DEDICATED TO HELPING BUSINESS ACHIEVE ITS HIGHEST GOALS.

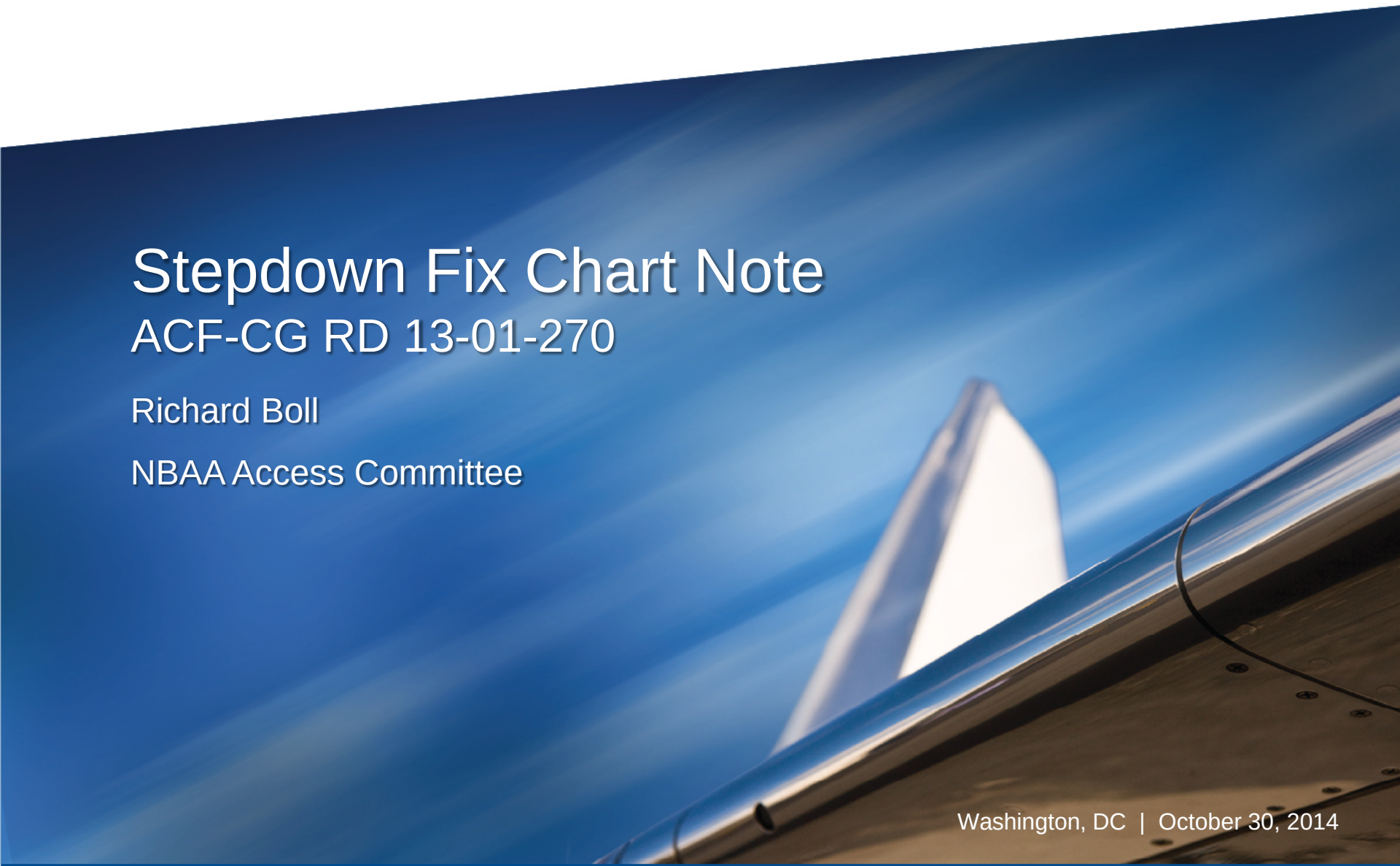
NBAA

# Stepdown Fix Chart Note

## ACF-CG RD 13-01-270

Richard Boll

NBAA Access Committee

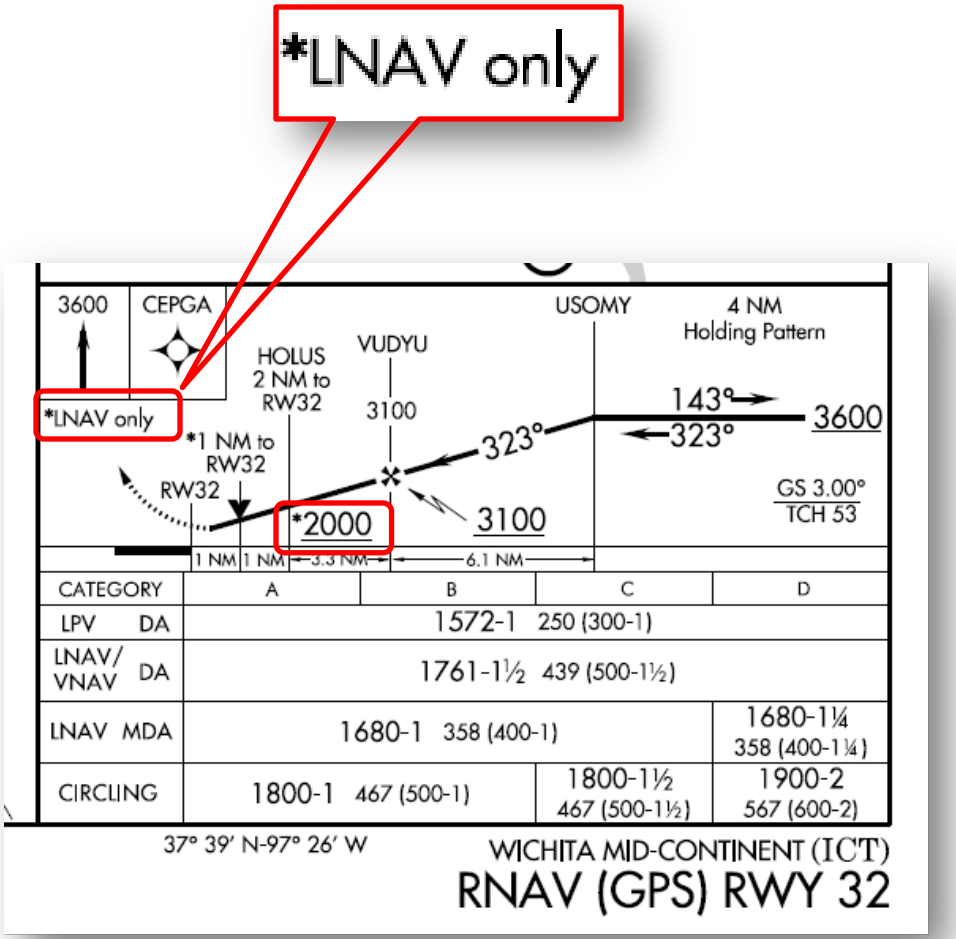


Washington, DC | October 30, 2014

# Stepdown Fix Chart Note
# ACF-CG RD 13-01-270

- Introduced by AIR 130 in April 2013
- Concerned the “LNAV only” note on the instrument approach profile view

“*Many interpret this note as the Stepdown fix only applies to the LNAV line of minima. In actuality, the Stepdown fix applies to both the LNAV and LNAV/VNAV lines of minima due to certain avionics limitations; in particular because baro-VNAV can be used on an approach with LNAV/VNAV minima*.”



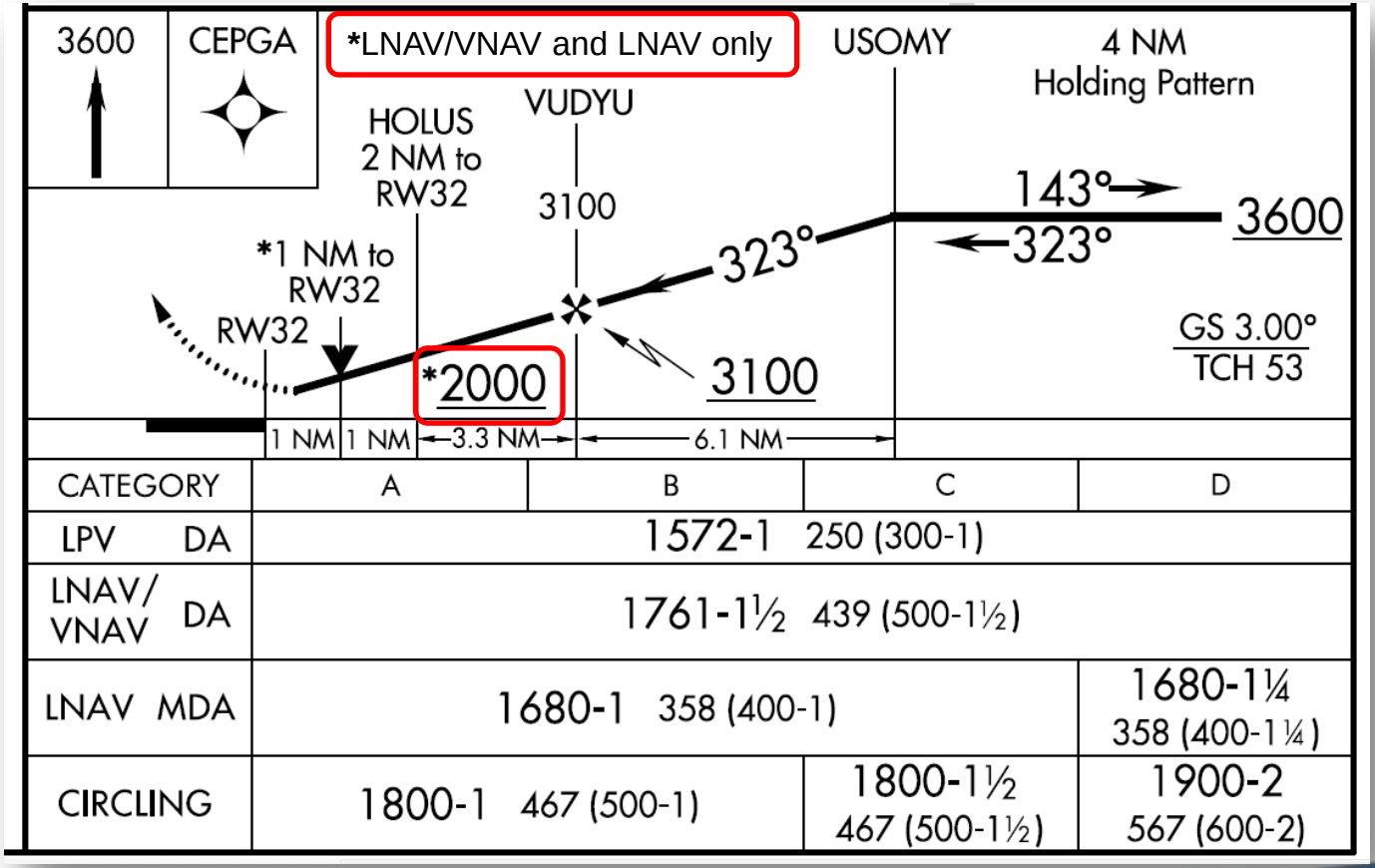
# Stepdown Fix Chart Note

## ACF-CG Action

- US IFPP decision to change Note from “LNAV only” to “LNAV/VNAV and LNAV only”
- Changes will be reflected:
  - AIM update scheduled for publication in January 2015
  - Next update of FAA Order 8260.19, Flight Procedures & Airspace
- Note will be applied either through amendment or P-NOTAM

# Stepdown Fix Chart Note

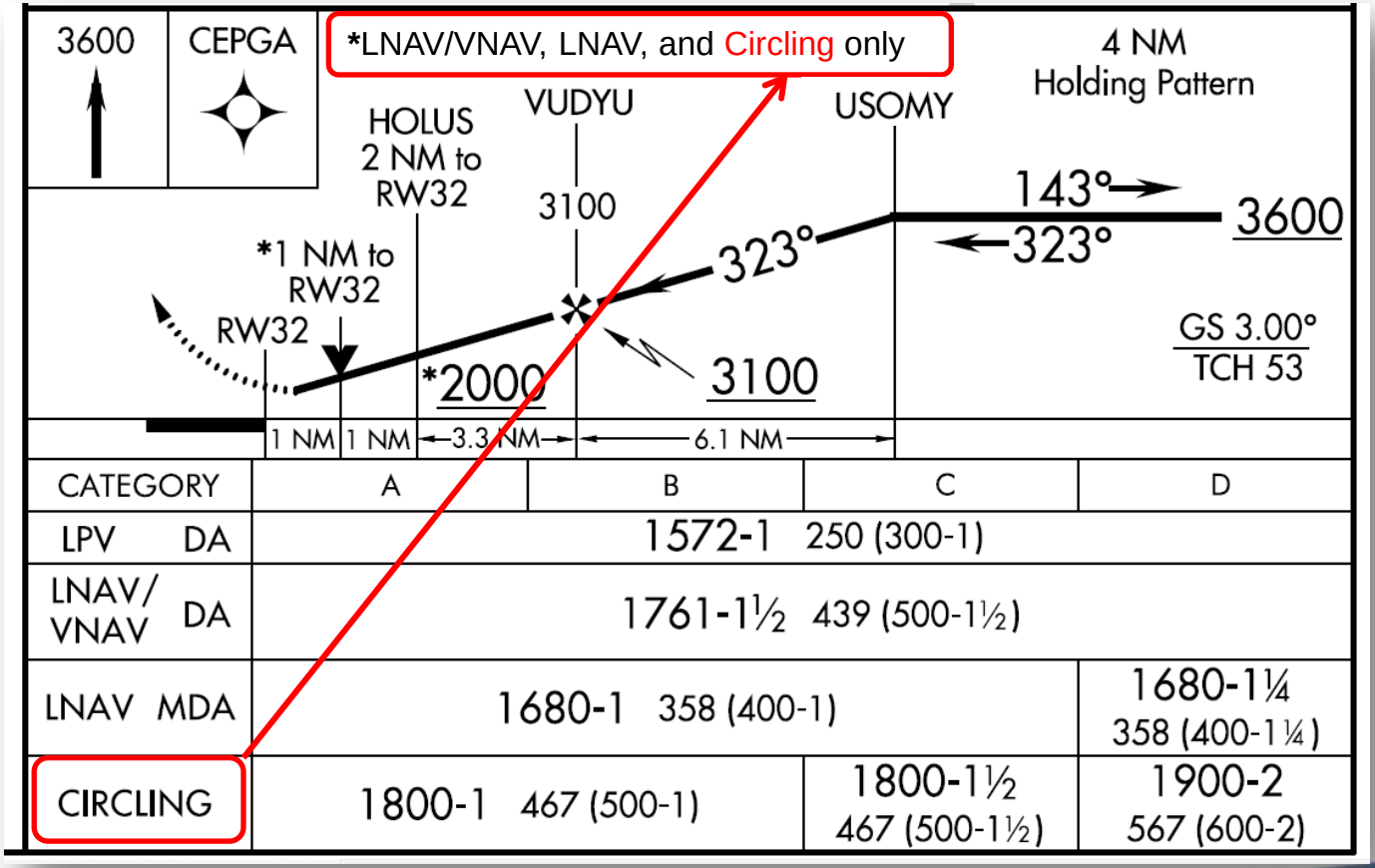
## Revised Note




| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| LPV DA | 1572-1 250 (300-1) | | | |
| LNAV/ VNAV DA | 1761-1½ 439 (500-1½) | | | |
| LNAV MDA | 1680-1 358 (400-1) | | | 1680-1¼ 358 (400-1¼) |
| CIRCLING | 1800-1 467 (500-1) | | 1800-1½ 467 (500-1½) | 1900-2 567 (600-2) |

# Stepdown Fix Chart Note

## Must Also Include “Circling” In The Note



# LNAV/VNAV Minima

## Vertically-Guided Approach

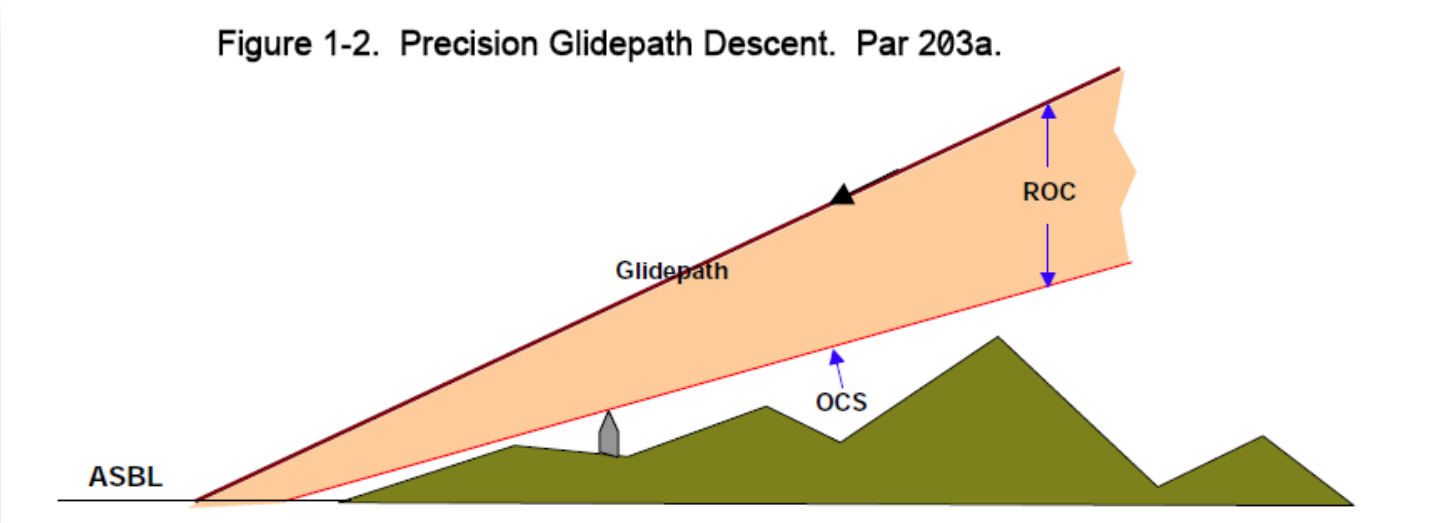
***3.0 General.***

*An LNAV/VNAV approach is a vertically-guided approach procedure using Baro-VNAV or WAAS VNAV for the vertical guidance. Obstacle evaluation is based on the LNAV OEA dimensions and Baro-VNAV OCS. The actual vertical path provided by Baro-VNAV is influenced by temperature variations…*

**Ref FAAO 8260.58, Volume 6, Paragraph 3**

# Vertically Guided Approaches

## ILS S/I, LPV, LNAV/VNAV Minima



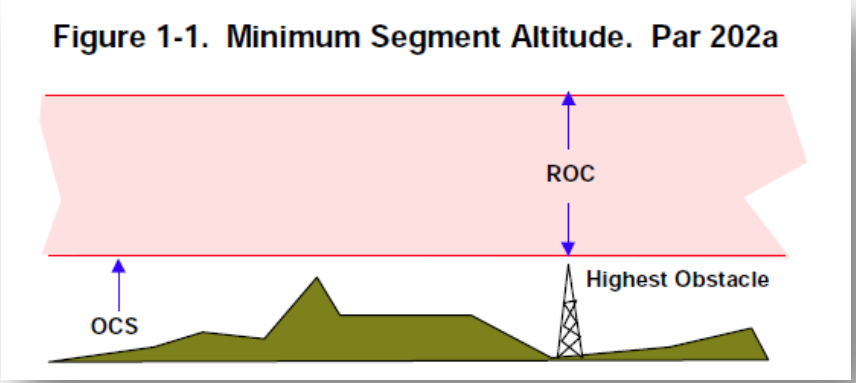

Sloping Obstacle Clearance Surface

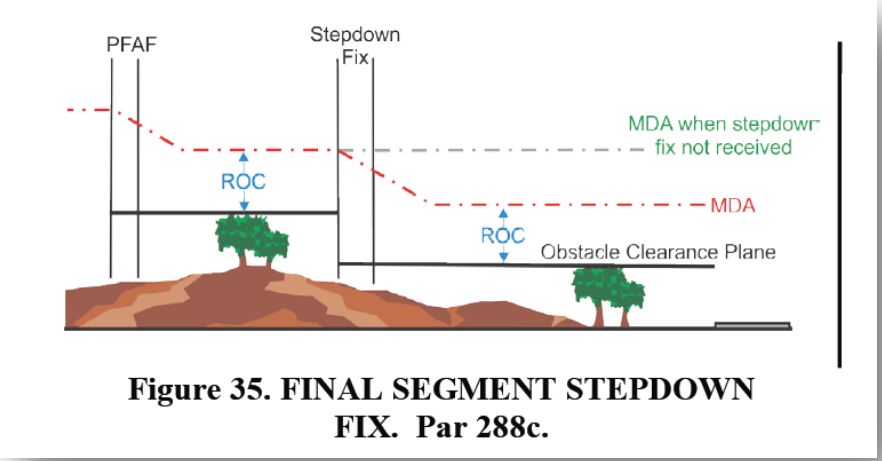
**Ref: FAA Order 8260.3B TERPS**

# Non-Vertically Guided Approaches

## S/I NPA, LNAV, LP, & Circling Minima

### Level Obstacle Clearance Surface



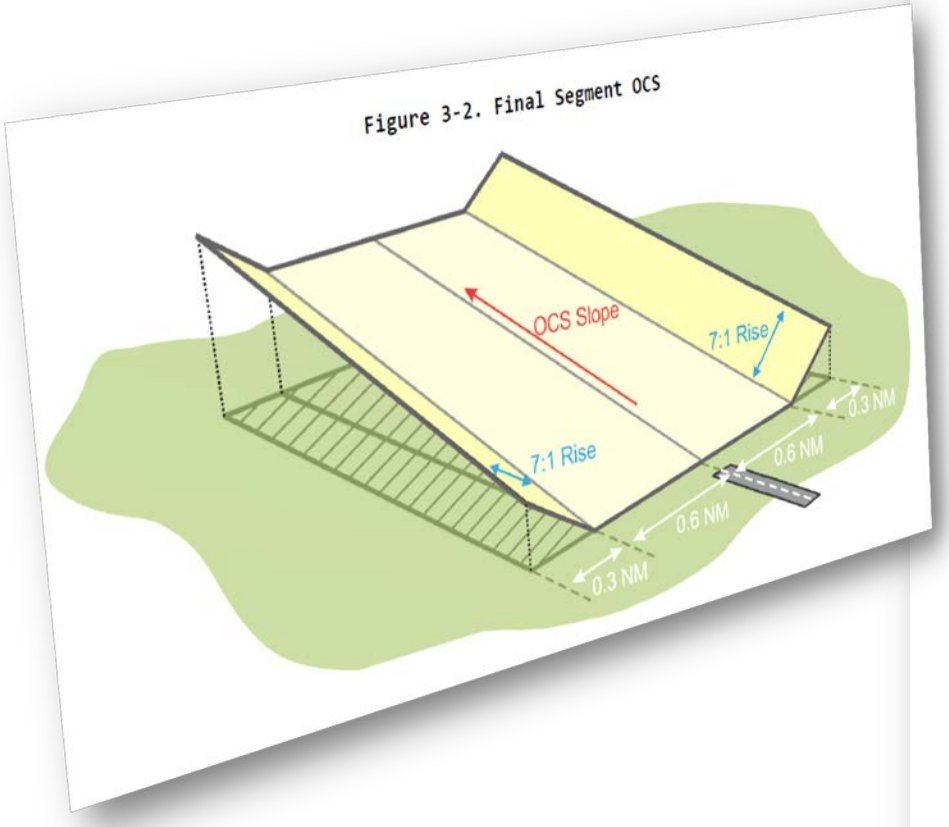



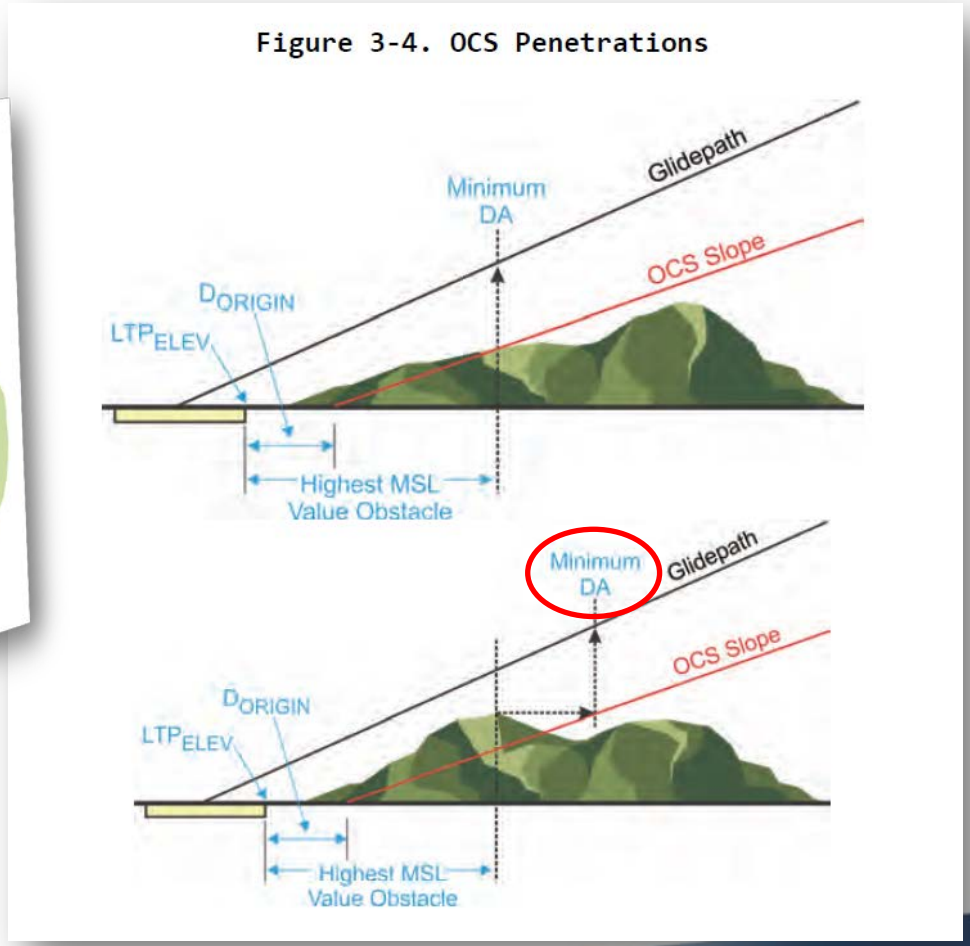

ROC Is Dependent On The Facility/System Providing Navigation Guidance

**Ref: FAA Order 8260.3B TERPS**

# Vertically Guided Approaches

## LNAV/VNAV Minima




**FAA Order 8260.58 Volume 6, Chapter 3**

# Vertically Guided Approaches

## LNAV/VNAV Minima

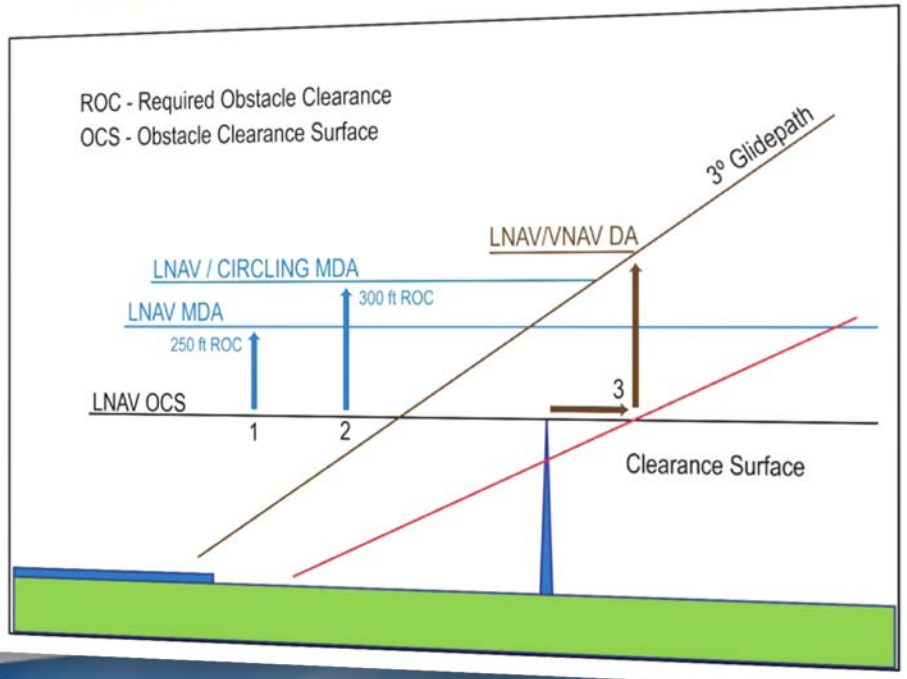
| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| LPV DA | 558/24 250 (300 – ½) | | | |
| LNAV/VNAV DA | 1572 – 5 1264 (1300 – 5) | | | |
| LNAV MDA | 1180 / 24 872 (900 – ½) | 1180 / 40 872 (900 – ¾) | 1180 / 2 872 (900 – 2) | 1180 / 2 ¼ 872 (900 – 2 ¼) |
| CIRCLING | 1180 – 1 870 (900 – 1) | 1180 – 1 ¼ 870 (900 – 1 ¼) | 1180 – 2 ½ 870 (900 – 2 ½) | 1180 – 2 ¾ 870 (900 – 2 ¾) |

**1572 – 5** 1264 (1300 – 5)

**1180 / 2**
872 (900 – 2)

*FIG 5–4–12*

**Explanation of LNAV and/or Circling Minima Lower than LNAV/VNAV DA**



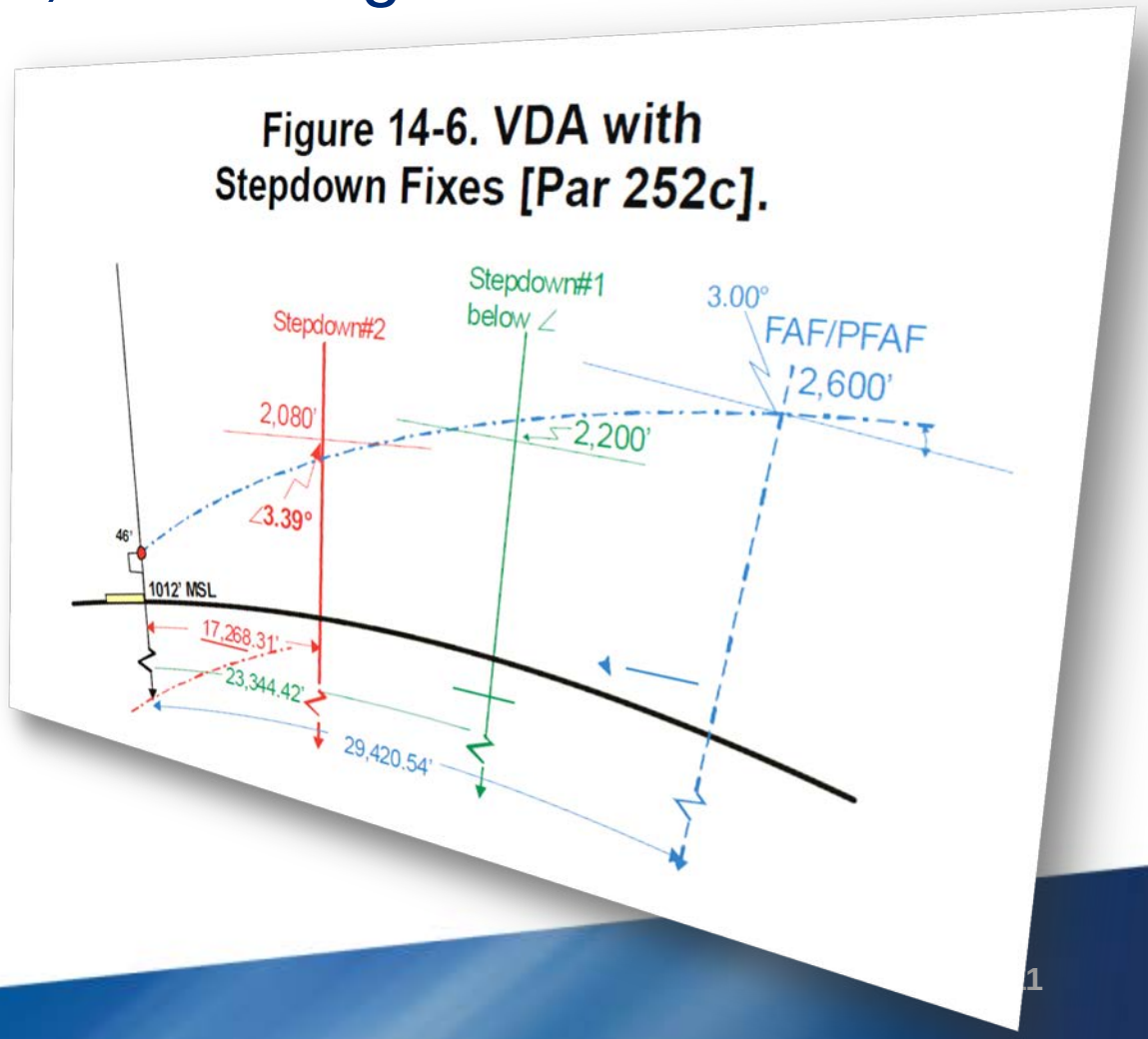

**Ref: AIM 5–4–5. Instrument Approach Procedure Charts**

# Non-Vertically Guided Approaches

## S/I NPA, LNAV, LP, & Circling Minima

**Stepdown Fixes (with FAF procedures and/or procedures published without PA/APV minima)**

*When stepdown fix location(s) cannot be modified, change the FAF/PFAF location or raise the FAF/PFAF altitude until stepdown fix(es) are at or below the vertical path of the VDA (must not exceed the maximum angle)*

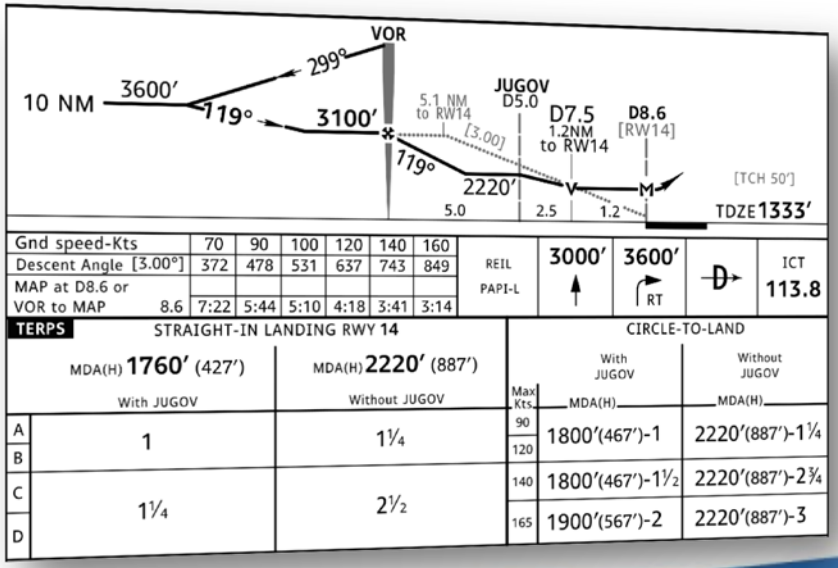


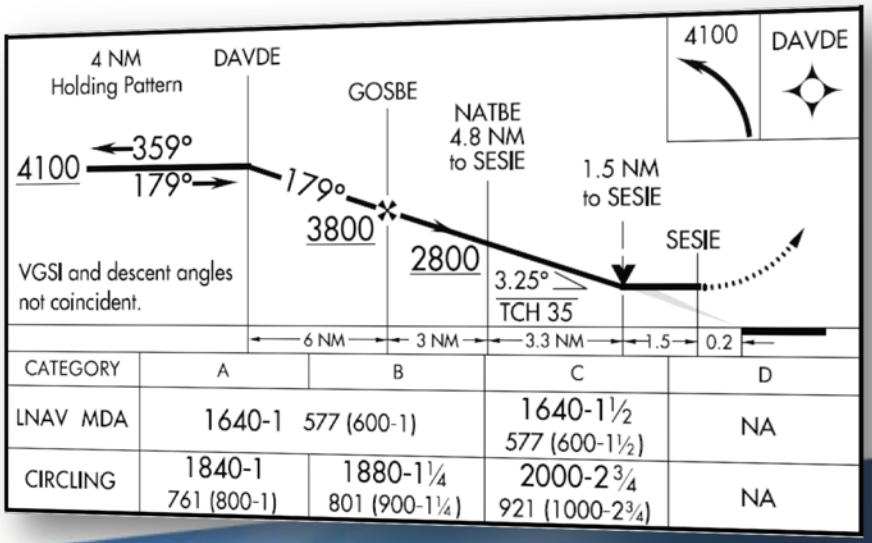

**Ref: FAA Order 8260.3B Vol1, Para. 252c**

# VDA on Non-Precision Approaches

## MDA (H) Minima

- VDA based on Baro-VNAV is advisory only
- Compliance with Stepdown fix altitude by reference to barometric altimeter **is mandatory**
- Industry is in agreement on this point



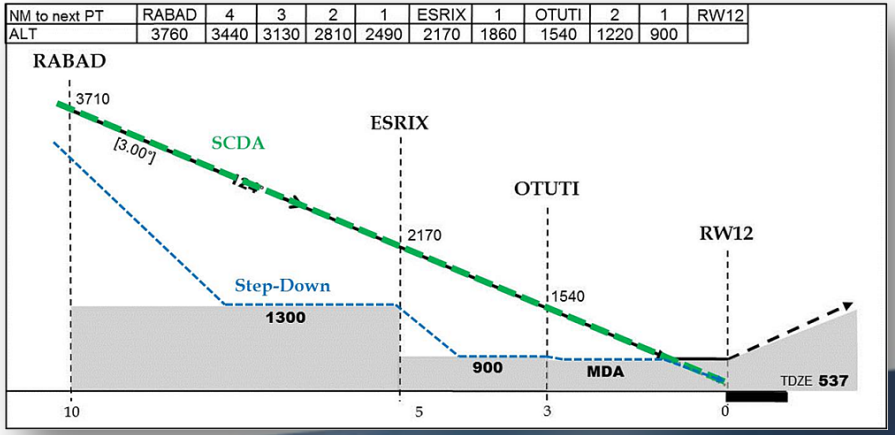



# Why Is This Important?

# Approach & Landing Accident Reduction

## Constant Descent Final Approach

- 37% of 76 approach & landing accidents/incident & 57% of CFIT accidents/incidents occurred during step-down non-precision approaches*
- Approximately 70% of rushed and unstable approaches involve an incorrect management of the descent-and-approach profile and/or energy level (i.e., being slow and/or low, being fast and/or high) #
- Development of approach design criteria supporting “Constant Descent Final Approach (CDFA)
- Eliminate “Drive & Drive”
- Promote:
  “Stabilized Approach Concept”
- LNAV/VNAV Minima supports this effort




***FlightSafety Foundation ALAR Briefing Note 7.2**

**#Airbus Flight Operations Briefing Notes: FSF ALAR Task Force Conclusions and Recommendations**

# How Should Pilots Apply Stepdown Fixes (SDF) Altitudes Using LNAV/VNAV Minima?

How does the pilot manage automation?

- Use LNAV and VNAV guidance?
- Set to the stepdown fix altitude in the preselector to ensure that the aircraft does not descend below the SDF altitude?
- Use vertical speed (VS) mode down to SDF altitude, then engage VNAV?
- Pilot workload?

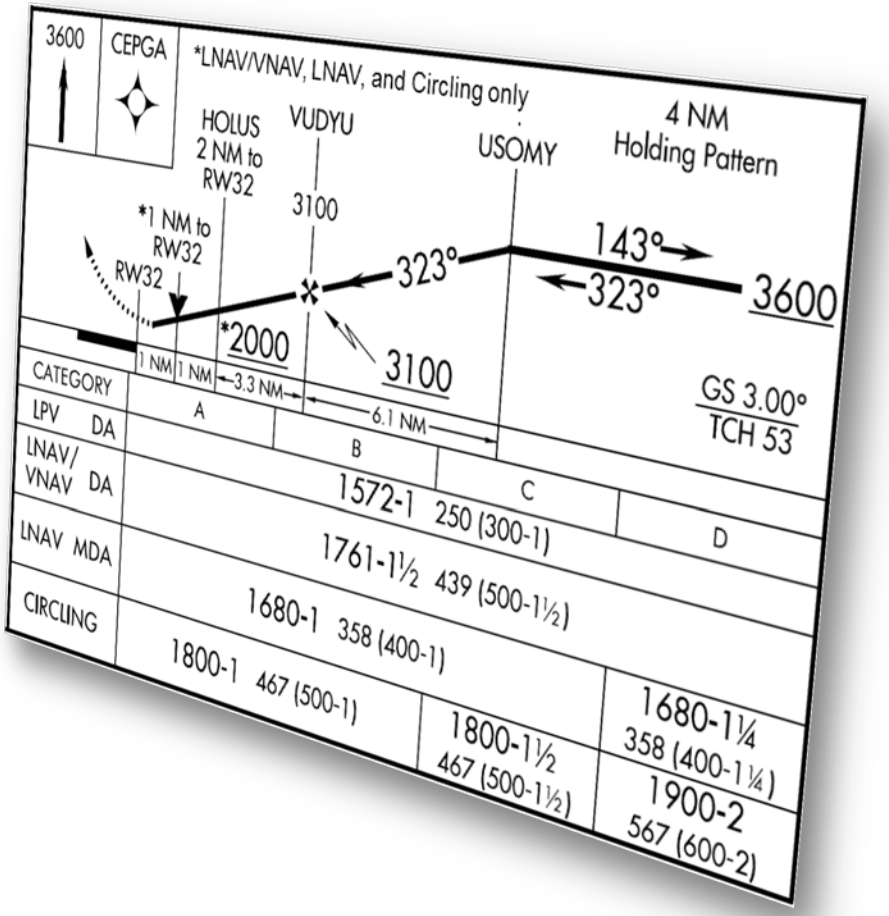
How does the pilot determine if they might go below the SDF altitude?

Actions to take:

- Manually take control?
- Revert to other automation modes?

Impact on stabilized approach?

Increased risk of accident/incident?



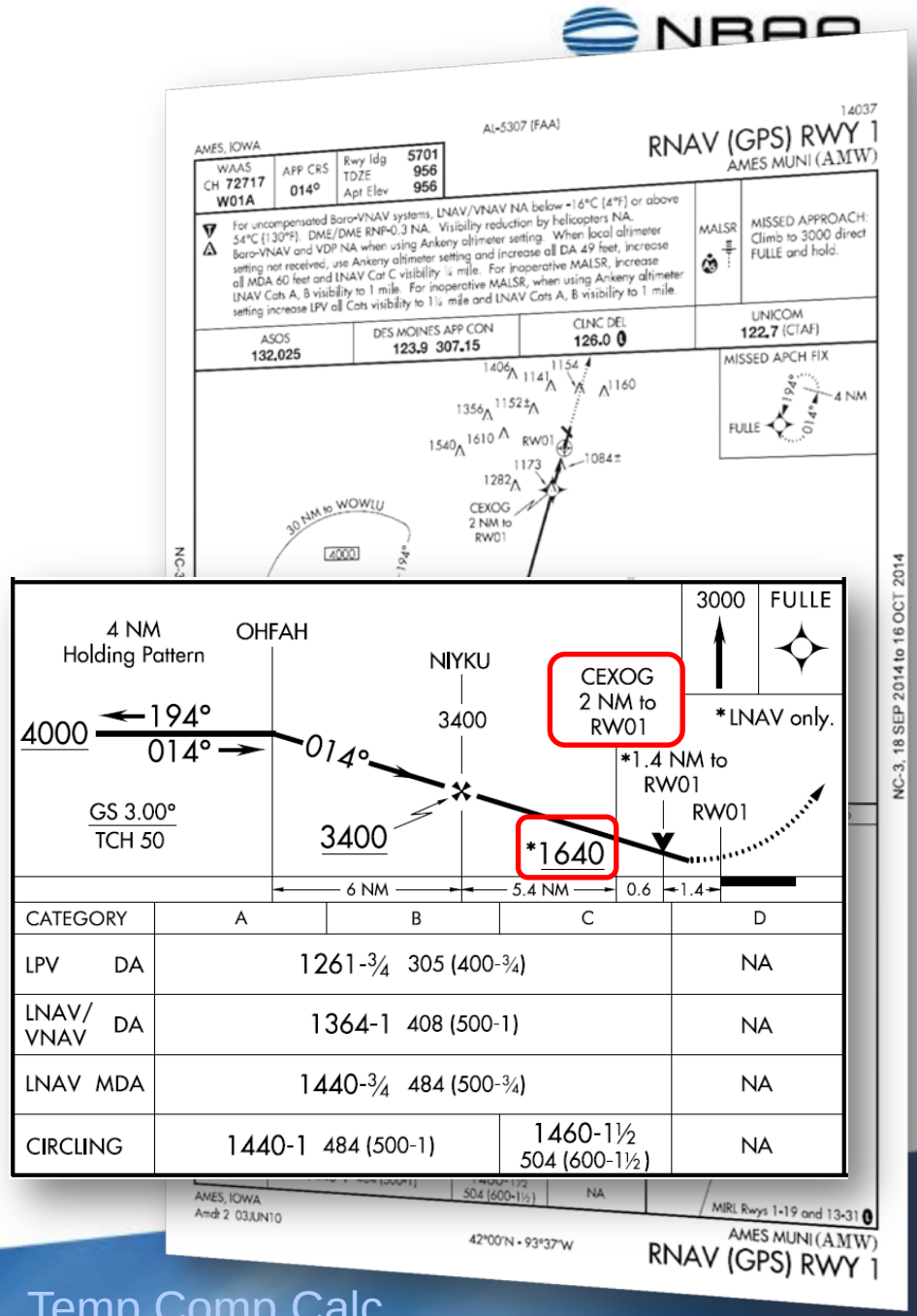
# Cold Temperature & Non-Temp compensated VNAV systems Ref (ACF-CG 92-02-110)

Cold temperature compensation raises stepdown fix altitudes

Example: Ames, IA RNAV (GPS) Rwy 1 approach

- Temp = - 10C
- CEXOG SDF height above airport = 648’
- Cold Temperature Compensation = 68’
- CEXOG temperature compensated crossing altitude = 1708’

What actions does the pilot take when approaching CEXOG on non-temperature compensated Baro-VNAV path?



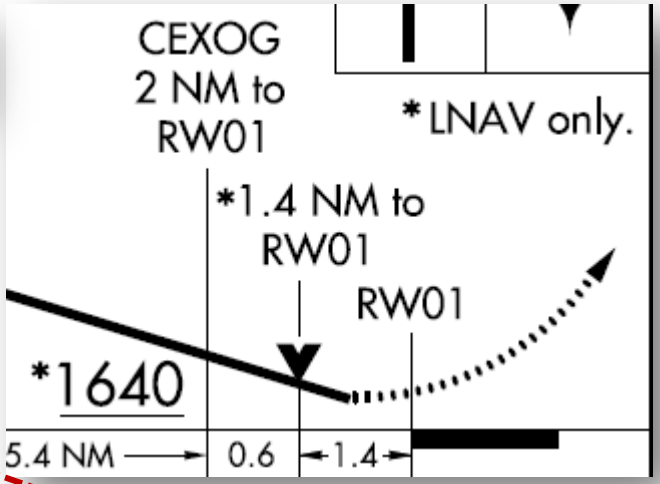

Temp Comp Calc

# Pilot Actions?

## VNAV Path Below Stepdown Fix Altitude

T
A

For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -16°C (4°F) or above 54°C (130°F). DME/DME RNP-0.3 NA. Visibility reduction by helicopters NA. Baro-VNAV and VDP NA when using Ankeny altimeter setting. When local altimeter





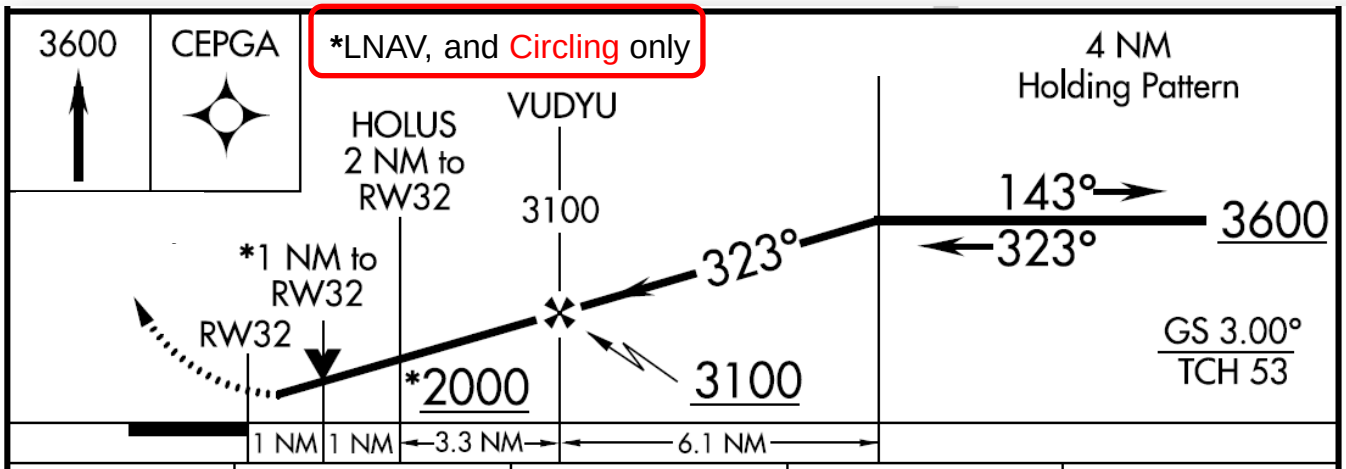


| | | | |
|---|---|---|---|
| LNAV/ VNAV | DA | 1364-1 408 (500-1) | NA |
| LNAV | MDA | 1440-¾ 484 (500-¾) | NA |

# Options….

# Remain “Status Quo”

## Retain Existing Note & Add “Circling”



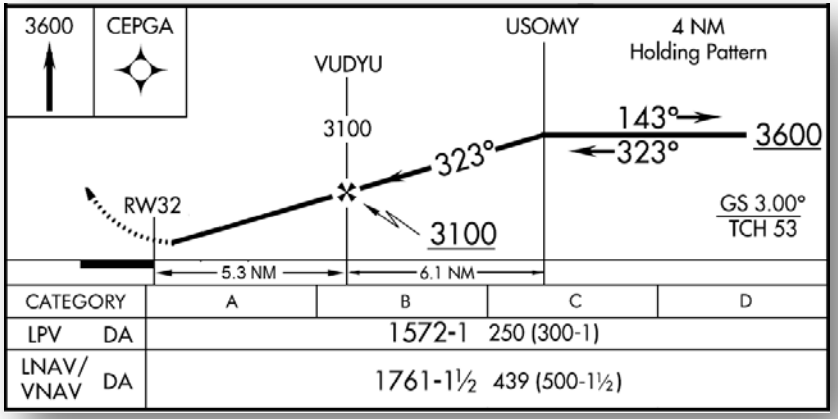

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| LPV DA | 1572-1 250 (300-1) | | | |
| LNAV/ VNAV DA | 1761-1½ 439 (500-1½) | | | |
| LNAV MDA | 1680-1 358 (400-1) | | | 1680-1¼ 358 (400-1¼) |
| CIRCLING | 1800-1 467 (500-1) | | 1800-1½ 467 (500-1½) | 1900-2 567 (600-2) |

# Separate Charts

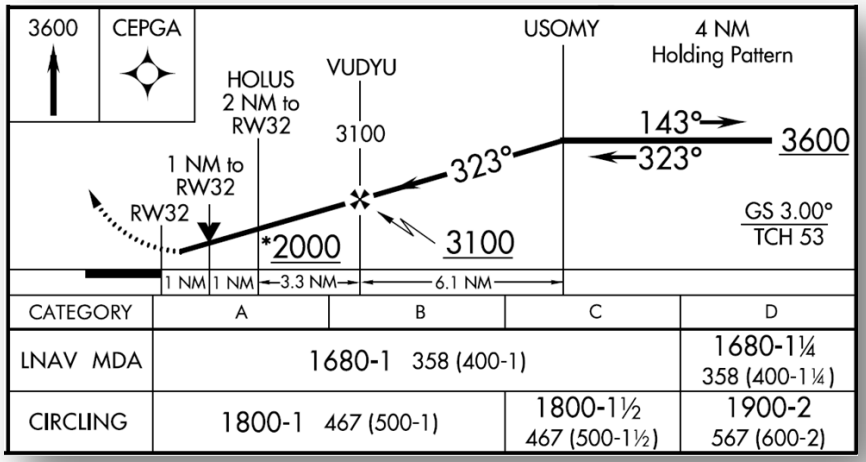
## Vertically Guided Approaches & Non-Vertically Guided Approaches

*Note 2: Do not establish altitude restrictions at fixes located between the PFAF and RWT on vertically guided approach procedures unless they are applicable to a non-vertically guided procedure* ***published on the same approach chart****.*

RNAV (GPS) **X** Rwy ##




RNAV (GPS) **Y** Rwy ##




**FAA Order 8260.19, Chapter 6, Section 8-6, Paragraph 8-6-3 d**

# Criteria Change

## Is LNAV/VNAV $10^{-5}$ OCS Criteria Compatible With A $10^{-3}$ System?

- Baro-VNAV is a $10^{-3}$ system. Driver behind AC 20-138D required AFM Statement:

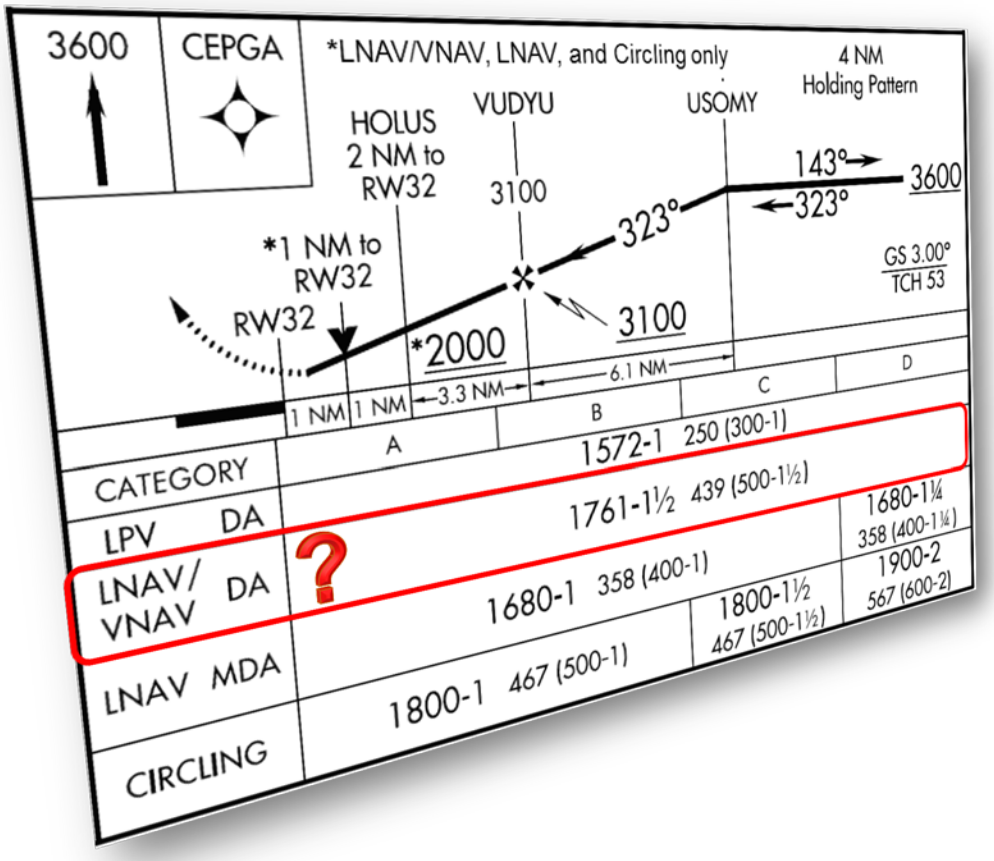
  "*When using the <insert name> VNAV system, the barometric altimeter must be used as the primary altitude reference for all operations; including instrument approach procedure step-down fixes*."

- If adequate:
  - Revise AC 20-138D. Remove any reference to applicability of stepdown fixes to LNAV/VNAV minima in paragraph 12-8
  - Retain existing note
- If inadequate:
  - Revise LNAV/VNAV OCS criteria in FAA Order 8260.58, or
  - Add mitigation. For example, on approaches with stepdown fixes in the final approach segment add limitation "Baro-VNAV NA"

**Ref: AC 20-138D Airworthiness Approval of Positioning and Navigation Systems**

# Removal of LNAV/VNAV Minima

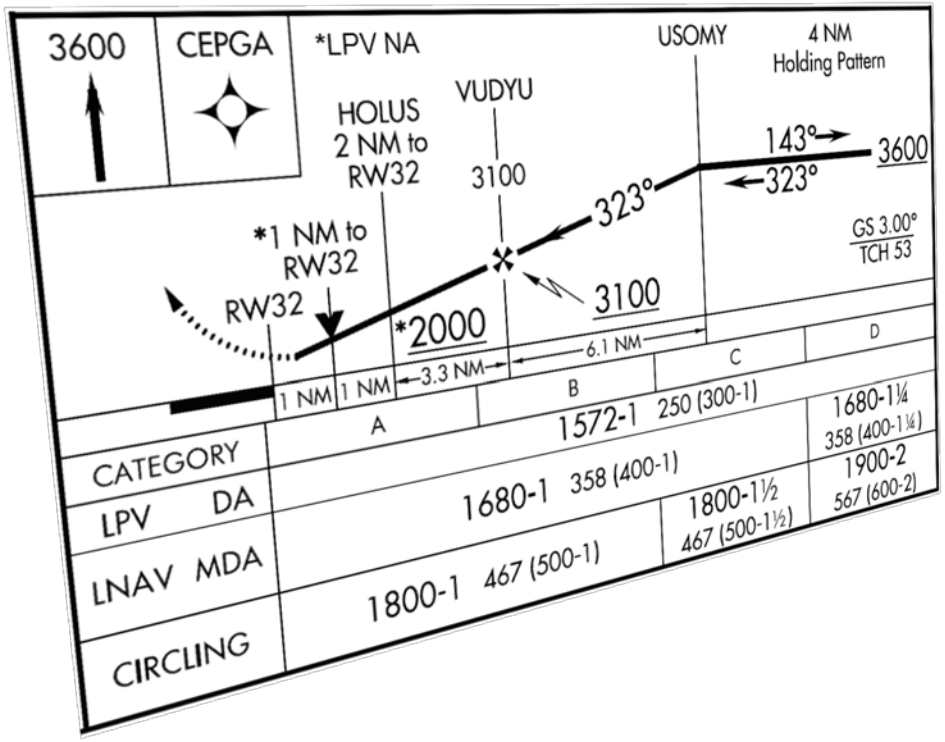
## Stepdown Fixes in the Final Approach Segment (FAS)




- Baro VNAV often used to fly to LNAV/VNAV minima
- LNAV minima already requires compliance with the stepdown fix altitude when Baro-VNAV is used
- SBAS/WAAS aircraft will use LPV minima if LOS permits
- If stepdown fix altitude is mandatory with LNAV/VNAV minima, what purpose does this line of minima serve?

# Removal of LNAV/VNAV Minima

## Stepdown Fixes with LNAV/VNAV minima




- Are we better served by removing LNAV/VNAV minima on those approaches with stepdown fixes in the final approach segment?
- LNAV minima retain VNAV with the published Vertical Descent Angle for ***advisory use only!***
- Eliminates confusion of stepdown fix applicability
- Reduces chart clutter

# NBAA Requested Actions

- Suspend action to amend chart note
- Short Term: Establish an FAA/Industry working group to identify, evaluate, and select suitable options to address the current issue
- Long-term: AFS to work with AIR to establish appropriate criteria within TERPS supporting continued use of LNAV/VNAV minima that reflect existing certification criteria respective to approach Baro-VNAV

NBAA

# DEDICATED TO HELPING BUSINESS ACHIEVE ITS HIGHEST GOALS.

National Business Aviation Association 1200 18th Street NW, Suite 400 Washington, DC 20036 (202) 783-9000 www.nbaa.org

# Ames IA Temp Compensation

| Iowa | | | |
|---|---|---|---|
| KALO | Waterloo Regional Airport | -35C/-31F | X |
| KAMW | Ames Muni | -26C/-15F | X |
| KBRL | Southeast Iowa Rgnl | -28C/-18F | X |
| KDBQ | Dubuque Rgnl | -34C/-29F | X |
| KIIB | Independence Muni | -30C/-22F | X |
| KIKV | Ankeny Rgnl | -26C/-15F | X |
| KSPW | Spencer Muni | -31C/-24F | X |

4/3/1¼

*TBL 7-2-3*

**ICAO Cold Temperature Error Table**

**Height Above Airport in Feet**

| Reported Temp °C | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1500 | 2000 | 3000 | 4000 | 5000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +10 | 10 | 10 | 10 | 10 | 20 | 20 | 20 | 20 | 20 | 30 | 40 | 60 | 80 | 90 |
| 0 | 20 | 20 | 30 | 30 | 40 | 40 | 50 | 50 | 60 | 90 | 120 | 170 | 230 | 280 |
| −10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 150 | 200 | 290 | 390 | 490 |
| −20 | 30 | 50 | 60 | 70 | 90 | 100 | 120 | 130 | 140 | 210 | 280 | 420 | 570 | 710 |
| −30 | 40 | 60 | 80 | 100 | 120 | 140 | 150 | 170 | 190 | 280 | 380 | 570 | 760 | 950 |
| −40 | 50 | 80 | 100 | 120 | 150 | 170 | 190 | 220 | 240 | 360 | 480 | 720 | 970 | 1210 |
| −50 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 450 | 590 | 890 | 1190 | 1500 |

***EXAMPLE–***

*Temperature–10degrees Celsius, and the aircraft altitude is 1,000 feet above the airport elevation. The chart shows that the reported current altimeter setting may place the aircraft as much as 100 feet below the altitude indicated by the altimeter.*