U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Chief Counsel
800 Independence Ave., SW.
Washington, DC 20591

Mr. William P. Wang
[redacted]

Re: Interpretation of 14 CFR §§ 23.149(b) and 23.161(d)

Dear Mr. Wang:

This letter responds to your June 26, 2015 request for a legal interpretation of Title 14, Code of Federal Regulations (14 CFR) §§ 23.149(b) and 23.161(d). You posed a number of questions, each of which is addressed below.

In your request you note that § 23.149(b), which establishes requirements for determining minimum control speed with the critical engine inoperative (V_{MC}), states that the V_{MC} determination is made with "the airplane airborne and the ground effect negligible." You question why the regulation was "written with ambiguity" and ask if it "could be interpreted to mean that the airplane is in ground effect, but barely."

Section 23.149 was revised in 1978 as part of the FAA's Airworthiness Review Program (43 FR 2302; January 16, 1978) to address ground effect when determining V_{MC} for takeoff. The revision specifically requires that the determination be made with the airplane experiencing negligible ground effect. As commonly defined, the term "negligible" refers to a factor that is "so small or unimportant or of so little consequence to warrant little or no attention."[1] Chapter 4 of the *Pilot's Handbook of Aeronautical Knowledge* (FAA-H-8023-25A) notes that "ground effect is most realized at altitudes less than the wingspan" and that "when the wing is at a height equal to its span, the reduction in induced drag is only 1.4 percent." Typically the flight tests used to determine V_{MC} are conducted "at altitude" where ground effect is non-existent. The FAA does not want an applicant to take advantage of the reduced drag conditions resulting from ground effect when calculating V_{MC} for certification. In the context of § 23.149(b)(2) the FAA would consider any determination of V_{MC} conducted at an altitude higher than the aircraft's wingspan to be an altitude where ground effect is negligible (i.e. the airplane could be in ground effect, "but barely.")

You further note that § 23.149(b)(2) states that the airplane must be "trimmed for takeoff" and ask whether this applies to elevator trim, rudder trim, aileron trim, stabilizer trim, or any device that exists in the airplane.

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[1] As defined in *Meriam-Webster Online Dictionary*, October, 2015

You are correct in noting that § 23.149(b)(2) requires that for the V_{MC} determination to be made the airplane be "trimmed for takeoff." Accordingly, if the manufacturer specifies a takeoff range or position for the elevator or other trimmable surfaces, including the rudder, ailerons, or other control surfaces, those surfaces must be set within that range or to that position. The FAA notes that for most airplanes type certificated under part 23 this requirement typically only affects elevators, as § 23.677(a) requires that "the pitch trim indicator must be clearly marked with a position or range within which it has been demonstrated that take-off is safe for all center of gravity positions and each flap position approved for takeoff." Similar requirements do not exist for other trim indicators. Additionally, there must be "means to indicate to the pilot the position of the trim device with respect to . . . the range of adjustment. . ."

You also note that § 23.149(b)(3) states that flaps must be "in the takeoff position(s)" and ask whether this refers to secondary surfaces only (e.g. wing flaps and leading edge flaps) or if this requirement also includes engine cowl flaps as well.

The requirement in § 23.149(b)(3) which specifies that flaps must be in the takeoff position, includes leading edge flaps, such as Krueger flaps. This specific paragraph is not intended to regulate the position of an aircraft's cowl flaps; however, the introductory language of paragraph (b) of § 23.149 states that V_{MC} for the airplane must be determined "for the takeoff configuration(s)." Accordingly, if the position of the airplane's cowl flaps were specified by the manufacturer as part of its takeoff configuration, the airplane's cowl flaps would be required to be set in that position for the V_{MC} determination.

You then discuss the Airplane Flying Handbook (FAA-H-98083-3A) and note that on page 12-29 it states that for takeoff, cowl flaps must be in the takeoff position and ask how the author of the handbook came to the conclusion that § 23.149(b)(3) included cowl flaps. Again, please note that the introductory language of paragraph (b) of § 23.149 states that V_{MC} for the airplane must be determined "for the takeoff configuration(s)." Accordingly, the position of the cowl flaps would only be required to be set in the takeoff position if the position of the cowl flaps were specified as part of the airplane's takeoff configuration.

You further note that the handbook offers no explanation as to how V_{MC} is affected with changes to wing flaps, cowl flaps, airplane trim, and ground effect. You ask whether it is "legal" for an examiner during a certification/rating flight test to ask questions pertaining to how changes to each of these configurations affect V_{MC}. You state that since there is no documentation that provides any guidance which definitely states how changes to each of these configurations affect V_{MC}, you believe an examiner may not ask these questions.

In the "Use of the Practical Test Standards" section of the Practical Test Standards for applicants seeking both private and commercial pilot certificates with airplane multiengine land or sea ratings (FAA-S-8081-14B and FAA-S-8081-12C, respectively) it states that "applicants shall be evaluated in ALL Tasks included in each Area of Operation of the appropriate practical test standard, unless otherwise noted." In Task H, Principles of Flight - Engine Inoperative, of Area of Operation I, Preflight Preparation, the examiner is required to determine that the applicant exhibits satisfactory knowledge related to engine inoperative

principles of flight by explaining numerous concepts, including reasons for loss of directional control. In Task A, Maneuvering with One Engine Inoperative, of Area of Operation X (for commercial pilots) and XI (for private pilots), Multiengine Operations, the applicant is required to exhibit "satisfactory knowledge of the elements related to maneuvering with one engine inoperative. Accordingly, any factor that could contribute to an airplane's loss of directional control could be the subject of inquiry by the examiner.

You further note that § 23.161(d) refers to "each multiple airplane" and request clarification of this term. The term "multiple airplane" in that paragraph is a technical error which should be stated as "multiengine airplane." The FAA is aware of this technical error and plans to correct it in our next revision to Part 23.

This response was prepared by Paul Greer, an attorney in the Regulations Division of the Office of the Chief Counsel and coordinated with the Small Airplane Directorate (ACE-100) of the Aircraft Certification Service. If you need further assistance you may contact us at (202) 267-3073.

Sincerely,

Lorelei Peter
Acting Assistant Chief Counsel
for Regulations, AGC-200