LANDING GEAR EMERGENCY

by Ingo Steinbach, TTCF Member

It was a dark and rainy night at Senai airport in Johor, southern Malaysia, just 80 miles north of the Equator. I was planning to practice some night instrument approaches, but had been delayed by a major thunderstorm that had passed through the area earlier in the evening. This is nothing unusual here in the tropics. It was still drizzling slightly with dark clouds and no moon. I had waited a little longer than usual to depart in order to ensure the best ride for my passenger, who was flying in a small airplane for his second time ever, and his first night flight. I had carefully calculated my fuel requirement for the flight and included a one hour reserve. By the time we departed on an IFR flight plan, the low clouds had lifted and we were flying in VMC under a higher overcast with occasional light rain. We marveled at the city below, heavily clogged with traffic.

As we climbed out, I sensed my 340 was flying slower than normal, and it seemed to take us longer to reach our cruising altitude. The low level winds were pretty strong - just under 30 knots, which is unusual for this area. I blamed our seemingly slow pace on the winds. Turning inbound on the approach, I began my pre-landing checklist and lowered the landing gear. Instead of the usual "three green" I had two green lights and one red light. I tested the bulbs and all were working. I cycled the gear twice and got the same indications. The sounds of the gear cycling all seemed normal, except possibly a more muffled locking sound than usual. That could have been my imagination, though.

I contacted the tower to tell them about our problem, and I let them know that we would shoot a missed approach and try to sort out our problem during a hold. This communication took some extra time. English is not the first language in Malaysia. Standard ATC communications go smoothly, but anything out-of-the-ordinary takes extra time. We were cleared to the standard holding pattern for the airport. Since I have been flying in the region for many years, the airspace was familiar. However, we were in light rain with low visibility and few visual cues outside the cockpit.

I have the full Aspen suite in my airplane with a PFD and two moving maps. In the airport environment, I vary the scales of the two maps such that one is zoomed in enough to show the runway centerline, while the other is zoomed out for situational awareness. We spent 10 minutes in the holding pattern troubleshooting our situation and allowing a couple airliners to land. While technically VFR, the darkness and mist meant I was primarily relying on my Aspen equipment while we flew the pattern.

Ingo Steinbach (second from left), his friend, and two Hindu priests who blessed his airplane on the island of Bali, Indonesia.

My airplane went through a major avionics upgrade two years ago. I am an A&P, and during the refurbishment I installed a fourth green light to confirm that the landing gear motor was in the lower end position with the lower limit switch activated. Twin Cessna pilots know that there can be a situation where all three green gear lights can be illuminated, yet the gear is not completely extended and fully locked. That is why during the emergency gear extension, pilots are instructed to continue cranking the handle until it stops. Only then is the gear down and locked. The fourth light I added tells me that the landing gear motor has run all the way to the end point and not stopped somewhere prior to that. In an emergency extension situation it's a reminder to keep cranking the handle until it stops!

I had rigged the landing gear only three months prior to this incident, including "downlock on free fall." The specs state that you should require about one turn before you can feel the end position. I had checked this during the re-rigging, and I got exactly one turn during while troubleshooting in the holding pattern, so I knew it was within spec. The same logic applies with the gear in the retracted position, so I cycled the gear and also got one turn. So I knew it was within spec on that end as well. All this meant that my gear problem was one of two things: 1) There was something wrong with the linkage of the left main gear, a worrying thought, or 2) it was just a defective gear-down switch.

There was nothing else I could do to troubleshoot, so I asked the tower for a flyby. They approved it and also sent a car and crew to the end of the runway. The malfunctioning light was on the left main gear, which meant that I would be doing the flyby on a runway with no IFR approach and no approach lights. The car lights were a big help.

The flight to the airport was challenging on multiple levels. We were at pattern altitude in marginal VFR conditions with darkness and light rain limiting our visibility. Moreover, as I flew toward the airport with the gear extended, the airplane required some unusual trimming, which confirmed that there was some sort of extension problem and not just a switch issue. My hopes for a good outcome were dashed. Then another challenge emerged: fuel.

When we first encountered the landing gear issue on approach, one of the first things I checked was my fuel status. I had 22 gallons per side. During my panel upgrade I had added two MVP50 engine

monitors (Electronic International) that included fuel gauges and fuel flow. I had carefully calibrated the units and tested them extensively for accuracy. I had even added a cushion of 3 gallons per side to be conservative. My normal cruise burn is 13.5 to 14 gph per side, but all the flying with the gear extended meant I had been flying at a higher power setting with a much richer-than-normal mixture, thus consuming much more fuel.

The first flyby, at about 20 feet AGL, was challenging as it was hard to maintain the runway heading. The airplane wanted to wander off. When we completed it, the observation was inconclusive so we did a second. The ground crew reported that the left main gear appeared to be extended but, of course, they could not be certain. At this point, my fuel gages showed 8 gallons per side. I decided to attempt a landing. My plan was to touch down gently and see if the gear would hold. If it didn't hold, I would do a go around and return for a gear up landing (with the engines shut down) which I felt would be a safer option. This may sound overly challenging but I have pretty good stick-and-rudder skills due to extensive aerobatic flying over the years. And there was one positive development: the surface wind had died down completely. I'd be landing in smooth air.

I began the landing sequence, touching down on the right main first with sufficient power to maintain straight-and-level flight and then gently lowering the left, very slowly increasing the load. It held! I ever-so-gently braked straight ahead and taxied to the hangar at a snail's pace. As we exited the airplane, I was baffled by what was going on. Was it just a light or switch? What about the unusual trimming I had to do? I got a flashlight and as soon as I looked in the gear well, I spotted the problem: a ruptured torque tube. Of course, I had inspected these carefully at the prior annual inspection and they were fine. Note that in the pictures to the right, its condition is deteriorated due to being exposed to a hot, humid climate in the three months since removal.

I began the repair process. First, I installed an electrical patch with two switches on the outside of the aircraft that allowed me to move the electric landing gear motor up and down in small increments, pausing at any point in the process. This patch was very helpful in the disassembly and re-rigging of the landing gear. As I raised the gear, I saw that with the damaged torque tube, the left main gear could only retract partially, a few degrees upwards. It had hung in the slipstream causing the additional drag and yaw I had experienced.

Soon I began to understand why the landing gear was not collapsing, even with the defective torque tube. It was a Cessna design feature called 'downlock on free fall' that saved me. 'Downlock on free fall' means that - with all links between the gearbox and the landing struts removed - the landing gear must lock itself securely when allowed to fall into the end-position. Only after a positive removal of the downlock, can the gear be retracted again. This process is controlled by the torque tubes that 'translate' the movement of the landing gear motor into the timed sequence that extends and retracts the gear.

MLG torque tubes have been a known problem area for decades. In spite of a new, more robust version they can still fail. The culprit is usually corrosion which can start on the inside of the tube, making detection difficult.

In my case the torque tube was seriously disrupted, unable to transfer the required torque. Our tests showed that the broken torque tube was still able to remove the downlock up to a degree that the left main gear would dangle free. It could not develop the torque required to fully retract the left main gear any more.

Intimidated by the potential of a gear failure without prior warning, and also to gauge how close I was to a gear up landing with the broken torque tube, we measured the force needed to break the downlock position on the defective side; only less than 40% of the required value as per rigging instructions in the maintenance manual was necessary to break the downlock and make the gear collapse! A less than butter-soft landing could have done this!

Why was there no indication in the cockpit that the left gear was dangling in flight? I studied the Cessna wiring diagram and found the answer. The red landing-gear-in-transition light is only activated while the gear motor is operating. The moment it is stopped by the upper end switch (on top of the landing motor gear,) the circuit becomes unpowered. Thus, the only indications of a gear problem would be altered flight characteristics (speed and yaw,) or observation by another aircraft or someone on the ground. In my situation, the winds that night and the fact that I was not flying at normal cruise but instead shooting approaches, did not give me a good, solid reference for judging the slightly degraded flight characteristics. I now estimate the dangling gear probably cost me 5 to 7 knots - not enough for me to detect during the unusual conditions that

night. The yaw was masked due to the P-factor of the airplane, particularly during climb-out.

There is another potential "gotcha" that I only realized during the evaluation and repair process a few weeks later: During my ordeal, my intention was to pull the gear-warning circuit breaker to avoid the horn blaring and distracting me during approach and landing. But my high workload made that impractical so I left the gear-warning breaker alone. This turned out to be a good thing since the wiring of the C340 prevents the gear from retracting if the gear-warning breaker is pulled. I have to admit that I was unaware of this feature. It is not mentioned in the POH!

I spent some time debriefing my performance during the flight. The darkness of night and the less-than-perfect weather added some challenges. In addition, the ground lights in the area were sometimes confusing. Should I have declared an emergency? My main reason for not doing so was to minimize the potential disruption at the airport. The controller was challenged enough with my situation and declaring an emergency would have really put him out of his comfort zone, as well as inconveniencing several inbound airliners (and hurting the reputation of GA in the area). As it was, the controller and I made a good team. He granted all my requests and I flew them just as he expected. Some of what I requested was non-standard, such as the quick tear-drop return from the second flyby to the full-stop landing (needed to minimize fuel consumption in case another go around with a final gear-up landing was indicated).

What about my passenger? Although he had little prior flying experience, he remained calm throughout. It was clear to me that he was responding to my calmness, and this is a lesson for all of us to remember in an emergency. Our passengers' concern (or alarm) will match ours so stay calm! I hope this article has provided some insights into Twin Cessna landing gear and being prepared for in-flight landing gear problems.

About the Author: Ingo Steinbach is an IFR rated commercial pilot with about 2,000 hour flight time. He's owned his 340A since 2003. He's flown his airplane about 800 hours in the U.S., Germany, and Singapore, where he currently lives and works. Due to scare hangar space in Singapore, he bases his airplane in Malaysia. The lack of good local maintenance prompted Ingo to get his A&P license several years ago.

From the Editor: *Main landing gear torque tubes have long been a service problem in Twin Cessna aircraft with electro-mechanical landing gear. In May of 2009 Cessna released Service Bulletin MEB09-2, which specified the replacement of all older tubes with new style tubes, also detailed inspection requirements. A copy of this service bulletin can be found in the Technical section of our website at www.twincessna.org.*