FLYING LESSONS for December 29, 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.

If you wish to receive the free, expanded *FLYING LESSONS* report each week, email "subscribe" to mastery.flight.training@cox.net.

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This week's lessons:

If a pilot on an Instrument Flight Plan accepts a clearance to visually follow a preceding aircraft, *the pilot also accepts responsibility for wake turbulence avoidance.*

A pilot flying VFR, even if participating in voluntary or required ATC services, *is expected to adjust flight path as necessary to preclude wake encounters.*

These statements from the *Aeronautical Information Manual* (AIM) section 7-3-1 make it clear pilots need to know how wingtip vortices and the wake turbulence they create form and move. We need to be able to "see" wake turbulence as part of our requirement to "see and avoid" other aircraft in flight.

See www.faa.gov/air_traffic/publications/ATpubs/AIM/Chap7/aim0703.html

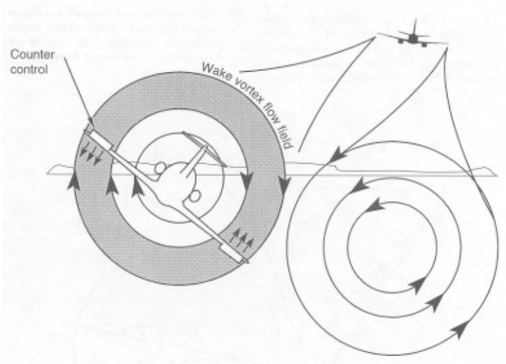
Wake turbulence is created as a by-product of lift. Spanwise flow of air across the top to the wing "spills off" the wingtip, swirling into a horizontal tornado with potentially incredible force.

Wingtip vortices are strongest when lift is at its greatest. This is another way of saying that tip vortices are most dynamic at high angles of attack…which is, of course, how most airplanes are flown in the airport environment. This is why we're told tip vortices are most dangerous behind and airplane with flaps extended…not necessarily because of the flaps themselves, but because airplanes with flaps extended tend to be operating at slower speeds and higher angles of attack. Regardless of flap position, when airplanes are at the lower end of their airspeed spectra, they generate their greatest tip vortices.

Although we usually think about large, transport-category airplanes when we worry about wake avoidance (and airplane weight is a factor in wake strength), all airplanes can—and do—create wake turbulence. In this recent mishap a cause is not yet known, but I'm certain a wake turbulence encounter is a prime suspect:

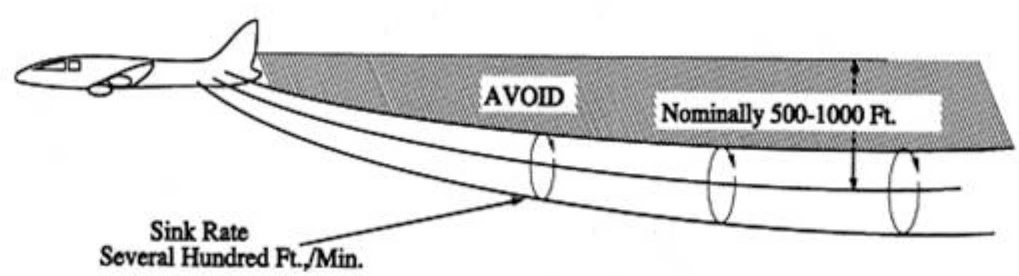
…the Cirrus [SR22] entered a left-hand traffic pattern for runway 3 from the north. ATC sequenced the Cirrus to land behind a Gulfstream Aerospace GV-SP (G550), which was ahead of the Cirrus. The Gulfstream had entered the left traffic pattern directly into the base leg. The local controller advised the Cirrus pilot to report when he had the Gulfstream in sight. The Cirrus pilot reported that the sun was in his eyes, and he did not report seeing the Gulfstream. Seconds later, the controller advised the Cirrus pilot that the Gulfstream was to his left and on final approach, and the Cirrus turned onto the base leg. Subsequently, as the Cirrus was entering the final approach leg and was about 1,900 feet, the Gulfstream overflew the Cirrus about 2,100 feet. The passenger in the Cirrus reported to investigators that immediately thereafter the pilot observed the Gulfstream, and he so informed the controller while continuing toward the runway. Then the controller advised the Cirrus pilot to standby for a possible go-around. Less than one minute later the Cirrus rolled into a steep bank and descended in a corkscrew-like maneuver into the ground…."

See www.ntsb.gov/aviationquery/brief.aspx?ev_id=20111215X31833&key=1



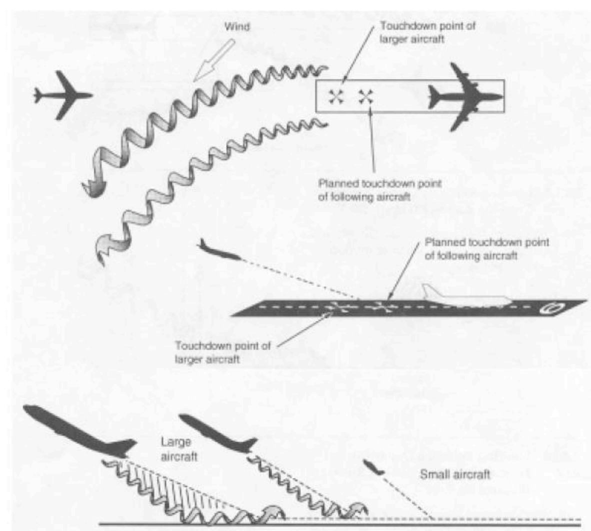
Wake-induced roll may eventually be implicated in this fatal tragedy. In a wake-generated roll the airplane may be spun by a vortex encounter so rapidly that even full control deflection cannot overcome the rolling motion. Attempting to resist the roll may overstress the airplane or cause the pilot to lose control and enter a spiral or spin. One of the benefits of introductory aerobatics and extreme-attitudes training (conducted in aerobatic-certificated airplanes with a qualified aerobatic instructor pilot) is a feel for when it is better to "go with the flow," and respond to an uncommanded roll by rolling the airplane all the way around to upright *with* the turbulent vortex…which when done correctly is actually safer that trying to fight the rolling moment.

Wakes generated by a large aircraft tend to descend about 500 to 1000 feet below the airplane's altitude, then level off while continuing their extreme rotation. A smaller airplane's wake may not descend so rapidly or far beneath the generating aircraft's altitude.



Wake turbulence blows with the prevailing wind, which can take it away from runways if there's a crosswind, but can cause it to interfere with operations on an intersecting or parallel runway. Wake turbulence generated by helicopters operating in ground effect can be extremely intense, similar in theory to a microburst, and follow a similar drift pattern.

It's your job to visualize wake turbulence behind *any* preceding aircraft. If you think you may encounter a wake, you must alter your route, your altitude, or your landing or takeoff point. Or you must delay long enough for the wake turbulence to subside (usually several minutes).



FAA's Advisory Circular 90-23F

provides greater detail about the nature of wake vortices, and along with AIM chapter 7 gives excellent advice for avoiding potential wake turbulence encounters.

See:
www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/23086
www.faa.gov/air_traffic/publications/ATpubs/AIM/Chap7/aim0703.html

ATC may advise you of possible wake turbulence, and at tower-controlled airports may suggest a takeoff delay to let wake turbulence dissipate (a delay that you as pilot-in-command can decline on your authority as PIC, ill-advised though that may be). However, you are personally responsible to "see" and avoid wake turbulence just as actively as you must see and avoid the preceding aircraft itself.

Questions? Comments? Let us know, at mastery.flight.training@cox.net

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Gary Mulligan writes:

> Tom, just wanted to say thanks for the great insight you offer each month in the Mastery Flight Training series. Your articles are especially helpful to me as I work on my CFI rating. **It is one thing to know how to fly, but an entirely different thing to learn how to teach someone to fly**, a daunting task in some respects. Wish I had gotten the CFI much earlier. I'm 61, having sold my business three years ago. I've been looking for a way to engage in my passion - flying. Have a great Holiday and I'm looking forward to more good stuff in the New Year.

Thank you very much, Gary. Let me know if there's anything more I can do to help you reach your goal. Happy New Year!

Another reader wrote about the December 22 *FLYING LESSONS Weekly*:

> Good stuff, as usual, Tom; thanks for the service. Your opening two accidents and the references to ice and the limits of anti-ice gear reinforced all the right points. Good as far as the issue of *external* airframe ice is concerned...but the Citation XL incident spoke more -- at least to me -- of the issue of *internal* icing of the airframe and the subtle, out-of-sight problems it can incur.
>
> Past incidents of internal airframe icing restricting controls played out last winter; fortunately, the craft survived those incidents. But every winter it seems we read of an accident in which no obvious cause presents itself but for which internal icing should be suspected. Internal icing can freeze cables in their runs, freeze pulleys, and create significant control-surface imbalances that become apparent only when the autopilot kicks off -- and occur in clear, blue-sky air when the aircraft has been subject to rain or snow on the ground or while on descent from its last flight.
>
> Remember: any water trapped in any part of the airframe becomes ice shortly after climbing to altitudes with temps below freezing...can even happen in the summer time with high-flying turbine or turbocharged/ turbonormalized airplanes, so warm weather isn't a complete hedge.
>
> Finding this problem on our first airplane, a Piper Cherokee (the ailerons and flaps could hold a *lot* of water) instilled in me a new no-go point: if my plane's been out in the rain or snow overnight, even if de-iced, I prefer to **put the airplane in a hangar warm enough to assure the melting of any internal ice and/or the draining of the control surfaces**...I might even take a look behind the luggage-compartment bulkhead to assure myself no water has pooled in the lower fuselage, where it could freeze up cables and contribute unseen weight that could morph into a CG issue.
>
> Sign me, an anonymous, ice-averse pilot. Thanks for what you do!

Thank you, my anonymous friend, for your input.

Reader and aviation safety program manager Robert Thorson writes about last week's *LESSONS* on ice certification and cockpit technology:

> As usual your salient information is presented clearly and accurately. Thanks for all the hard work you put into your newsletter.

My worry is that what "we know" maybe leaves a large number of pilots out of the equation. Perhaps we are giving credit for knowledge that does not exist. The rhetorical question is not being quietly answered. It appears to me that the overall body of aviation knowledge is being lost in flight instruction and that the new risks are not seen. This is particularly true in flight in icing conditions. Obviously experience accounts for something here as well.

Concerning automation and TAA [Technologically Advance Aircraft]...The old risks have migrated to new risks in different areas. They still lead to the same result. Unfortunately training has not picked up on where and what the risks are exactly. The accident still occurs but the path to it is different. The Boeing 727 pilot could speak KVARS and reverse current relays, the B-777 pilot responds to EICAS messages fed in a particular order. The analysis of the system and response are vastly different because engineers have built the man- machine interface differently. The pilot must be taught the significance of the message or a series of messages. **The mental model has changed with automation**.

As Instructors we must make sure we teach far above rote and that takes time and a lot of work. Your newsletter helps tremendously in this regard.

Thank you very much, Robert. Perhaps focusing on what is really "conventional wisdom" and what is not should be a major theme of *FLYING LESSONS* in 2012.

Along the same lines (and not to pick on the best example of TAAs, but merely to illustrate the point), *Aviation Consumer* published the results of a study this week that show advanced technology and a whole-airplane parachute system have not in and of themselves made cross-country, IFR lightplane operation less deadly. In fact, the Cirrus SR20/SR22 fleet's safety record is "just average," with a total accident rate an impressive half that of similar airplanes. But its *fatal* accident rate is significantly higher than much of the competition, and just slightly better than Mooney and high-performance Piper airplanes (based on estimated fleet operating hours). The story remains the same: **regardless of the technology and safety systems we put aboard our airplanes, ultimately it's the pilot's ability to understand and use technology properly** that determines whether those technologies are an improvement, are neutral as a factor for improving pilot decision-making or mishap survival, or (in worst case) are even a risk-increasing distraction.

AVweb posted a synopsis of the report. I'm looking forward to reading the full report, and encourage *FLYING LESSONS* readers to read *Aviation Consumer*'s account for the positive lessons we can all learn.

See:
www.avweb.com/avwebflash/news/Cirrus_Safety_Record_Average_205914-1.html
www.aviationconsumer.com/

Frequent Debriefer David Heberling adds:

Thank you for delving into a very big problem with today's automation, namely manual reversion scenarios. We in the airline industry are NOT being instructed in the failure modes of the automation that hands us the airplane when it reaches its maximum limitations. This is a terrible point to be handed an airplane to hand fly. The lessons to be learned from the Air France Flight 447 crash are yet to filter down into our training departments. I recently flew with an F/O [First Officer] who was told he was "too proficient in hand flying the aircraft" by a check airman. I think this problem is bigger than an engine failure at V1. I know I have practiced "V1 cuts" so much over the years that I could do them in my sleep. Yet, it you were to hand me an airplane massively out of trim in IMC being vectored for the approach, I could not give you the odds of me successfully managing that scenario to a safe landing.

Yes, we have introduced high altitude stalls into our curriculum [as a result of Air France 447] and it has been eye-opening. A stall at high altitude is nothing like a stall down low. It takes a very long time to regain lost airspeed at high altitude. The focus of these types of stalls is to reduce AOA [Angle of Attack] and regain airspeed. Altitude loss is not a concern. I find it interesting that we have to fight the trim and push forward on the controls to keep from loading up the wing and reentering the stall and/or suffering structural failure. This is obviously an issue for anyone recovering from a diving spiral [we see this even in light airplanes—tt].

For some reason, severe icing has not been a concern of our training department. Maybe it is a function of our only needing to come through the training department once per year to meet regulatory requirements. They may only want to introduce one concept at a time. However, there are also the reports of aircraft getting engine icing behind the fan blades on the stators at high altitude. There have been a number of engine

> flameouts under this condition. At least one aircraft has had to make a dead stick approach and landing because they could not restart any engine. There is a lot of inertia in our training departments where new ideas take time to become adopted. **We have all become so enamored of our "gee whiz" glass cockpits, it is taking precious time to take its dark side into account.** Even more pressing is the short-changing of pilots in the basics of flying skills to spend more time learning the "glass". However, even the ballistic parachute on new airplanes cannot stem the carnage caused by accidents where they are most likely to occur, in the traffic pattern.

I think we're trending toward a tight focus for future issues of *FLYING LESSONS*: the appropriate use of cockpit technology to *enhance* the pilot's flying skills, not replace them. All indications are this is an issue at all levels, from Sport Pilot to air carriers. Thank you, David.

With more about last week's report, reader Byron Hamby writes:

> Given the recent number of accidents involving autopilots, it would be a great idea to have autopilot systems gave more warning of an impending failure or nearing their limitations. Our stall warning systems are engineered to warn us before we stall so the autopilot should be able to do the same. It might save some pilots especially pilot who depend on autopilot systems.

Thank you, Byron. Many autopilot systems have a light on the annunciator panel or autopilot control faceplate that illuminates when the trim is running. But I don't know of any that continuously self-test and provide an aural or visual warning as they are trending toward but *before* they reach their continuous-run or disconnect limits. Avionics techs and engineers out there—do you know of any autopilots that provide this kind of warning? Are there any design issues that are obvious to someone in-the-know that may not be so apparent to end-users like me? Please let us learn from you.

Readers, tell us what you think, at mastery.flight.training@cox.net.

We've been discussing the Number 1 cause of fatal general aviation events, according to the U.S. Federal Aviation Administration: **Loss of Control during Maneuvering Flight**. In early January we'll have a wrap-up of this cause…including *FLYING LESSONS'* usual correlations of accident causes into specific techniques you can use in your training and everyday flying to avoid the most frequent ways people die in general aviation airplanes. Please stand by….

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

Flying has risks. Choose wisely.

Thomas P. Turner, M.S. Aviation Safety, MCFI
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year
