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TO: Primary Operation and Safety Inspectors

As an instructor and check airman of turbojet aircraft for over 26 years, I have trained a multitude of pilots on the subject of performance. I have catalogued numerous methods and observed several commercially available products that pilots have presented to me during class. The inappropriate methods range from not performing the calculations at all, to elaborate, but incorrect, rules of thumb. The products I have tested range from downright incorrect and deceptive, to thorough, clear and comprehensive. Like you, I am on the forefront of promoting aviation safety and I hope you will find this letter informative.

First, I would like to mention a publication that is an excellent primer on the issues I will be discussing. The book, which can be found on Amazon.com, is called “Aircraft Performance-Myths and Methods” by James Deuvall. I recommend this book to all my students and even the highest time pilots find it very helpful.

The proper use of Part 25 performance charts, irrespective of the manufacturer or model, is a complex process. The obstacle clearance method discussed in most, if not all, part 142 schools, while consistent with the AFM, are wholly inadequate to the preparation of pilots flying in today’s changing environment. The reason for this is that all AFMs use, as an obstacle clearance example, the rare and simplistic condition of clearing a single, relatively short, known obstacle. This example calculation is very straightforward and even somewhat intuitive. Rarely is any time spent instructing pilots how to meet a climb gradient, such as a departure procedure (DP), ODP or SID. Because of this, most pilots, as well as some vendors, use that same intuitive methodology to meet extended climbs associated with DPs. As a result, erroneous maximum weight calculations are the rule rather than the exception. If an operator is not using a performance calculator, I can assure you that either the charts are not being referred to at all or are incorrectly done so. It only takes a matter of a few minutes to uncover the potentially life-threatening errors manual methods produce.

Now, I have also found that the use of a calculator, by itself, does not provide adequate assurance of correct computations either. It is very important to understand that calculators also use a methodology and I have found that some popular calculators simply automate the same improper methods that pilots use manually. The best known of these is UltraNav. I have encountered this product numerous, numerous times as an instructor. UltraNav self-proclaims and promotes, as a benefit of their product, several erroneous assumptions. Every Part 25 aircraft, by certification, uses a specific profile to

construct the AFM data. That profile, referred to as the Net Takeoff Flight Path, is absolutely integral to the validity of the numbers published in the AFM and mentioned in both Part 121, 125 and Part 135 regulations. In order for the aircraft to achieve the values in the AFM, the aircraft must fly the profile precisely. If a calculation deviates from this profile, none of the promised performance, within the AFM, can be assured. The profile requires ALL aircraft to climb, within second segment, to a maximum altitude and no higher. There are a few exceptions however, for example manufacturers who have provided specialized charts for extended climbs while maintaining engine time limits, but most aircraft have mandatory level-offs from 400 to 1500 feet. This is one of those non-intuitive computations typically overlooked by pilots attempting to compute performance by hand and almost universally not observed during Part 142 simulator sessions. The intuitive, but incorrect, method would be to not lower the nose if an engine failure occurs and hold V2 no matter what altitude is required to clear obstacles. This is exactly what most simulator instructors teach and what the UltraNav performance calculator calculates. Unfortunately, as I mentioned previously, the resulting flight path of holding second segment beyond the limits of the AFM is entirely hypothetical. UltraNav calls this "always-in-second-segment" flight path "True Flight Path", which they have "coined" within their product. The validity of this path is entirely false. Abacus and AFMsolutions (written by the same gentleman who wrote UltraNav) also make similar assumptions.

The only performance calculator that follows the Net Takeoff Flight Path and incorporates the engine-time and other system limits correctly is the CAVU Companies' product EFB-Pro.

The Cessna CPCalc product, while certified under the same provisions as an AFM, does not appear to follow its own print version of the AFM Net Takeoff Flight Path procedure. If you enter a climb gradient in CPCalc, lets say a 6% climb to some altitude above 2500ft; the calculator will provide the total distance from the end of the runway to the beginning of the level-off segment. If you divide that value into the AFMs maximum level off altitude, you will get a gradient that is less than the 6%. This can only occur if the path of the aircraft falls below the 6% gradient during the climb or the level-off (third segment) has been initiated above the maximum level-off height. This is an apparent disconnect between the AFM and the calculator.

The other non-manual method, which is becoming increasing more popular, is the use of runway analysis. There are several vendors of such products available to business class jet operators, but the most popular, I believe, is APG (offered free through ARINC Direct, a factor in its popularity). While I have nothing against the actual calculations provided, I have observed consistent misuse of this tool. Runway analysis comes to us from the airline industry. Within that environment, runway analysis is a safe and well-managed practice. Airlines typically use an internal engineering department to construct "escape procedures" and flight test those procedures with "average ability" crew and standardized equipment in mind. Line pilots are then familiarized, during simulator sessions, with the procedures they will encounter along their scheduled routes.

Runway analysis, when utilized within the part 135 and 91 worlds, poses many unique safety issues. Unlike the airlines, who train to proficiency on a handful of "escape procedures", the Part 135 crew potentially faces several thousand uniquely modified DPs at a moments notice. I have never encountered an operator who was required to provide, nor has voluntarily provided, enhanced simulator/flight training specific to runway analysis even when authorization was needed to use this method. During training, what I

invariably encounter are crews who refer to the maximum weight listed for a runway and then the entire process ends there. Operators are universally unaware of the special procedures involved in using runway analysis correctly and safely. Here are just a few that I have encountered. Since the modified procedure will most likely deviate from the normal departure procedure, crews must set up FMSs and brief differently. Rarely, if ever, is this done. Crews are universally unaware of the reduced safety margins, both laterally and vertically, utilized in constructing the unique runway analysis DPs (AC120-91). I have never seen an operator actually flight test the procedure, as the airlines do. Briefing points should include items such as when the DP procedure becomes obsolete (The point where the modified DP deviates from the normal procedure. When the aircraft passes this point, the aircraft is committed to the normal procedure). Since the FMSs maybe set up independently, one for the SID, the other for the modified DP, a thorough understanding of who will be the pilot flying (PF) must be briefed in the event of an engine failure. Routinely the modified DP will incorporate a hold, the location and entry of which must be briefed. Additionally, the method of navigating must be considered since wind drift may lead to a flight path that lies outside of the safety area.

As inspectors and examiners, I am aware that you can not advocate the use of specific products as I am at liberty to do; however, I would encourage you to contact me and/or acquire a copy of the aforementioned book to learn more about this area of flight safety that has gone largely unnoticed by the industry. I should also mention that in no way do I financially benefit from any of the products mentioned. I am sharing this information with you as a professional pilot and instructor devoted to the continuing safety of general aviation.

With regards,

Darrell Rahn