Know Your Systems

I read with great interest the *ASW* cover story for December 2011–January 2012 when I saw the photograph caption, "This aircraft struck terrain while departing with the flaps and slats retracted." I thought to myself in disbelief, "What? No takeoff warning? Again?"

Dishearteningly, I believe that from a maintenance perspective at least, this was a preventable accident. Had the technicians and the flight crew better analyzed and understood the problem of the ram air temperature (RAT) probe overheating and realized the implications of the probe being heated on the ground in the first place, this tragedy might not have happened. I also read the report by Spain's Civil Aviation Accident and Incident Investigation Commission (CIAIAC) and was very surprised to see that, in spite of the attention given to the R2-5 relay as a possible cause of the takeoff warning system (TOWS) not operating properly and how it controls the RAT probe heat, the relay, or at least its functionality, was not declared the "smoking gun" in the accident.

On the MD-82 aircraft the RAT probe heater is electrically powered "ON" when the aircraft is in the air and it is "OFF" (not powered) when the aircraft is on the ground. This on/off circuit is controlled by the R2-5 relay air/ground logic through an electrical ground input via a "nose landing gear down" and a "nose landing gear oleo" switch. The R2-5 relay is energized when the aircraft is on the ground and de-energized in flight. Thus, the R2-5 relay "fail mode" is to the flight mode. In other words, if the controlling circuit to the R2-5 relay from the aircraft's electrical systems should fail, the relay would de-energize and the systems controlled by the R2-5 relay would operate "normally" as if the aircraft were in flight.

In addition to controlling the RAT probe heat, the R2-5 relay provides control inputs to three other systems, none of which would have a flight deck effect if the R2-5 relay was in the "flight" mode while the aircraft was on the ground. The R2-5 relay controls an "inhibit" signal to the aircraft's electrical system AC [alternating current] bus control unit "AC CROSS-TIE" circuit when the aircraft is on the ground. This inhibit signal prevents the aircraft's left and right buses from being connected to each other when the APU [auxiliary power unit] or an external power source is powering the buses.

The R2-5 relay controls the standby radio rack fan from being powered "ON" in flight by removing an electrical ground from the fan control circuit when the radio rack fan switch is placed in the "Venturi" position. And the R2-5 prevents TOWS warnings in flight by supplying an electrical ground input to the central aural warning unit.

On the ground, a malfunction of the R2-5 relay or its controlling circuit would not provide any indication of a faulty TOWS unless a check of the TOWS was performed by the flight crew (one of the CIAIAC's recommendations) prior to takeoff. Under normal conditions, the only indication the flight crew would have of the R2-5 relay air/ground circuits being in the "flight" mode when the aircraft is on the ground would be exactly what was noticed: the RAT probe overheating.

Although the CIAIAC report discussed the possibility of faulty contacts in the R2-5 relay as possibly affecting the TOWS and RAT probe heat, and in spite of the inconclusive findings by the CIAIAC of the R2-5 relay being the cause of the faulty TOWS, the fact is that the RAT probe could not have been "ON" and overheated on the ground unless the R2-5 relay contacts powering the RAT probe heat were in the "flight" mode. And if the R2-5 relay was in the "flight" mode while the aircraft was on the ground, then the TOWS would be inhibited.

I was pleased to see that one of the recommendations made by the CIAIAC was the "requirement that the source of the malfunction be identified before using an MEL [minimum equipment list]." However, I was disappointed that this recommendation was made only applicable to the RAT probe heat system. I believe identifying the source of a malfunction prior to applying the MEL is crucial, particularly when something is operating when it should not be. Not doing so has the potential for improperly applying the MEL to render what appears to be a malfunctioning system "inoperative" when that system is operating when it should *not* be.

This is not to say that the MEL cannot or should not be applied in some of these cases. But often, if something is operating when it should not be, the fault is in another system. In this case, I believe the RAT probe overheating was an indication of a bigger problem that deserved closer scrutiny. I cannot stress enough the importance of understanding how the applicable aircraft systems that we apply the MEL to are *supposed* to work before we point to them as being the faulty systems.

Regardless of the CIAIAC's findings as to the cause of this accident, I will use this accident as a teaching tool for the importance of understanding how a system is supposed to work, identifying the source of an apparent malfunction before using the MEL, and the potential life-threatening consequences of not doing so.

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Wind Farm Turbulence

I am writing in the hope that readers of *ASW* may be aware of research or data pertaining to the generation of wake turbulence by a wind turbine and the threat this turbulence may pose to aircraft flying at a low level.

There is little doubt that wind turbines generate unstable air on their lee side, as this is the very reason turbines are spaced apart in wind farms. My question is, "Could the severity of the turbulence generated by one or more turbines be sufficient to cause a flight risk to small or medium-sized aircraft entering the wake turbulence area?"

Wind farms are relatively new to Australia, and aerial firefighting agencies are looking to develop policies which will guide aerial firebombing pilots on how to fly safely in the vicinity of these structures. Any data that readers have on this topic would be greatly appreciated. Material can be emailed to <inman.janet@cfs.sa.gov.au>.

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