrated, take **ONE** of the following actions:

(a) Adjust the obstacle height below the surface or remove the penetrating obstacles.

(b) Do not publish a VDP, limit minimum visibility to 1 mile, and take action to have the penetrating obstacles marked and lighted.

(c) Do not publish a VDP, limit minimum visibility to 1 mile, and publish a note denying the approach (both straight-in and circling) to the affected runway at night.

(3) If the 20:1 surface is penetrated on circling runways, mark and light the penetrating obstacles or publish a note denying night circling to the affected runway.

252. DESCENT ANGLE / GRADIENT. The OPTIMUM nonprecision final segment descent gradient is 318 ft/NM which approximates a 3.00° angle. The MAXIMUM descent gradient is 400 ft/NM which approximates a descent angle of 3.77°. Calculate descent gradients from the plotted position of the FAF or stepdown fix to the plotted position of a stepdown fix or final endpoint (FEP) as appropriate (see figure 14-7). The FEP is formed by the intersection of the final approach course (FAC) and a line perpendicular to the FAC that extends through the runway threshold (first usable landing surface for circling only procedures). When the maximum descent gradient is exceeded, straight-in minimums are NOT authorized; however, circling only minimums may be authorized if the maximum circling descent gradient is not exceeded (see paragraph 252d). In these cases, publish the actual descent gradient to TCH rather than to CMDA.

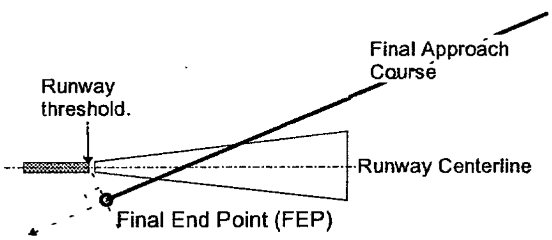


Figure 14-7. FINAL END POINT, Par 252.

a. Non-RNAV Approaches. FAF and/or last stepdown fix (SDF) location and altitude should be selected to provide a descent angle and TCH coincident (±0.20°, ± 3′) with the lowest published visual glide slope indicator (VGSI) glide slope angle, when feasible; or, when VGSI is not installed, the FAF and/or last SDF location and altitude should be selected so as to achieve a near optimum final segment descent gradient. To determine the FAF or SDF altitude necessary to align the descent angle with the lowest VGSI, calculate the altitude gain of a plane with the slope of the lowest published VGSI glide slope angle emanating from the lowest published VGSI threshold crossing height (TCH) to the FAF or SDF location. To determine the OPTIMUM FAF or SDF altitude, calculate the altitude gain of a 318 ft/NM gradient (3° angle) extending from the visual TCH (when there is not a VGSI, see table 18A) to the FAF or SDF location. Round this altitude up or down to the 100′ increment for the FAF or 20' increment for the SDF. Ensure that ROC requirements are not violated during the rounding process. If the gradient from TCH to SDF is greater than the gradient from TCH to FAF, continue the greater gradient to the FAF and adjust the FAF altitude accordingly. If ATC application of hold-in-lieu of PT criteria in paragraph 234e(1) or intermediate segment obstacles prohibit this altitude, consider relocating the FAF to achieve an altitude that will satisfy these requirements and the VGSI or optimum descent gradient (see figure 14-8).

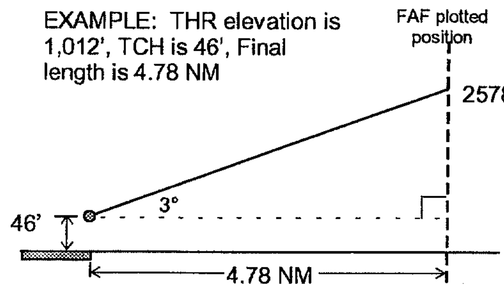
SL in NM:

$$FAF\ Altitude = THRe + TCH + (318 \times SL)$$

SL in feet:

$$FAF\ Altitude = THRe + TCH + (\tan(VGSI\ angle) \times SL \times 6076.11548)$$

where: THRe = THR Elevation
SL = Segment Length



$$2578.04 = 1012 + 46 + (318 \times 4.78)$$

or

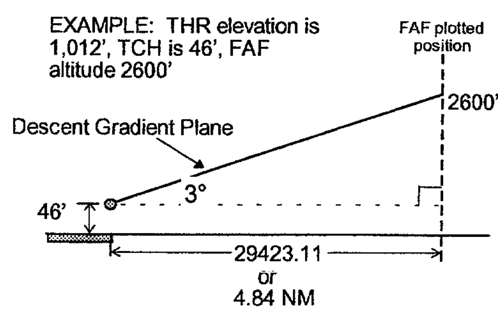
$$2580.12 = 1012 + 46 + \tan(3°) \times (4.78 \times 6076.11548)$$

Figure 14-8. FAF ACTIVITIES GIVEN FINAL LENGTH, Par 252a.

b. RNAV Approaches. If feasible, place the FAF waypoint where the optimum descent angle, or the lowest published VGSI (if installed) glidepath angle intersects the intermediate altitude or the altitude determined by application hold-in-lieu of PT criteria in paragraph 234e(1). When an SDF is used, the SDF altitude should be at or below the published VGSI glide slope angle (lowest angle for multi-angle systems). See figure 14-9.

$$SL = \frac{(FAF\ Altitude - [THRe + TCH])}{\tan(3°\ or\ VGSI\ angle)}$$

where: SL = Segment Length in feet
THRe = Threshold Elevation



$$29423.11 = \frac{2600 - (1012 + 46)}{\tan(3°)}$$

Figure 14-9. FINAL LENGTH GIVEN FAF ALTITUDE, Par 252b.

c. Determining Final Segment Descent Gradient and Angle.

(1) Final Without Stepdown Fixes. Calculate the final descent gradient by dividing the height loss from FAF to TCH by the segment length in NM.

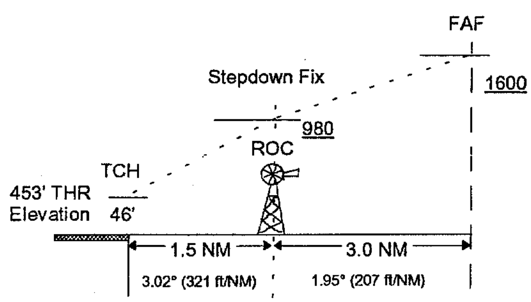
$$\text{Descent Gradient} = \frac{\text{Height Loss}}{\text{Segment Length (NM)}}$$

The descent gradient divided by 6076.11548 is the tangent of the segment descent angle(θ).

$$\text{Tan}(\theta) = \frac{\text{Descent Gradient}}{6076.11548}$$

For RNAV SIAP's, this angle is the glide slope computer setting.

(2) Final With Stepdown Fix. The maximum descent angle is calculated using the difference between the FAF/stepdown altitude and the stepdown/TCH altitude as appropriate. Descent gradient and angle computations apply to each stepdown segment. Height loss in the last segment flown is from the stepdown fix minimum altitude to the TCH (see figure 14-10).



$$\text{Descent Gradient} = \frac{(1600 - 980)}{3.0}$$

$$\text{Descent Gradient} = 207 \text{ ft / NM}$$

$$\text{Tan}(\theta) = \frac{207}{6076.11548}$$

$$\theta = 1.95°$$

$$\text{Descent Gradient} = \frac{(980 - (453 + 46))}{1.5}$$

$$\text{Descent Gradient} = 321 \text{ ft / NM}$$

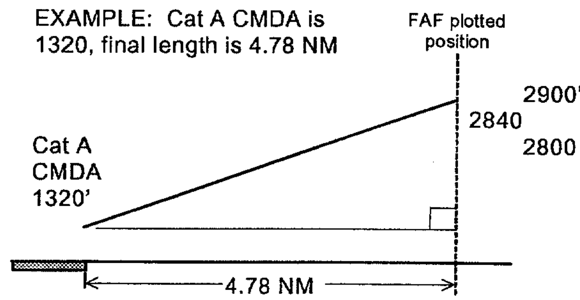
$$\text{Tan}(\theta) = \frac{321}{6076.11548}$$

$$\theta = 3.02°$$

Figure 14-10. DESCENT GRADIENT AND ANGLE, Par 252c(2).

d. Circling Approaches. The maximum descent angle is calculated using the difference between the FAF/stepdown altitude and stepdown/lowest circling minimum descent altitude (CMDA) as appropriate (see figure 14-11).

FAF Altitude = CMDA + (318 × Seg. Len. in NM)



To calculate FAF altitude for a given descent gradient:
$2840.04 = 1320 + (318 \times 4.78)$

Figure 14-11, FAF NET GIVEN SEGMENT LENGTH, Par 252d.

To calculate Descent Gradient and Angle given a FAF altitude and final length:

$$\text{Descent Gradient} = \frac{(2900 - 1320)}{4.78}$$

$$\text{Descent Gradient} = 331$$

$$\text{Tan}(\theta) = \frac{331}{6076.11548}$$

$$\theta = 3.12°$$

253. VISUAL DESCENT POINT (VDP) (applicable to straight-in procedures only). When dual minimums are published, use the lowest minimum descent altitude (MDA) to calculate the VDP distance. **PUBLISH A VDP FOR ALL STRAIGHT-IN NONPRECISION APPROACHES** except as follows:

- Do not publish a VDP associated with an MDA based on part-time or full time remote altimeter settings.
- Do not publish a VDP located prior to a stepdown fix.
- If the VDP is between the MAP and the runway, do not publish a VDP.

a. For runways served by a VGSI, using the VGSI TCH, establish the distance from THR to a point where the lowest published VGSI glidepath angle reaches an altitude equal to the MDA. Use the following formula:

$$\text{VDP Distance} = \frac{\text{MDA} - (\text{TCH} + \text{THR Elevation})}{\text{Tan}(\text{VGSI Angle})}$$

b. For runways NOT served by a VGSI, using an appropriate TCH from table 18A, establish the distance from THR to a point where the greater of a 3° or the final segment descent angle reaches the MDA. Use the following formula:

$$\textit{VDP}\ \text{Distance} = \frac{\text{MDA} - (\text{TCH} + \text{THR Elevation})}{\text{Tan}(^{*}\ \text{Angle})}$$

* final segment descent angle or 3°, whichever is higher.

c. Marking VDP Location.

(1) For Non-RNAV SIAP's, mark the VDP location with a DME fix. The DME must be collocated with the facility providing final approach course guidance (USN/USA/USAF NA). If DME is not available, do not establish a VDP. Maximum fix error is ± 0.5 NM.

(2) For RNAV SIAP's, mark the VDP location with an along track distance (ATD) fix to the MAP. Maximum fix error is ± 0.5 NM.

(3) If the final course is not aligned with the runway centerline, use the THR as a vertex, swing an arc of a radius equal to the VDP distance across the final approach course (see figure 14-12). The point of inter-section is the VDP. (For RNAV procedures, the distance from the point of intersection to the MAP is the ATD for the VDP.)

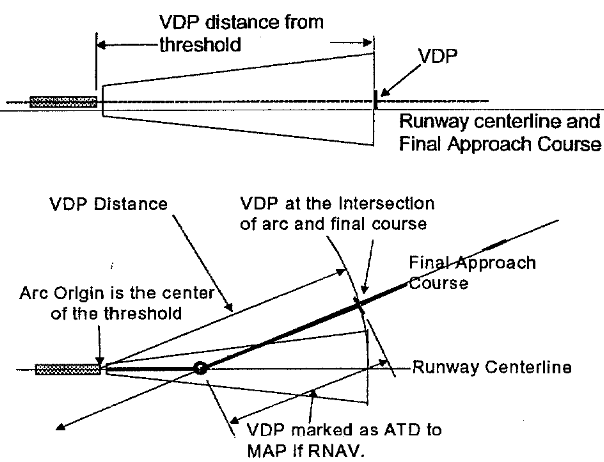


Figure 14-12. VDP LOCATION, Par 253c(3).

254.-259. RESERVED.

SECTION 6. CIRCLING APPROACH

260. CIRCLING APPROACH AREA. This is the obstacle clearance area which shall be considered for aircraft maneuvering to land on a runway which is not aligned with the FAC of the approach procedure.

a. Alignment and Area. The size of the circling area varies with the approach category of the aircraft, as shown in table 4. To define the limits of the circling area for the appropriate category, draw an arc of suitable radius from the center of the end of each usable runway. Join the extremities of the adjacent arcs with lines drawn tangent to the arcs. The area thus enclosed is the circling approach area (see figure 15).

Table 4. CIRCLING APPROACH AREA RADII. Par 260a.

Approach Category	Radius (Miles)
A	1.3
B	1.5
C	1.7
D	2.3
E	4.5

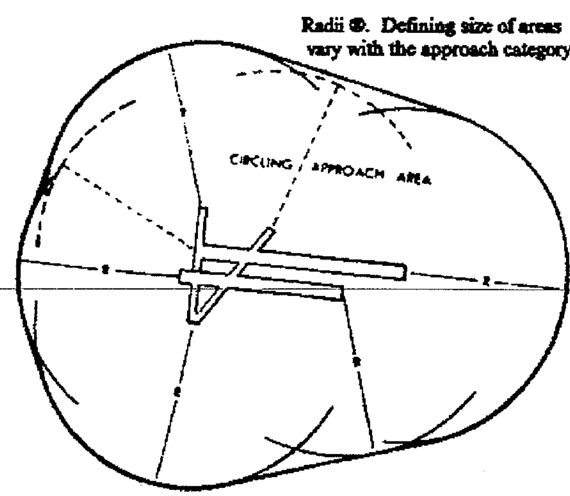


Figure 15. CONSTRUCTION OF CIRCLING APPROACH AREA. Par 260a.

b. Obstacle Clearance. A minimum of 300 feet of obstacle clearance shall be provided in the circling segment at a point 15 flying miles from the MAP. When PCG is available, a secondary area for the reduction of obstacle clearance is identified within the missed approach area. It has the same width as the final approach secondary area at the MAP, and expands uniformly to a width of 2 miles at a point 15 miles from the MAP (see figure 16). Where PCG is not available beyond this point, expansion of the area continues until PCG is achieved or segment terminates. Where PCG is available beyond this point, the area tapers at a rate of 30° inward relative to the course until it reaches initial segment width.

NOTE: Only the primary missed approach procedure shall be included on the published chart.

271. MISSED APPROACH ALIGNMENT. Wherever practical, the missed approach course should be a continuation of the FAC. Turns are permitted, but should be minimized in the interest of safety and simplicity.

272. MAP. The MAP specified in the procedure may be the point of intersection of an electronic glidepath with a DH, a navigation facility, a fix, or a specified distance from the FAF. The specified distance may not be more than the distance from the FAF to the usable landing surface. The MAP shall **NOT** be located prior to the VDP. Specified criteria for the MAP are contained in the appropriate facility chapters.

273. STRAIGHT MISSED APPROACH AREA. When the missed approach course is within 15° of the final approach course, it is considered a straight missed approach (see figure 16). The area considered for obstacle evaluation is specified in paragraph 270.

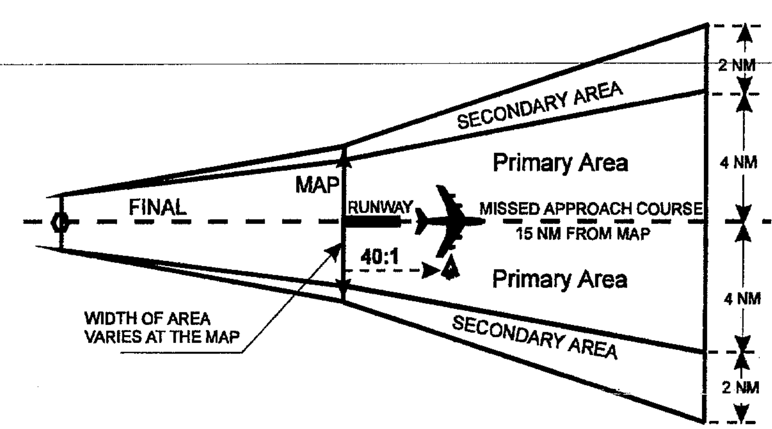


Figure 16. STRAIGHT MISSED APPROACH AREA. Par 270 and 273.

274. STRAIGHT MISSED APPROACH OBSTACLE CLEARANCE. Within the primary missed approach area, no obstacle shall penetrate the missed approach surface. This surface begins over the MAP at a height determined by subtracting the required final approach ROC and any minima adjustments, per paragraph 323 from the MDA. It rises uniformly at a rate of 1 foot vertically for each 40 feet horizontally (40:1). See figure 17. Where the 40:1 surface reaches a height of 1,000 feet below the missed approach altitude (paragraph 270), further application of the surface is not required. In the secondary area, no obstacle may penetrate a 12:1 slope that extends outward and upward from the 40:1 surface at the inner boundaries of the secondary area. See figure 18. Evaluate the missed approach segment to ensure obstacle clearance is provided.

a. Evaluate the 40:1 surface from the MAP to the clearance limit (end of the missed approach segment). The height of the missed approach surface over an obstacle is determined by measuring the straight-line distance from the obstacle to the nearest point on the line defining the origin of the 40:1 surface. If obstacles penetrate the surface, take action to eliminate the penetration.

b. The preliminary charted missed approach altitude is the highest of the minimum missed approach obstruction altitude, minimum holding altitude (MHA) established IAW paragraph 293a, or the lowest airway minimum en route altitude (MEA) at the clearance limit. To determine the minimum missed approach obstruction altitude for the missed approach segment, identify the highest obstacle in the primary area; or if applicable, the highest equivalent obstacle in the secondary area. Then add the appropriate ROC (plus adjustments) for holding or en route to the highest obstacle elevation. Round the total value to the nearest hundred-foot value.

c. Determine if a climbing in holding pattern (climb-in-hold) evaluation is required (see paragraph 293b). If a climb in holding is intended at the clearance limit, a climb-in-hold evaluation is mandatory.

(1) Calculate the elevation of the 40:1 surface at the end of the segment (clearance limit). The 40:1 surface starts at the same elevation as it does for obstacle evaluations. Compute the 40:1 rise from a point on the line defining the origin of the 40:1 surface in the shortest distance and perpendicular to the end-of-segment line at the clearance limit.

(2) Compute the ROC surface elevation at the clearance limit by subtracting the appropriate ROC (plus adjustments) from the preliminary charted missed approach altitude.

(3) **Compare the ROC surface elevation** at the clearance limit with the 40:1 surface elevation.

(a) If the computed 40:1 surface elevation is equal to or greater than the ROC surface elevation, a climb-in-hold evaluation is NOT required.

(b) If the computed 40:1 surface elevation is less than the ROC surface elevation, a climb-in-hold evaluation **IS** required. FAA Order 7130.3, Holding Pattern Criteria, paragraph 35, specifies higher speed groups and, therefore, larger template sizes are usually necessary for the climb-in-hold evaluation. These templates may require an increase in MHA under TERPS, paragraph 293a. If this evaluation requires an increase in the MHA, evaluate the new altitude using the higher speed group specified in paragraph 35. This sequence of review shall be used until the MHA does not increase, then the 40:1 surface is re-evaluated. If obstacles penetrate the 40:1 surface, take action to eliminate the penetration.

d. The charted missed approach altitude is the higher of the preliminary charted missed approach altitude or the MHA established under paragraph 274c(3)(b).

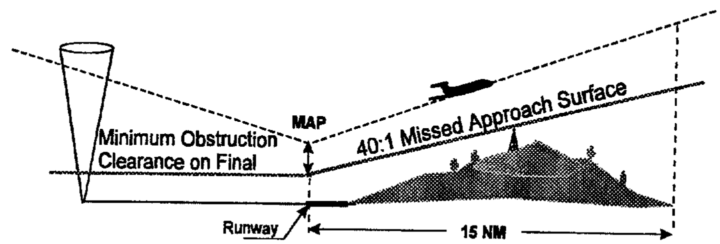
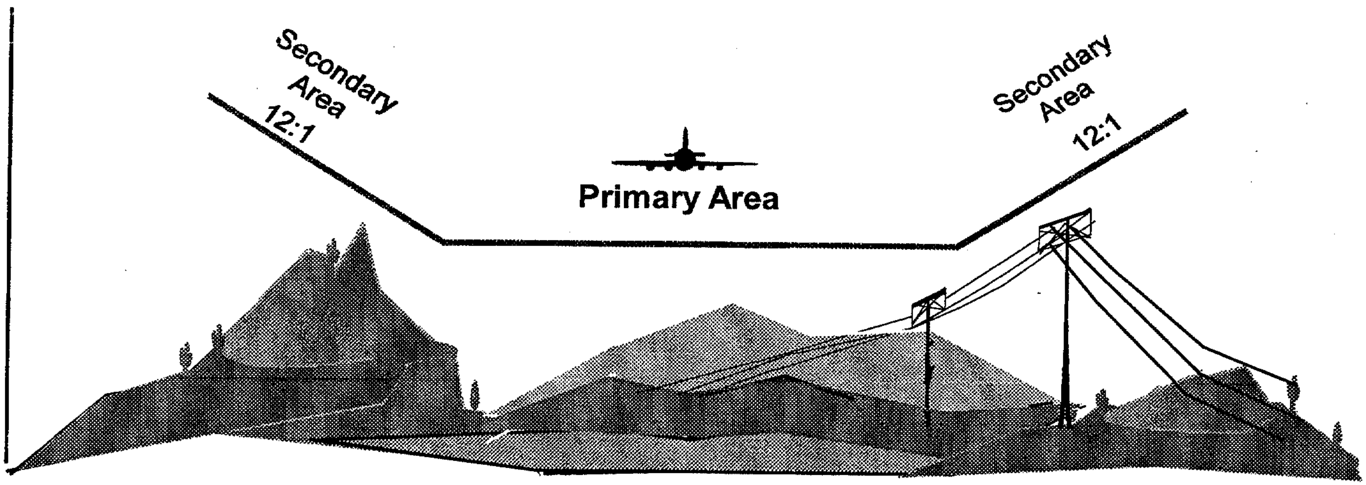


Figure 17. STRAIGHT MISSED APPROACH OBSTACLE CLEARANCE. Par 274.



WHEN COURSE GUIDANCE IS AVAILABLE

Figure 18. MISSED APPROACH CROSS SECTION. Par 274.

275. TURNING MISSED APPROACH AREA. (See Volume 3 for special provisions). If a turn of more than 15° from the FAC is required, a turning or combination straight and turning missed approach area must be constructed.

NOTE: If the HAT value associated with the DA/MDA is less than 400 feet, construct a combination straight and turning missed approach (see paragraph 277) to accommodate climb to 400 feet above touchdown zone elevation prior to turn.

a. The dimensions and shape of this area are affected by three variables:

(1) **Width of final approach area** at the MAP.

(2) **All categories of aircraft** authorized to use the procedure.

(3) **Number of degrees of turn** required by the procedure.

provided the angular divergence between the signal sources at the fix does not exceed 23° (see figure 28). For limitation on use of DME with ILS, see Volume 3, paragraph 2.9.1.

b. ATD Fixes. An ATD fix is an along track position defined as a distance in NM, with reference to the next WP along a specified course.

c. Fixes Formed by Marker Beacons. Marker beacons are installed to support certain NAVAID's that provide course guidance. A marker beacon is suitable to establish a fix only when it marks an along course distance from the NAVAID it is associated with; e.g. localizer and outer markers.

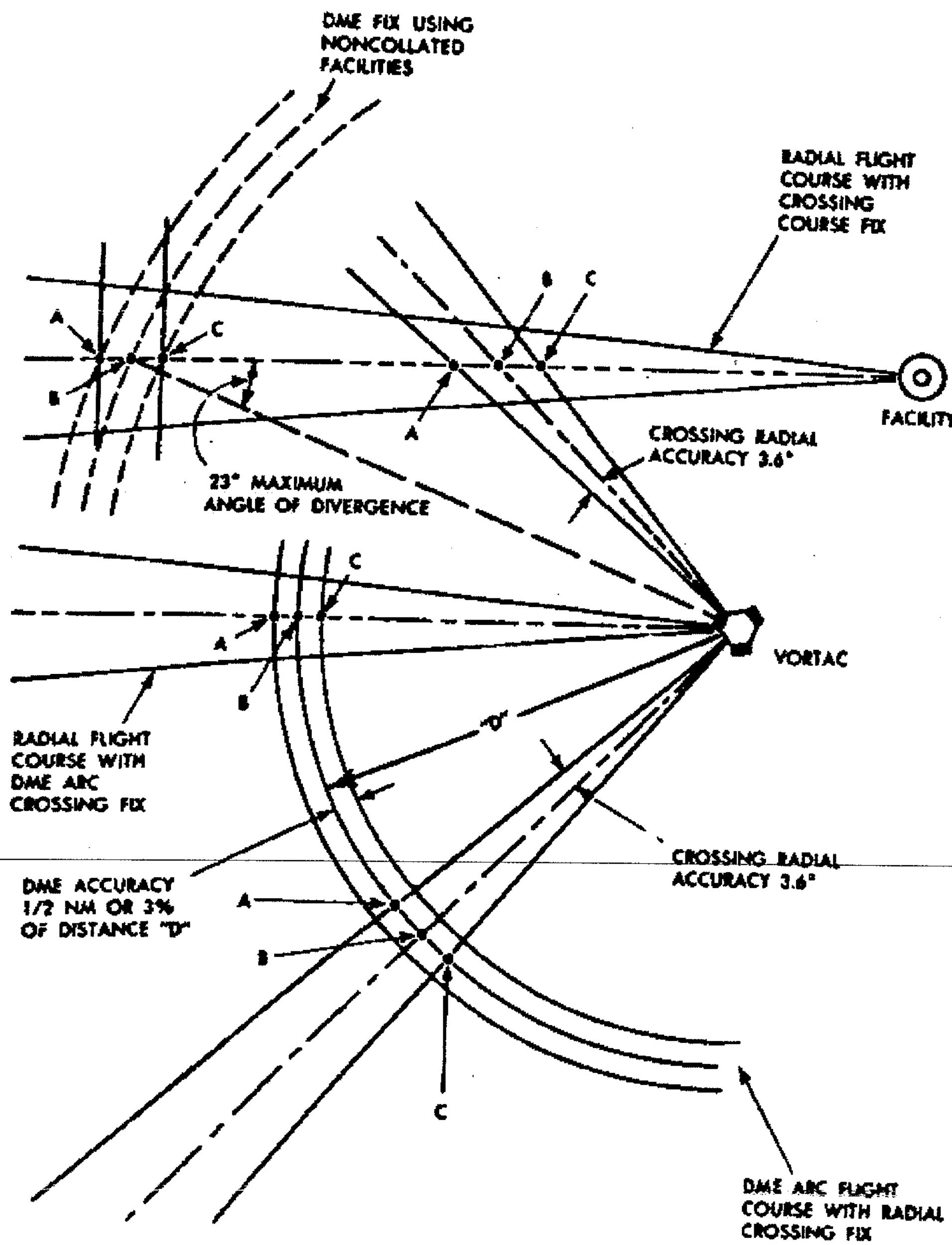


Figure 28. INTERSECTION FIX DISPLACEMENT. Par 281 and 282a.