

**GOVERNMENT/INDUSTRY AERONAUTICAL CHARTING FORUM**  
**Instrument Procedures Group**  
**(Originally presented at ACF 92-02)**  
**HISTORY RECORD**

**FAA Control # 92-02-104**

**SUBJECT:** TERPS Paragraph 323a, Precipitous Terrain Additives

**BACKGROUND/DISCUSSION:** The drafters of the TERPS criteria intended that the nominal obstacle clearance in the segments of approach procedures be increased when significant precipitous terrain underlies any of the approach segments. The language contained in TERPS 323a is vague which has resulted in the general failure of the FAA to make allowances for precipitous terrain where such additives will adversely affect minimums. Two cases in point are the LOC/DME RWY 28L SIAP at Monterey, California and two procedures that approach Medford, Oregon from the south. At these locations terrain located within the primary areas of the intermediate segments is several thousand feet higher than the airport elevation yet the FAA field offices have subjectively disregarded the precipitous characteristics of the terrain.

**RECOMMENDATION:** TERPS 323a and related approach-segment-specific language should be revised to provide comprehensive and objective parameters for the application of precipitous terrain additives. Pending such revisions, the procedures at Monterey and Medford should forthwith be revised to include conservative precipitous terrain additives. Additionally, the FAA should expeditiously review all procedures that are known to have terrain significantly higher than the airport that underlies initial or intermediate approach segments.

**COMMENT:** This recommendation affects the United States Standard for Terminal Instrument Procedures (TERPS), FAA Order 8260.3B.

Submitted by: Charles K. Guy,  
May 13, 1992

**AIR LINE PILOTS ASSOCIATION**

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**INITIAL DISCUSSION (Meeting 92-02):** Records of the initial discussion and minutes of meetings 93-01 through 94-02 are not available.

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**MEETING 95-01:** Remote Altimeter Setting Source (RASS) in precipitous terrain formula (.14 x elevation differential) is a recent change to RASS. A similar type formula is also desirable for a precipitous terrain addition. Item remains open. Mr. Chuck Everest, AVN-210, will report at the next meeting. ALPA agreed to provide information to AVN-210 on this item.  
**ACTION:** AVN-210 and ALPA.

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**MEETING 95-02:** Chuck Everest, AFS-421, reported that developing a specific formula for a precipitous terrain additive is impossible until there is a clear definition of "precipitous terrain".

A strawman definition was presented to the group; however, more development is needed. During the discussion, Tom Young, ALPA, requested that paragraph 323a be revised to reflect that ROC "shall" vice "should" be increased. Chuck stated that this is not possible until a criterion is first established. **ACTION: AFS-421.**

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**MEETING 96-01:** Don Pate, AFS-450, presented a briefing on the FAA's on-going study of this issue. A three-phase program was presented outlining the proposed methodology to resolve the issue. Discussion followed concentrating on the American Airlines accident at Windsor Locks, CT. ALPA also expressed concerns that procedure specialists may not be coordinating sufficiently with air carriers and FBO's when designing approaches. **ACTION: AFS-450.**

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**MEETING 96-02:** Don Pate, AFS-450, presented a briefing on the FAA's on-going study of this issue. During the study, it was discovered that the National Center for Atmospheric Research (NCAR) had developed a computerized program to evaluate weather predictions. This model is adaptable for precipitous terrain modeling; however, the process would be labor intensive and cost approximately \$80K-\$100K per runway. Since there is no FAA funding available, follow on efforts are being coordinated with NASA Ames and the USAF to determine if alternate resources are available to address this issue. In the interim, the current process of soliciting user comments must be continued. ALPA noted that a specific request for a precipitous terrain additive on approaches to runway 15 at Windsor Locks, CT was denied by AVN-100; their rationale being that precipitous terrain additives must be applied to all approaches at a specific airport, not to a single runway. Jim Nixon, AFS-440, took an IOU to research and standardize policy. **ACTION: AFS-440, AFS-450, and AVN-160.**

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**MEETING 97-01:** Don Pate, AFS-450, presented a briefing on the FAA's on-going study of this issue. He noted that the National Center for Atmospheric Research (NCAR) had responded to the FAA's request to develop a general model, with accompanying software, that could be applied to an approach to a specific runway. Certain parameters such as wind and terrain characteristics along the approach would be specified and the model would identify if an adjustment is necessary and the amount of ROC increase needed. The FAA Weather IPT has indicated that, based on current commitments, the project will be added to the 1999 budget. Steve Hickok, HAI, noted that helicopters should be included in the study. Details of Don's briefing are contained in the attached status document. Terry Deplois, AVN-160, briefed the current AVN policy to get user input on precipitous terrain activity in the interim. He also stated that the ROC has been doubled on the VOR/DME RWY 15 IAP at Bradley, CT as a result of the November 1995 American Airlines MD-88 landing accident. The revised IAP is scheduled for publication on May 22. **ACTION: AFS-450.**

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**MEETING 97-02:** Don Pate, AFS-450, reported that funding has been received for the project and a contract is in place for the National for Atmospheric Research (NCAR) to assist AFS-450 in the development of an analytically based geographic definition of precipitous terrain and associated formulas for use by procedure developers to identify and make appropriate adjustments for precipitous terrain. Don then gave a presentation outlining AFS-450 action to present, and talked to the attached Status Document. AFS-450 will work

closely with NCAR to ensure that the terms of contract are adequately addressed to accomplish these goals. NCAR will develop a simple empirical model for determining the required increases in obstacle clearance near precipitous terrain. **ACTION: AFS-450.**

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**MEETING 98-01:** Jack Corman, AFS-420, provided an update briefing. AFS-420 is continuing work with the contractor (National Center for Atmospheric Research (NCAR)) in the development of an analytically based geographic definition of precipitous terrain and associated formulas for use by procedure developers to identify and make appropriate adjustments for precipitous terrain. AFS-420 will work closely with NCAR to ensure that the terms of the contract are adequately addressed to accomplish these goals. NCAR will develop a simple empirical model for determining the required increases in obstacle clearance near precipitous terrain. Plans are to present adjustments at the next forum. **ACTION: AFS-420.**

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**MEETING 98-02:** A representative of the Oklahoma City section of AFS-420 was unable to attend. Howard Swancy, AFS-420, briefed that AFS-420 has a preliminary model for precipitous terrain evaluation that should be finalized by December 31<sup>st</sup>. Once finalized, the model will be used for criteria development. **ACTION: AFS-420.**

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**MEETING 99-01:** Howard Swancy, AFS-420, briefed progress on this issue. The OPI is Alan Jones, AFS-420, who was unable to attend the meeting. A Phase I model has been developed and is now undergoing expert analysis to determine the model's efficiency. This model expresses precipitous terrain analytically by evaluating DTED based upon the general concepts of "high enough", "rough enough", and "steep enough". On any flight segment, the primary and secondary areas and an additional buffer area can be evaluated quantitatively for aspects of high, rough and steep. Currently, several programs are being examined to quantify these different aspects of terrain and then determine a threshold value for precipitous terrain ROC adjustments. The sheer volume of data points to be analyzed necessitates computer automation of the process. The National Center for Atmospheric Research (NCAR) will continue working with the FAA over the next several months in developing Phase II and perhaps Phase III models and the software necessary to successfully develop and implement precipitous terrain criteria. AFS-420 will continue tracking the program and report. **ACTION: AFS-420.**

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**MEETING 99-02:** Bill Hammett, AFS-420 (ISI), presented a status update paper prepared by Alan Jones, AFS-420. The first cut of the new trial software produced some memory allocation problems. Therefore, the target development completion date is delayed from March 31<sup>st</sup> to April 14<sup>th</sup>. Verification of the software, field trials and refinements are expected to take another six months. Full implementation of the new criteria for straight final and intermediate segments is planned for October. **ACTION: AFS-420.**

**MEETING 00-01:** Dave Eckles, AFS-420, presented a status update paper prepared by Alan Jones, AFS-420. The first cut of the new trial software produced some memory allocation problems. Therefore, the target development completion date is delayed from March 31<sup>st</sup> to April 14<sup>th</sup>. Verification of the software, field trials and refinements are expected to take another six months. Full implementation of the new criteria for straight final and intermediate segments is planned for October. **ACTION: AFS-420.**

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**MEETING 00-02:** Dave Eckles, AFS-420, presented a status update paper prepared by Alan Jones, AFS-420. Software to determine precipitous terrain and the required adjustment is currently being installed on the FAA's Instrument Approach Procedure Automation (IAPA) system. Brad Rush, AVN-160, confirmed that operational testing and evaluation (OTE) would begin later this year. Kevin Comstock, ALPA, requested examples of test results when available. Wally Roberts, ALPA, recommended Medford, OR and Monterey, CA as test sites. Brad agreed to provide examples to ALPA after OTE is complete. **ACTION: AFS-420 and AVN-160.**

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**MEETING 01-01:** An update report from Alan Jones, AFS-420, was not provided. Brad Rush, AVN-160, provided an update on AVN-100 operational testing and evaluation (OTE). The software evaluation of Medford, OR specified a precipitous terrain adjustment of 368'. Now that it has been determined that the software will analyze terrain and provide a recommended adjustment, implementation issues must be addressed; e.g., should the adjustment apply to precision approaches, should the software adjustment always be applied or manual override allowed, how will the impact of higher minima be received by the user community, etc. AFS-420 has a meeting scheduled for May 11 to discuss these issues and will report the results at the next meeting. **ACTION: AFS-420 and AVN-160.**

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**MEETING 01-02:** Norm LeFevre, AFS-420, briefed that TERPS Change 20 will contain criteria requiring use of the automated program to determine the minimum precipitous terrain ROC adjustment additive by segment. Implementation policy regarding the scope of application (each approach developed regardless of location, accept the automated adjustment without human override) and start-up policy (phase-in or immediate implementation) has not been decided. Implementation policy will be presented at the next ACF meeting. Brad Rush, AVN-160, briefed that AVN-100 OTE is complete. **ACTION: AFS-420.**

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**MEETING 02-01:** Norm LeFevre, AFS-420, briefed the FAA's automated precipitous terrain program. Basically a computer model will determine if the terrain is precipitous, then the automated program will determine the minimum amount of adjustment. Revised precipitous terrain criteria will be included in TERPS change 21. FAA will include automation software, which requires digitized terrain data with the TERPS change. How this will be accomplished; e.g., web site, software disk, etc., is still under discussion. **ACTION: AFS-420.**

***Editorial Note:*** The following proposed TERPS change schedule was provided: Change 19 was delayed due to managerial change in AFS-420. It is targeted for AFS-1 signature by the end of May. Change 20, which will only include a new Chapter 3, Takeoff and Landing Minimums should be in formal coordination by June 1<sup>st</sup>. Change 21, which will

*include the precipitous terrain software as well as new circling approach criteria, is targeted for formal coordination/comment by the end of September.*

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**MEETING 02-02:** Tom Schneider, AFS-420, briefed that the FAA's automated precipitous terrain program development is complete and is ready to be installed in IAPA. Implementation of the program (where and how to apply the software) is still under study. Revised precipitous terrain criteria will be included in TERPS change 20 and will include an automation module. **ACTION: AFS-420.**

**Editorial Note:** Tom briefed the following proposed TERPS change schedule noting that change numbers, contents, and dates are subject to revision:

- Change 20. Precipitous terrain; new circling criteria; new Chapter 10 (estimated March 03)
  - Change 21. New Volume 2, non-precision criteria; inclusion of 8260.38 criteria.
  - Change XX. 8260.44 criteria added to Volume 4.
  - Change XX. New Chapter 3, visibility & landing minima criteria.
  - Change XX. New Volume 5, copter criteria.
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**MEETING 03-01:** Tom Schneider, AFS-420, provided a handout outlining the current status. Some headway has been made. TERPS criteria development for an automated precipitous terrain evaluation is complete and is still planned to be included in TERPS Change 20. There was an AFS-AVN meeting in Oklahoma City in February to discuss implementation issues. Kevin Comstock, ALPA, asked what the implementation issues are. Bill Hammett, AFS-420 (ISI), responded that the primary issues included: whether there should be provisions for a manual override of the automation program or should the automated adjustment be accepted en toto; should an adjustment be required for precision final approaches; and, how to handle the impact of possible high adjustments to existing procedures. Mark Ingram, ALPA, requested a briefing at the ACF on impact as the automated precipitous terrain additive is applied at randomly selected airports.

**ACTION: AFS-420.**

On a sidebar discussion, Pat Fair, ATA-130, questioned charting specifications for terrain depiction on IAP charts. She noted that there have been instances where some IAPs at an airport have terrain depicted and others do not, depending on runway and how the IAP is centered. John Moore, AVN-503, stated that the specs require that if approaches to one runway depict terrain at an airport, then all approaches at the airport should depict terrain. The exception is when the terrain area does not rise to 500' above the airport.

**Editorial Note:** Bill Hammett briefed the following proposed TERPS change schedule noting that change numbers, contents, and dates are subject to revision:

- Change 20. Precipitous terrain; new circling criteria; new Chapter 10 (now estimated for coordination in October 03)
- Change 21. New Volume 2, non-precision criteria; new Volume 5, copter criteria; and will also include adding 8260.44 criteria to Volume 4. (Note: 8260.38 criterion is now planned for inclusion in 8260.48A.)
- Change XX. New Chapter 3, visibility & landing minima criteria – will be a separate change (number TBD).

**MEETING 03-02:** Bill Hammett, AFS 420 (ISI) briefed a report from Alan Jones and Larry Schwartzkopf, AFS-420. AFS-420 is in the process of validating the algorithms used and results provided by the IAPA software. This validation should be complete not later than November 2003 and the IAPA program will be available for operational use by January 2004. Per ALPA's request at the last meeting, AFS-420 ran the automated software against several approaches to provide a sample impact. The following results were recorded:

1. Windsor Locks/Bradley Intl, CT: RNAV (GPS) RWY 6, RNAV (GPS) RWY 15, and VOR or TACAN RWY 15 - No adjustment required.
2. ASPEN, CO: VOR/DME-C - 161 foot adjustment required.
3. Medford, OR: RNAV (GPS)-D - 54 foot adjustment required. VOR/DME-C - 67 foot adjustment required.

**ACTION:** AFS-420.

**Editorial Note:** Bill also briefed the following tentative TERPS change schedule emphasizing that change numbers, contents, and dates are subject to revision:

- (1) Change 20. Precipitous terrain; new Chapter 10; revised Chapter 11; "Q" Routes added to Chapter 15; new circling criteria.
- (2) Change 21. New Chapter 3, visibility & landing minima.
- (3) Change 22. New Volume 2, non-precision approach criteria.
- (4) Change XX. Order 8260.44 criteria added to Volume 4.
- (5) Change XX. New Volume 5, revised helicopter criteria.

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**MEETING 04-01:** Tom Schneider, AFS-420, briefed that AFS-420 and AVN-100 are jointly working on an implementation plan. As briefed at the last meeting, the automated precipitous terrain software has been developed and is scheduled for inclusion in TERPS change 20. Mark Ingram, ALPA, noted that since FAA's IAPA system is currently capable of applying the automated adjustment, why doesn't the FAA use the software in the interim period awaiting Change 20. Steve Bergner, NBAA, supported this position, stating that if it is available, it should be used. Tom responded that several issues must be resolved first. Specifically, should the software be applied to vertically guided final approach segments? Also, where should the software be applied? AVN-100 recommends application only in designated mountainous areas (DMAs) under Part 95. AFS-420 desires application to all intermediate and final approach segments regardless of airport location; therefore, a compromise plan will have to be developed. Steve suggested that immediate application in DMAs and other areas later. Tom closed by stating that the Manager, AFS-420 is aware of the issue and has promised a meeting upon his return from extended temporary duty in Washington, DC.

**ACTION:** (AFS-420).

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**MEETING 04-02:** Tom Schneider, AFS-420, briefed that as a result of discussion at the last ACF meeting, AFS-400 issued a policy memorandum to AVN-1 on June 18 directing the IAPA precipitous terrain programming be implemented as soon as possible. Specific guidelines and documentation requirements were also provided. Brad Rush noted that since Baro-VNAV is not authorized in areas of precipitous terrain, the initial application is to LNAV/VNAV IAPs. No problems have been encountered thus far. The group agreed the issue could be closed. **Item Closed.**

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