FLYING LESSONS for April 7, 2011

suggested by this week's aircraft mishap reports

FLYING LESSONS uses the past week's mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific make and model airplane have little direct bearing on the possible causes of aircraft accidents, so apply these *FLYING LESSONS* to any airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. You are pilot in command, and are ultimately responsible for the decisions you make.

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This week's lessons:

I watched a demonstration by the pilot of a U.S. Air Force F-22 Raptor on one of the nicer weather-days at this year's Sun n' Fun (if you were there you know what I mean). The Raptor's most unique characteristic, from an observer's standpoint, is its ability to maneuver at extremely high angles of attack—maintaining a constant AoA of over 60° in sustained flight.

Watch an F-22 maneuver, however, and you may notice an interesting pattern. Any time the fighter changes attitude under a g-load, the pilot does so incrementally. He or she changes pitch, then changes bank; or the pilot changes bank and then changes pitch. You *never* see a radical pitch and bank change simultaneously. Watch the other flight demonstration pilots and teams, from local aerobats to Julie Clark to the U.S. Navy's Blue Angels, and you'll see the same pattern.

The phenomenon to avoid is called "rolling Gs." Changing bank angle while simultaneously changing G-load creates a differential in the loading of one wing (or one stabilizer) relative to the other. This in turn applies a twisting force on the attach points that will be much more powerful than if the G-load is applied symmetrically on the airframe.

Rolling G limits do not appear in most civilian airplane Pilot's Operating Handbooks. For example, however, the USAF's Northrop T-38A is limited to +6.0/-2.5G at 3000 pounds of fuel on board (FOB) when symmetrical, but +4.3/-0G in unsymmetrical flight (where "unsymmetrical flight" is defined as "full aileron deflection"). The G-load envelope changes with reductions in fuel weight. The Bellanca Decathalon reportedly gives a rolling G limit in its flight manual (I'm sure a reader will confirm). FAR 23 defines an airplane's asymmetrical flight G-limit for any given weight to be 2/3rds of the symmetric G-load at the same weight for the same aircraft (FAR 23.349(2)(b)).

Why does this matter to me? Rolling Gs can affect any airplane. This week the NTSB released a preliminary report on an accident that took place in March (it's defined as an "accident" because the airplane suffered substantial damage in flight, although the pilot landed safely and no one was hurt):

> The pilot [was] cruising at 4,500 feet, and was engaged in correlating the indications of two panel-mounted navigation receivers in the cockpit. He also had a handheld GPS mounted on the flight control yoke. During the correlation effort, the pilot noticed that he was about to intrude into…military restricted airspace…. He initiated a turn to the right, with a bank angle that he estimated to be about 45 degrees, in order to avoid the restricted airspace. During the turn, the pilot referred to the GPS to ensure that he would clear the restricted area. When he returned his attention to the airplane's attitude, he noticed that the bank angle had increased to about 75 degrees right wing down, and the pitch attitude had decreased to about 20 degrees airplane nose down. At that point, the pilot noted that the airspeed was about 190 mph, which was in the yellow (caution) range of the airspeed indicator scale.

> The pilot stated that he leveled the wings, and then initiated a pull-up. During the pull-up, he heard three or four "thumps" in rapid succession. After recovery to level flight, the airplane continued to "fly fine," but the pilot was concerned about the thumps, since he had never heard noises like them in that airplane. The pilot then flew the airplane "gingerly" back to his home field, where he landed uneventfully.
>
> Federal Aviation Administration inspectors [found] a diagonal wrinkle about 2 feet long [that] extended up and forward from the juncture of the fuselage side and bottom; the wrinkle intercepted the juncture at about the second bulkhead/former forward of the tail cone. On the opposite side of the aft fuselage, the skin was crumpled and dented in the same general region as on the right side, but the deformation did not exhibit the linear pattern observed on the right side. On the lower aft fuselage, the forward bottom skin was separated from its lap joint with the aft bottom skin at the aforementioned bulkhead/former; the skin was torn from the fasteners, which remained in the bulkhead. The FAA inspectors did not observe any indications of pre-event damage or corrosion in the affected areas. A cockpit G-meter that was operational during the event registered a maximum of about 2.5g and a minimum of about minus 0.7g, but the accuracy of the meter was not determined.

See www3.ntsb.gov/aviationquery/brief.aspx?ev_id=20110319X34215&key=1

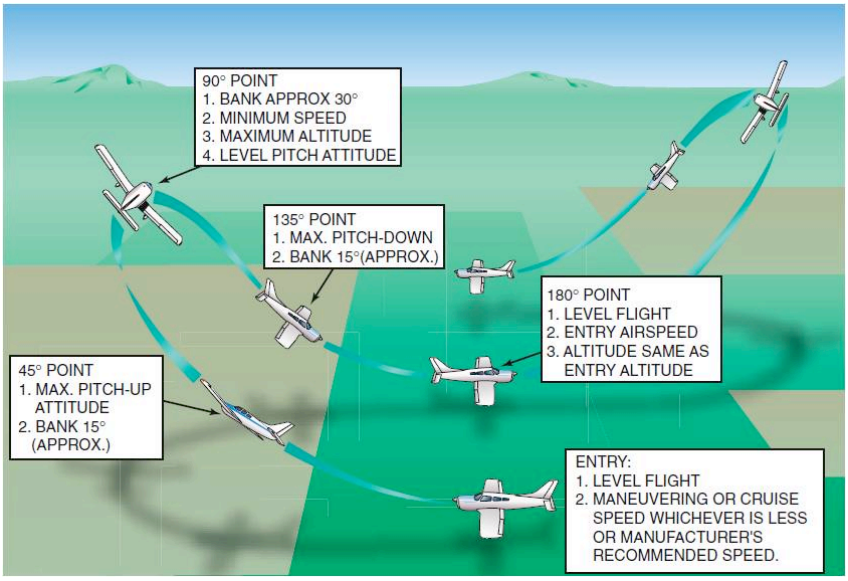
Three possibilities exist to explain the damage (which was likely enough to render the airplane uneconomical to repair):

- First is that the G-meter was incorrect and the airplane experienced a much higher G-load than indicated (the type has a design load of 4.4Gs and an ultimate load of 6.6Gs).
- Second, there might have been a pre-existing condition of some sort that reduced load-carrying capability or changed the balance of moveable tail surfaces enough to induce flutter at high speeds (the airplane in question is 55 years old, ample time for issues to arise due to improper maintenance or neglect).
- Third, the pilot may have been more aggressive about pulling up while still rolling out of the nearly vertical bank.

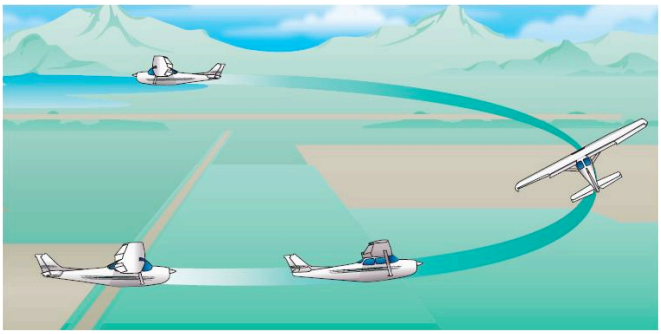
The airplane *may* have suffered the effects of "rolling Gs."

The FAA warns us about rolling Gs without making it terribly obvious. At least it does so on the Commercial Pilot Practical Test Standards (PTS) and supporting Advisory Circulars. Two similar "performance maneuvers" from the U.S. Commercial checkride teach us to avoid large, simultaneous changes in pitch and bank—to avoid rolling Gs.

The Lazy 8, king of the so-called "commercial maneuvers," requires bank angles up to 30° and pitch attitudes to just above the power-on stall, with a correspondingly low attitude on the "down" side of each turn. But the key to flying the Lazy 8 to Practical Test standards is to make continuous, but *very small*, changes in bank and pitch…although you are continually changing both pitch and bank throughout the maneuver, you are intentionally changing them extremely slowly.



There's no rapid, big change in a properly flown Lazy 8… in part to teach us to avoid rolling Gs.



Contrast this with the chandelle, which also calls for changing pitch and bank to the same maximum values. Unlike the Lazy 8, however, the PTS calls for a smooth but rapid roll into maximum bank, and a pitch up to maximum attitude, at the beginning of the maneuver. Tellingly, the proper technique for entering the chandelle is to roll to a 30° bank angle first, *then* pitch to the maximum bank angle. No rolling Gs…just like the F-22, Julie Clark and the Blue Angels!

The PTS and Chapter 9 of the *Airplane Flying Handbook* don't come right out and say it, but the technique appears designed to teach, among other things, that big changes in bank and pitch should not occur simultaneously.

See www.faa.gov/library/manuals/aircraft/airplane_handbook/media/faa-h-8083-3a-4of7.pdf

This NTSB preliminary report that prompted this week's *FLYING LESSONS* also contains *LESSONS* about navigation, situational awareness, division of attention, and appropriate response to an abnormal situation. Comments or questions on anything this report suggests? Tell us what you think at mastery.flight.training@cox.net.

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We have been focusing on the 10 most common causes of fatal general aviation mishaps according to the U.S. Federal Aviation Administration. Member comment on Top 10 Cause #8: Loss of Control En Route/During Cruise, has trcikled down to nothing during *FLYING LESSONS*' Sun n' Fun break. So we'll wrap up the discussion next week, and move on to the seventh most common cause of fatal accidents in general aviation airplanes: En route attempted visual flight in instrument meteorological conditions.

Any more discussion of Top 10 Cause #8, Loss of Control En Route/During Cruise? Send your comments and ideas at mastery.flight.training@cox.net.

Flying Unfamiliar Airplanes

Not just "Experimental" airplanes, this advice is sound for your first flights in any *airplane that is new to you. From the U.S. Federal Aviation Administration:*

Experimental airplane flights represent a small portion of total general aviation (GA) flights in the

United States. However, a significant number of fatal accidents occur in them. Many of those accidents take place when experienced pilots first fly an unfamiliar aircraft, especially when they are the second owner or pilot of an experimental amateur built aircraft. Data also shows that fatal accidents often occur when pilots with little experience in a particular type of aircraft fly in challenging conditions, such as poor weather.

A new Advisory Circular (AC 90-109, Airmen Transition to Experimental or Unfamiliar Airplanes) advises that all pilots should consider the first flight in any particular experimental airplane a test flight. It also urges pilots to review the hazards and risks outlined in the AC and complete the recommended training. AC 90-109 provides information and guidance to owners and pilots of experimental airplanes and to flight instructors who teach in them. The Federal Aviation Administration worked with the GA community, including the Experimental Aircraft Association (EAA), the Aircraft Owners and Pilots Association (AOPA) and the National Association of Flight Instructors (NAFI), to develop the recommendations in the AC. It complements AC 90-89A, Amateur-Built Aircraft and Ultralight Flight Testing Handbook, which addresses the testing of newly-built experimental airplanes.

This AC is part of the FAA's focus on reducing general aviation accidents by using a non-regulatory, proactive strategy to get results. The agency's goal is to reduce the GA fatal accident rate per 100,000 flight hours by 10 percent by 2018.

See www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1018499

Share safer skies. Forward *FLYING LESSONS* to a friend.

Fly safe, and have fun!

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