

**APPENDIX 10. GUIDE FOR DETERMINING CLIMB PERFORMANCE
AFTER STC MODIFICATIONS** (not applicable to SFAR 23, SFAR 41, or to commuter
category)

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1. INTRODUCTION. Section 23.1587 requires certain performance information to be included in the AFM. These include the climb requirements and rate of climb information as specified by §§ 23.69, and 23.77. Additionally, some turbine-powered airplanes may have the maximum weight of § 23.1583(c) limited by climb performance. If an airplane is modified externally (and/or an engine change) and the changes are deemed significant enough to produce measurable effects, any appropriate requirements and information should be determined for inclusion in the AFM supplement.

2. GENERAL. Supplemental Type Certificates involve modifications to in-service airplanes that may, for one reason or other, not exactly match Type Design climb performance data that was determined and published in the AFM. These effects can be the result of engine power deteriorations, added antennae, exterior surfaces not polished or smooth, propeller nicks, or a variety of other reasons. In addition, it is difficult and costly to obtain calibrations of engine power output that may have been available during the original certification process. The extent of performance degradation observed after incorporating external modifications could be partially due to deficiencies present in the airplane prior to modification. In other instances, the results of performance measurements indicate that there is little or no effect from the modification, and the test airplane closely matches the values contained in the basic AFM even though analysis indicates some degradation. For either of these situations, the actual loss in performance could be skewed or masked by these other variables. For these reasons, any climb performance measurements conducted as part of an STC modification should be conducted such that the actual effects of the modification are identified. One effective means of accomplishing this is to measure the performance of the unmodified airplane then repeat the same tests with the external modifications incorporated. Any variations from the basic performance predictions due to engine power or other variables will be minimized or eliminated.

3. PROCEDURE FOR EXTENDING CLIMB PERFORMANCE TO ADDITIONAL AIRPLANES. The conditions to be evaluated should be identified from a review of the applicable regulations and related to the modifications to be incorporated. The instruments that are to be involved in the flight tests should have recent calibrations. The airspeed system should be verified to be in agreement with the basic airplane calibrations.

Prior to modifications, conduct a series of climbs utilizing the general procedures and information presented in paragraphs 25, 26, and 28 of this Flight Test Guide. Test speeds and other conditions may be abbreviated to those that are presented in the AFM. The AFM can also be utilized as a guide to identify how climb performance is predicated to vary with altitude and other conditions. Results should be corrected to some standard in accordance with Appendix 2, or some other acceptable method. The before and after tests should be conducted, as nearly as possible, at the same airplane weight.

After the modification, the series of climbs conducted above should be repeated. Apply the same procedures and corrections as before. Corrected results of climbs before and after the modification should be compared by plotting the combined results. The performance in the AFM is useful in identifying how climb performance was predicated to change with altitude and temperature. It is likely that there will be some scatter and variations in the final results. With a limited amount of testing, the effects of the modification should be determined conservatively and identified in a manner suitable for presentation in the AFM supplement.

4. "ONE ONLY" AIRPLANE. Often, there are circumstances where the full range of performance tests before and after the STC modification are not warranted. These might include:

- a. A limited effectivity such as a one-only modification.
- b. An excessively conservative reduction in published climb performance, which would not limit normal operations of the airplane and limitations are not affected.

The conditions to be evaluated should be identified from a review of the applicable regulations and related to the modifications to be incorporated. The instruments that are to be involved in the flight tests should have recent calibrations. The airspeed system should be verified to be in agreement with the basic airplane calibrations.

If the reduction in climb performance is not limiting, then it may be acceptable to conduct tests of the modified airplane only and provide analysis that could be used to support and compare with the tests. Values of climb degradation should be selected that are sufficiently conservative to overcome any variations or discrepancies that may have been present. This should not involve any requirements of § 23.1583. The information required by § 23.1587, however, could be excessively conservative without degrading normal operations of the airplane in service.

For example, analysis predicts that a particular modification will reduce the one-engine-inoperative climb performance by 50 feet-per-minute, and limited testing shows a reduction of 30 feet-per-minute. In order to overcome the introductory considerations and variables, a degradation in climb performance should be obviously conservative. The higher of the two rate of climb degradation values could be doubled to achieve this objective. For this example, the AFM supplement would reflect a degradation in one-engine-inoperative climb performance of 100 feet-per-minute.

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