

ACF Charting Forum

Step-Down Fix Issue/Note

Presented to: Charting Forum

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Date:



Federal Aviation
Administration



Step-Down Fix Chart Notation Issue

- RNAV (GPS) approaches can have minima for 2D and 3D operations (LNAV, LNAV/VNAV, LPV).
 - Using step-down fixes in the final approach segment can lower the 2D LNAV minimums.

Problem Statement

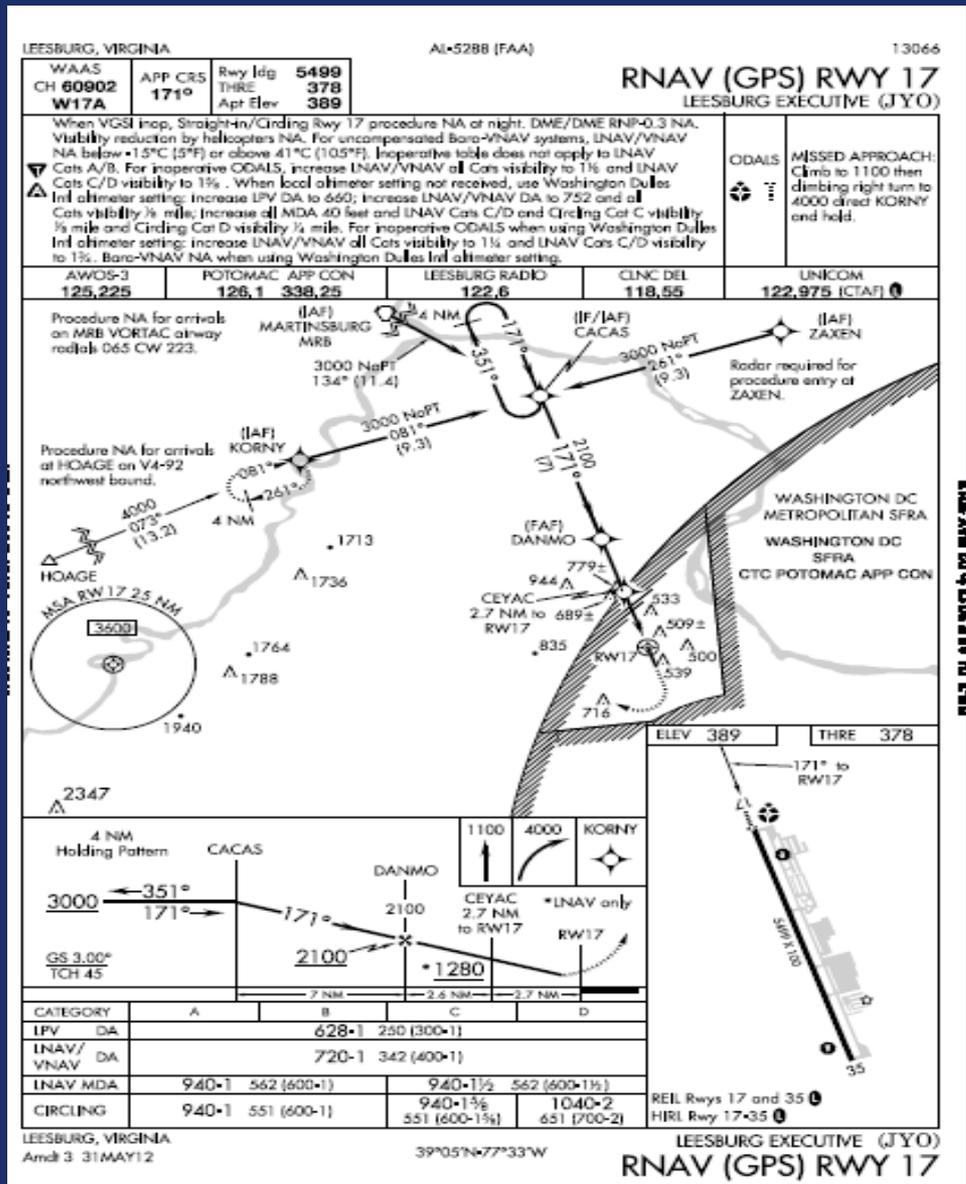
- **Profile view chart notation (*LNAV only) implies step-down fixes only apply to LNAV line of minima.**
 - This can be misinterpreted by aircrew and some procedure designers as not applicable to LNAV/VNAV.



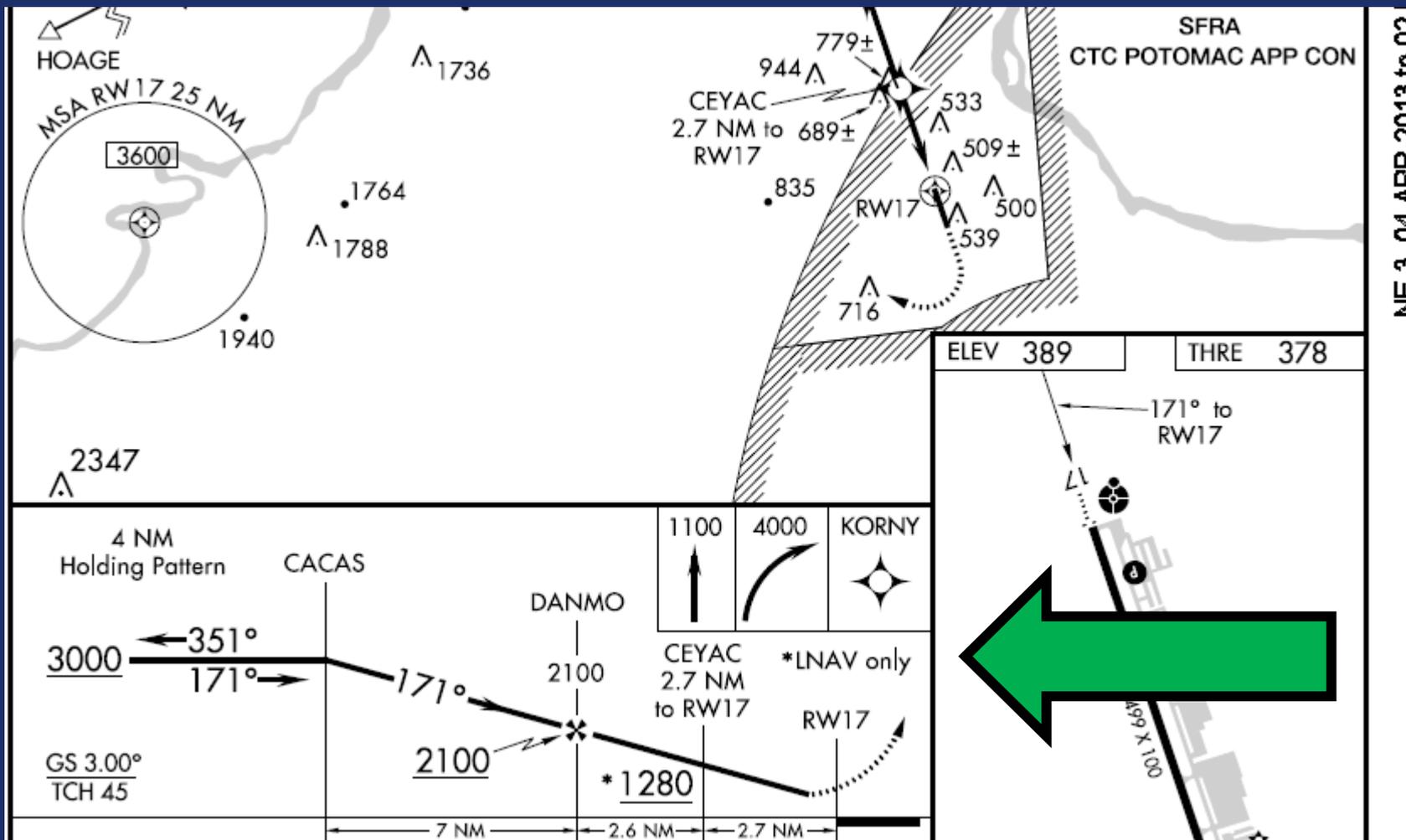
Sample Chart

Profile view at CEYAC states

*LNAV Only



Step Down Fix example



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Step-Down Fix Chart Notation Con't

- **All 3D lines of minima are not the same.**
 - LPV is equivalent to ILS.
 - LNAV/VNAV is not.
- **All 3D vertical guidance is not the same.**
 - SBAS provides geometric guidance.
 - Baro-VNAV does not.
 - SBAS supports 10^{-5} operation without mitigations.
 - Baro-VNAV does not.
- **Both SBAS and baro-VNAV can be used for LNAV/VNAV.**



Baro-VNAV Issue

- **Baro-VNAV systems are required to have the following AFM(S) limitation:**
“When using the *<insert name>* VNAV system, the barometric altimeter must be used as the primary altitude reference for all operations.” [emphasis added]
- AC 20-129, Sep 12, 1988; Appendix 2, Pg 3, sample flight manual supplement limitations section.
- **The limitation is an operational mitigation because baro-VNAV is a 10^{-3} system.**
 - For 10^{-3} systems, misleading information is probable.
 - This is why RNP AR requirements for baro-VNAV include a more stringent vertical error budget.



Baro-VNAV Issue Con't

- **Operators/pilots are increasingly treating baro-VNAV vertical guidance as equivalent to ILS.**
 - Increasing aircraft automation, displays (looks like a duck, quacks like a duck).
 - “New” RNAV(GPS) LNAV/VNAV minima.
 - Baro-VNAV previously used only for “advisory” purposes.
 - Losing awareness of AFM(S) limitation.
 - Chart note implies step-down fix does not apply to LNAV/VNAV (*LNAV only).



LNAV/VNAV Step-Down Fix

- OCS surfaces commensurate with 10^{-5} operation.
- Current design criteria permits placing a step-down fix at the bottom of the OCS.
- It is possible for baro-VNAV to provide a misleading glidepath that takes the aircraft below the step-down fix altitude.
 - Baro-VNAV is 10^{-3} system used for a 10^{-5} operation.



LNAV/VNAV SDF Con't

- **Navigation system along-track errors can combine with baro-VNAV system errors.**
- **Misleading glidepath can place aircraft in compromised vertical position without alert.**
 - Aircraft separation from obstacle may not meet desired level of safety.
- **Mitigated by aircrew using the barometric altimeter for compliance with all altitude restrictions**
 - Includes step-down fixes.



Simple Charting Revision

- **Change step-down fix note to:**

“ *N/A LPV ”

- Clearly states the step-down fix is not applicable to LPV.
 - Removes any doubt that step-down fix does apply to both LNAV and LNAV/VNAV.
 - No complicated segregation for SBAS vertical guidance versus baro-VNAV guidance.
- Reinforces baro-VNAV AFM(S) limitation (as intended) to use barometric altimeter as an operational mitigation.
- No other charting or criteria change needed.

