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UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

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SPECIAL CIVIL AIR REGULATION

PERFORMANCE CREDIT FOR TRANSPORT CATEGORY AIRPLANES EQUIPPED WITH STANDBY POWER

Standby power is power and/or thrust obtained from rocket engines and is separate from the power obtained from the airplane's main engines. Such power and/or thrust is available for a relatively short period for use in cases of emergency. The standby power system may be capable of producing more than a single thrust period. This special regulation authorizes the Administrator to grant performance credit to transport category airplanes when standby power is used in one or more of the following regimes of flight: Take-off with one engine inoperative, approach climb with one engine inoperative, and the balked landing climb. By "performance credit" is meant the taking into account the increased performance of the airplane with standby power and, because thereof, the approval of higher maximum weights for the airplane than the weights approved on the basis of the airplane's performance without standby power. In granting performance credit, this regulation prescribes the applicable conditions and limitations.

Rocket assist take-off units were developed initially for the military services to provide additional take-off power for heavily loaded flying boats and carrier-based aircraft. The additional thrust improved the climb performance in the take-off regime and permitted the airplane to attain a safe altitude and air speed in the event of engine failure. The reliability of such units has increased to the point where some civil operators have adopted them for use as emergency standby power in the event of engine failure. Other operators have been reluctant to adopt standby power installations and the attendant weight penalties without reasonable performance credit being given the airplane. With the performance credit granted by this regulation for the use of standby power, it is anticipated that such credit might be considered a compensating economic factor justifying the installation of standby power on such airplanes.

The currently effective regulations did not contemplate the use of standby power; however, the Administrator of Civil Aeronautics has established for an interim period a conservative policy permitting transport category airplanes equipped with standby power to operate at an increase in the normally approved weights by an amount equal to the weight of the standby power units.

In this regulation, the criteria for granting performance credit were formulated with the intent of providing an over-all level of performance equivalent to that intended by the currently effective regulations. To this end, appropriate criteria are established with respect to the amount of performance credit which may be applied in determining the new take-off paths, the extent to which the maximum certificated take-off and landing weights may be increased, and operating procedures to be followed in service for the use of standby power and for the associated changes in the airplane's configuration and speed.

The basic element of the various criteria established in this regulation entails a comparison of flight paths. In Civil Air Regulations Draft Release No. 57-28, all of the flight paths were based on procedures involving attainment of the en route configuration and the acceleration to a safe en route speed. Further consideration of this proposal indicates that an undue amount of flight testing and computation would be required for those flight conditions which presently do not involve the establishment of such flight paths. In addition, it appears that comparison of flight paths involving a particular procedure is not essential for the purpose of establishing an equivalent level of safety. In view of the foregoing, this regulation requires comparison of flight paths with respect to the take-off regime consistent only with that required by the currently effective airworthiness performance requirements; i.e., Part 4b and Special Civil Air Regulations Nos. SR-422 and SR-422A. Further, the establishment of maximum landing weights is based on a comparison of flight paths obtained with a fixed airplane configuration and at the speed and power condition appropriate to the all-engines-operating landing climb or the one-engine-inoperative approach climb, as applicable.

Performance credit for standby power with respect to the take-off path is limited by the specification that the all-engines-operating take-off path reflect a conservatively greater margin of over-all performance than the one-engine-inoperative take-off path with standby power in use. It is intended that this margin exist throughout the take-off path prescribed by the applicable performance requirements. This regulation provides for the establishment of the margin by the Administrator; however, in

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no case can this margin be less than 15 percent. In view of the many different types of airplanes to which this regulation is applicable, a higher margin might be necessary in certain cases to insure safe day-to-day operations.

For reciprocating-engine-powered airplanes, the provisions of this regulation require that the applicant establish a procedure for the use of standby power for attaining the en route configuration and a safe en route speed in the event of an engine failure during the take-off. Provisions for such procedures are contained in the regulations for turbine-powered airplanes and will therefore be applicable to such airplanes. The establishment of the procedures made applicable to reciprocating-engine-powered airplanes is left to the discretion of the applicant to select the altitude at which the acceleration is to take place, the basic limitation being that the slope along all points of the airborne portion of the take-off path must be positive. This will provide for the critical operation of clean-up and acceleration during the take-off which are not covered by the performance requirements of Part 4b and which have been cited in the past in connection with several accidents. In addition, with respect to the clearing of obstacles, the take-off path scheduled in the Airplane Flight Manual for airplanes for which the performance requirements of Part 4b are applicable must be appropriately modified to reflect the effect of the aforementioned procedure.

The criteria for the establishment of maximum certificated take-off weights involve two separate comparisons of take-off paths. These comparisons must be carried out to a height of 400 feet above the take-off surface. This minimum height is intended to be associated with a procedure where standby power is actuated within the neighborhood of the critical engine failure speed V_1. These provisions are intended to limit the increase in maximum take-off weight consistent with the over-all level of performance currently attained with respect to the one-engine-inoperative take-off and to limit the amount of standby power for which performance credit can be granted to insure a reasonable margin of performance for the all-engine day-to-day operations.

The provisions for the establishment of maximum certificated landing weights require only a comparison between two flight paths based on a steady climb and fixed configuration. One represents a climb path at the maximum weight previously certificated without standby power and the other a climb path at the increased weight with standby power. In addition, there is a provision which requires the establishment of procedures for the execution of balked landings and missed approaches in conjunction with the use of standby power.

A question has been raised as to whether duplicate sets of standby power units are required to obtain performance credit for both the take-off and the approach stages of flight. It is intended by this regulation to require duplicate sets of standby power for a flight for which the use of standby power is necessary to comply with both the maximum certificated take-off and the maximum certificated approach weight limitations. Where the use of standby power is necessary for compliance with the maximum certificated weight limitations for only one regime of flight, i.e. take-off or approach, one set of standby power units is required.

There are also included safety criteria for the installation and operation of the standby power system.

The Board presently has under consideration a special regulation which would be applicable to non-transport category airplanes equipped with standby power.

Interested persons have been afforded an opportunity to participate in the making of this regulation (22 F.R. 10464), and due consideration has been given to all relevant matter presented.

In consideration of the foregoing, the Civil Aeronautics Board hereby makes and promulgates the following Special Civil Air Regulation, effective October 27, 1958.

Contrary performance provisions of the Civil Air Regulations notwithstanding, the Administrator may grant performance credit for the use of standby power on transport category airplanes. Such credit shall be applicable only to the maximum certificated take-off and landing weights, the take-off distance, and the take-off paths, and shall not exceed that found by the Administrator to result in an over-all level of safety in the take-off, approach, and landing regimes of flight equivalent to that prescribed in the regulations under which the airplane was originally certificated without standby power. (Note: Standby power is power and/or thrust obtained from rocket engines for a relatively short period and actuated only in cases of emergency.) The following provisions shall apply:

(1) Take-off; general. The take-off data prescribed in §§ (2) and (3) shall be determined at all weights and altitudes, and at ambient temperatures if applicable, at which performance credit is to be applied.

(2) Take-off path.

(a) The one-engine-inoperative take-off path with standby power in use shall be determined in accordance with the performance requirements of the applicable airworthiness regulations.

(b) The one-engine-inoperative take-off path (excluding that portion where the airplane is on or just above the take-off surface) determined in accordance with paragraph (a) of this section shall lie above the one-engine-inoperative take-off path without standby power at the maximum take-off weight at which all of the applicable airworthiness requirements are met. For the purpose of this comparison, the flight path shall be considered to extend to at least a height of 400 feet above the take-off surface.

(c) The take-off path with all engines operating, but without the use of standby power, shall reflect a conservatively greater over-all level of performance than the one-engine-inoperative take-off path established in accordance with paragraph (a) of this section. The aforementioned margin shall be established by the Administrator to insure safe day-to-day operations, but in no case shall it be less than 15 percent. The all-engines-operating take-off path shall be determined by a procedure consistent with that established in complying with paragraph (a) of this section.

(d) For reciprocating-engine-powered airplanes, the take-off path to be scheduled in the Airplane Flight Manual shall represent the one-engine-inoperative take-off path determined in accordance with paragraph (a) of this section and modified to reflect the procedure (see § (6)) established by the applicant for flap retraction and attainment of the en route speed. The scheduled take-off path shall have a positive slope at all points of the airborne portion and at no point shall it lie above the take-off path specified in paragraph (a) of this section.

(3) Take-off distance. The take-off distance shall be the horizontal distance along the one-engine-inoperative take-off path determined in accordance with § (2)(a) from the start of the take-off to the point where the airplane attains a height of 50 feet above the take-off surface for reciprocating-engine-powered airplanes and a height of 35 feet above the take-off surface for turbine-powered airplanes.

(4) Maximum certificated take-off weights. The maximum certificated take-off weights shall be determined at all altitudes, and at ambient temperatures if applicable, at which performance credit is to be applied and shall not exceed the weights established in compliance with paragraphs (a) and (b) of this section.

(a) The conditions of § (2)(b) through (d) shall be met at the maximum certificated take-off weight.

(b) Without the use of standby power, the airplane shall meet all of the en route requirements of the applicable airworthiness regulations under which the airplane was originally certificated. In addition, turbine-powered airplanes without the use of standby power shall meet the final take-off climb requirements prescribed in the applicable airworthiness regulations.

(5) Maximum certificated landing weights.

(a) The maximum certificated landing weights (one-engine-inoperative approach and all-engines-operating landing climb) shall be determined at all altitudes, and at ambient temperatures if applicable, at which performance credit is to be applied and shall not exceed that established in compliance with the provisions of paragraph (b) of this section.

(b) The flight path, with the engines operating at the power and/or thrust appropriate to the airplane configuration and with standby power in use, shall lie above the flight path without standby power in use at the maximum weight at which all of the applicable airworthiness requirements are met. In addition, the flight paths shall comply with the provisions of subparagraphs (i) and (ii) of this paragraph.

(i) The flight paths shall be established without changing the appropriate airplane configuration.

(ii) The flight paths shall be carried out for a minimum height of 400 feet above the point where standby power is actuated.

(6) Airplane configuration, speed, and power and/or thrust; general. Any change in the airplane's configuration, speed, and power and/or thrust shall be made in accordance with the procedures established by the applicant for the operation of the airplane in service and shall comply with the provisions of paragraphs (a) through (c) of this section. In addition, procedures shall be established for the execution of balked landings and missed approaches.

(a) The Administrator shall find that the procedure can be consistently executed in service by crews of average skill.

(b) The procedure shall not involve methods or the use of devices which have not been proven to be safe and reliable.

(c) Allowances shall be made for such time delays in the execution of the procedures as may be reasonably expected to occur during service.

(7) Installation and operation; standby power. The standby power unit and its installation shall comply with the provisions of paragraphs (a) and (b) of this section.

(a) The standby power unit and its installation shall not adversely affect the safety of the airplane.

(b) The operation of the standby power unit and its control shall have proven to be safe and reliable.

(Sec. 205 (a), 52 Stat. 984; 49 U.S.C. 425 (a). Interpret or apply secs. 601, 603, 604, 605, 52 Stat. 1007, 1009, 1010, as amended, 49 U.S.C. 551, 553, 554, 555)

By the Civil Aeronautics Board:

/s/ Mabel McCart

Mabel McCart
Acting Secretary

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