



# Federal Aviation Administration

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## Memorandum

Date: . July 8, 2016

To: Pat Mullen, Acting Manager, Small Airplane Directorate, ACE-100

From: John Hardie, Acting Manager, Fort Worth Aircraft Certification Office, ASW-140

Prepared by: Dennis Barbini, Shared Services Branch, ASW141

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Aircraft Structures International Corporation STC Cessna Model 208 Airplane, Longitudinal Control Force During Takeoff Flap Retraction, FAA Project #ST02289AC-A

ELOS Memo#: ST02289AC-A-F-1

Regulatory Ref: 14 CFR 23.143(c), 23.145(b)(6)

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This memorandum informs the certificate management aircraft certification office of an evaluation made by the Small Airplane Directorate on the establishment of an equivalent level of safety finding for the Aircraft Structures International Corporation Supplemental Type Certification (STC) on Cessna Model 208B airplanes.

### **Background:**

Aircraft Structures International Corporation has applied for a STC to modify Cessna Aircraft Company (Cessna) model 208B airplanes with an upgraded Pratt and Whitney PT6A-140 engine (867 shaft horsepower). This engine will replace the existing Pratt and Whitney PT6A-114/114A engine (600/675 shaft horsepower).

The FAA granted ELOS Memo No. 11-09<sup>1</sup> on February 22, 2012 for a similar modification to the Cessna model 208B (FAA Project SA9502SC-A) involving an increase in engine horsepower, which could not literally meet § 23.145(b)(6). This ELOS finding showed that literal compliance to § 23.145(b)(6) could not be found during certification testing for the modified airplane.

During the certification effort on SA9502SC-A, the modified aircraft was flight tested to show compliance with § 23.145(b)(6), amendment 23-50, for longitudinal control. During those tests,

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<sup>1</sup> [http://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library](http://rgl.faa.gov/Regulatory_and_Guidance_Library)

the airplane was trimmed at the Cessna Airplane Flight Manual flap setting 20 at 150 KIAS ( $V_{FE}$ ) and MCP. The flaps were then retracted rapidly from flap setting 20 (takeoff position) to flap setting 0 while measuring the maximum pitch control force throughout the transition. Results of the flight tests showed that the modified airplane exceeded the one hand on wheel pitch control force limit of 50 lbs. (reference § 23.143(c)) during flap transition from flap settings 20 to 0.

**Applicable regulation:**

14 CFR 23.143(c)

14 CFR 23.145(b)(6), amendment 23-50

**Regulation requiring an ELOS Finding:**

14 CFR 23.145(b)(6), amendment 23-50

**Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including changes, limitations, or equipment needed for equivalency)**

The following features provide an equivalent level of safety required by § 23.145(b)(6):

1. The airplane makes use of an electric trim system that may easily be used by the pilot during flap transition to cancel the resulting stick force. This procedure will be included in the applicable airplane flight manual supplement (AFMS). In the event an electric pitch trim failure, the manual trim system can be used to mitigate high control forces. The AFMS will include a note to caution the pilot that high control forces may occur if the pitch trim system fails.

2. The flap system is gated at flap setting 10, allowing the pilot to retract the flaps incrementally and re-trim to keep the one hand on wheel pitch control force limit below the 50 lb. limit specified by § 23.143(c). The AFMS will include this procedure as an optional flap transition procedure.

**Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety intended by the regulation:**

The pilot operates the Cessna model 208B's electric trim through a thumb operated switch on the left hand side of the control yoke. Cessna demonstration pilots recommend that pilots operate this trim whenever the flaps are repositioned—trimming down, while flaps are coming down and trimming up, while flaps are coming up. It is possible to keep elevator control forces nearly zero during flap transition using this technique.

It is possible to keep the stick forces on the modified airplane below the limits of § 23.143(c) if the maneuver required by § 23.145(b)(6) is modified to allow flap retraction to be done in stages with re-trimming at the 10-degree flap gate. The Cessna Pilot's Operating Handbook specifies raising the flaps after takeoff in increments, with a pause at 10-degree flaps to allow the aircraft to accelerate.

**FAA approval and documentation of the ELOS finding:**

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper F-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Accountable Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number must be listed in the Type Certificate Data Sheet under the Certification Basis section (TCs & ATCs) or in the Limitations and Conditions section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulation(s):

14 CFR 23.145, Longitudinal control, paragraph (b)(6), amendment 23-50  
(documented in ELOS Memo ST02289AC-A-F-1)

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July 8, 2016

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Pat Mullen, Acting Manager, Small Airplane Directorate,  
Aircraft Certification Service

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Date

ELOS Originated by: Fort Worth ACO	ACO Manager: John Hardie	Routing Symbol: ASW-140
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