

GOVERNMENT/INDUSTRY AERONAUTICAL CHARTING FORUM
Instrument Procedures Group
April 22, 2008
HISTORY RECORD

FAA Control # 08-01-279

Subject: Expected Airplane Performance on Instrument Departure Procedures

Background/Discussion:

There has been a long history of confusion among pilots and operators of turbine-powered, transport airplanes as to whether the TERPS-based climb gradient published on instrument departure procedures is based on normal, all-engines operating performance or whether it is based on one-engine inoperative performance. Order 8260.3, US Standard for Terminal Instrument Procedures (TERPS), Chapter 2, Section 1, paragraph 201 (b) states that TERPS criteria are predicated on normal aircraft performance:

b. The following is an excerpt from the foreword of this order: "These criteria are predicated on normal aircraft operations for considering obstacle clearance requirements." Normal aircraft operation means all aircraft systems are functioning normally, all required navigational aids (NAVAID's) are performing within flight inspection parameters, and the pilot is conducting instrument operations utilizing instrument procedures based on the TERPS standard to provide ROC. While the application of TERPS criteria indirectly addresses issues of flyability and efficient use of NAVAID's, the major safety contribution is the provision of obstacle clearance standards. This facet of TERPS allows aeronautical navigation in instrument meteorological conditions (IMC) without fear of collision with unseen obstacles. ROC is provided through application of level and sloping OCS.

The Aeronautical Information Manual (AIM) fails to underscore the above distinction for pilots flying an Obstacle Departure Procedure (ODP) or Standard Instrument Departure (SID). TERPS provides additional guidance with respect to non-normal performance of the aircraft in Chapter 2, Section, 1, paragraph 203 (e):

e. Extraordinary circumstances, such as a mechanical or electrical malfunction, may prevent an aircraft from achieving the 200 ft/NM minimum climb gradient assumed by TERPS. In these cases, adequate obstacle clearance may not be provided by published instrument procedures. Operational procedures contained outside TERPS guidelines are required to cope with these abnormal scenarios.

In comparison, guidance contained in ICAO's PANS-OPS 8168, Volume I, Flight Procedures, Section 3, Departure Procedures, provides pilots with far more information regarding the level of performance expected of the aircraft on an IFR departure and the responsibilities of the operator in the event of an engine failure on takeoff:

GENERAL CRITERIA FOR DEPARTURE PROCEDURES

1.1 INTRODUCTION

1.1.1 Application

1.1.1.1 The criteria in this section are designed to provide flight crews and other flight operations personnel with an appreciation, from the operational point of view, of the parameters and criteria used in the design of instrument departure procedures. These include, but are not limited to, standard instrument departure (SID) routes and associated procedures (see Annex 11, Appendix 3).

Note.— Detailed specifications for instrument departure procedure construction, primarily for the use of procedures specialists, are contained in PANS-OPS, Volume II, Part I, Section 3.

1.1.1.2 **These procedures assume that all engines are operating.** In order to ensure acceptable clearance above obstacles during the departure phase, instrument departure procedures may be published as specific routes to be followed or as omnidirectional departures, together with procedure design gradients and details of significant obstacles.

1.2 OPERATOR'S RESPONSIBILITY

1.2.1 Contingency procedures

Development of contingency procedures, required to cover the case of engine failure or an emergency in flight which occurs after V1, is the responsibility of the operator, in accordance with Annex 6. An example of such a procedure, developed by one operator for a particular runway and aircraft type(s), is shown in Figure I-3-1-1. Where terrain and obstacles permit, these procedures should follow the normal departure route.

Advisory Circular, AC 120-91, *Airport Obstacle Analysis*, provides guidance to operators of turbine-powered, transport category airplanes on takeoff obstacle avoidance following an engine failure on takeoff. This AC provides important information concerning the differences between the TERPS criteria and the one-engine inoperative takeoff obstacles avoidance requirement of a turbine-powered, transport aircraft:

7. TERPS CRITERIA VERSUS ONE-ENGINE-INOPERATIVE REQUIREMENTS.

a. **Standard Instrument Departures (SID) or Departure Procedures (DP) based on TERPS or ICAO Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS) are based on normal (all engines operating) operations.** Thus, one-engine-inoperative obstacle clearance requirements and the all-engines-operating TERPS requirements are independent, and one-engine-inoperative procedures do not need to meet TERPS requirements. Further, compliance with TERPS all-engines-operating climb gradient requirements does not necessarily assure that one-engine-inoperative obstacle clearance requirements are met. TERPS typically use specified all-engines-operating climb gradients to an altitude, rather than certificated one-engine-inoperative airplane performance. TERPS typically assume a climb gradient of 200 feet per nautical mile (NM) unless a greater gradient is specified. For the purposes of analyzing performance on procedures developed under TERPS or PANS-OPS, it is understood that any gradient requirement, specified or unspecified, will be treated as a plane which must not be penetrated from above until reaching the stated height, rather than as a gradient which must be exceeded at all points in the path. Operators must comply with 14 CFR requirements for the development of takeoff performance data and

procedures. There are differences between TERPS and one-engine-inoperative criteria, including the lateral and vertical obstacle clearance requirements. An engine failure during takeoff is a non-normal condition, and therefore takes precedence over noise abatement, air traffic, SIDs, ODPs, and other normal operating considerations.

While AC 120-91 is primarily directed at Part 121 and Part 135 operators, it may also be referenced by Part 91 operators.

Since the TERPS Order makes a clear distinction regarding the expected level of aircraft performance on a TERPS-based instrument procedure and further states that contingency procedures may be required to provide suitable obstacle clearance following an engine failure, we believe it is necessary for the AIM to contain similar advisory language.

Current AIM guidance contained in 5-2-8 (e) (4) has been insufficient for many operators of large and turbine-powered transport airplanes.

Recommendations:

The AIM should clearly state the expected level of aircraft performance when flying IFR departure procedures. AIM section 5-2-8 (b) could be revised as follows:

b. What criteria are used to provide obstruction clearance during departure?

2. ODPs and SIDs assume normal aircraft performance and that all engines are operating. Development of contingency procedures, required to cover the case of engine failure or other emergency in flight that may occur after liftoff, is the responsibility of the operator.

AIM section 5-2-8 (e) (4) could be revised to include the following "NOTE":

4. Consider the effect of degraded climb performance and the actions to take in the event of an engine loss during the departure.

Note: Guidance concerning contingency procedures addressing an engine failure on takeoff after V1 speed on a large or turbine-powered transport airplane may be found in AC 120-91, *Airport Obstacle Analysis*.

Comments: This recommendation affects the Aeronautical Information Manual.

Submitted by: Richard J. Boll II

Organization: NBAA

Phone: 202-783-9000

FAX: 202-331-8364

E-mail: richard.boll@sbcglobal.net

Date: March 28, 2008

Initial Discussion - Meeting 08-01: New issue introduced by Rich Boll, NBAA. NBAA believes that the AIM language relating to aircraft performance on departures is not clear in affirming that underlying TERPS and Pans-Ops criteria are based on all engines operating. The NBAA recommendation includes specific AIM changes. The Forum consensus was that the recommended NBAA changes are valid. Tom Schneider, AFS-420, recommended the issue be forwarded to AFS-410 for editorial review and consideration for inclusion in the March 12, 2009 AIM Change. Bruce McGray, AFS-410, accepted the task.

ACTION: AFS-410.

Meeting 08-02 Bruce McGray, AFS-410, briefed that the recommended AIM changes presented by Rich Boll, NBAA, at the last meeting were coordinated through AFS-400 and with slight modifications will be forwarded for publication in the August 27, 2009 AIM change. The revised text with changes shown in red is shown below:

Add the new paragraph as 5-2-8(b)2 and re-number current paragraphs accordingly:

ODPs and SIDs assume normal aircraft performance, and that all engines are operating. Development of contingency procedures, required to cover the case of an engine failure or other emergency in flight that may occur after liftoff, is the responsibility of the operator. (More detailed information on this subject is available in Advisory Circular AC 120-91, Airport Obstacle Analysis, and in the "Departure Procedures" section of chapter 2 in the Instrument Procedures Handbook, FAA-H-8261-1.)"

Amend paragraph 5-2-8(e)4 to read as follows:

Consider the effect of degraded climb performance and the actions to take in the event of an engine loss during the departure. *Pilots should notify ATC as soon as possible of reduced climb capability in that circumstance.*

NOTE- Guidance concerning contingency procedures that address an engine failure on takeoff after V1 speed on a large or turbine-powered transport category airplane may be found in AC 120-91, Airport Obstacle Analysis.

Rich agreed the revised language is acceptable. AFS-410 will track the requested AIM change for August 27, 2009 publication. **ACTION: AFS-410.**

Meeting 09-01 Bruce McGray, AFS-410, briefed that the recommended AIM changes presented by Rich Boll, NBAA, at meeting 08-01 were coordinated through AFS-400 and with slight modifications forwarded for publication in the August 27, 2009 AIM change. However, there was a last minute objection from with the ATO. Bruce reported that the change has been sitting within the ATO since November. Rich Boll, NBAA, author of the change asked what the objection was. Bruce responded there were no specifics to the objection, just that it may be inappropriate at this time. He will continue to track the change. **Item Open – Pending Publication (AFS-410).**

Editor's Note: *Post meeting follow-up coordination with the AFS-400 AIM OPR reveals that the change was, in fact, forwarded for publication and will be included in the August AIM change.*

Meeting 09-01 Bruce McGray, AFS-410, was absent when this issue was discussed; however, Bill Hammett, AFS-420 (ISI), briefed that the recommended AIM changes presented by Rich Boll, NBAA, at meeting 08-01 were included in the August 27 AIM Change - See AIM paragraphs 5-2-8b2 and 5-2-8e1(d). Since all action is complete, Bill recommended the issue be closed and the Group concurred. **ITEM CLOSED**.
