U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: REDUCED AND DERATED TAKEOFF THRUST (POWER) PROCEDURES
Date: 5/4/88
Initiated by: ANM-110
AC No: 25- 13
Change:

1. PURPOSE. This advisory circular (AC) provides guidance for the certification and use of reduced thrust (power) for takeoff and derated takeoff thrust (power) on turbine powered transport category airplanes. It consolidates FAA guidance concerning this subject and serves as a ready reference for those involved with airplane certification and operation. These procedures should be considered during airplane type certification and supplemental type certification activities when less than engine rated takeoff thrust (power) is used for takeoff.

2. APPLICABLE FEDERAL AVIATION REGULATIONS (FAR). The applicable regulations are §§ 25.101, 25.1521, and 25.1581 of Part 25.

3. BACKGROUND. Takeoff operations conducted at thrust (power) settings less than the maximum takeoff thrust (power) available may provide substantial benefits in terms of engine reliability, maintenance, and operating costs. These takeoff operations generally fall into two categories: those with a specific derated thrust (power) level, and those using the reduced thrust (power) concept, which provides a lower thrust (power) level that may vary for different takeoff operations. Both methods can be approved for use, provided certain limitations are observed. The subjects discussed herein do not pertain to inflight thrust cutback procedures that may be employed for noise abatement purposes.

4. DEFINITIONS. Customarily, the terms "thrust" and "power" are used, respectively, in reference to turbojet and turboprop installations. For simplicity, only the term "thrust" is used throughout this AC. For turboprop installations, the term "power" should be substituted. For purposes of this AC the following definitions apply:

a. Takeoff thrust.

(1) Rated takeoff thrust, for a turbojet engine, is the approved engine thrust, within the operating limits established by the engine type certificate under the provisions of Part 33, and is limited to periods of not more than five minutes for takeoff operations.

(2) Takeoff thrust, for an airplane, is normally the engine rated takeoff thrust, corrected for any installation losses and effects, that is established for the airplane under Part 25. Some airplanes use a takeoff thrust setting that is defined at a level that is less than that based on the engine

rated takeoff thrust. Section 25.1521 requires that the takeoff thrust rating established for the airplane not exceed the takeoff thrust rating limits established for the engine under Part 33. The value of the takeoff thrust setting parameter is presented in the Airplane Flight Manual (AFM) and is considered a normal takeoff operating limit.

b. Derated takeoff thrust, for an airplane, is a takeoff thrust level less than the maximum takeoff thrust, for which exists in the AFM a set of separate and independent, or clearly distinguishable, takeoff limitations and performance data that complies with all the takeoff requirements of Par When operating with a derated takeoff thrust, the value of the thrust setting parameter which establishes thrust for takeoff is presented in the AFM and is considered a normal takeoff operating limit.

c. Reduced takeoff thrust, for an airplane, is a takeoff thrust less than the takeoff (or derated takeoff) thrust. The airplane takeoff performance and thrust setting are established by approved simple methods, such as adjustments, or by corrections to the takeoff or derated takeoff thrust setting and performance. When operating with a reduced takeoff thrust, the thrust setting parameter which establishes thrust for takeoff is not considered a takeoff operating limit.

d. A wet runway is one that is neither dry nor contaminated.

e. A contaminated runway is a runway where more than 25 percent of the required field length, within the width being used, is covered by standing water or slush more than 0.125 inch (3.2 mm) deep, or that has an accumulation of snow or ice. However, in certain other situations it may be appropriate to consider the runway contaminated. For example, if the section of the runway surface that is covered with standing water or slush is located where rotation and liftoff will occur, or during the high speed part of the takeoff roll, the retardation effect will be far more significant than if it were encountered early in the takeoff while at low speed. In this situation, the runway might better be considered "contaminated" rather than "wet."

5. REDUCED THRUST: ACCEPTABLE MEANS OF COMPLIANCE. Under §§ 25.101(c), 25.101(f), and 25.101(h) of the FAR, it is acceptable to establish and use a takeoff thrust setting that is less than the takeoff or derated takeoff thrust if:

a. The reduced takeoff thrust setting:

(1) Does not result in loss of systems or functions that are normally operative for takeoff such as automatic spoilers, engine failure warning, configuration warning, systems dependent on engine bleed air, or any other required safety related system.

(2) Is based on an approved takeoff thrust rating or derating for which complete airplane performance data is provided.

(3) Enables compliance with the applicable engine operating and airplane controllability requirements in the event that takeoff thrust, or

derated takeoff thrust (if such is the performance basis), is applied at any point in the takeoff path.

(4) Is at least 75 percent of the takeoff thrust, or derated takeoff thrust if such is the performance basis, for the existing ambient conditions.

(5) For turboprop installations, is predicated on an appropriate analysis of propeller efficiency variation at all applicable conditions.

b. Relevant speeds (V_{EF}, V_{MC}, V_1, V_R, and V_2) used for reduced thrust takeoffs are not less than those which will comply with the required airworthiness controllability criteria when using the takeoff thrust (or derated takeoff thrust, if such is the performance basis) for the ambient conditions, including the effects of an Automatic Takeoff Thrust Control System (ATTCS). It should be noted, however, that in determining the takeoff weight limits, credit should not be given for an operable ATTCS.

c. The airplane complies with all applicable performance requirements, including the criteria in paragraphs a and b above, within the range of approved takeoff weights, with the operating engines at the thrust available for the reduced thrust setting selected for takeoff. However, the thrust settings used to show compliance with the takeoff flight path requirements of § 25.115 and the final takeoff climb performance requirements of § 25.121(c) should not be greater than that established by the initial thrust setting.

d. Appropriate limitations, procedures, and performance information are established and are included in the AFM.

e. A periodic takeoff demonstration is conducted using the airplane's takeoff thrust setting and the event is logged in the airplane's permanent records. An approved engine maintenance procedure or an approved engine condition monitoring program may be used to extend the time interval between takeoff demonstrations.

f. The AFM states, as a limitation, that takeoffs utilizing reduced takeoff thrust settings:

(1) Are not authorized on runways contaminated with standing water, snow, slush, or ice, and are not authorized on wet runways unless suitable performance accountability is made for the increased stopping distance on the wet surface.

(2) Are not authorized when the antiskid system, if installed, is inoperative.

(3) Are not authorized unless the operator establishes a means to verify the availability of takeoff or derated takeoff thrust to ensure that engine deterioration does not exceed authorized limits.

(4) Are authorized for airplanes equipped with an ATTCS, whether operating or not, provided no performance credit is allowed for the one-engine-inoperative thrust increase.

g. The AFM states that:

(1) Application of reduced takeoff thrust in service is always at the discretion of the pilot.

(2) When conducting a takeoff using reduced takeoff thrust, takeoff thrust may be selected at any time during the takeoff operation.

h. Procedures for reliably determining and applying the value of the reduced takeoff thrust setting and determining the associated required airplane performance are simple (such as the assumed temperature method). Additionally, the pilot is provided with information to enable him to obtain both the reduced takeoff thrust and takeoff thrust, or derated takeoff thrust if such is the performance basis, for each ambient condition.

i. Training procedures are developed by the operator for the use of reduced takeoff thrust.

6. DERATED THRUST: ACCEPTABLE MEANS OF COMPLIANCE. For approval of derated takeoff thrust provisions, the limitations, procedures, and other information prescribed by § 25.1581 of the FAR, as applicable for approval of a change in thrust, should be included as a separate Appendix in the AFM. The AFM limitations section should indicate that when operating with derated thrust, the thrust setting parameter should be considered a takeoff operating limit. However, inflight takeoff thrust (based on the maximum takeoff thrust specified in the basic AFM) may be used in showing compliance with the landing and approach climb requirements of §§ 25.119 and 25.121(d), provided that the availability of takeoff thrust upon demand is confirmed by using the thrust-verification checks specified in paragraph 5e above.

Darrell M. Pederson

DARRELL M. PEDERSON
Acting Manager, Aircraft Certification Division