



Federal Aviation Administration

Memorandum

Date: August 15, 2012

To: Ross Landes, Manager, Seattle Aircraft Certification Office, ANM-100S

From: Ali Bahrami, Manager, Transport Airplane Directorate, ANM-100

Prepared by: Eric Brown, ANM-150S

Subject: INFORMATION: Equivalent Safety Finding for the Falcon 50 Airplane with the Aviation Partners Inc, (API) Winglets for the Use of Analysis in Lieu of Flight Test in Natural Icing Conditions, FAA Project ST11512SE-T

ELOS Memo#: ST11512SE-T-ES-1

Regulatory Ref: § 25.1419, Amendment 25-72

This memorandum informs the Certificate Management Aircraft Certification Office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for Dassault Aviation Mystere- Falcon 50 Airplanes equipped with Aviation Partners, Inc. (API) winglets.

Background

API submitted a request for an ELOS finding to Title 14, Code of Federal Regulations (14 CFR) 25.1419 for Falcon 50 airplanes equipped with winglets to allow use of analysis only in lieu of analysis and flight test in measured natural atmospheric icing conditions to demonstrate compliance with the icing certification requirements to demonstrate safe flight in icing conditions.

Section 25.1419 identifies certification requirements for operation in icing conditions. Section 25.1419(a) requires analysis to establish that the ice protection for the various airplane components is adequate considering the various airplane operational configurations. Section 25.1419(b) requires flight testing in measured natural atmospheric icing conditions to verify the analysis, to check for icing anomalies, and to demonstrate that the ice protection system and its components are effective. Section 25.1419(b) also requires additional

laboratory and flight testing as needed. Typically, analysis is conducted to predict the ice shapes that will form on unprotected surfaces. Dry air flight testing is then conducted with predicted artificial ice shapes to evaluate airplane performance and handling characteristics. Flight testing in measured natural atmospheric icing conditions is performed to confirm that the analysis correctly predicted the artificial ice shape used in the dry air flight test.

Advisory Circular (AC) 25.1419-1A, paragraph 3.f, proposes the use of similarity analyses as an acceptable means of compliance when an applicant can show that the proposed configuration has been previously flight tested in measured natural atmospheric icing conditions. Since evidence cannot be produced that the proposed winglet installation configuration on the Falcon 50 series airplanes have been previously flight tested in those conditions, and since the applicant proposes to show compliance by analysis, an equivalent level of safety finding is required for this program.

Applicable regulation(s)

§ 25.1419

Regulation(s) requiring an ELOS finding

§ 25.1419, Amendment 25-72

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The API winglet is a highly swept, non-deiced surface attached at the wing tip, similar to winglets previously certified on 737NG, 737-300/500 and 757-200 airplanes. Flight testing on past projects has shown that addition of winglets can result in improved handling and performance characteristics, or as a minimum, no decrement to the airplane handling and performance characteristics. Typically, ELOS findings are granted based on compensating factors in design. In this case, the design was not changed, however the tools used to verify analysis have improved since the regulation was implemented. Provided that a sufficiently conservative analysis is performed, use of analytical methods may, in part, be acceptable substitute for flight testing in measured natural atmospheric icing conditions in order to establish the small incremental differences between the baseline airplane configuration, and the winglet equipped airplane. In order to substantiate the ELOS, API will show the analysis along with the validation methodology to provide a suitable alternative to flight testing in measured natural atmospheric icing conditions.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

The FAA considered the winglet-equipped Falcon 50 design, and determined that an ELOS for § 25.1419 can be granted to allow use of analysis in lieu of flight testing in measured natural atmospheric icing conditions. The analysis provided by API will show that no ice protection is required for the winglets, that the analysis is sufficiently conservative to justify use of an independent computer code to predict ice shapes instead of flight testing in measured natural atmospheric icing conditions, that even if the clean winglet is operating near its maximum lift, it would still exhibit acceptable handling qualities, that the contaminated winglets have acceptable handling qualities within the normal operating envelope with expected roll, sideslip, yaw and sideslip and yaw rates. The analysis will also show that the drag increase resulting from the contaminated winglets does not exceed the wing drag benefit resulting from the uncontaminated winglets. If the effects of the stalled uncontaminated winglet are to be used for the contaminated winglet, API will show that the characteristics of the stalled winglets are similar (for example, the extent and nature of separated airflow and any induced flow effects on the aileron and inboard wing surfaces). API analysis will also address potential flutter concerns. The FAA has determined that the conservatism of the analysis regarding the effect of the winglet ice shapes on airplane handling and performance serves as a compensating factor and an acceptable alternative to flight testing in measured natural atmospheric icing conditions.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper ES-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS memorandum number should be listed in the Limitations and Conditions Section of the STC certificate. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulation(s):
§ 25.1419 (documented in TAD ELOS Memo ST11512SE-T-ES-1).

Original Signed by

Robert C. Jones

Transport Airplane Directorate,
Aircraft Certification Service

August 30, 2012

Date

ELOS Originated by SACO:	Project Engineer Eric Brown	Routing Symbol ANM-150S
-----------------------------	--------------------------------	----------------------------