

FAA Draft Order 8260.GPSDEP, regarding GPS Departure Procedures

In addition to the narrative and formulaic descriptions of this Draft Order, here follows a listing of the accompanying graphic depictions:

Figure 1: GPS Departures, Minimum Distances from DER [Departure End of Runway] to WP

Figure 2: GPS Departure, up to 15-degree Turn

Figure 3: GPS Departure, 90-degree Turn Beyond 30 NM from ARP [Airport Reference Point]

Figure 4: GPS Departure, 120-degree Turn, Fly-Over Waypoint

Figure 5: GPS Departure, 90-degree Turn, Below 10,000' MSL, Fly-Over Waypoint

Figure 6: GPS Departure, 30-degree Turn, Fly-Over Waypoint

Figure 7: GPS Departure, 30-degree Turn, Fly-By Waypoint

Figure 8: GPS Departure, 120-degree Turn, Fly-Over Waypoint, 1 NM from DER

Figure 9: GPS Departure, 120-degree Turn, Fly-Over Waypoint, more than 30 NM from ARP

Figure 10: GPS Departure, Evaluation of Obstacles

Figure 11: GPS Departure, Climb and Hold Departure

[Figure XX, added by Mark Ingram]: General Turning Performance (Constant Altitude, Steady Turn)  
[with thanks to Al St. Germain, of MKC FAA]



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

Flight Procedures  
Branch, AFS-440

P.O. Box 25082  
Oklahoma City, Oklahoma 73125

SEP 13 1996

Captain Randolph J. Babbitt President  
Air Line Pilots' Association International  
535 Herndon Parkway  
P.O. Box 1169  
Herndon, VA 22070

Dear Captain Babbitt:

Enclosed for your review is Draft FAA Order 8260.GPSDEP for GPS Departures.


Any comments or recommendations may be submitted to:

Federal Aviation Administration  
Flight Procedures Branch, AFS-440  
P.O. Box 25082  
Oklahoma City, OK 73125

You may FAX your comments directly to this office at 405-954-4809.

Your comments need to be received by this office by October 17, 1996, in order to be given consideration in the development of this order. We value your input, and if you have any questions, please contact Chuck Everest at 405-954-5811.

Sincerely,



Lyle G. Wink  
Manager, Flight Procedures Branch

Enclosure

8/28/96

1  
2  
3  
4 **CIVIL UTILIZATION OF GLOBAL POSITIONING SYSTEM (GPS)**  
5 **SUBJ: DEPARTURE PROCEDURES**

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6 **1. PURPOSE.** This order, in conjunction with Order 8260.3B, United States Standard for Terminal  
7 Instrument Procedures (TERPS), and Order 8260.38A, Civil Utilization of Global Positioning System  
8 (GPS), provides criteria for establishing GPS departures for use by aircraft equipped and certified  
9 under TSO-C129, Airborne Supplemental Navigation Equipment Using the GPS.  
10

11 **2. DISTRIBUTION.** This order is distributed to the branch level in the Offices of Air Traffic  
12 Systems Development; Communications, Navigation, and Surveillance Systems; Airport Safety and  
13 Standards; Aviation System Standards; and in the Air Traffic, and Flight Standards Services; to the  
14 National Flight Procedures Office; to the Regulatory Standards and Compliance Division at the Mike  
15 Monroney Aeronautical Center; to the regional Flight Standards, and Air Traffic divisions; to the  
16 Europe, Africa, and Middle East International Area Office; and to all Air Route Traffic Control  
17 Centers, Radar Approach Control Facilities, Radar Air Traffic Control Centers, and Terminal Radar  
18 Approach Control Facilities.  
19

20 **3. DEFINITIONS.**  
21

22 **a. Baseline.** A line, perpendicular to the course line at the latest position of the fix displacement  
23 tolerance area, used for construction of turn area expansion arcs.  
24

25 **b. Departure End of Runway (DER).** The end of the TORA.  
26

27 **c. Fly-By Waypoint.** A fly-by waypoint requires the turn be initiated prior to the waypoint (WP)  
28 to provide a smooth path transition to the succeeding course.  
29

30 **d. Fly-Over Waypoint.** A fly-over waypoint precludes any turn until the WP is overflowed and  
31 is followed by an intercept maneuver to the next segment.  
32

33 **e. Reference Line.** A line parallel to the course line, following a turn waypoint (TWP), used to  
34 construct a second set of expansion arcs.  
35

36 **f. Reference Waypoint.** A WP of known location used to geodetically compute the location of  
37 another WP.  
38

39 **g. Takeoff Run Available (TORA).** The length of runway declared available for the ground run  
40 of an aircraft departure.

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**Distribution:** A-W(UA/ND/AS/VN/AT/FS)-3; AVN-100(150CYS); AMA-200(80CYS);  
440  
A-X(FS/AT)-3; AEU-1(10CYS); A-FAT-1/8(1ea)

**Initiated By:** AFS-

41  
42 **h. Turn Anticipation.** The capability of GPS airborne equipment to determine, and enunciate to  
43 the pilot, the location of the point along a course, prior to a TWP, where a turn should be initiated to  
44 provide a smooth path to intercept the succeeding course.  
45

46  
47 **SECTION 1. GENERAL CRITERIA**  
48

49 **4. GENERAL.**  
50

51 **a. Positive Course Guidance.** All GPS segments are assumed to have positive course guidance.  
52 **NOTE:** Criteria for instructions “Climb to an altitude and turn” is not provided due to the inability  
53 to specify a positive course.  
54

55 **b. Waypoint Substitution.** Existing fixes/navigational aids (NAVAIDS) may be substituted for  
56 a WP where conveniently located. For purposes of simplicity in this criteria, the term WP will be  
57 used arc to denote a fix.  
58

59 **c. Waypoint Displacement Area.** Terminal GPS fix displacement tolerance applies where the  
60 plotted position of the WP is at, or within, 30 nautical miles (NM) of the departure airport's reference  
61 point (ARP). En route fix displacement applies beyond 30 NM from the ARP. See Order 8260.38A,  
62 appendix 1, table 1.  
63

64 **d. Waypoints.** Provide “fly-by waypoints” whenever possible. Specify “fly-over waypoints”  
65 only to achieve an operational advantage or benefit. Establish WP’s at route course changes and at  
66 other points of operational benefit.  
67

68 **e. Departure Route Segment Terminators.** Departure route segments begin and end at a WP.  
69

70 **f. Waypoint Definition.** For departure WP’s located on runway centerline extended, establish  
71 coordinates using the reciprocal of the opposite direction runway true bearing and the appropriate  
72 distance applied from the DER. Where two or more segments are aligned along a continuous  
73 geodesic line, align and construct all succeeding WP’s based on a true bearing and distance from the  
74 first (reference) WP in the sequence. Where turns are established, use the TWP as the reference WP  
75 to construct succeeding WP’s and segments aligned on a continuous geodesic line following the turn.  
76

77 **g. Course Change at Waypoints.** The departure course at a WP is the bearing from that WP to  
78 the following WP. The arrival course at the WP is the reciprocal of the course from that WP to the  
79 preceding WP. The difference between the departure course and the arrival course at a WP equals  
80 the amount of turn at that WP. Maximum course change allowable is 120 °.  
81

82 **5. IDENTIFICATION OF GPS INSTRUMENT DEPARTURE PROCEDURES.** Departure  
83 procedures, based on GPS, are identified by using the term "GPS Departure," followed by the takeoff  
84 runway (RWY) number; e.g., GPS DEPARTURE RWY 27. Multiple departure procedures from the  
85 same runway must identify a geographical route or use a transitional route name; e.g., BRAXTON  
86 FOUR GPS DEPARTURE, or GPS DEPARTURE, RWY 27, LEMHI TRANSITION.

87  
88 **6. ROUTE DESCRIPTION.** Specify the magnetic courses and include the names of all WP's in  
89 the order flown with any altitude restriction crossing requirements specified at the WP 's or  
90 alongtrack distance (ATD) fixes. Preface the route description with, "Select 1 NM receiver  
91 sensitivity." For clarity, chart procedures with three or more WP's beyond DER and add a statement  
92 to FAA Form 8260-15, Departure Procedures/Takeoff Minimums; e.g., "Chart runway 27, Lemhi  
93 transition, departure procedure."

94  
95 **7. APPLICATION.** Apply diverse departure criteria contained in Order 8260.3B, chapter 12, to  
96 determine if GPS departure routes are required.

97  
98  
99

**a. Departures begin at DER.**

100 **b. Aircraft Departure Speed Turning Radii.** See table 1.

101  
102 (1) **For all turns below 10,000 feet mean sea level (MSL),** use 250 knots indicated airspeed  
103 (KIAS) unless a speed restriction of 180 KIAS is noted on the procedure for that turn.

104  
105 (2) **For turns at 10,000 feet MSL and above,** use 310 KIAS unless a speed restriction of 180  
106 or 250 KIAS is noted on the procedure for that turn.

107  
108 (3) **Exception:** Use 1.75 NM turn radius where the first turnpoint is within 6 NM of DER.

109  
110 (4) **Where 180 or 250 KIAS is required,** publish a speed restriction. Example: "Do not  
111 exceed (180/250) KIAS," or "Do not exceed (180/250) KIAS until Chuck WP."

112  
113 **8. AREA.**

114  
115 **a. Initial Climb Area .** See appendix 1, figure 1.

116  
117 (1) **All departures must proceed** along the runway alignment during the initial climb to a  
118 specified WP past DER. Locate the first WP after DER on extended runway centerline at a sufficient  
119 distance from DER to allow the aircraft to climb to at least 400 feet above airport elevation. The  
120 minimum distance allowable is 2 NM, based on a climb of 200 ft/NM, where DER elevation is the  
121 airport elevation. See appendix 1, figure 1. Where a shorter distance is required, or the 400-foot rule  
122 above airport elevation cannot be achieved within 2 miles of the DER, publish a climb gradient.  
123 Climb gradients exceeding 400 ft/NM require FAA, Flight Standards Service, approval.

124  
125 (a) **Locate a fly-by waypoint so as to provide a minimum distance of 2 NM plus**  
126 **distance of turn anticipation ( DTA) from DER.** See appendix 1, figure 1. The distance is  
127 measured from DER to the plotted position of the WP.

128  
129 (b) **Locate a fly-over waypoint at a minimum distance of 2 NM from DER.** See  
130 appendix 1, figure 1. The distance is measured from DER to the plotted position of the WP.

131  
132

133           **(2) Initial Segment Width.** See appendix 1, figure 2. From a point 500 feet each side of  
134 runway centerline:

135  
136           **(a) Splay the area at 7.5 °**, angular with the course line, until it reaches the width of the  
137 primary area.

138  
139           **(b) From the same point, splay a line at 15 °**, angular with the course line, until it  
140 reaches a distance of 1 mile from the primary area boundary. This defines the secondary area width.

141  
142           **b. Departure Route Segments .**

143  
144           **(1) Length.** Segment length is measured between plotted positions of the WP 's. The length  
145 of a segment shall be sufficient to encompass all turn anticipation and outside turn expansion  
146 requirements. **The minimum segment length:**

147  
148           **(a) In the case of two successive fly-by turning waypoints,** is the DTA of the first WP  
149 plus the DTA of the second WP.

150  
151           **(b) In the case of two successive fly-over waypoints,** is the amount of outside turn  
152 expansion required to complete the construction of the turn and intercept the course to the second  
153 WP.

154  
155           **(c) From a fly-by to a fly-over waypoint,** is the DTA of the first WP.

156  
157           **(d) From a fly-over to a fly-by waypoint,** is the amount of outside turn expansion  
158 required to complete the construction of the turn at the first WP, and intercept the course to the  
159 second WP, plus the DTA of the second WP.

160  
161           **(2) Width.**

162  
163           **(a) Where the segment begins at , or within, 30 NM from the ARP .** See appendix 1,  
164 figure 3.

165  
166           1 **Primary Area:** 2 miles on each side of the segment centerline.

167  
168           2 **Secondary Area:** 1 mile on each side of the primary area.

169  
170           **(b) Where the segment begins or extends beyond 30 NM from the ARP .** See  
171 appendix 1, figures 3 and 9.

172  
173           1 **Primary Area:** 3 miles on each side of the segment centerline.

174  
175           2 **Secondary Area:** 3 miles on each side of the primary area.

176  
177           **(c) Once the departure segment expands to the respective primary and secondary**  
178 **area widths,** the area widths remain constant, except for turn expansion areas, until reaching 30 NM

179 from ARP, or the en route structure, whichever occurs first. See paragraph 12. At the 30 NM point  
 180 from the ARP, the areas splay to the dimensions stated in paragraph 8b(2), using the primary area 30 °  
 181 splay method. Secondary area splay lines begin and end abeam their corresponding primary area  
 182 splay lines. See appendix 1, figure 3.

183  
 184 **9. TURN AREA EXPANSION.** Expand obstacle clearance areas for turns of more than 15 °.  
 185 Establish outside expansion areas for fly-over waypoints. See appendix 1, figures 4 and 5. Inside  
 186 expansion is not required for fly-over waypoints. Provide inside expansion area for fly-by waypoints.  
 187 See appendix 1, figure 6.

188  
 189 **a. Outside Expansion Area.**

190  
 191 **(1) Construct a line perpendicular** to the course centerline at the latest point of the  
 192 displacement tolerance of the TWP. This line, C'-A-B, is the baseline for constructing a set of arcs to  
 193 establish boundaries of the outside expansion areas. See appendix 1, figure 5.

194  
 195 **(2) Using point C on the baseline as a center point,** draw an arc with radius R1 from C' on  
 196 the outside edge of the primary area of the turn. (R1 is a turning radius selected from table 1.) Draw  
 197 a second arc with radius R2, using point C as a center point, from the outer edge of the secondary  
 198 area on the outside of the turn. (R2 is R1 plus [1 NM or 3 NM] of secondary width, whichever  
 199 applies.) See appendix 1, figure 5.

200  
 201 **TABLE 1**

202  
 203 **FLY-BY or FLY-OVER WAYPOINT TURN RADIUS (R1)**  
 204 **FOR INSIDE and OUTSIDE TURNS**  
 205

<u>AIRCRAFT SPEEDS (KIAS)</u>	<u>180</u>	<u>250</u>	<u>310</u>
<u>TURNING RADII (NM):</u>			
Below 10,000' MSL	2.5	4.2	NA
10,000' MSL and Above	3.4	5.5	7.7

206  
 207  
 208 **(3) To determine the elevation for application of table 1,** use the flight track distance to the  
 209 WP applying the 200-feet per mile and/or published climb gradient where applicable.

210  
 211 **(4) Locate point D:**

212  
 213 **(a) On the baseline at a distance R1 from point C for turns 90 ° or greater.** See

214 appendix 1, figure 5.

215 **(b) On the reference line at a distance from point C for turns less than 90 °.**

216 Construct this reference line from point C parallel to the course following the TWP. See appendix 1,  
217 figure 6.

218

219 **(c) At the intersection of R1 radius arc and the baseline, or reference line,** whichever  
220 is applicable.

221

222 **(5) Using point D as a center point,** draw two arcs with radius R1 and R2, respectively.

223 Using tangent lines at 30° relative to the succeeding course, connect these arcs to the succeeding  
224 primary and secondary area boundaries, respectively. See appendix 1, figure 5. (On shallow angled  
225 turns, the 30° tangent will not always be possible. This occurs where the tangent point falls inside  
226 the secondary area's boundary.) See appendix 1, figure 6. Radius R1 and R2 arcs define the primary  
227 and secondary expansion areas, respectively.

228

229 **(6) Connect corresponding arcs** with straight tangent lines.

230

231 **(7) The radii in table 1 apply also for the primary area boundary radii.** Use the turning  
232 radius for 250 KIAS.

233

234 **(8) Expansion within the splay areas.** When a turn occurs prior to the splayed areas  
235 reaching the primary and secondary widths, the same construction applies as above; except, the  
236 primary area is drawn from the edge of the primary area abeam the latest point of the displacement  
237 tolerance of the TWP. Draw the secondary arc of radius R2. Extend the secondary area splay (prior  
238 to turn), until it intersects the arc at point E. See appendix 1, figure 8. Crosstrack fix displacement  
239 tolerances need not be considered in the construction of the 7.5°, 15°, and 30° splay areas, with  
240 regard to possible overlap of the splay boundary.

241

#### 242 **b. Inside Expansion Area.**

243

244 **(1) Locate a point on the primary area boundary on the inside of the turn,** at the DTA  
245 measured parallel to the course back from the earliest point of the TWP's displacement area. See  
246 appendix 1, figure 7. The DTA is determined by the following formula:

247

$$248 \text{DTA} = \text{TR} \times \tan(\text{turn angle} \div 2) \text{ Where: TR} = \text{Turning Radius from table 1}$$

249

250

251 **(2) From the DTA point,** splay the primary area by an angle equal to one-half of the course  
252 change.

253

254 **(3) Draw the secondary area parallel to the primary splay,** a distance equal to the  
255 secondary area width at the DTA point.

256

257 **(4) When the first WP is less than 2 NM beyond the DER,** the inside turn boundary begins  
258 500 feet abeam the DER. See appendix 1, figure 8.

259

260 **10. OBSTACLE CLEARANCE.** The area considered for obstacle clearance begins at the DER.  
 261 The maximum required obstacle clearance (ROC) for level flight is 1,000 feet in non-mountainous  
 262 areas, and 2,000 feet in designated mountainous areas, except when Order 8260.3B, paragraph 1720,  
 263 is applied. Do not compute a climb gradient above an altitude which satisfies these ROC's.

264  
 265 **a. Primary Area.** No obstacle shall penetrate a 40:1 obstacle identification surface (OIS)  
 266 which begins at the DER and rises from DER elevation in the direction of flight. The 40:1 OIS rises  
 267 along the shortest distance in the primary area from its beginning to the obstacle. See appendix 1,  
 268 figures 2 and 10.

269  
 270 **b. Secondary Area.** No obstacle shall penetrate a 12:1 OIS which rises from the edge of the  
 271 primary area perpendicular to the segment course. In a turn expansion area, the 12:1 OIS rises  
 272 perpendicular to the edge of the primary area. See appendix 1, figures 2 and 10. Determine the  
 273 height of an equivalent obstacle on the edge of the primary area, then evaluate the equivalent obstacle  
 274 relative to the 40:1 OIS, at that point.

275  
 276 **Example:** A 9,840-foot MSL obstacle is located in the secondary area, 2,700' from the edge of the  
 277 primary area.

278  
 279 **Step 1.** Determine the elevation of an equivalent obstacle ( $E_E$ ) on the edge of the primary  
 280 area:

281

Rise of 12:1 slope to edge of primary area:	$\frac{2700'}{12} = 225'$
Elevation of obstacle ( $E_O$ )	9,840'
Less 12:1 rise	<u>- 225'</u>
$E_E$	9,615'

282  
 283  
 284  
 285  
 286  
 287  
 288  
 289 **Step 2.** Determine the 40:1 OIS elevation at equivalent obstacle:

290  
 291  
 292 D = distance (NM) from DER measured along the shortest distance  
 293 within the primary area = 21,344' = 3.513 NM

294

Plus 40:1 rise:	$\frac{21,344'}{40} = 533.6'$
DER elevation	7,640.0'
40:1 rise	+ <u>533.6'</u>
40:1 OIS elevation at equivalent obstacle	8,173.6'

300  
 301  
 302  
 303 (Equivalent obstacle elevation exceeds 40:1 OIS elevation;

304 an **OIS penetration exists** . Proceed to step 3.)

305

306 **Step 3.** Determine minimum climb gradient (G):

307

308  $E_E$  9,615'

309

310 DER elevation -7,640'

311

312 Height ( $H_E$ ) of equivalent obstruction above DER 1,975'

313

314 
$$G = \frac{48D + H_E}{D}$$
 (round to next higher 5-foot increment)

315

316

317

318 
$$\frac{48(3.513) + 1975}{3.513} = 610.2' = 615/NM$$

319

320 **Step 4.** Minimum climb gradient termination altitude ( $A_T$ ):

321

322 
$$A_T = 48D + E_E$$
 (round to the next higher 100-foot increment)

323

324

325 
$$[3.513 \times 48] + 9615' = 168.6' + 9615' = 9783.6' = 9800' \text{ MSL}$$

326

327 **11. Climb Gradients.**

328

329 **a. For the initial climb area** , calculate a climb gradient to the first WP, as necessary, using the following formula:

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

332 
$$G = \frac{H_C}{D_I}$$

Where:  $G$  = climb gradient (ft/NM)

$D_I$  = distance (NM) from DER measured along the route centerline

$H_C$  = height (ft) to climb above DER (allow for elevation differential between airport elevation and DER elevation)

**Example:** The first WP is located 1.6 NM beyond the DER:

$$G = \frac{400}{1.6} = 250 \text{ ft / NM}$$

348 **b. For any segment**, including the initial climb area, avoid obstacles (including equivalent  
 349 obstacles from paragraph 10b) which penetrate the OIS, by specifying a climb gradient that provides  
 350 48 ft/NM ROC applied over distance (D). Apply the minimum climb gradient required for obstacle  
 351 clearance. The minimum climb gradient for an obstacle is determined from the formula:  
 352  
 353

$$G = \frac{(48D) + H_o}{D}$$

354

355

356

357 Where: G = Climb Gradient (ft/NM)

358

359 H<sub>o</sub> = Height (ft) of obstacle above DER (ft)

360

361 D = Distance (NM) from DER measured along the shortest distance  
 362 within the primary area  
 363

364

365 **c. Specify the climb gradient to an altitude** where a gradient greater than 200 ft/NM is no  
 366 longer required. The climb gradient termination altitude (A<sub>T</sub>) may be determined by the formula:

$$A_T = 48D + E_o \text{ (round to the next higher 100-foot increment)}$$

367

368

369 Where: E<sub>o</sub> = Obstacle Elevation (MSL)

370

371 D = (as defined in paragraph 11b)

372

373 A<sub>T</sub> = (3.15 X 48) + 9,615' = 9,783.6' = 9,800'

374

375 **d. Multiple Climb Gradients .**

376

377 (1) **Where multiple climb gradients exist within a segment (e.g., due to obstacle**  
 378 **clearance, as well as Air Traffic Control requirements),** publish the highest computed climb  
 379 gradient for that segment.

380

381 (2) **Where climb gradients change within a segment**, specify a WP to mark that change.  
 382 Publish other than standard climb gradients according to their respective segments or required  
 383 distance.

384

385 **12. CLIMB IN A HOLDING PATTERN.** Apply the criteria in Order 8260.3B, paragraph 293b,  
 386 and Order 8260.38A, paragraph 8. See appendix 1, figure 11.

387

388 **13. END OF DEPARTURE .** The departure area shall terminate at a WP or an existing en route  
 389 fix/NAVAID from which the aircraft can continue en route operations. When the departure joins an  
 390 en route airway, the departure dimensions end at the point where the departure course and the en  
 391 route course intersect. At that point, if the aircraft has not reached the minimum en route altitude, as  
 392 determined by flight track distance and applicable climb gradient, the departure obstacle evaluation

393 continues to the point where the minimum altitude for en route is reached. This evaluation is  
394 conducted using the same method for all 40:1 OIS evaluations. A climb gradient may be required to  
395 clear any penetration or to reach the minimum en route altitude at the point where the departure  
396 evaluation terminates. Measure the shortest distance within the merged primary areas to the obstacle  
397 to be evaluated. See appendix 1, figure 10. This evaluation includes all possible transition routings.  
398  
399

## 400 SECTION 2. DIRECTIVE FEEDBACK INFORMATION

401  
402 **14. INFORMATION UPDATE.** Forward for consideration any deficiencies found, clarification  
403 needed, or suggested improvements regarding the content of this order to:  
404

405 DOT/FAA  
406 ATTN: Flight Procedures Branch, AFS-440  
407 P.O. Box 25082  
408 Oklahoma City, OK 73125  
409

410 **a. Your Assistance is Welcome.** FAA Form 1320-19, Directive Feedback Information, is  
411 included at the end of this order, for your convenience. If an interpretation is needed immediately,  
412 you may call the originating office for guidance. However, you should also use the FAA Form 1320-  
413 19 as a follow-up to the verbal conversation.  
414

415 **b. Use the "Other Comments"** block of this form to provide a complete explanation of why the  
416 suggested change is necessary.  
417  
418  
419  
420

421 Thomas C. Accardi  
422 Director, Flight Standards Service  
423  
424  
425  
426

427 William J. White  
428 Deputy Director, Flight Standards Service

FIGURE 1. GPS DEPARTURES  
MINIMUM DISTANCES FROM  
DER TO WP.

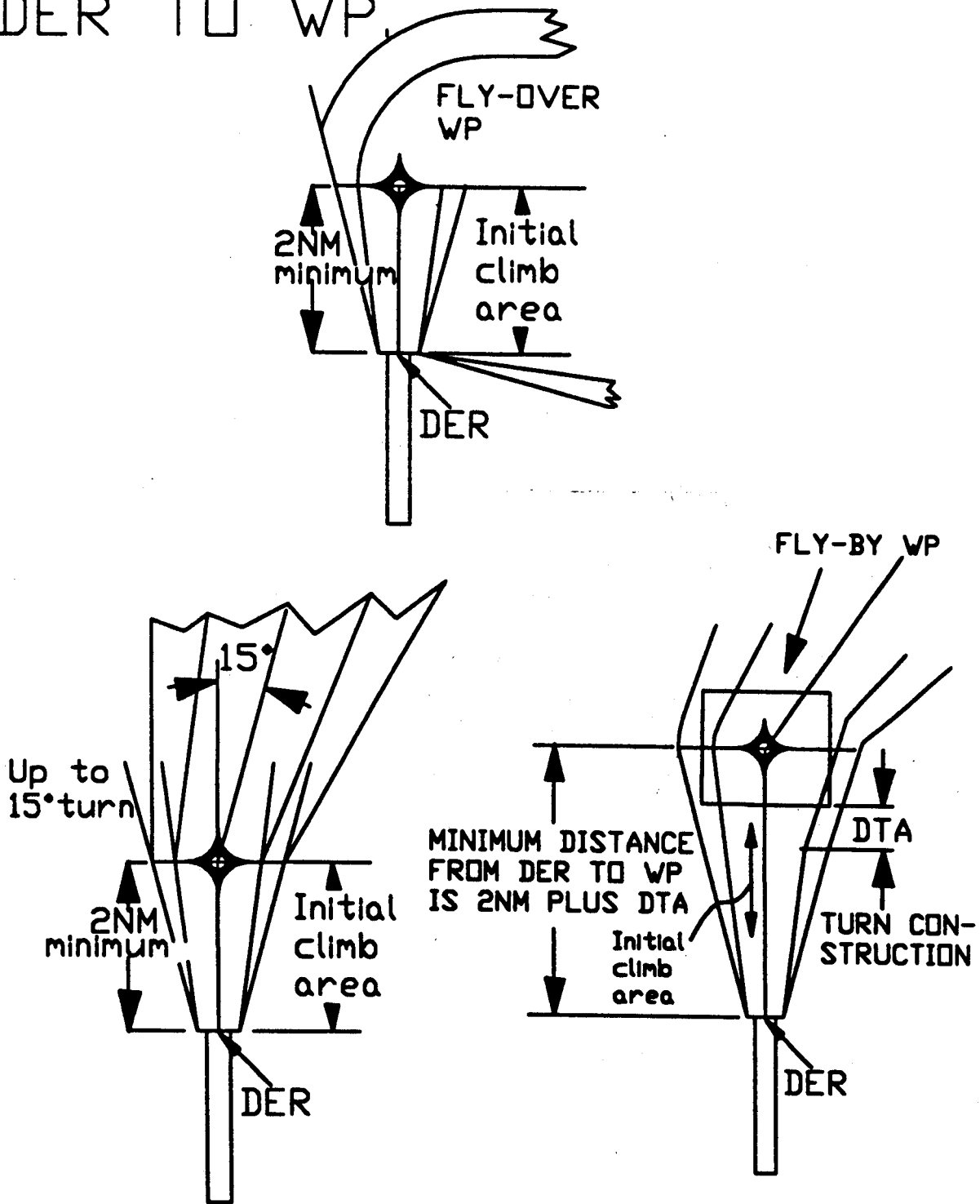


FIGURE 2. GPS DEPARTURE,  
UP TO 15° TURN

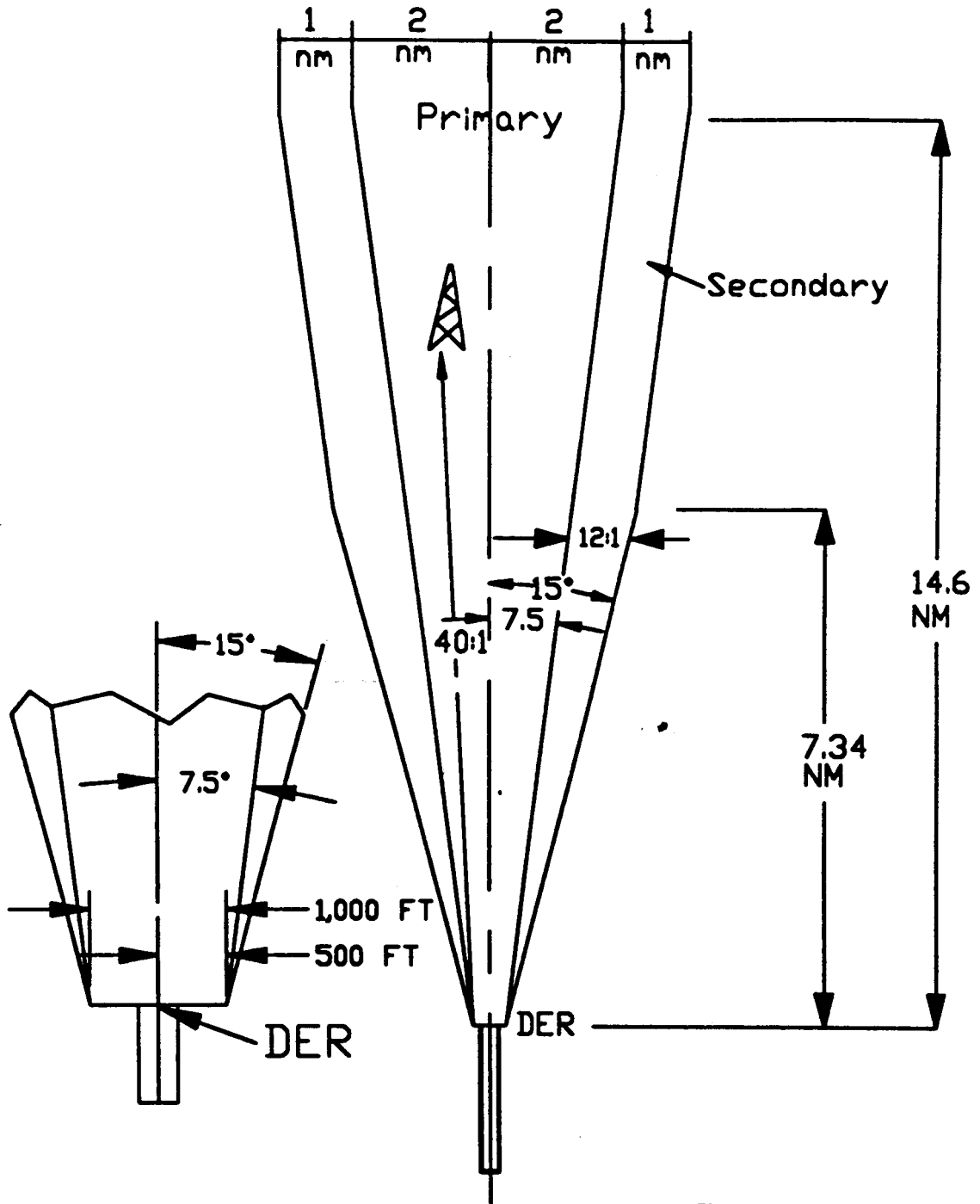


FIGURE 3. GPS DEPARTURE, 90° TURN BEYOND 30 NM FROM ARP.

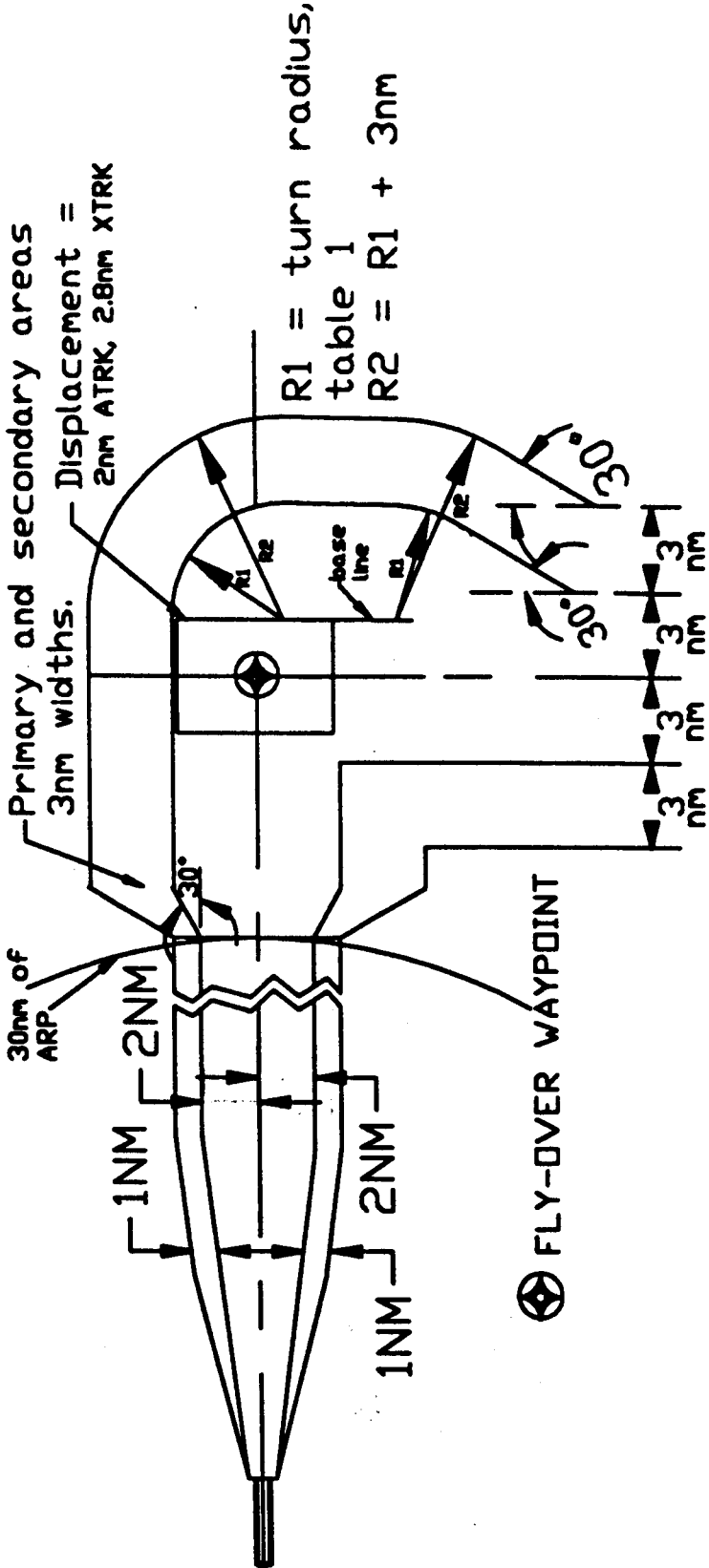


FIGURE 4. GPS DEPARTURE, 120°  
TURN, FLY-OVER WAYPOINT.

EXPANSION CONSTRUCTED AT LATEST  
POINT OF ATRK DISPLACEMENT

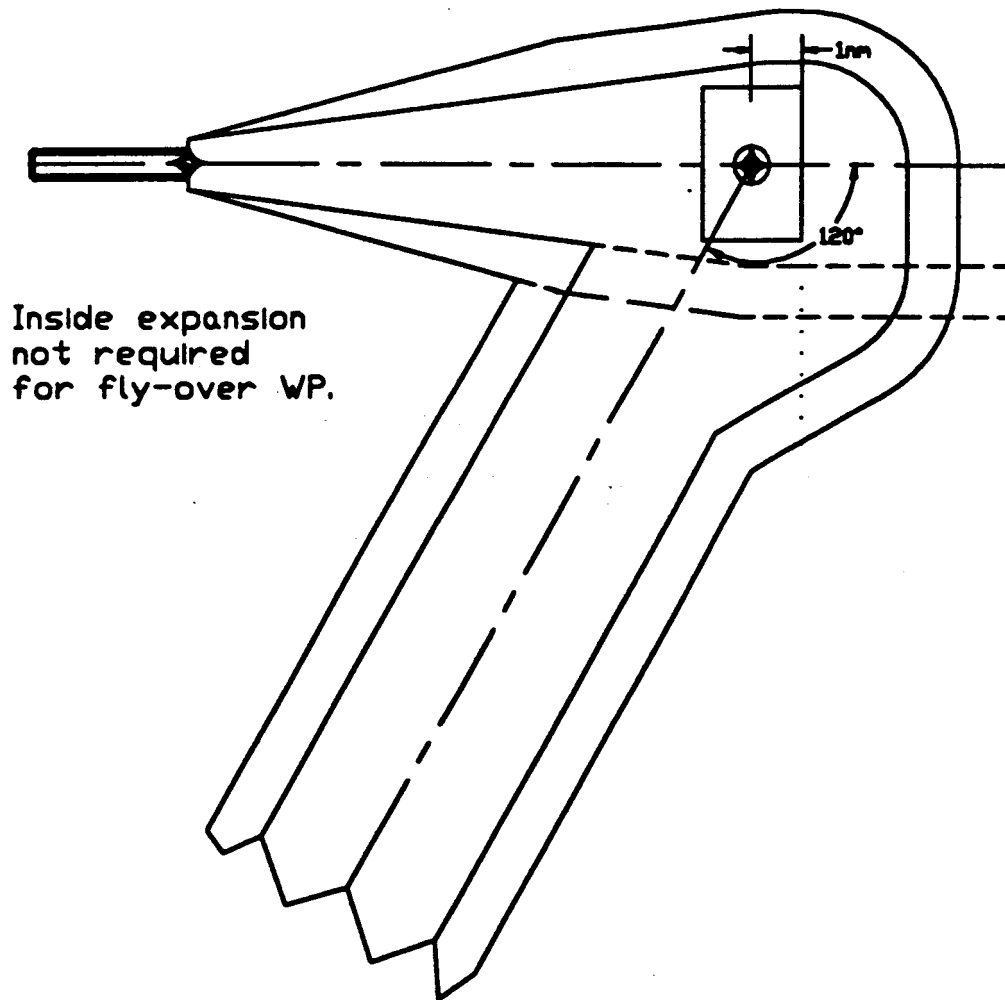


FIGURE 5. GPS DEPARTURE, 90°  
TURN, BELOW 10,000' MSL, FLY-  
OVER WAYPOINT.

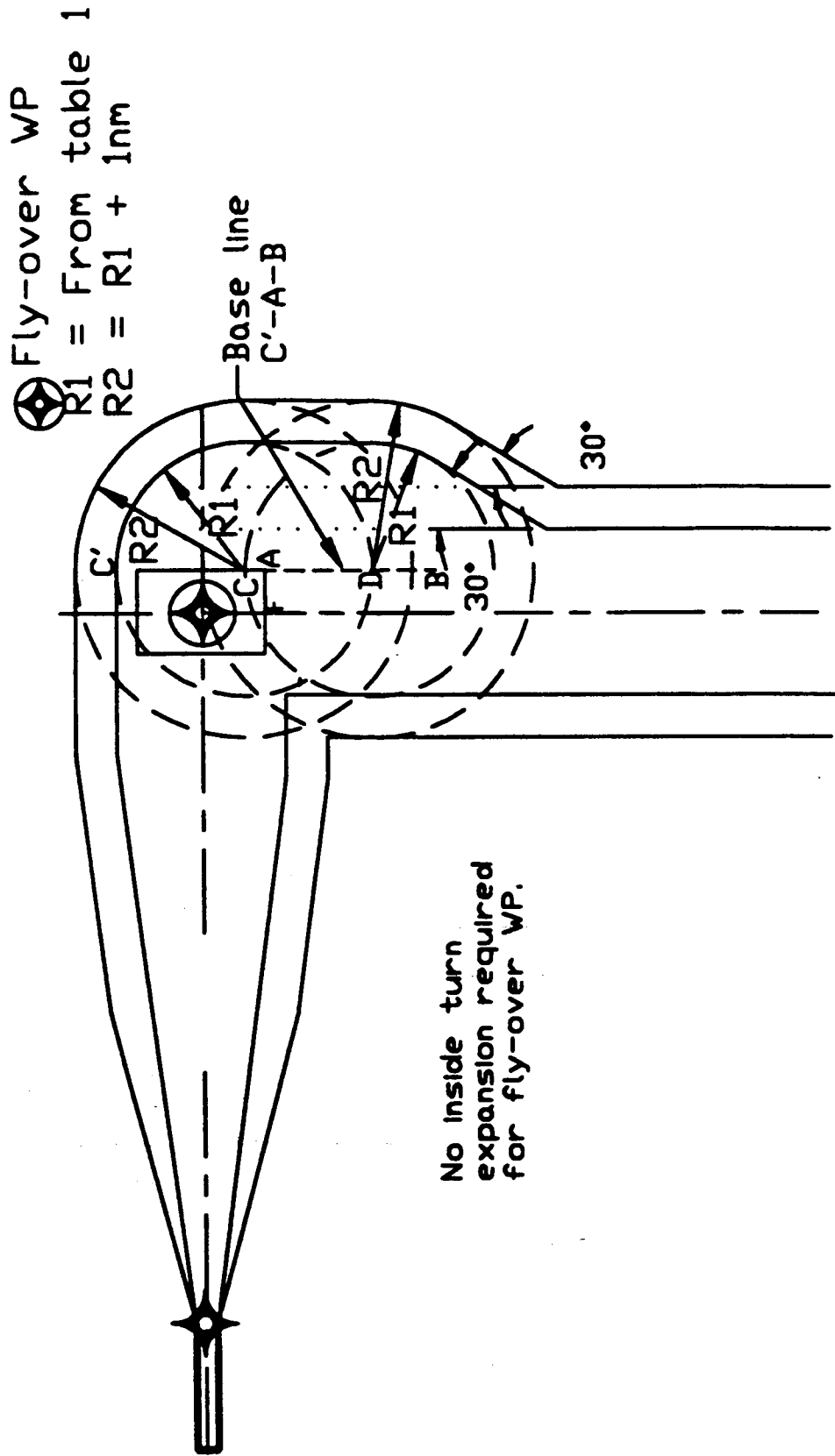


FIGURE 6. GPS DEPARTURE 30°  
TURN, FLY-OVER WAYPOINT.

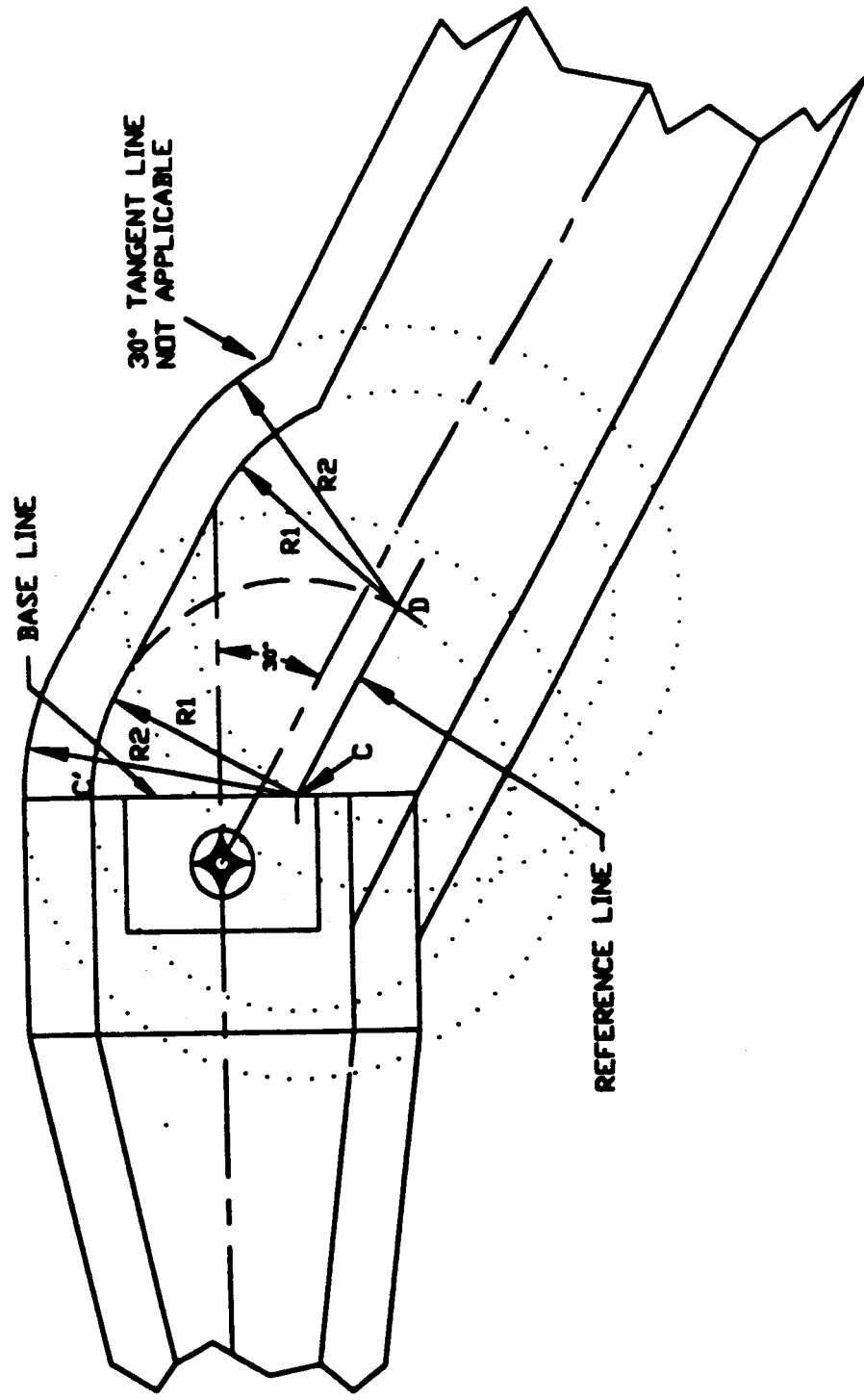


FIGURE 7. GPS DEPARTURE 30°  
TURN, FLY-BY WAYPOINT.

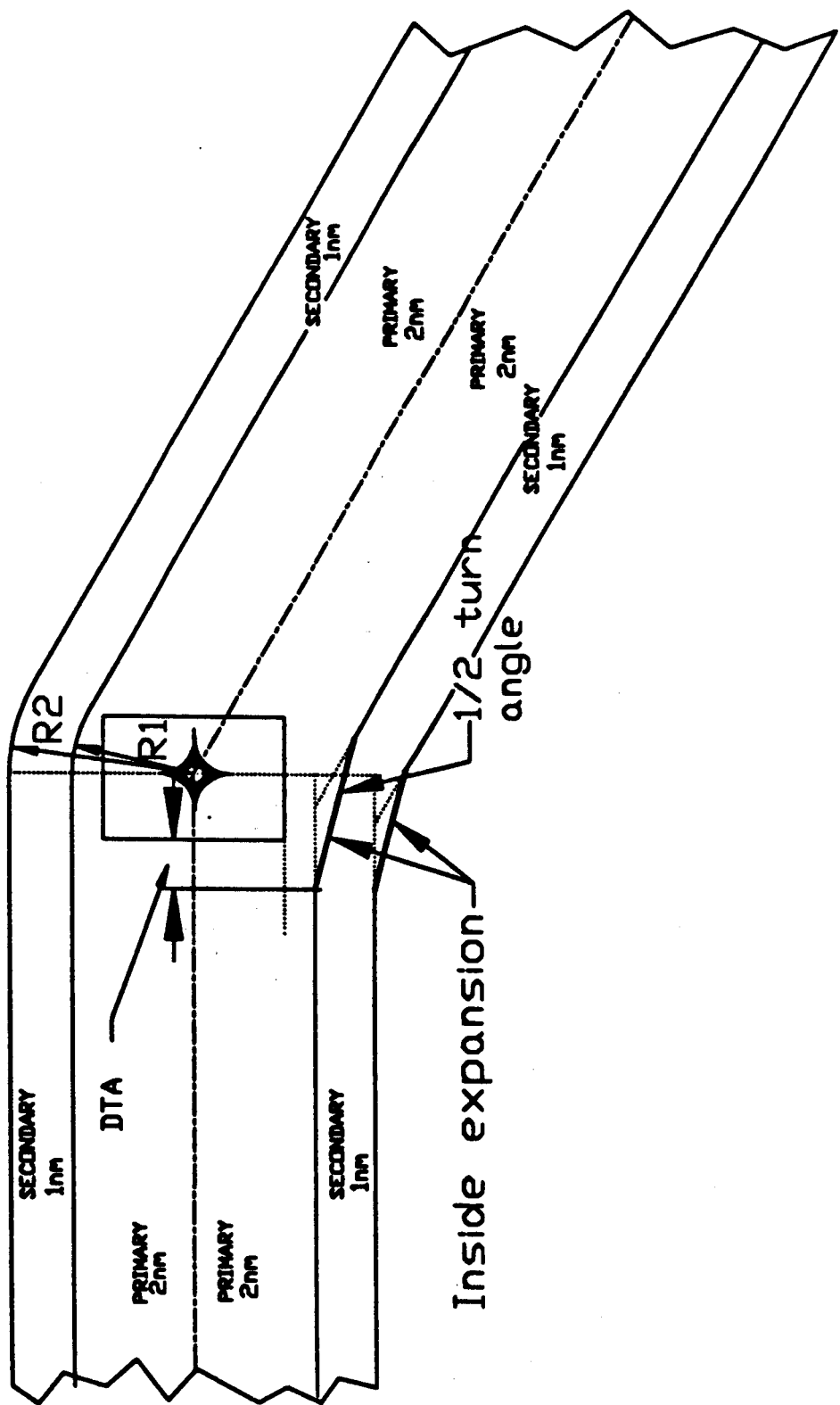
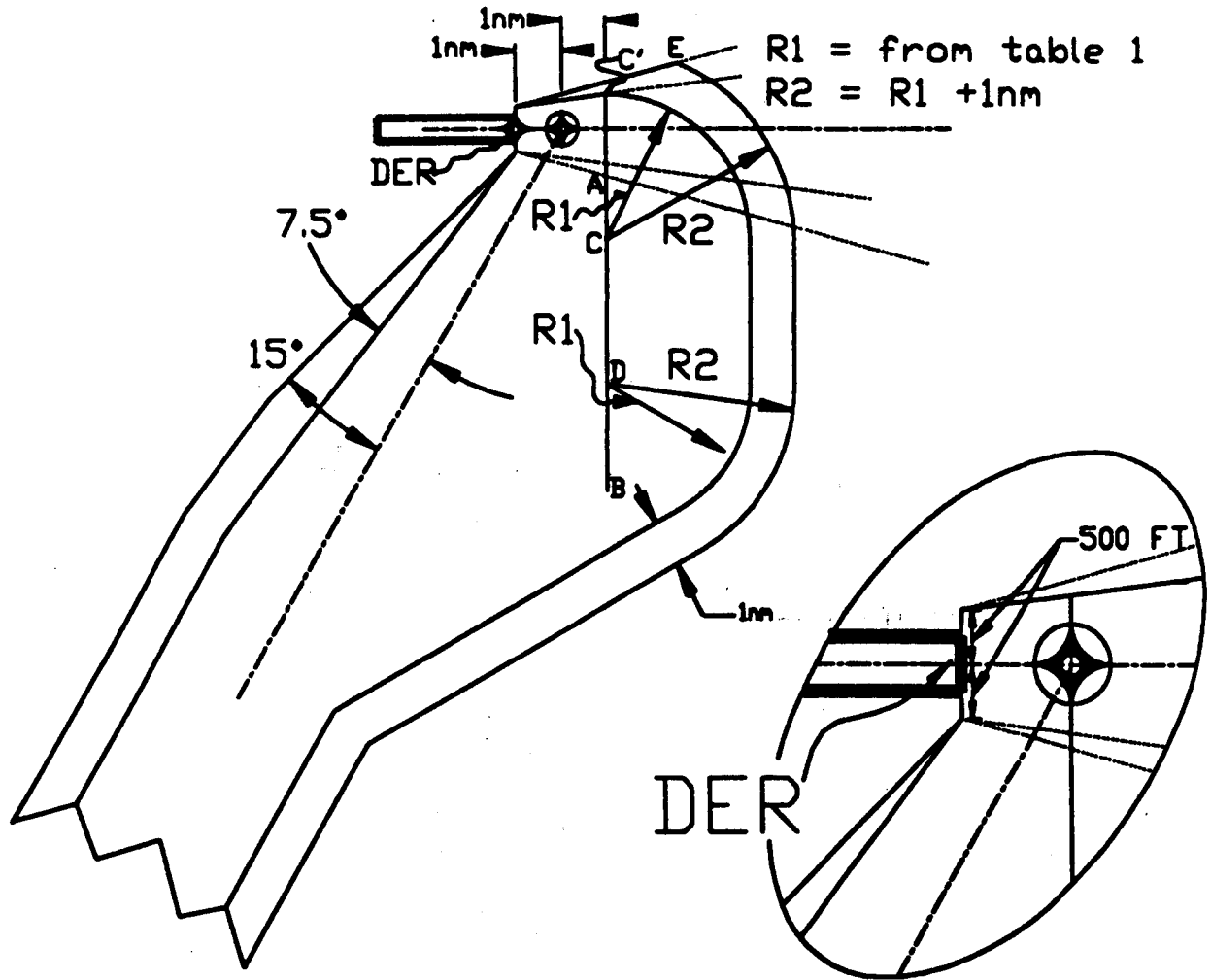


FIGURE 8. GPS DEPARTURE, 120°  
TURN FLY-OVER WP, 1N FROM DER.



EXPANSION CONSTRUCTION BEGINS 1NM BEYOND  
PLOTTED POSITION  
OF TURN WP.

Displacement  
area not  
applicable

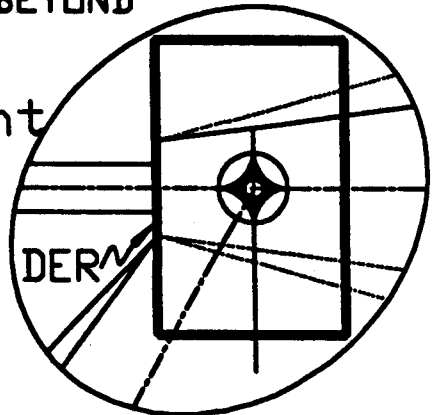


FIGURE 9. GPS DEPARTURE 120° TURN  
 FLY-OVER WAYPOINT MORE THAN 30  
 NM FROM ARP.

OUTSIDE EXPANSION CONSTRUCTED FROM  
 LATEST POINT OF ATRK DISPLACEMENT.

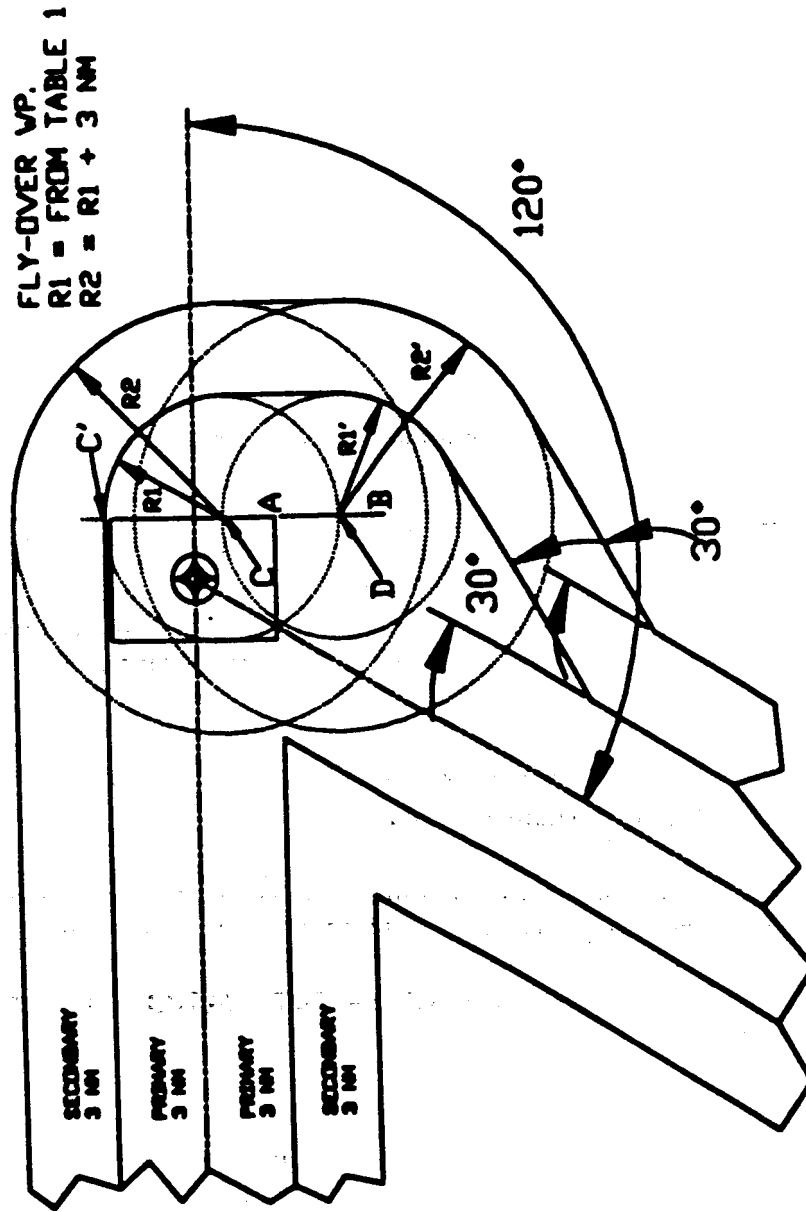


FIGURE 10. GPS DEPARTURE, EVALUATION OF OBSTACLES.

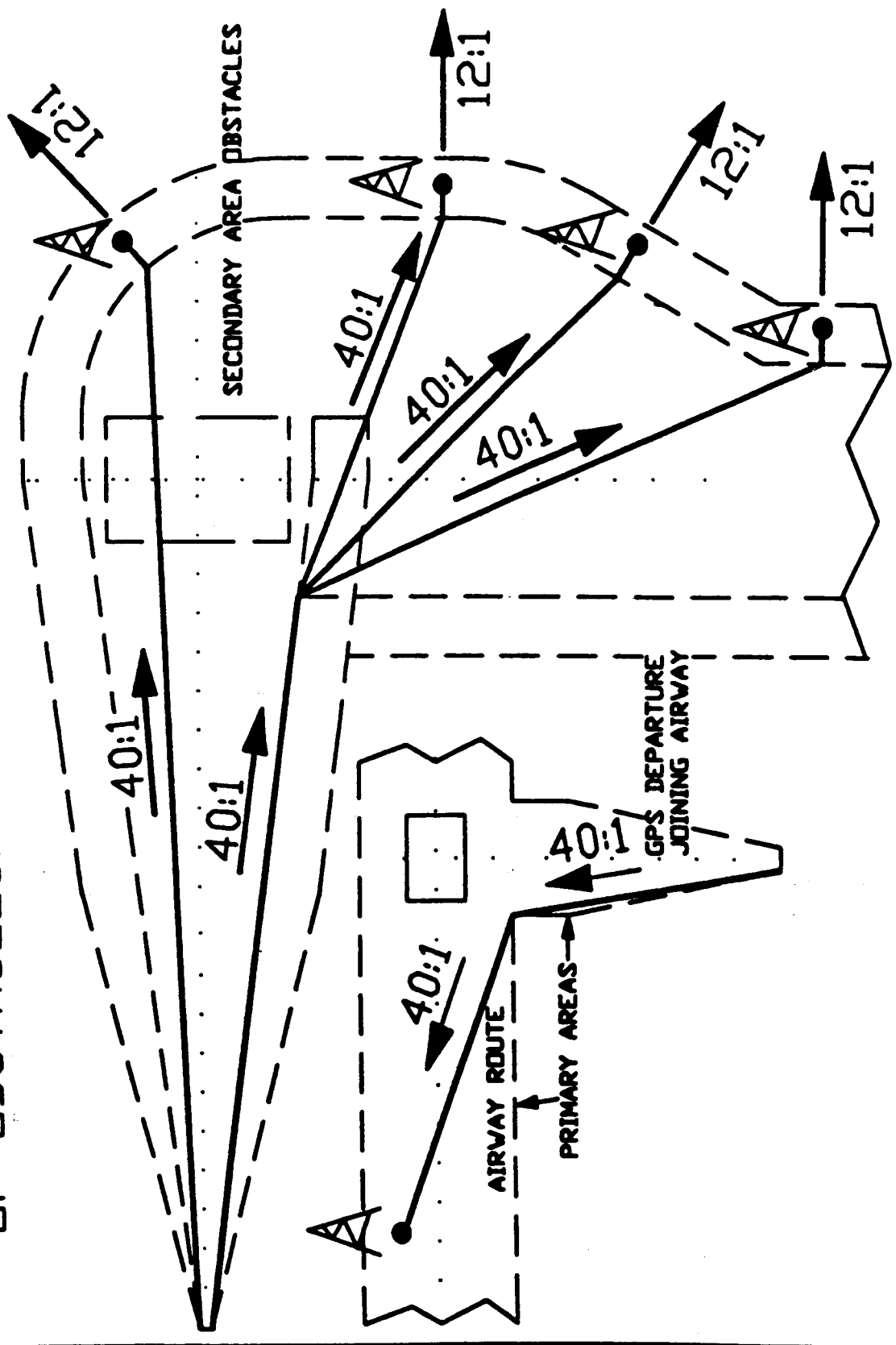


FIGURE 11. CLIMB AND HOLD DEPARTURE.

