GOVERNMENT/INDUSTRY AERONAUTICAL CHARTING FORUM
Instrument Procedures Group
April 29-30, 2002
HISTORY RECORD

FAA Control # 02-01-245

Subject: Along-Track-Distance (ATD) Step-down Fixes for RNAV Approaches with Published LNAV-only and LNAV/VNAV Minima.

Background/Discussion: As an increasing number of RNAV (GPS) approaches are published with both LNAV-only and LNAV/VNAV lines of minima, AOPA is concerned that the absence of step-down fixes will lead to higher minima for users of TSO-C129 (LNAV-only) GPS units. The IFR-certified GPS units used in GA aircraft permit the use of LNAV-only minima. However, the addition of LNAV/VNAV minima allows "high-end" users equipped with advanced Flight Management Systems (FMS) to enjoy lower minima by permitting the use of a Decision Altitude (DA), as opposed to a Minimum Descent Altitude (MDA) found in "classic" and traditional LNAV non-precision approaches. The ability to use a DA comes from the Barometric Vertical guidance (Baro-VNAV) provided by FMS. Unfortunately, these flight management systems have database issues and limitations that preclude the use of a step-down (or more accurately, an ATD) fix in the final approach segment of a procedure. Therefore, in some cases where both LNAV and LNAV/VNAV lines of minima are published for the same procedure, the step-down fix has been eliminated, resulting in higher minima for the GA community (who conduct the largest number of RNAV procedures).

A few examples illustrating this difficulty have been brought to the attention of AOPA. The first involves the RNAV (GPS) approach to runway 24 (see attached) at Carlsbad, California (KCRQ). This procedure was published with both LNAV-only and LNAV/VNAV minima. The LNAV-only MDA for this procedure is 1,334 feet above the touchdown zone elevation (HAT). The problem is that in constructing this approach, step-down fixes were not used because of the difficulties they would create for FMS users. Had this procedure been designed like an ILS with a non-precision LOC procedure, the LNAV-only minima would have been closer to a 514 foot HAT. The addition of two step-down fixes would have lowered the MDA of this approach by over 800 feet. Clearly the GA community is being penalized for the technical limitations of certain high-end avionics.

To address this issue, the FAA has (in certain locations) developed RNAV (GPS) Y and Z approaches to the same runway. An example that illustrates this can be found at the Baltimore-Washington International Airport (KBWI). For runway 28, RNAV (GPS) Y and Z approaches are published. The "Y" approach (see attached) has both LNAV-only and LNAV/VNAV minima, and the stand-alone LNAV MDA is 677 feet. The "Z" approach (see attached) was developed with LNAV-only minima. The difference between the two approaches is that the "Z" approach has a step-down fix in the final approach segment. Because of this, the LNAV MDA for the "Z" approach is 317 feet, or 360 feet lower than the "Y" approach that contains no step-down. The publication of this "Z" approach would solve GA's dilemma in this instance; however, this "Z" approach does not appear in the databases of GPS units used by GA. In short, GA pilots suffer the same penalty as that faced in the Carlsbad scenario where only a single approach plate was published.

Recommendations: Whenever TERPS criteria allows and it is advantageous to do so, instrument approach procedures should be developed incorporating a step-down fix (or fixes) in the final approach segment, regardless of the provision of LNAV/VNAV minima.

Option 1: Publish a single approach plate with both lines of minima incorporating step-down fixes when necessary.

> **Advantages:** A single approach plate lessens the number of plates in each publication, reducing both charting costs and volume. This option would allow GA users the advantage to having an approach with the lower minima made possible through the use of step-down fixes.
>
> **Possible Issues:** The incorporation of a step-down fix may cause issues for FMS equipped operators. If manufactures such as Jeppesen choose not to encode these fixes as waypoints, this may mitigate the problems faced by high-end users. However, this would lead to a lack of conformity between the database and approach plates for FMS users, which they may be unable/unwilling to accept.

Option 2: Publish a "Y" and "Z" approach in each instance where it is necessary to accommodate both LNAV-only minima with step-down fixes and LNAV/VNAV procedures (as was done at KBWI).

> **Advantages:** The precedent has been set with existing procedures. This strategy would ensure that both communities enjoy the lowest possible minima resulting from the establishment of RNAV (GPS) procedures. The problem of database harmonization would also be solved for the FMS crowd.
>
> **Possible Issues:** The addition of a second, or "Z" approach will increase the workload placed on the FAA (AVN), which may have a direct impact on the number of approaches they are able to produce. It will also be incumbent upon database manufactures to ensure that "Z" approaches, those that incorporate step-down fixes, are available for the TSO-C129 units commonly utilized by GA pilots.

The aforementioned scenarios are not intended to identify all possible options, issues, or solutions. Instead, AOPA's goal is to stimulate discussion while working toward a solution for our members.

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KCRQ McCLELLAN-PALOMAR

JEPPESEN 9 NOV 01 (12-1) Eff 29 Nov

CARLSBAD, CALIF RNAV (GPS) RWY 24

ATIS	SOCAL Approach (R)	*PALOMAR Tower	*Ground
120.15	127.3	CTAF 118.6	121.8

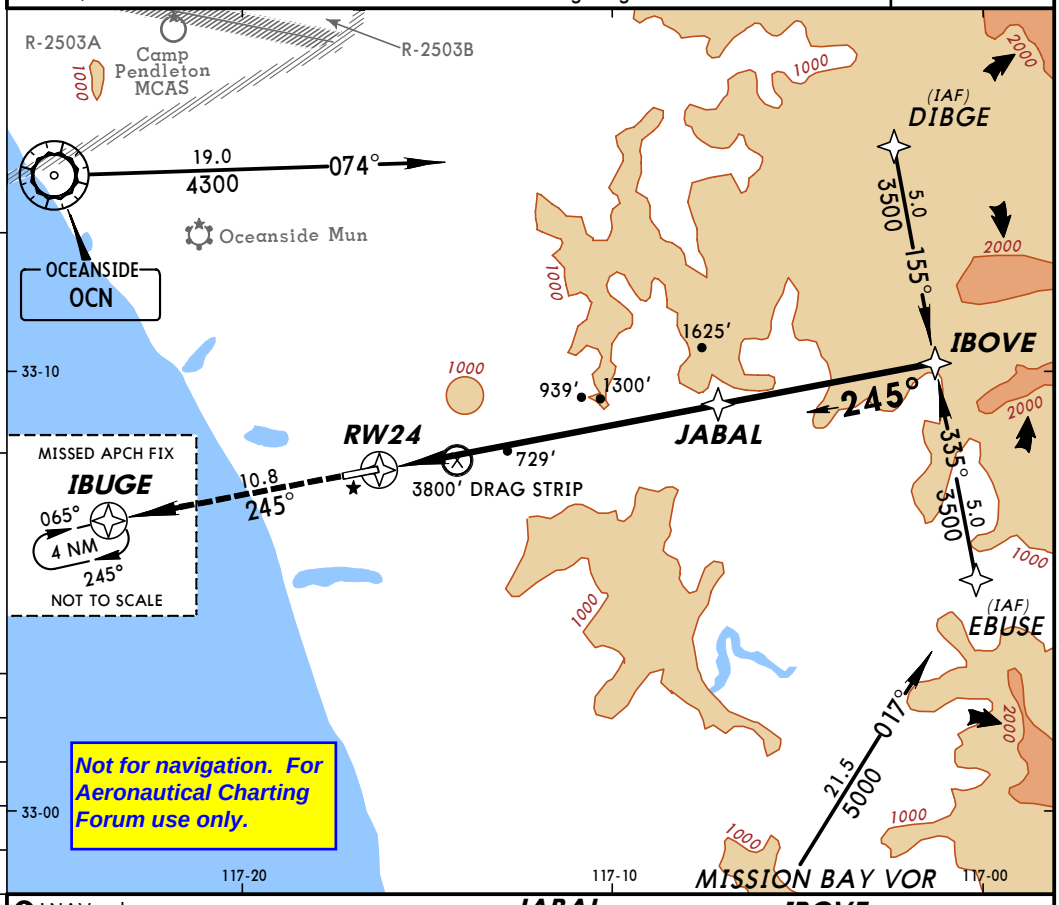
RNAV	Final Apch Crs	Minimum Alt	LNAV/VNAV DA(H)	Apt Elev 328′
	245°	JABAL 3100′ (2774′)	740′ (414)	TDZE 326′

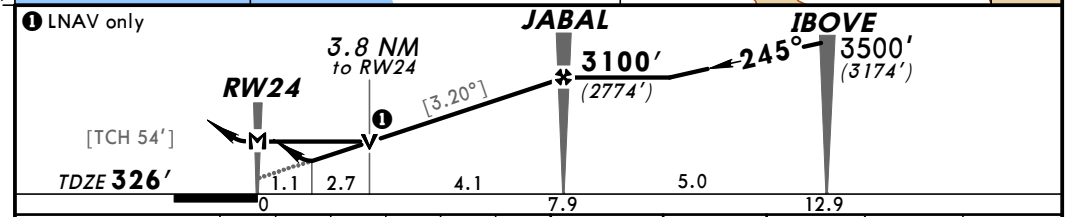
MISSED APCH: Climb to 2000′ via 245° course to IBUGE and hold.

1. CAUTION: 3800′ drag strip underlying final approach course may be mistaken for runway. 2. Baro-VNAV not authorized below -15°C (5°F). 3. GPS or RNP-0.3 required. 4. DME/DME RNP-0.3 not authorized. 5. Pilot controlled lighting 118.6.

7400′ MSA RW24

BRIEFING STRIP™





Gnd speed-Kts	70	90	100	120	140	160
Descent angle [3.20°]	396	510	566	679	793	906
MAP at RW24						

MALSR PAPI 2000′ via 245° IBUGE

STRAIGHT-IN LANDING RWY 24

	LNAV/VNAV DA(H) 740′ (414′) RAIL out	LNAV/VNAV DA(H) 740′ (414′) ALS out	LNAV MDA(H) 1660′ (1334′) RAIL out	LNAV MDA(H) 1660′ (1334′) ALS out
A	RVR 40 or ¾		RVR 60 or 1¼	
B			RVR 60 or 1¼	1½
C			2½	
D	NA		NA	

CIRCLE-TO-LAND

Max Kts	MDA(H)
90	1660′ (1332′) - 1¼
120	1660′ (1332′) - 1½
140	1660′ (1332′) - 3
D	NA

AMEND 0

CHANGES: New procedure.

KBWI
BALTIMORE-WASHINGTON INTL

JEPPESEN
22 DEC 00 (12-7)

BALTIMORE, MD
RNAV (GPS) Y Rwy 28

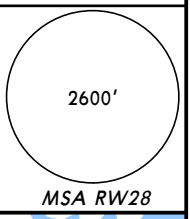
BRIEFING STRIP™

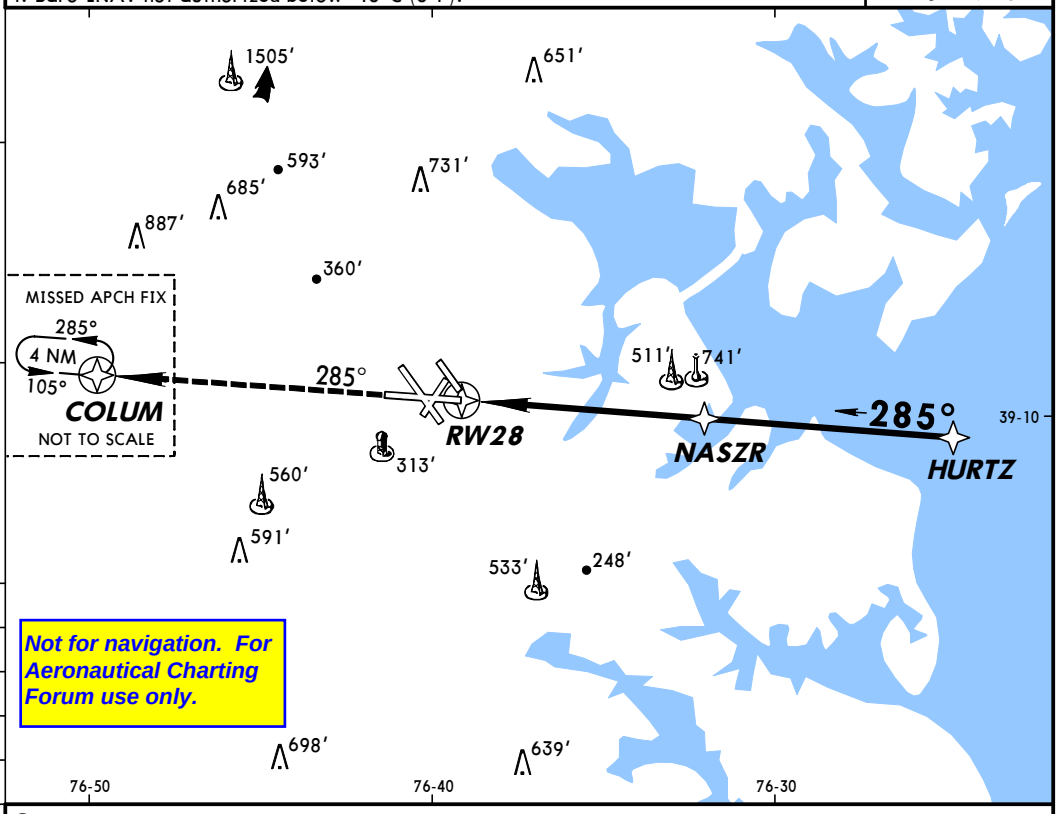
D-ATIS		BALTIMORE Approach (R)	BALTIMORE Tower	Ground
115.1	127.8	119.7	119.4	121.9

RNAV	Final Apch Crs	Minimum Alt NASZR	LNAV/VNAV DA(H)	Apt Elev 146′ TDZE 143′
	285°	2000′ (1857′)	440′ (297′)	

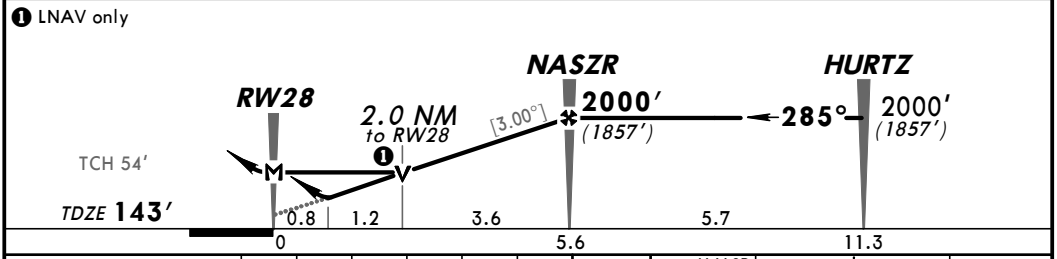
MISSED APCH: Climb to 2500′ via 285° course to COLUM and hold.

1. RADAR required. 2. GPS or RNP -0.3 required. 3. DME/DME RNP -0.3 not authorized. 4. Baro-LNAV not authorized below -15°C (5°F).





Not for navigation. For Aeronautical Charting Forum use only.



Gnd speed-Kts		70	90	100	120	140	160
Descent angle	3.00°	372	478	531	637	743	849
MAP at RW28							

MALSR
VASI
2500′ via 285° COLUM

STRAIGHT-IN LANDING RWY 28

	LNAV/VNAV DA(H) 440′ (297′)			LNAV MDA(H) 820′ (677′)			CIRCLE-TO-LAND	
		RAIL out	ALS out		RAIL out	ALS out	Max Kts	MDA(H)
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1	90	820′ (674′)-1
B							120	
C				1 1/2	2		140	820′ (674′)-2
D	RVR 50 or 1			1 3/4	2 1/4		165	820′ (674′)-2 1/4

AMND 0

CHANGES: Procedure identifier.

KBWI
BALTIMORE-WASHINGTON INTL

JEPPESEN 22 DEC 00 (12-8)

BALTIMORE, MD
RNAV (GPS) Z Rwy 28

D-ATIS		BALTIMORE Approach (R)	BALTIMORE Tower	Ground
115.1	127.8	119.7	119.4	121.9

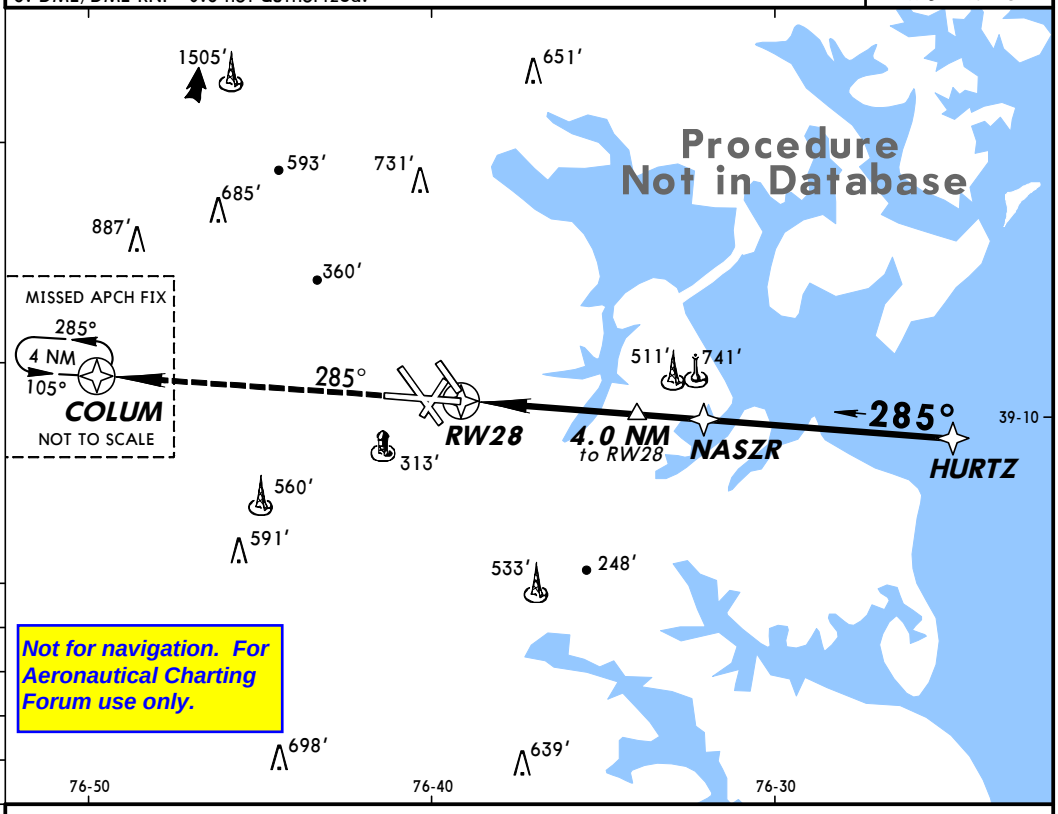
RNAV	Final Apch Crs	Minimum Alt NASZR	LNAV MDA(H)	Apt Elev 146′ TDZE 143′
	285°	2000′ (1857′)	460′ (317′)	

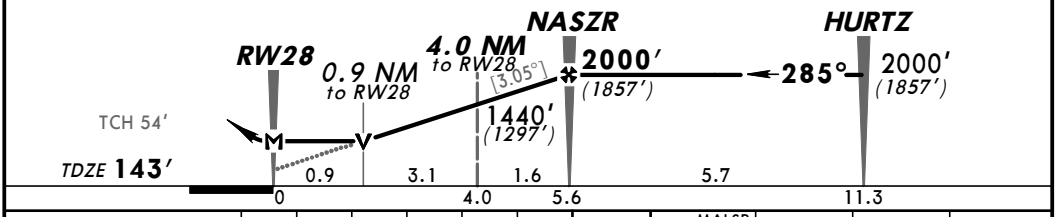
MISSED APCH: Climb to 2500′ direct COLUM and hold.

1. RADAR required. 2. GPS or RNP -0.3 required.
3. DME/DME RNP -0.3 not authorized.

2600′
MSA RW28

BRIEFING STRIP™





Gnd speed-Kts		70	90	100	120	140	160
Descent angle	3.05°	378	486	540	648	755	863
MAP at RW28							

MALSR
VASI
2500′
COLUM

STRAIGHT-IN LANDING RWY 28

	LNAV/VNAV	LNAV MDA(H) 460′ (317′)		
			RAIL out	ALS out
A	NA	RVR 24 or 1/2	RVR 40 or 3/4	RVR 50 or 1
B				
C				
D		RVR 50 or 1		

CIRCLE-TO-LAND

Max Kts	MDA(H)
90	640′ (494′) -1
120	
140	640′ (494′) -1 1/2
165	740′ (594′) -2

AMEND 0

CHANGES: Procedure identifier.

INITIAL DISCUSSION (Meeting 02-01): New issue presented by Mike Brown, AOPA, expressing concern that FAA policy is prohibiting stepdown fixes in the final approach segment (FAS) when a RNAV approach is published with both LNAV and LNAV/VNAV minima. The absence of a stepdown fix for the LNAV only procedure can result in significantly increased MDAs thereby penalizing the low end user. Mike recommends that stepdown fixes should be incorporated in RNAV procedure design when TERPS criteria allows and offered two recommendations for consideration; 1) publish a single chart incorporating the stepdown fix with two lines of minima, or 2) publish separate LNAV and LNAV/VNAV approach charts. The consensus of the group is that FAS step-down fixes provide a benefit and should be included where allowed by criteria. Norm LeFevre, AFS-420, will work with Brad Rush, AVN-160, to develop policy to mitigate the issue. ACTION: AFS-420 & AVN-160.

MEETING 02-02: Tom Schneider, AFS-420, led the discussion on this issue. The group consensus was that stepdown fixes should be developed for LVAN/VNAV procedures with LNAV minima when lower LNAV minimums may be achieved. All agreed that publishing a single procedure with stepdown fix is preferable to publishing two procedures with alphabetical suffixes. Steve Bergner supported publishing these fixes as ATD only without names. Jim Terpstra, Jeppesen, recommended the fixes be named. Bill Hammett, AFS-420 (ISI), suggested that CNFs be used in lieu of pronounceable names. Jim agreed that this would be acceptable. Jim also stated that LNAV/VNAV users could ask database developers to strip the stepdown fix from the string. He also stated that stepdown fix altitudes must specify at-or-above altitudes and not provide steeper descent gradients inside the stepdown fix wherever possible. Kevin Comstock, ALPA, questioned if LNAV would be impacted; Jim assured him it would not. AFS-420 and AVN-160 will jointly work policy issues for Order 8260.19. The consensus was that the issue could be closed. ITEM CLOSED.
