Those Who Have and Those Who Haven't … Yet!

I have often heard a quip, "There are two kinds of pilots. Those who have and those who will." We're talking about gear up landings: those who have already done one and those who will do one in the future. The quip is usually spoken right after one has happened. Also, the quip comes off as fatalistic, since it postulates that everyone who flies a retractable is destined to have one. This is unfortunate because the gear up landing accident, like many other accidents, is avoidable.

Unlike many other accidents, the gear up landing accident usually does not cause personal injury. The primary casualty is the pocket book due to repair costs and a damage history for the airplane. There may also be an underwriting review by the insurance carrier. The FAA's local FSDO will certainly have some questions for the pilot. Depending on what they find in the investigation, it could result in counseling, a 709[1] ride, or an enforcement action. The airport could be closed for as long as two hours until the runway is cleared. As a result of the closure, other arriving aircraft may be forced to divert and that carries a risk of fuel emergencies. Larger airports may remove the stricken aircraft from the runway by the most expeditious means possible. While this quickly restores the runway to service, it can also result in additional damage to the stricken plane.

Now, what causes gear up landing accidents? There are two general causes: equipment failure and pilot error. Gear up landings as a result of equipment failure are relatively infrequent. Since they are still a possibility, how do you deal with them? You need to know how your airplane's gear extension system works. Some, like the Piper Arrow use a gear extension-retraction system that is hydraulically actuated by an electrically powered reversible pump. Others, like the Mooney MSE are equipped with an electrical gear extension-retraction system. Some aircraft, like the Piper Arrow, use gear position lights[2] in the shape of a triangle to individually indicate which gears are down and locked. Others, like the Mooney MSE, use a gear down position indicator[3] on the floorboard as well as a gear down light on the annunciator panel.

In addition to knowing how your airplane's gear extension-retraction system works, you also need to know the emergency gear extension procedures for your airplane. In all airplanes you first need to adjust power and pitch to obtain the specified gear extension (V_{LE}) speed, check that your master switch is properly set, check that your circuit breakers are in and make sure that your gear handle is in the down position. The remaining emergency gear extension procedures will vary depending on the type of extension-retraction system your airplane uses. For airplanes that use a hydraulic gear extension system, you may need to put your emergency gear lever in the emergency down position and even go so far as to use elevator and rudder in a porpoising and yaw maneuver to shake the gear into a locked down position. For airplanes that use an electrical gear extension system, you may need to pull your landing gear actuator circuit breaker then pull an emergency gear extension some number of times.

Both the Piper Arrow and the Mooney MSE have gear warning horns that come on at low power settings when the gear handle is still in the up position. You should familiarize yourself with the sound of these horns by cutting back the power with the gear up, but do it at a safe altitude. The

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1 Until a few years ago, this competency checkride was called a 609 ride.

2 These lights have individual press-to-test capabilities. The bulbs pull out easily, so if a particular light remains unlit, you can swap the suspect bulb with one of the lit bulbs.

3 This illuminated gear-down position indicator has two marks that align when the landing gear is down and illuminates when the green gear down light is on. A red and white striped decal appears when the landing gear is not in the down position.

first time I heard the Mooney's gear warning horn, I was practicing slow flight at 3,000 feet MSL. I thought it sounded like the stall warning horn but a quick look at the airspeed indicator quickly dispelled that concern. One pilot, who heard the horn just before landing gear up, said he thought it was the middle or inner marker and was trying to turn off the marker beacon audio. If you are uncertain of what these horns sound like, schedule some time with a local flight instructor. Your CFI will be willing to demonstrate all of the horns: marker beacons, stall warning, and gear warning.

Gear freezing in the gear well is an equipment hazard that presents itself during the winter for those of us who fly in the northeast. If you have just taxied on slushy taxiways or if you have just taken off on a slushy runway, you should cycle the gear a few times instead of simply retracting it. The recycling action will help rid the aircraft of accumulated slush, thereby minimizing the risk of your gear being frozen in the well when it is time to land.

Alternator failures also contribute to gear extension problems. If your alternator should fail on takeoff, do not retract the gear. Stay in the pattern and land immediately. If it fails during cruise, start shutting down non-essential[4] electrical equipment, adjust power and pitch to quickly reach gear extension (V_{LE}) speed, and extend the gear, then proceed to the nearest airport. You may also want to put in a notch of approach flaps, though now you must fly at the flap extension (V_{FE}) speed.

Pilot error is the most frequent cause of all accidents, in general, and of gear up landings in particular. If we were to analyze these accidents, we would probably find that most of them had as a common denominator some break from routine. Examples of break from routine are go arounds and a heavy work load from ATC on an instrument approach.

Picture this go around scenario. The pilot is mentally focused on landing, the pre-landing checklist has been completed. The aircraft is well established on final then something happens that causes the pilot to reject the landing. The pilot immediately initiates the go around procedure: full power, flaps up a notch, positive rate of climb, pitch for best angle of climb (V_X), gear up, flaps up another notch, pitch for best rate of climb (V_Y). The pilot stays in the pattern, turning crosswind to downwind to base to final. The pre-landing checklist was done at initial pattern entry, so the pilot does not redo the checklist. While entering the flare, the pilot hears a horn that sounds like the stall warning horn. Seconds later the pilot hears and feels scraping and clunking sounds. Through the windscreen the pilot sees bent propeller blades. So what was wrong with that picture? The pre-landing checklist was only done once. Since the gear was already checked down, it had never been unchecked in the pilot's mind.

The FAA recommends that the gear be extended and the pre-landing checklist be completed prior to reaching the base leg in normal landing situations.[5] An engine failure would be an example of an abnormal landing situation. In this latter situation, you would want to maximize your glide range by pitching for best glide speed and minimizing drag by not extending gear or flaps until you have the landing site made. If your landing will be on other than an airport, you

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[4] Your flight conditions, VMC or IMC and day or night, will determine just what equipment is essential. During day VMC in our area, you could turn off everything except COM1/NAV1 and the transponder.

[5] U.S. Department of Transportation, Federal Aviation Administration, Flight Standards Service. Flight Training Handbook, AC 61 - 21A, Revised 1980.

may want to land with the gear retracted depending on the terrain. If you must ditch, then you should touch down in the water with the gear up.

When I was a newly minted CFI, the first instructing that fell to me was transitioning pilots from a Grumman Tiger to a Mooney MSE. The Mooney is an airplane that likes to fly; you can flight plan it at 155 - 160 KTAS. From a speed perspective, it often proved to be a handful for transitioning pilots. To help my students, I borrowed some instrument flying concepts. My rationale was that if it works inbound from the final approach at a distance of five or more miles, it should work for a visual approach at a distance of one or two miles. My technique involved an application of pitch, power, and speed brakes to slow the airplane to gear extension speed[6] while still one or two miles outside the pattern. My experience with this also demonstrated that by the time the gear was down and locked, the airplane was at the top of the white arc (V_{FE}), where a notch of approach flaps could be added. At this point, the first pre-landing check or GUMP[7] check would be conducted. On downwind entry, power would be reduced to 18 inches of manifold pressure, followed by another GUMP check. Abeam the approach numbers, power would be reduced to 15 inches of manifold pressure, followed by another GUMP check. On base leg, landing flaps would be set, pitch for 500 FPM rate of descent, followed by another GUMP check. On final, pitch for final approach speed, perform final GUMP check, pull throttle to the idle position, flare, and land. The primary point of this procedure was to use the landing gear to produce drag and help the transitioning pilot slow the airplane to a manageable speed. As a secondary point, however, it teaches the use of multiple GUMP checks, one for initial gear extension plus one for each pattern leg. For pattern work and go arounds I teach the same procedure, with the gear being extended on the crosswind leg.

For instrument approaches, you should extend the landing gear at glide slope interception on a precision approach and at the final approach fix on a non-precision approach. I heard of an instance last year where a pilot, inbound from the final approach fix (FAF) in IMC, was asked to keep his speed above 120 KIAS. In complying with ATC's request to keep his speed up, the pilot forgot to extend his landing gear. I have thought about this accident at length, not to judge the pilot, but to consider how I would handle it if I were ever in the same situation. First, I would not deviate from my instrument approach procedures. I would still drop the gear at glide slope interception or FAF, depending on the approach. Next, I would consider the airplane's V_{LE} speed relative to the speed requested by ATC. In the case of a Mooney MSE V_{LE} speed is 132 KIAS, so it would be easy to accommodate ATC's speed request with the gear down. The same applies to a Piper Arrow with a V_{LE} speed of 150 mph (130 KIAS). If I were flying an airplane with a lower V_{LE}, I would advise ATC that I was unable to comply[8] and ask them if they wanted to vector me around for another pass or have me execute the missed approach procedure. Also, I execute GUMP checks at glide slope interception on an ILS, at the FAF for all approaches, and at the middle marker (MM), decision height (DH), and minimum descent altitude (MDA), depending on the facilities available.

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[6] V_{LE} for the Mooney MSE is 132 KIAS.

[7] **G**as (turn on boost pump and switch tanks if necessary) **U**ndercarriage (check gear handle and gear lights for indications that gear is down and locked) **M**ixture (push mixture knob to full rich position) **P**rop (push propeller knob to full forward position).

[8] FAR 91.3 establishes the Pilot in Command as directly responsible for, and the final authority as to, the operation of the aircraft.

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In the beginning of this article I mentioned the quip, “There are two kinds of pilots. Those who have and those who will.” I also said the quip comes off as fatalistic, since it postulates that everyone who flies a retractable is destined to have a gear up landing accident. The CFI who gave me all of my advanced training, including my transition to retractable gear airplanes, said it differently. He said, "There are those who have and those who haven’t yet!" He also said, "GUMP check! GUMP check! GUMP check …!"

So, in closing, I will just say that the more GUMP checks you do, the safer you become and your risk of a gear up landing is substantially reduced. To those pilots who would advocate spending money for supplementary gear warning systems, I will say if a gear warning horn does not get the pilot's attention, why would another audio tone make a difference? I will go so far as to say that over-reliance on gear warning systems can add to pilot complacency. There is still no substitute for a thorough and oft repeated GUMP check.