Descending from FL280, over the Gulf of Mexico, on a typical late summer day, meaning a good chance for thunderstorms!

Inbound to Houston, Texas from central Florida I am remaining approximately 60 NM off shore instead of one of the standard arrival procedures to avoid some unnecessary bumps and build-ups over the Houston area since I had sufficient fuel to deviate to New Mexico or back to Florida. Using the Nexrad and Radar on my Multi-Function Display, along with ATC guidance, I am avoiding the worst of the storms but I am IMC with occasional ice accumulation requiring use of Propeller De Ice and Inertial Separator in the open position.

Suddenly (it's never slowly, is it!) the CAWS amber GEN 1 OFF annunciator illuminates followed by the CAWS amber N ESTNL BUS annunciator. Since I am using the autopilot and things are not TOO bad outside, FLY THE AIRPLANE FIRST, I can attend to these annunciations. Following emergency procedures I reset GEN 1. However, GEN 1 does not reset and now the CAWS amber BATTERY* annunciator illuminates! Huh? Things are starting to get a little busy inside the airplane while I am still dodging build-ups and descending into the Houston area IMC.

Ok, first things first, notify ATC that I need to find some clearer air (should not be in Icing Conditions with GEN 1 off) and that I am having some "issues" that I need to correct when able, still have lots of fuel. I head south; get out of the clouds, level, at FL220. I now review the emergency procedures for GEN 1 OFF – if Gen 1 does not reset. The continuing procedure reads: "GEN 2 load - reduce until Battery current is positive (not discharging)". I look up and see the Battery ammeter* showing an average discharge of 105 amps (it is cycling higher and lower) and it's blinking! What else can I reduce? I thought, from training that the Non-Essential Bus Auto Load shed would take care of the additional load. And what happened to GEN 2? What about the CAWS amber BATTERY* annunciator? Picked a bad week to quit drinking (coffee).

Before I continue with this saga let me translate the emergency procedure regarding GEN 1 OFF and the reduction of battery current until positive charge. With GEN 1 OFF and the Non-Essential Bus Auto-Load shed indicating, GEN 2 should be able to carry most of the remaining electrical load. However, even with GEN 2 indicating 28 Volts and at or below it's maximum rating of 115 Amps, it may happen that the Battery will come on line, indicated at the BAT Volt/Ammeter, by a discharge (a minus sign) of the Battery and a lower (Battery) voltage than GEN 2 or what should have been the Battery's approximate voltage before engine start. The

Battery is assisting an actually diminishing line voltage from GEN 2 due to a higher amperage load than is actually being indicated.

That was a translation? Lets think of the electrical system as a train. The train has three engines-the Main Engine (Gen 1) pulling the largest load, the Support Engine in the middle (Battery) capable of pushing or pulling limited loads to assist and the Rear Engine (Gen 2) pushing a percentage of the total load to help the Main Engine. The RPM of the engines is voltage; the cargo load is the amperage and the speed of the train (system voltage) is relative to the RPM of the largest Engine(s). Since the Support Engine (Battery) is a lower RPM (voltage) than the Main/Rear Engines it will coast (charge) once one or both of the other two engines are at their normal RPM's. The problem that can occur is if the Main Engine shuts down while pulling a heavy load. The Rear Engine will increase its power to maintain the train speed while the train crew disconnects excess cargo load (Non-Essential Bus Auto-Load shedding). The Engine RPM [indicated and measured at each engine] of the Rear Engine is maintaining, not over heating (over-voltage), but the speed of the train is decreasing-wheels slipping? When the speed decreases to the Support Engine's RPM, then the Support Engine joins the Rear Engine to pull the load.

Back to the fun! Clear of clouds I turn off the Propeller De Ice hoping to drop a lot of amperage. The Battery discharge only reduces by approximately 30 amps so it is still blinking and discharging at approximately 65-70 amps! And now I notice that the Battery Voltage is indicating 20.5 Volts and I think it is dropping!!! What's going on with Gen 2? I see the GEN 2 Volt/Ammeter on the EIS showing 28.3 Volts and 110 Amps. Shouldn't Gen 2 be able to produce more amps? What else can I turn off? And oh by the way, I am flying south over the Gulf of Mexico, away from land in order to remain clear of clouds/build-ups, ATC wants to help and I would LOVE to land-NOW!

Again, its daytime, fuel is not a problem and the engine is fine but the electrical items are interesting to say the least. And lets remember that this is not winter type weather, which would require more heat related items for safety of flight, which means more amperage.

With the help of ATC and my on-board equipment it is decided to head for Corpus-Christi, which is better weather and not that much farther that Houston (which I really don't care about at this point anyway). It is still about 35 minutes to landing and I need to reduce the electrical load further before I lose my Battery/GEN 2. What else can I turn off? What is causing this mess?

Why did I say I could lose my Battery/Gen 2? Answer: How long will the Battery remain useful if it is discharging at 60 amps or greater? The best answer available is 20 minutes-at 60 amps. And from my (hopefully useful) analogy of the electrical system it is apparent that Gen 2 is *not* carrying the remaining load correctly, it (Gen 2) will overload if the Battery goes off line. **And,** I am still about 30-35 minutes from landing! What else can I safely turn off to avoid the above conclusion?

Here's the good news. Obviously I successfully concluded the flight. Here's the BETTER news. This did not really happen. Yes, I have been in the exact area with the exact weather described and I have experienced the electrical malady being discussed, but not at the same time (thankfully only during training).

The electrical system design and redundancy of the PC12 are excellent and I have only heard of one or two complete Gen 1 failures. However, it does not mean that everything always works correctly as designed. The Non-Essential Bus holds the control over the majority of the high amperage loads that can affect the operation of Gen 2, after a Gen 1 failure. These include the Landing Gear motor (Max 100 amps), the AOA Plate Heat (Max 30 amps), the Recirculation fans (Max 30 amps)-Electric Air Conditioning (Max 125 amps) and Cabin Heater/Under floor Heater (Max 75 amps each-Note: Only the A/C or the Heaters operate, not both). What is not included that draws some energy (Max 29 amps) is the Windshield Heat (the Co Pilot's Windshield heat is on the Non-Essential Bus for the MSN 100-400, except 321 aircraft). Note: A Service Bulletin was issued over three years ago relating to a ground strap location for Gen 2 that affected Gen 2 performance. This bulletin, strongly recommended but not mandatory, was for all PC12's until MSN 600. If your aircraft has not already received this update, I strongly urge you to comply with it at the earliest date.

If you suspect a higher that normal amperage load due to a scenario similar to the one just described, select OFF the items than would have been dis-connected by the Non-Essential Bus Auto-Load shed. Example: Cabin Air Conditioning/Recirculation System, Cabin Heat, Co Pilot Windshield Heat, ALL External lights.

A Safe Pilot is one who is always learning.

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* During this article I am referring to the CAWS amber annunciation “BATTERY” which is associated with MSN 321,401 and after aircraft. This annunciation is to indicate either the Battery is in an over volt condition or that the discharge rate is greater than 60 amps (with the associated volt/amp problem blinking at the overhead Battery Volt/Ammeter). MSN 101-400, except MSN 321, the Battery indications mentioned above will be shown on the EIS-BAT Indicator and EIS annunciators only.