Loss of Primary Generator while operating in icing conditions? It's not just a Commercial thing.

As of March, 2017, after nearly 18 years of study by first the European Joint Aviation Authority (JAA) and now EASA (European Aviation Safety Agency) they, Europe, have finally approved single-engine turboprops to commercially operate night and/or in IMC conditions for its entire 32 member states (countries).

The FAA was a little faster, having approved Part 135 (commercial) single-engine aircraft beginning May of 1998.

There appear to be some differences of opinion regarding commercial operations involving single-engine aircraft, specifically night and/or in IMC. But the reason for this article concerns a probable consequence of the pre-final rule changes from EASA which now includes "two separate electrical generating systems, each one capable of supplying adequate power to all essential flight instruments, navigation systems and aeroplane systems required for continued flight to the destination or alternate aerodrome".

Additionally, "an emergency electrical supply system of sufficient capacity and endurance capable of providing power, following the failure of all generated power, to additional loads necessary for all of the following (essential equipment)…"

The following have been FAA rules since May 1998:

FAA Part 135.163 specifies equipment requirements for aircraft carrying passengers under IFR, and § 135.163(f) (1) and (2) require that single-engine aircraft have:

(a) Two independent electrical power generating sources each of which is able to supply all probable combinations of continuous in-flight electrical loads for required instruments and equipment; or (Same as EASA)

However, not included with EASA rule is below FAA requirement

(b) In addition to the primary electrical power generating source, a standby battery or an alternative source of electric power that is capable of supplying 150

percent of the electrical loads of all required instruments and equipment necessary for safe emergency operation of the aircraft for at least 1 hour

Sometime around early 2015 it suddenly occurred to FAA folks that, specifically Part 135 approved Legacy (MSN 101-888) PC12s, were probably operating out of compliance regarding 135.163(f)(1) or (2)(b). They began internal studies to find a solution without causing harm to the already approved, numerous Part 135 Legacy PC12s operating in the United States. The main area of concern is Flight in Known Icing conditions and a then loss of Generator 1.

Generator 2, based on Pilatus procedures, could handle the remaining electrical load under non-commercial operating conditions but under the 150% requirements of Part 135 this would not be possible using the existing published Emergency Procedures.

It came to a boiling point early this year when some letters were sent to Part 135 operators requiring compliance within 10 days. What actually was happening was a final "push" to resolve conflicting views regarding the Legacy PC12 electrical systems by requesting input from Part 135 operators regarding corrected procedures to follow for approval/continuing compliance with Part 135 regulations. The FAA said it would review all data with Pilatus and Part 135 operators and have a resolution within 6 months.

Whether or not you are flying Part 135 or Part 91 the following pertains to all PC12 operators, including PC12NGs.

Pilatus Pilots Operating Handbook, all 3 versions, Section 2 Limitations has ALWAYS stated "Flight in icing conditions is only approved with all ice protection systems, generator 1 and generator 2 serviceable.

It is clear enough to me: if you cannot "service" Generator 1, then leave the Icing conditions. Once clear of the icing you can turn off the icing equipment that is loading Generator 2. It appears to me that early FAA inspectors just read the existing published Limitations and Emergency procedures and thought that was sufficiently safe. Me too!

The FAA or any pilot now should be wondering "what can be safely turned OFF" while still in icing conditions and after clear of icing, what else, if anything more, to comply? Time to review what most drivers *LOVE* - electrical!

Let's start off with the following (includes the PC12NGs): if Generator 1 shuts OFF then the Non-Essential Bus auto "load-sheds" OFF as well. What is shut OFF? Equipment that draws large amounts of electrical, non-essential loads (amps), which are the VCCS, Landing Gear motor (Legacy only), both Heaters and all air Blowers plus (Legacy only) part of the Angle-of-Attack heat - reason enough to leave icing! One or two other items are on Non-Essential Bus but I am writing "big load" items only. Note: VCCS or Heaters can run at one time, not simultaneously.

Continuing with Legacy only now, the Propeller De Ice is the number 1 Highest Load item now, followed by Co-pilot's windshield heat, if wired to Generator 2 Bus, followed by Co Pilot's Pitot and Static Heat (separate Circuit Breakers).

Generator 2 is rated at 115 Amps and even with the Auto Load-Shedding will still draw too much amperage to comply with the Part 135 requirement. At this point it is *very* important for Legacy pilots to observe the Battery amps for possible discharging and if it is happening, to remove additional non-essential loads (see next paragraph) to either reduce or eliminate the Battery discharging. This could be happening due to the Battery load assisting with Generator 2 even if the amperage output reading for Generator 2 is showing less than its maximum 115 amps.

What should you shut off if still in icing conditions but in the process of departure? Co Pilot's Windshield heat, Co Pilot's Pitot and Static, sometimes labeled LH Pitot and LH Static, plus ALL external lights. Once clear of icing shut off Propeller De Ice system and Pilot's windshield (when Outside Temperature permits), if needed to comply.

What I just described as a load-shed procedure is basically what the FAA has approved for Part 135 Legacy PC12s [Info 17011 8/01/2017]. Once the operators have added the additional load-shedding procedures to their Emergency Procedures and submitted to regional FAA they should be allowed to continue commercial operations. Of course the current production NGs are in compliance without changes required since the NG, as well as modified Legacys with the PT6A-67P engine, both have dual 300 amp, Generators.

Why did Pilatus not consider this electrical dilemma when first built?
One of the early goals for Pilatus, if not the first, when building the PC12 was to be a Commuter aircraft serving European Countries. When first produced the only Commercial Operating rules were from International Civil Aviation Organization

(ICAO) for International, Commercial multi-engine aircraft and the general commercial rules for single-engine (piston) aircraft were to fly day, VMC conditions with equipment compliance relating to an engine failure in-flight and the electrical capability to make a safe glide to landing, guidelines established in 1948. From the formation of JAA (1970?), the electrical requirements that are now a current EASA rule were used by Pilatus as specifications for the first PC12s built. Coincidentally as the JAA was forming discussions in 1997, FAA research was concluded and the approved changes began in 1998. The European agency's [EASA was formed 2002 replacing JAA] continued research specifically targeted turboprop reliability but could not come to a consensus. Throughout the years since the first PC12 production, changes continued concerning single-engine procedures from EASA member countries and other countries. Pilatus continued with the evolution of the PC12, from the Series 10 (2001) to the NG (2008), which was built to comply with FAA as well as member state requirements.

Whether flying privately or commercially it is the responsibility of the Pilot-in-Command to be cognizant of the operational capabilities of the aircraft being flown. Electrical systems have tended to be a "snoozer" when being discussed but assuming the aircraft will "auto" take care of you should never be taken for granted. I very much believe that the Pilatus engineers designed an electrical system for "dummies" from the first and have done a wonderful job. The Legacy PC12 can possibly make you work just a bit if an electrical problem occurs. The current NG version is practically no work and is the greatest yet for dummies, but drivers should still have an understanding for the infamous "Murphy" events.

"A safe pilot is always learning"

John Morris - ACFT Services

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