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Mr. R.J. Mather
Chief, Engineering
Airworthiness Branch
Ottawa, Ontario
K1A 0N8

Dear Mr. Mather:

The purpose of this letter is to respond to a concern your agency has with the structural substantiation of Part 23 airplane modifications involving increased engine power in Advisory Circular No. 23-12.

Federal Aviation Regulation Part 23 and its predecessor Civil Aviation Regulation 3 both define minimum cruise speed (V_{Cmin}) for normal category airplanes as $V_{Cmin} = 33 (W/S)^{0.5}$, except that V_{Cmin} need not exceed 0.9 times the maximum level flight speed (V_H). The minimum design dive speed, V_D , is correspondingly established as $1.4V_{Cmin}$.

Transport Canada is currently questioning the policy governing Supplemental Type Certificate (STC) engine modifications/changes. The Federal Aviation Administration (FAA) has not issued a requirement to revise the Velocity-Load Factor (V-n) diagram when certificating a higher horsepower engine installation. Transport Canada accepts the original V-n diagram validity for an STC if V_C was originally established by wing loading, but invalid if V_C was originally established by using a factor of V_H .

In order for this position to be accurate, wing loading and speed must consistently have a close correlation. There are numerous currently certificated airplanes, however, that do not have this relationship. The following data is an example of an existing airplane:

W/S = 27.5 pounds per square foot
 $V_H = 245$ Knots
 $V_C = 33(27.5)^{0.5} = 173$ Knots
 $V_D = 1.4V_C = 242$ Knots

If the designer, however, chose $V_C = 0.9V_H = 220$ Knots, the resulting dive speed would be $V_D = 1.4V_C = 308$ Knots.

The above noted example is representative of a number of airplanes and illustrates that accepting the wing loading derivation to V_C does not necessarily equate to the most conservative design result. Furthermore, this example illustrates that the design standard allows V_H to reside anywhere from stalling speed (V_S) to the maximum operating speed (V_{ne}). This has not proven to be a problem during the 2 billion flight hours of general aviation service history, substantiating that the pilot is required to manage the airplane's airspeed within the established limits regardless of horsepower available.

In summary, the development of a new V-n diagram for STC engine installations affords the customer little, if any, benefit at a significantly higher cost. The FAA believes the current policy adequately addresses the applicable safety issues and does not anticipate a change to this policy.

Thank you for your concern in aviation safety. I hope this adequately addresses the issue you had risen. If you have any comments, please feel free to contact Jim Griswold, of my staff, at (816)426-6941.

Original Signed By
Michael K. Dahl

Michael K. Dahl
Manager, Policy & Regulations Branch

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